PONDICHERRY MUNICIPALITY

Faecal Sludge and Septage Management Policy, Operational Guidelines and Action Plan

Table of Contents

LIST OF ABBREVIATIONS

BIS	Bureau of Indian Standards
CPHEEO	Central Public Health and Environmental Engineering Organization
CSE	Centre for Science and Environment
CSTFs	City Sanitation Task Forces
FFD	Faecal Flow Diagram
FSSM	Faecal Sludge Septage Management
FSM	Faecal Sludge Management
FSTP	Faecal Sewage Treatment Plant
GoAP	Government of Andhra Pradesh
GoI	Government of India
PM	Greater Pondicherry Municipality Municipal Corporation
IHHT	Individual Household Toilet
MA&UD	Municipal Administration & Urban Development
MLD	Million Liter per Day
NBC	National Building Code
OSS	Onsite Sanitation
PESTLE	Political Economical Social Technological Legal Environmental
PPE	Personal Protective Equipment
STP	Sewage Treatment Plant
SWM	Solid Waste Management
SWOT	Strength Weakness Opportunity Threats
VTO	Vacuum Truck Operator
WHO	World Health Organization

TERMINOLOGY

Faecal Sludge	Faecal sludge comprises all liquid and semi-liquid contents of pits and vaults accumulating in on-site sanitations installations, namely un-sewered public and private latrines or toilets, aqua privies and septic tanks. These liquids are normally several times more concentrated in suspended and dissolved solids than wastewater. The physical, chemical and biological qualities of faecal sludge are influenced by the duration of storage, temperature, soil condition and intrusion of ground water or surface water in septic tanks or pits, performance of septic tanks, and tank emptying technology and pattern.
On-site Sanitation	On-site sanitation is a system of sanitation whose storage facilities are contained within the plot occupied by a dwelling and its immediate surroundings. For some systems (e. g. double- pit or vault latrines), faecal matter treatment is conducted onsite and also by extended in-pit consolidation and storage. With other systems (e.g.septic tanks, single-pit or vault installations), the sludge has to be collected and treated off-site. (WHO, 2006, p. 180)
Faecal Sludge and Septage Management (FSSM)	FSS Management (FSSM) deals with on-site sanitation systems, while wastewater man- agement is concerned with sewered sanitation. FS may be treated in separate treatment works or co-treated with sludges produced in wastewater treatment plants. (Strauss et al., 2002). Faecal Sludge Management (FSM) involves safely collecting, transporting, treating and disposing the faecal sludge from the on-site sanitation systems. A more commonly used term has been septage management, which is "a historical term to define sludge removed from septic tanks" (Tilley, Ulrich, Lüthi, Reymond, & Zurbrügg, 2014). On-site sanitation systems collect, contain and partially treat the faecal waste and waste water. The sludge accumulated in these systems need to be periodically removed and treated before being disposed into the environment.
Septage	Septage means the liquid and solid material that is pumped from a septic tank, cesspool, or such on site treatment facility after it has accumulated over a period of time. Usually a septic tank retains 60% - 70% of the solids, oil and grease that enter it.
Septic Tank	Septic Tank means a water-tight receptacle which receives the discharge of a plumbing system or part thereof, and is designed to accomplish the partial removal and digestion of the suspended solid matter in the sewage through a period of detention.
Sewage	Sewage means water-borne human or animal wastes, excluding oil or oil wastes, removed from residences, buildings, institutions, industrial and commercial establishments together with such ground water, surface water and storm water as may be present.
Sewerage	Sewerage means and includes, but not limited to, any system or network of pipe line, ditches, channels, or conduits including pumping stations, lift stations, and force mains, service connections, including other constructions, devices and appliances appurtenant thereto, which includes the collection, transport, pumping and treatment of sewage to a point disposal.

PONDICHERRY MUNICIPALITY
FSSM POLICY AND ACTION PLAN

POLICY DOCUMENT

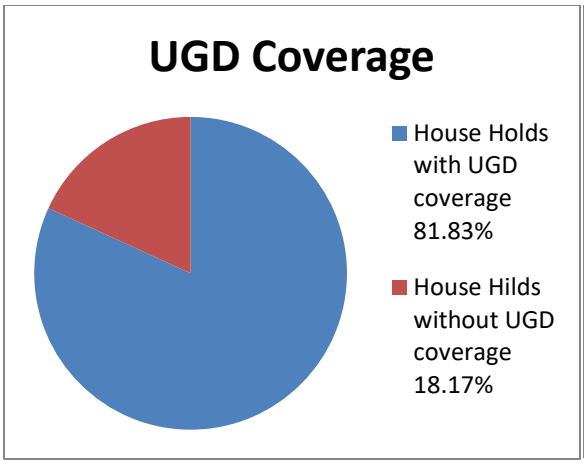
1. Background and Purpose

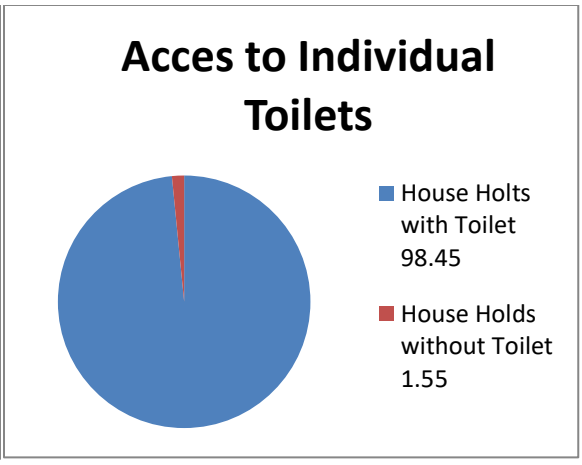
1.1. Sanitation status in Pondicherry Municipality

As per the 2011 Census, Pondicherry Municipality has a population of 2,44,377. The city is divided into 42 Wards comprising in 8 Assembly Constituencies. The Pondicherry Municipality came into existence in the year 1974 to fulfill the basic infrastructure requirements of its residents. The City is well known for its rich Indo-French architecture and cultural heritage and is also emerging as tourism Destination. The city has high in-migration, due to large magnitude of education and economic opportunities available.

Sewerage remains the gold standard of sanitation services in Pondicherry Municipality despite some short falls in coverage and underutilization of existing capacity. Based on the 2011 Census, an assessment of the sanitation services was carried out and the resulting data are presented in the faecal flow diagram below.

Pondicherry Municipality has a mix of on-site sanitation facility coupled with sewerage system for collection of septage and waste water. The Faecal Flow Diagram (FFD) reveals that a meager 1.55 percent household in the city do not have access to adequate sanitation facilities like an individual toilet within their premises.
98.45 percent population do have access to individual household toilets. It further states that out of 98.45 percent, about 18.17 percent households are not connected to the sewerage network and therefore depend on on-site sanitation facility.
0.44 percent population use Community Toilet facility to defecate. If we include the community toilet data, a total of 18.61 percent of the household produce faecal sludge, which is not connected with the underground drainage network (UGD) and it is being disposed in open environment without any treatment. Remaining 81.39 percent of the households are presently connected to the UGD network and the entire quantity of setage generated is treated through centralized Sewage Treatment Plant(STP).





1.2. Need for City FSSM Policy

Looking at the current baseline, it is important that departments responsible for managing the portfolio of public health, may undertake necessary precautionary measures, so that PM's citizen are not adversely affected. Bearing this in mind, PM's earnest effort has been to contain the ill effect of the disposal offaecal matter directly into the environment. There is need to take necessary steps and it is with this view this that the FSSM policy is being conceived and prepared.

Currently there are 5 STPs in PM area, which are under operation. These STPs aggregate to a total of 51.5MLD installed capacities for the entire city of which 37.5MLD is its current operating capacity. As per Census 2011, 96.04 percent of the total households in PM area are using IHHT and CT. With the implementation Swachh Bharat Mission programme, the percentage of users has increased are more IHHTs are sanctioned to the householders, who earlier did not have access to such a facility. Thus, while the containment of human waste will be largely achieved under SBM.

While the design standards and guidelines for construction of toilets, septic tanks have already been given and published by the Bureau of Indian Standards (BIS), attention interms of treatment of septage requires to be addressed in the current scenario. The National FSSM Policy, 2016 provides a frame work to managing faecal sludge across the sanitation value chain by cities. The CPHEEO also has provided guidance notes for treatment of septage and faecal sludge with its Sewerage Manual of 2013. The last four years of SBM implementation too has provided impetus towards creating awareness, building capacities of the officials and developing infrastructure to achieve ODF. Given this overall enabling environment and quantum of households' dependent on septic tanks, PM proposes a holistic approach for faecal sludge management as a way forward.

This policy document outlines the measures Puducherry envisages towards preparedness to handle the sanitation value chain, beyond treatment methods. PM mean while has also been preparing itself by conducted training programmes, capacity building workshops, monitoring and evaluation plan, financial planning to support the roll out of its policy.

1.3. Key areas of improvement to be addressed while formulating policy for FSSM

While onsite sanitation is prevalent in the city, there are major gaps in its implementation across the sanitation service chain. The gaps and consequences on lack of access to toilets are well reported, but the issues pertaining to septage collection, conveyance and treatment remain largely unknown and unaddressed. A part from a series of technical challenges associated with faecal sludge emptying, haulage and treatment, inadequate organizational and regulatory synergies are some areas that also need attention as Puducherry moves forward in managing this service. There is urgent need to take appropriate measures to address these issues so that successful implementation is carried out and the goal is achieved. A summary of issues that requires to be addressed also provides the city an opportunity to reform and improve overall services delivery system, are:

- Reaching the unserved and poor
- Improving demand responsiveness
- Scope for integrated city-wide approach
- Strong legal and regulatory frame work
- Improvements to city financial capacity
- Increasing awareness of all stakeholders
- Potential for of concerted action between stakeholders
- Technology choices

2. Objectives and Commitments of FSSM Policy

2.1. Vision

The vision articulated by Pondicherry Municipality is as follows, "All the inhabitants falling under the PM area will live in a city that is free from health hazards, environment pollution and shall be adopting the best practices in sanitation". It provides for a targeted attention desirous for improved onsite sanitation services together with faecal sludge and septage management for benefitting the whole city with focus on the urban poor.

2.2. Objectives

Puducherry city through this FSSM Policy articulates and set priorities, commitments and direction for city-wide implementation of FSSM services in all the areas of PM, such that safe and sustainable sanitation becomes a reality for all households. More specifically, the Policy will:

a) Main stream FSSM in the city by the year 2021. Ensure that all benefits of wide access to safe sanitation accrue to all citizens across the sanitation value chain with containment, extraction, transportation, treatment, and disposal/re-use of all faecal sludge, septage and other liquid waste and their by-products and end-products.

b) Suggest and identify ways and means, including the methods and resources, towards creation of an enabling environment for realizing safe and sustainable FSSM in the City.

c) Define the roles and responsibilities of various government entities and agencies, and of other key stakeholders such as the private sector, civil society organizations and citizens for effective implementation of FSSM services throughout the country.

d) Enable and support synergies among relevant Central Government / State Government programs such as SBM, AMRUT and the Smart Cities Mission to realize safe and sustainable sanitation for all at the earliest, possibly by2021.

e) While not compromising on the eventual compliance to the strict environmental discharge standards already set, it shall be recognizing the constraints in achieving these standards, it will help in adopting an appropriate, affordable and incremental approach towards achieving these standards.

f) Mitigate gender-based sanitation insecurity directly related to FSSM, reducing the experience of health burdens, structural violence, and promote involvement of both genders in the planning and design of the sanitation infrastructure.

2.3. Scope

This policy shall apply to all the areas within PM, whether public or private, residential, commercial, institutional, industrial, proposed/planned or existing.

3. Policy outline and Commitments

PM intends to foster FSSM, among others, as a means to supporting the achievement of universal and safe environmental sanitation leading upto out comes on public health and environment. The policy statements not necessarily in any particular order translating the intent to action are as follows:

a) PM believes in addressing and achieving public health and environmental safety goals through city wide; integrated and life cycle based planning in tandem with complementing sanitation services like sewerage systems, solid waste management, etc. A step by step planning will serve as a basis for all decisions.

b) PM believes cost-effectiveness and equity (including gender issues) will be two cornerstone principles that will be used while fostering FSSM.

c) PM understands resource management and loop closure as one of the basic pillars of sustainable development and the nexus between different sectors is recognized. In accordance, PM will establish formal institutional and programmatic linkages with other state departments / agencies whose could be beneficiaries of some of the products and processes, emerging out of this policy, from time to time.

d) PM will formulate and legalize all rules and regulations required to foster; operationalize the policy as a first step to indicate its intent to providing primacy for operationalizing this policy.

e) PM will formulate clear roles and responsibilities of various actors in the FSSM eco system and strive to formalize them institutionally as personnel/ service provider/ citizen roles using existing tools and instruments.

f) PM intends to continually build institutional capacities and of all personnel involved in identifying solutions and implementation of projects and activities, both within and outside formal delivery process.

g) PMwillorcausetokickstartactionsacrossallstepsofthevaluechaininequalmeasurele ading to envisaged outputs and outcomes. Where, integration to other schemes / programs is envisioned, the needs of this policy would be considered in equal standing to other schemes / programs.

h) PM assures to create an accurate database to support its evidence-based decision-making at every stage, from planning to service provision and user satisfaction.

i) PM believes a community driven process could provide equal results to conventional processes and use the tenets of the policy to further ward level approaches currently piloted under SBM in Puducherry. PM also commits to translate increased citizen awareness into quantifiable demand to support the processes at every stage value chain.

j) PM desires achievement of SDG 2030 goals as a key milestone and institutionalize processes for continued implementation and management of FSSM sector. A critical aspect considered will be renewed emphasis on monitoring and learning to advice time to time the implementation actions.

k) PM believes in the importance of piloting project (s) and R & D to ensure that best learning's are available for decision-making. These iterative processes on various subjects will be used to achieve the envisioned goals.

l) PM intends to use best of the range technologies at every stage of project management. Primacy will be provided to occupational health & safety at all stages involving human involvement with wastes. Mechanization and automation are approaches to be used for service providers,both internal and external and at the generation and treatmentend.

m) PM intends to follow applicable standards and norms the available from time to time. Where such aspects are not available, PM will strive to follow best value for money approaches and principles. In the context of constructing treatment facilities, the focus will be on achieving treatment compliances against national public health & environmental safety standards / norms, prior to working on recycling & reuse.

n) Given that PM mandate to deliver sustainable sanitation services encompasses more than one sector, and multiple projects / programs are underway, it will undertake strategic annual review of the progress of the sector and address inter-linkages on a priority basis. When needed, PM can choose to update the policy in the light of the benefits derived from the program and any changes to external activities.

o) PM will and through its awareness creation under SBM linked IEC activities, aim to create an aware and responsive citizenry. The idea is to ensure citizens are at the centre of the overall planning processes, whose needs specific to FSSM are captured and service satisfaction levels are always considered as performance markers.

p) PM commits to ensure financial sustainability while implementing all activities under this policy. Efforts will be made to ensure financial resources for creation of physical infrastructure, institution building, capacity building, improved institutional processes to advance FSSM on par with other infrastructure.

q) PM intends to foster and formally apply best services management talent from the public and private sector in an appropriate measure, from time to time, best serving to achieve the goals.This intent is to create an enabling environment for the private sector and could include formalization of processes hitherto provided for in an unorganized manner.

r) PM commits to address last mile connectivity, obviate any barriers to access and include all disadvantaged population into the overall system by way of graded financial subsidies and other financial modes at every stage, as apre-condition.

s) PM believes in the use of state of the art IT and mobile applications to manage all activities related to FSSM, from point of generation until its safe disposal with support of continual monitoring, including reporting of outputs and outcomes.

t) PM will seek institutional support from time to time from established and recognised knowledge platforms and use available support from different projects / programs, to further FSSM sector.

4. Step by Step Approach: Operationalizing FSSM

Bench marking the service performance across the sanitation value chain through a city level assessment is the first step in the planning process. It is an important exercise, which provides an initial sense of the state of FSSM facility in the city. It helps in understanding the context and identifying the gaps in key services.

Detailed assessment of the services will need to be carried out across each link in the chain through appropriate field assessments. As policies and regulations already exist ensuring user interface and toilet access, the policy and ensuing operational guidelines focuses on the last four stages of the value chain, i.e. collection & / containment; emptying and conveyance; treatment; reuse and disposal. A snapshot of the aspects covered under critical stages are as follows:

4.1. Collect & /Containment

The first step in this regard is that PM will undertake necessary steps to create a database of all the onsite sanitation facilities that are currently being used in the city. Although current standards provide for comprehensive guidelines regarding construction of septic tank, it is important to understand compliance levels to take corrective measures to support the overall processes in the subsequent steps of the value chain. It is with this view that PM will undertake survey of containment system or on-site sanitation system to understand adequacy and address through a robust action plan. It will further strengthen the permitting and inspection process of the septic tank as a vital requirement in the

building plan approval for sanctioning of new houses construction. Group housing will be dealt with provisions of having proper onsite sanitation facility within the said complex. In either case, care will be taken to support future migration to sewerage connections when networks are made available.

4.2. Emptying and Conveyance

Conveyance describes the movement of sludge from individual septic tanks to treatment facilities, municipal or regional. Currently, these services are largely unregulated across the city of Pondicherry Municipality. Immediate steps include measured regulation of operators through a system of licensing directed towards enforcement of health and safety standards for prevention of open dumping; and secondly planning for a system of emptying every containment facility with a pre-defined or demanded frequency (typically once every two to three years subject to use levels of households / public accommodations / community or public toilets, and the like). This containment emptying will be contingent on having completed a survey of individual containment facilities to take a fair judgement on the process of emptying.

4.3. Treatment

The focus of treatment will primarily be on reaching public health and environmentally safe levels in the first stage and further subject to end use opportunities, suitable reuse treatment mechanisms will be devised. For treatment PWD will assess the load of septage and assess the requirement of capacity for treatment plant, either exclusively for septage treatment or co-treatment with wastewater or solid waste.

4.4. Reuse and Disposal

Reuse/disposal refers to the methods in which products are ultimately returned to the environment, either as useful resources or reduced-risk materials. The treated septage can be used as a soil enricher or as filling material at construction sites. ULB should carry out primary assessment for availability of market and demand for reuse. It is understood that the State FSSM policy recommends co-locating of pure septage associated infrastructure, i.e. building faecal sludge treatment plants next to either sewage treatment plants or solid waste management plants, to gain advantage from synergies in operation and maintenance (effluent from FSTP can go to STP, or output of FSTP can be co-composted with solid waste, etc.).The understanding is that productive value generation from a resource management and financial sustainability perspective will be the last step of the process and dealt with on a case by case basis, at this stage.

5. Legislative and Regulatory Contexts

5.1. Central laws and Rules

The legal context for FSSM includes environment laws, municipal building byelaws, legal rehabilitation of “manual scavenging” and institutional laws that provide for the

establishment, powers and functions of local authorities. The first category includes the Environment (Protection) Act, 1986; the Municipal Law, and the Water (Prevention and Control of Pollution) Act, 1974 which provides a framework for control of effluent, sewage and septage discharge. Further, the Solid Waste Management (SWM) Rules, 2016 under the Environment (Protection) Act apply for the final and safe disposal of post-processed residual faecal sludge and septage to prevent contamination of ground water, surface water and ambient air. Further, the SWM Rules 2016 will also applies on the disposal and treatment of faecal sludge and septage, before or after processing, at landfills and if used for use as compost. The provisions of the National Building Code of India published by the Bureau of Indian Standards (BIS) as applicable for Septic tanks soak pits, cess pools, leach pits, drainage fields etc. also need to be examined.

The Employment of Manual Scavengers and Construction of Dry Latrines (Prohibition) Act, 1993 has put a ban on the use of dry latrines, i.e., latrines with no water-seal or flushing mechanism, and the stops employment of persons for manually carrying human excreta which is referred as night soil. This was supplemented in 2013 with the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 by which "hazardous cleaning" in relation to sewers and septic tanks was also banned. The law now provides that manual cleaning of sewers and septic tanks, if necessary, may be carried out only in highly controlled situations, with adequate safety precautions, and in accordance with specific rules and protocols framed for the purpose.

It is a fundamental premise that all efforts planned for will be within the ambit of the existing rules and regulations, legally bound principally or otherwise. Safety norms as provided in the Sewerage and Sewage Treatment Manual is decision-making criteria to ensure safeguards under the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013.

5.2. State Laws, Rules and Regulations

All the stakeholders involved in FSSM in the sanitation value chain should adhere to the requirements of this policy and the State Laws, rules and regulations enacted from time to time and or suitably adapted to Puducherry's requirements.

5.3. Formation of rules and regulation at PM level

PM will formulate rules and regulation in the form of septage bye-laws, guidelines for registration and operation of VTOs, DSOs, monitoring frame works of the overall process etc. within the boundaries of the policy. These will be complimented and supplemented with regulations from time to time with an intention further the FSSM sector requirements across the value chain. Site selection for sludge use and application by parties (like residential layouts) and PM would need a prior consent to operate from the competent authority (like State Pollution Control Board).

6. Roles and Responsibilities

PWD, PM and households are the key stakeholders in the overall process of FSSM. They perform different roles given the context and interfaces they are exposed to.

Level	Lead Roles	Supportive Roles
PM	• Design, develop, plan and implement ULB level FSSM strategy • Awareness and behaviour change campaign to engage diverse stakeholders • Develop training programmes for masons to build requisite skills for construction of quality septic tanks as per BIS / NBC norms • Set up systems to ensure financial sustainability in provisioning of FSSM services • Achieve the objectives of FSSM Policy in a time- bound manner • Funding through specific schemes and plans • Monitor and evaluate FSSM strategy and develop its implementation plan • Implement Municipal Byelaws and Septage Byelaws	• Create enabling environment for the NGOs and private sector to contribute to safe and sustainable FSSM
PWD	• Set up and ensure operation of systems for 100% safe and sustainable collection, transport, treatment and disposal of faecal sludge & septage • Develop expertise, in-house and outsourced, to provide safe and effective FSSM services • Design and implement plans to eliminate manual scavenging and rehabilitate the manual scavengers • Set up Septage discharging/unloading points at required locations	• Create enabling environment for the NGOs and private sector to contribute to safe and sustainable FSSM
Household / Community	• Timely and regular cleaning of septic tanks through approved entities • Regular maintenance and monitoring of septic tanks • Timely payment of user fee and/or charges, if any, towards FSSM services • Ensure Building Byelaws for construction of OSS are followed • Practice of Septage Bye laws as issued by the PM	• Engage with decision-makers at PM level to ensure that they receive good quality FSSM services

7. Implementation Strategy

Faecal Sludge and Septage Management (FSSM) for the local bodies includes both residential and non- residential/commercial waste (but not including industrial waste). Implementation guidelines are most important as it provides direction, with knowledge, procedure and facilities for the efficient management of FSSM practices. In particular, the City Sanitation Task Forces (CSTFs) shall take up active planning and advisory role in co-operation with the municipal councils in order to dedicate appropriate resources and attention to the challenges of faecal sludge management.

PM has planned to address the city and ward wide FSSM issues by looking at the sanitation value chain of FSSM practices in a manner that addresses the technical, financial, institutional, regulatory and social dimensions to the best possible manner to the benefit its inhabitants. It has a comprehensive plan for faecal sludge and septage management with outlined objectives at each step in the value chain. Idea of conceiving an exclusive Septage Management Cell (SMC) is being considered under the Department of Public Health, which will look at all the modalities of FSSM starting from the awareness generation to its capture and reuse. A Septage Management Committee is being proposed under this policy which will be convened by the Municipal Health Officer and Assistant Engineer (Sanitation) under the chairmanship of the Commissioner with representative from various line departments to monitor the city-wide implementation programme.

8. Timelines

The agreed timelines for operationalizing the policy is as follows:

A.	**CITIZENS**	
1	Launch of dedicated helpline in PM to include VTO requisition feature and FSSM- related complaints	Jan 2020
B.	**CONTAINMENT**	
1	Assess adequacy of on-site sanitation systems (OSS) – disseminate learning (PM/state/national/international)	Feb 2020
2	Preparation of action plan to address existing inadequacies if appropriate, & incorporation into FSSM plans	Dec 2019
3	Prepare and implement plan to strengthen permitting / inspection process	Jan 2020
C.	**EMPTYING & CONVEYANCE**	
1	Rapid assessment of emptying market (supply and demand)	Jan 2020

2	Prepare VTO licensing programme (including training & enforcement) to improve quality of services (part of C7)	Dec 2019
3	Launch licensing programme for VTOs (coordinate with C6 and D2)	Jan 2020
4	Monitor effectiveness of implementation of licensing program – disseminate learning (PM/state/national/international)	Jan 2020
5	Pilot FSSM mobile application to improve access to data – disseminate learning (PM/state/national/international)	Feb 2020
6	Prepare Emptying and Conveyance Business Plan (ECBP) to increase demand and affordability of services	Jan 2020
7	Launch ECBP (including training, BCC campaigns, contracts, etc.)	Feb 2020
8	Monitor effectiveness of implementation of ECBP – disseminate learning (PM/state/national/international)	Mar 2020
D.	**DISPOSAL, TREATMENT AND REUSE**	
1	1st Phase of Disposal Sites (DS) – Assess feasibility of existing DS & upgrade	Dec 2019
2	Monitoring plan; train DSOs and VTOs (coordinate with C3)	Jan 2020
3	Assessment Reuse Market: assess production of and demand for treated FSS – disseminate learning	Mar 2020
E.	**CITY & WARD FSSM PLANS**	
1	Launch City FSSM Plan	Jan 2020
2	Disseminate learning on implementation of FSSM Plan within PM	Feb 2020

9. Expected Outcomes

As this Policy is implemented across the city, it is expected to yield significant benefits in terms of improved public health indicators and service level benchmarks, reduced pollution of water bodies and ground water, and resource recovery leading to reuse of treated waste and other end products. Envisaged outcomes are;

- Safe containment, collection and conveyance of 100 percent human waste to treatment and disposal sites.
- Cost effective solutions for management of human waste through integrated network sewerage and faecal sludge septage management.
- Clarity among different stakeholders on identifying and implementing best and economically viable sanitation solutions.
- Improvement in technical capability among ULB staff to effectively implement city FSSM.
- Scheduled emptying of septic tanks or other containment systems at an interval of 3 years as recommended by CPHEEO Sewerage and Sewage Treatment Manual and the MoUD Advisory on Septage Management (2013).
- Safe disposal of all collected faecal sludge and septage at designated sites. (Sewage Treatment Plants, Faecal sludge Treatment Facilities for safe and scientific disposal, etc.)
- Continuous improvements in efficiency and effectiveness in the entire FSSM chain: containment, collection, conveyance, treatment and disposal.
- Contamination of water bodies and groundwater from human waste (Faecal matter) reduced to zero levels in all the towns and cities.
- Nuisance from faecal sludge reduced to minimum levels, resulting in nuisance-free living space in the city.
- Maximumreuseoftreatedsludgeasfertilizerinfarmlands,parks,gardensandothersuchvenues, reuse of treated sewage, as source of energy where feasible, and any other productive uses.
- Drastic reduction in incidences of diseases due to safe and sustainable FSSM services.

10. Policy Evaluation

This Policy shall come into force from the date of issue of this resolution. Policy may be reviewed a sand when required for assessing its effectiveness and making changes if necessary.

11. Power of PM

Not with standing anything contained in the foregoing paragraphs of the Pondicherry Municipality Faecal Sludge & Septage Management Policy and Operational Guidelines, 2019 the ULB by issuance of notification in the official gazette may amend or withdraw any of the provisions and / or the schemes mentioned hereinabove.

Interpretation – Should any doubt arise as to the interpretation of any of the provisions of these Rules, the matter shall be referred to the Pondicherry Municipality (PM),whose decision thereon shall be final.

FSSM ACTION PLAN

Part B: Guidance Notes to support policy rollout

- Planning Stage

1. Snapshot of Sanitation Services in Puducherry

As Puducherry is yet to be well connected with the UGD Network, the sewage treatment plants in the city are not running with full capacity. PM's effort in providing access to the onsite sanitation to its citizens by constructing household toilets and up-grading the existing PT & CT facilities under SBM-U has resulted in making Pondicherry Municipality Open Defecation Free (ODF). It has increased the toilet coverage significantly in the city, which will be subsequently visible in the results on the census data survey to be undertaken by the Government of India. As per 2011 census, there are 60638 households in PM limit, out of which 49618 households were covered with underground Sewerage System(81.83%) and 10080 households are having Septic Tank connections (16.62%) and the remaining 940 households are using Community Toilets (1.55%). A graphical representation of the status on urban sanitation, septic tanks, wastewater management in Pondicherry Municipality is shown in Figures 1, 2, 3 and Table 1 below.

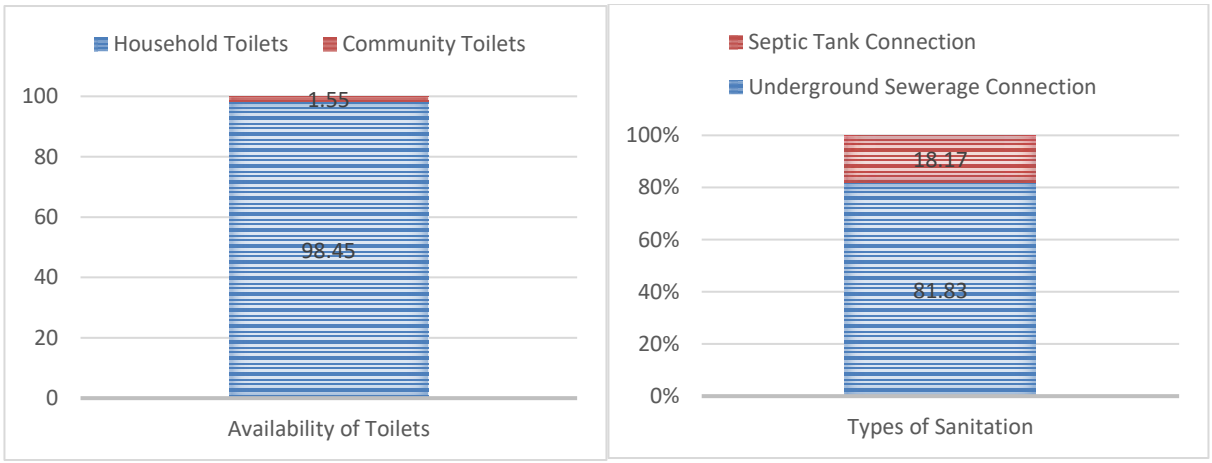


Figure 1: Picture Status of Urban Sanitation in Pondicherry Municipality (Source, Census 2011)

Legend	Status	Ward Number
	UGD in operation	1 to 38
	Septic Tank Connection	38,39,40,41,42

Figure 2: Sanitation Blocks in Pondicherry Municipality

Figure 3: Showing Septic Tank Coverage at the Ward Level

2. Planning Stage steps

2.1 Standards and Norms

From time to time, standards and norms are available as different solutions are tested, understood and legalized. When new containment facilities need to be constructed, they should be in conformation with design norms outlined in National Building Code, 2005 and CPHEEO Manual, 2013, IS: 2470 Code of practice for installation of septic tanks - Part 1: Design and Construction and Part 2: Secondary treatment and disposal of septic tank effluent 1985 (Reaffirmed1996).

2.2 Outsourcing Emptying Services

A rapid assessment of emptying and conveyance market will be undertaken to figure out the demand and supply for desludging. Possibility of Public Private Partnership (PPP) venture shall be looked into for carrying out the emptying activities after the finalization of disposal sites with the help of private Vacuum Truck Operators (VTOs). It is therefore essential that PM puts in place a proper monitoring and evaluation mechanism for such contract and provide necessary support for training the operators using standard operating procedures (SOPs) and health and safety (H&S) guidelines. Option of providing individual license could also be worked out through guidelines in respect of regularization and registration. To make this service more affordable, an emptying and conveyance business plan will be prepared for the VTOs or the private contractors, doing a SWOT analysis and after looking at the CAPEX and OPEX involved in the cleaning process.

2.3 Awareness creation and Behaviour Change Communication

It is essential that the households clean their septic tank in a cycle of every 3 years and accordingly a Behaviour and Communication Change (BCC) campaign will be conducted by consumer profiling for segmented targeting. Proper marketing mix will be adopted to scale up and to make it a profitable business which will be appealing for the private sector to invest in this segment. Wherever possible, awareness generation activities should be led by City Sanitation Task Force, orasub-committee including members of CSTFs and other interested parties.

a) Awareness generation for residents: Members of Resident Welfare Associations, community organizers, self-help groups and the public should be sensitized periodically on the need for periodic emptying of septic tanks. The health hazards associated with improper collection and treatment of waste, and the ill-effects of sewage discharge into fresh water/storm water drains should be explained to the residents. Where scheduled services is proposed, community should be introduced to the processes at the start and repeated after every second year.

2.4 Grievance Redressal

The service level benchmark suggested by CPHEEO which is also applicable to the new sanitation benchmark should at least be 80% to consider it as a success. It is therefore important that FSM related complaints raised by the citizens are addressed in a timely manner by suitable technological interventions like a separate APP, which is inclusive for the entire population especially focusing at the urban poor.

2.5 Planning and Scheduling Emptying of Septic Tanks

PM shall take the following steps for emptying and conveyance.

a) Determine households using on-site containment systems and ascertain sludge contained and to be emptied every year (presuming a 3-year emptying cycle period for individual households and more accelerated cycles for public and commercial facilities).
b) Determine price per emptying (and accounting for how it may differ based on volume and containment facility location) that operators could charge.
c) Estimate trucks required for emptying and design a database for maintaining a register for containment facilities that are emptied.
d) Create a registration system for private truck operators which permit legally emptying of septic tanks within the ULB jurisdiction. Samples for permits and receipts required for this proposed system are included in Annexures 3, 4, and 5. Pursuant to this, PM will establish a system for penalizing trucks that operate without valid permits/licenses.
e) PM will also mobilize additional vehicles, where needed public or private means, to support an agreed emptying system.

2.6 Emptying Process

PM shall take the following steps to facilitate smooth emptying processes:

a) The septic tanks should not be fully emptied; small amount of sludge of around 1 to 2 inches should be left in the septic tank to facilitate decomposing of incoming faecal waste.
b) No fire or flame should be used near the septic tanks as there may be inflammable gases inside septic tanks.
c) Proper safety gear (including uniform, tools, and well-maintained vehicles) or personal protective equipment (PPE) as per specification mentioned in Annexure 7 must be used by the operator while desludging /emptying the septic tanks/pits. The rules under the Prohibition of Employment as Manual Scavengers and their Rehabilitation Act, 2013 provide for a comprehensive list of safety gear that should be used while providing these services.
d) Operators should clean their surroundings before leaving and after desludging; residents should not find their homes or surroundings dirtier after the desludging activity is carried out around their area.

2.7 Treatment Process

PM shall take the following steps while planning and setting up treatment processes:

a) Operators shall be for bidden by regulation to dispose sludge collected from the septic tanks or pits into fields, rivers, open drains, forests, outer limits of the cities or barren land etc. These regulations shall be enforced and violations subject to financial and / or legal penalties.
b) PM will assess the possibilities of sludge treatment at the existing STPs in the city which are maintained by PWD (Part B, section for details of STPs).
c) Input quality of the collected septage should be tested at the treatment facility for checking presence of any metal or traces of industrial waste.
d) Septage should be reused/disposed of only after it meets the parameters in Annexure6.

2.8 PPP Engagement

The process of enumeration of Vacuum tank operators who are rendering service in PM limit is in progress. To leverage the private sector capability in providing on time services the current policy enables consultation and association with operators'. PM will monitor the activities of the VTO with the help of septage bye-laws and will provide training to the operators from time to time. PM will further look into the occupational health and safety requirements of the VTOs by as a welfare measure not only for the person involved in desludging process but also for their family.

The private sector operator will be engaged with PM under a licensing procedure to carryout necessary work on septagede sludging. Option of providing individual license could also be worked out through guidelines, for regularization and registration. To make this service more affordable, an emptying and conveyance business plan will be prepared for the VTOs or the private contractors.

PM will also support framing contracts identifying performance level and further to encourage in carrying out ethical practices in sludge disposal. Suitable incentives will be added for the private sector operators.

For effective operationalize of scheduled septic tank emptying service and treatment facilities, PM shall also explore the option of private sector participation. The following points should be taken into consideration by the ULB:

- Explore private sector participation for various activities like procurement, operations and maintenance of the suction emptier trucks, construction and operations of septage treatment facility and possible re-users of treated septage within the city as well as in near by cities.
- Develop performance based contracts such that payment is linked to the performance of private sector for providing the services.

2.9 Record Keeping, Monitoring, Evaluation and Reporting

Record keeping, monitoring and reporting are an integral part of any infrastructure system. Record keeping requirements will be codified to ensure transparent activities between different partners in the ecosystem – PM, PWD, households, operators. A sample manifest form is detailed out in Annexure 5.

a) The completed document or documents with signatures of the household /property, suction truck operator, and treatment plant operator (PWD) should be submitted to the local government for their records. These documents would validate that the sludge collected from households is disposed of at proper treatment facilities.
b) A database system such as the one discussed in access and collection will need to be developed and maintained.
c) Where possible, GIS should be used to be plan the route of suction emptier trucks and track emptying trucks for regular record keeping.
d) Consumer grievance redressal system for faecal sludge management should also be set up as a part of urban local body record keeping systems and helpline numbers to be shared with residents as a part of monitoring and record keeping systems for faecal sludge management.

2.10 Service Level Benchmarks

The service level bench marks suggested by CPHEEO is also applicable to the new sanitation benchmark should be at least 80% to consider it a success. It is therefore important that FSM related complaints raised by the citizens are addressed in a timely manner by suitable technological interventions like a separate APP, which is inclusive for the entire population, especially focussing at the urban poor.

At the ULB level, the PM is adopting Sanitation Benchmark framework of revised service level benchmarks for sanitation that assess performance of city wide sanitation, capturing on-site sanitation systems and sewage management. Sanitation Benchmark framework for revised Service Level Benchmarks for Sanitation is as under:

Current SLB indicators (Sewerage System)	**Proposed Sanitation Benchmark (Sewerage +Onsite systems)**
1. Coverage of sewerage network services	**1. Coverage of adequate sanitation system**
Total number of properties with individual connections to sewerage network as a percentage of total number of properties in the city.	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.

Current SLB indicators (Sewerage System)	Proposed Sanitation Benchmark (Sewerage + Onsite systems)
2. Collection efficiency of sewerage network	**2. Collection efficiency of sanitation system**
Quantum of sewage collected at the intake of the treatment plant to the quantity of sewage generated (as per CPHEEO, 80% of water consumed is generated as sewage).	Weighted average of collection efficiency of each sanitation system, weighted by share of households' dependent on each sanitation system.
3. Adequacy of sewage treatment capacity	**3. Adequacy of treatment capacity of Sanitation System**
Adequacy is expressed as secondary treatment capacity available as a percentage of normative wastewater generation.	Weighted average of adequacy of treatment plant capacity available for each sanitation system, weighted by share of household's dependent on each sanitation system.
4. Quality of sewage treatment	**4. Quality of treatment of sanitation system**
Quality of treatment is measured as a percentage of WW samples that pass the specified secondary treatment standards, that is, treated water samples from the outlet of STPs are equal to or better than the standards laid down by the GoI agencies for secondary treatment of sewage.	Weighted average of quality of treatment of each sanitation system, weighted by share of household's dependent on each sanitation system.
5. Extent of reuse and recycling of sewage	**5. Extent of reuse and recycling in sanitation system**
Quantity of sewage that is recycled or reused after secondary treatment as a percentage of quantity of sewage received at the treatment plant.	Weighted average of extent of reuse of treated wastewater and sludge after adequate treatment as a percentage of sewage and sludge received at the treatment plant, weighted by share of household dependent on each sanitation system.

PM will develop a database, registry of certified on-site sanitation system, robust reporting format to track compliance of households (establishments, etc.) with outcomes and process standards. These sanitation benchmark will further be linked to the Service Level Improvement Plan (SLIP) to address the gaps and create new investment projects.

All these activities will be performed by the Septage Management Cell (SMC) under the direct supervision of the head Health Section prior to approvals from Commissioner. As per City FSSM plan, a database will be developed by the city for all such properties having a septic tank under different property categories, i.e. residential, commercial, industrial, institutional etc. and shall be monitored daily by PM in such a way that necessary cleaning

is carried out every 3 years. A Management Information System (MIS) will be developed accordingly to monitor the progress.

2.11 Community Engagement and Stakeholder Involvement

FSSM practice is designed keeping community at the centre is incomplete without their active participation in conceptualizing projects and subsequent involvement at development and implementation stage through Participatory Learning Action (PLA) and Participatory Urban Appraisal (PUA) process for an inclusive growth which creates employment opportunity and helps in reducing poverty.

It is therefore important that all the stakeholders are involved in an integrated coordinated approach for a successful implementation FSSM programme. PM will take necessary steps by involving community, Self Help Groups (SHGs), NGOs and PWD in implementing the sanitation program.

It is essential that the households clean their septic tank every three years, and for achieving this a Behaviour and Communication Change (BCC) campaign will be conducted and further adopting segmentation, targeting and positioning will be carried out as per the consumer behaviour. Proper marketing mix will be adopted to scale up and to make it a profitable business, which will be appealing for the private sector to invest in this segment.

2.12 Actions by Community

Citizen having onsite sanitation should also be considered for following the option to push the business opportunity and thereby helping them draw benefit from such a scheme;

a) All the individual households of the RWAs shall treat their sludge in a decentralized manner wherever the system is not connected through sewer and will get a property tax rebate of 10%.
b) All the new apartments which will be constructed and are do not access to sewer lines will be required to design their own sludge management system and will use the recycled water in their premises. In doing so they will get a rebate of 10% towards Property Tax or Rs. 10,000/- (Ten Thousand) whichever is less.
c) All the new malls, big hotels, industries, clubs, colleges, universities, hospital, sports stadium etc. which will be constructed and not having access to a sewer line will have to design their own sludge management system and will use the recycled water within their premises.

2.13 Actions by PM

Rules, Regulations and Operational guidelines for Faecal Sludge and Septage Management should address the following:

a) Delineation of private (Individual houses, Group Housing, Institutions etc.) and public responsibilities (Urban Local Bodies and local authorities) in relation to faecal sludge and septage management.

b) Detail of the planning and implementation process for carrying out safe and sustainable management of all faecal sludge and septage. This may be integrated with over all city land use planning, within a time-based plan of holistically addressing waste water management via onsite, decentralized and centralized systems.
c) Design of septic tank, pits etc. (adopted as per local condition) including siting and method of approval of building plan or retrofitting existing installations to comply with the rules.
d) Special provisions for medium and large format real estate developments.
e) Periodicity of desludging and O & M of installations and the responsibilities of the households (owner/occupant)
f) Operating procedure for desludging including Occupational H & S procedures.
g) Licensing, record keeping, monitoring and reporting arrangements for faecal sludge and septage service providers.
h) Methods and location of transport (conveyance), treatment and safe disposal.
i) Tariff or cess/tax etc. for septage management in the city.
j) Penalty clauses for untreated discharge for households as well as desludging agents.
k) Regular monitoring and evaluation of the entire process of FSSM.
l) Training, accreditation, education and awareness programs under FSSM.

FSSM ACTION PLAN

Guidance Notes to Support Policy Roll Out – O&M Stage

OPERATIONAL GUIDELINES FOR SEPTAGE MANAGEMENT

These operational guidelines are framed by PM drawing from the provisions and specifications related to septage management of the National Building Code, 2005, revised CPHEEO Manual on Sewage and Sewerage Treatment 2012, Advisory Note on Septage Management in Urban India, 2013 and National FSSM Policy2017.

The objective of these guidelines is to promote a comprehensive and integrated approach to septage management covering collection, storage, desludging, transportation, treatment, disposal and reuse and ensure compliance with various national level guidelines and regulations.

The guidelines cover the following key elements of septage management.

a) Design and construction of septic tanks
b) Conversion of insanitary latrines into sanitary latrines
c) Septic tank pumping and de-sludging
d) Septage transportation
e) Treatment, disposal and reuse of septage
f) Information, education and communication
g) Training programs
h) Record keeping and reporting(MIS)
i) Help line for septage management

The operational guidelines for each of these key elements are as follows.

1. Design and construction of Septic Tanks

The household are encouraged to adopt the improved version of the designs of septic tanks as prescribed by the NBC and IS Code 2470 and CPHEEO manual. PM shall adopt regulations on septic tank designs and construction methods as part of building plan regulations.

The town planning department of the Municipal Corporation shall ensure that the septic tank designs conform to the guidelines at the time of approval of building plan. The town planning department and/or sanitation department shall inspect the septic tanks during their construction to ensure that there are no deviations from the approved design. The existing guidelines for septic tanks and suggested designs need to be adopted by the households are provided under Annexure1.

2. Conversion of Insanitary Latrines into Sanitary Latrines

The Public Health Department of the Corporation shall undertake a survey to identify the insanitary latrines and improperly constructed septic tanks. All households with insanitary latrines shall be given notices to convert them into septic tanks and twin pits as per the provisions of the Manual Scavenging Act 2013 and Septage Bye-laws of PM. Households with improper septic tanks shall be educated to retrofit them as per

the approved designs. For slums and informal settlements twin pits may be permitted as per guidelines laid down in Annexure 2.

3. Pumping and Desludging

The households, institutions, commercial entities etc., shall undertake desludging of the septic tanks and pits once in every three years or when they get filled-up whichever is earlier as per the NBC code and CPHEEO guidelines. The operators shall obtain licenses for collection and transportation operations as per the formats provided in Annexure 3 and 4 of these guidelines. The households are required to engage the licensed operators for collection and transportation to desludge the septic tanks and pay the user charges as per the markets rates or rate / taxes prescribed by the PM. The PM reserves the right to regulate and fix the user charges in case the market rates are observed to be high and unaffordable to households.

The licensed operators shall have trained workers equipped with uniforms, safetygear, tools and vacuum trucks as defined in the Manual Scavenging Act 2013. The operator, drivers and workers shall have adequate training in septage desludging and transportation. The licensed operators are required to adopt approved standards and procedures for pumping and desludging. Desludging workers shall wear appropriate personal protective equipment, including rubber gloves, rubber boots, a face mask, and eye protection. The operator shall ensure the availability of protective gear for workers and materials for cleaning on a daily basis. After desludging, workers should follow proper hygiene practices such as washing hands with soap. The workers should avoid entering into septic tank and it should be done in exceptional cases with proper care and use of safety equipment. After each desludging operation, the area shall be properly cleaned and disinfected with relevant cleaning agents such as bleaching powder and lime.

4. Septage Transportation

Service providers shall deploy septage vehicles as per the scheduled of emptying of the household for the purpose of desludging. The septage vehicles shall be fitted with Global Position System (GPS) and the details of GPS shall be shared with PM for monitoring purpose.

The driver and service providers shall be responsible for safe operation of the vehicle and equipment at all times and only drivers and workers with adequate training shall be deployed. Transportation shall be undertaken on pre-designed routes avoiding busy roads and peak traffic. In the event of accidental spillage of sludge/septage, the operator shall immediately initiate action to contain the sludge/septage, minimize the environmental impact, and begin the clean-up procedures. The operator shall notify the concerned officials about the spillage and the nature of remedial action within 24 hours. Penalties may be imposed on the operators who shall not comply with the guidelines.

5. Septage Treatment, Disposal and Reuse

The PM shall facilitate construction and operation of a septage disposal sites in the existing sewage treatment plant. PM may adopt appropriate financing model including Public Private Partnership (PPP) for construction and O & M of faecal sludge / septage treatment plant and shall levy user charges as appropriate for meeting capital and O & M expenditure.

The operator of the sewage treatment plant in case of co-treatment and the septage treatment plant shall implement a comprehensive environmental management plan to ensure compliance with environmental and social standards. The septage treatment plant shall adopt appropriate technology for treating septage and the disposed sludge and waste water after treatment shall strictly comply with the norms as per the relevant legislations.

It is the responsibility of the operator of the treatment plant to ensure the compliance with treatment and discharge norms as per APSPCB guidelines. The reuse of treated waste shall be permitted as per the standards and norms. It shall be mandatory for all licensed operators for collection and transportation of septage to dispose the septage only at the plant or any such place as designated by PM. The de-sludging service providers are prohibited to dispose the septage at any other location and would attract penalties for the same. PM will notify penalty structure as framed in the septage bye-law and may revise the same from time to time.

The guidelines in this section 5 shall become effective only after identification and construction of disposal sites. The PM reserves the right to suggest the septage disposal locations and the operators of collection and transportation shall comply with the same.

6. Information, Education and Communication(IEC)

The PM shall develop appropriate IEC materials and undertake IEC campaigns through print and electronic media, outdoor medium and consultations and workshops targeting the residents to promote adoption of proper toilet designs, construction methods, periodic desludging and safe sanitation practices.

The builders, masons and suppliers of the septic tanks and pits shall be exposed to better designs and better methods of construction. The operators of collection and transportation shall be provided information on standard operating procedures. Non-government Organization (NGOs), Community Based Organizations (CBOs), women's groups and school children shall be extensively involved in undertaking IEC campaigns. Operators and other involved parties shall also develop IEC material and educate communities on safe management of septage.

7. Training Programs

PM shall support capacity building of various stakeholders including its own staff through appropriate institutions of repute namely Pondicherry University, NSKFDC, RCUES etc. PM shall engage these agencies to undertake training needs assessment, design training modules and deliver the training programs.

8. Record Keeping and MIS

PM shall create a computerized MIS platform for monitoring and evaluation (M&E) for baseline data and progress on implementation of septage management guidelines through a separate cell formed under the health department as Septage Management Cell. PM shall maintain data base and information related to septage generation from households and commercial establishments, insanitary latrines, location of septic tanks, details of operators responsible for collection of desludge and details of septage treatment plant. PM shall ensure that the operators of collection and transportation and treatment of septage maintain detailed records of their operations as listed at Annexure5.

9. Help line for Septage Management

PM shall establish a dedicated help line with trained staff for providing support to residents on all aspects of septage management including septic tank designs, approval process, methods of construction, information on masons, and periodicity of desludging, contact details of operators and soon.

FSSM POLICY AND ACTION PLAN

Part C: Annexures

ANNEXURE 1: SEPTIC TANK SPECIFICATIONS, GUIDELINES, AND DESIGNS

Depending on the geography, soil condition, water seepage capacity of the soil the design can be prepared and approved by the Local Bodies. Proper septic tank design considers the following factors:

- Sized properly with appropriate sludge detention time, volume and hydraulic retention time
- Proper inlet and outlet structures
- At least one baffle separating the tank into multiple compartments
- Watertight
- Access port for each compartment that allows for inspection and pumping

Table 1: Recommended Sizes of Septic Tanks as per Number of Users (Number of Users Length (M) Breadth (M) Liquid Depth for a Cleaning Interval)

Number of Users	Length (M)	Breadth (M)	Liquid Depth for Cleaning Interval of 3 Years
5	1.5	0.75	1.05
10	2.00	0.90	1.40
15	2.00	0.90	2.00
20	2.30	1.10	1.80
50	5.00	2.00	1.24
100	7.50	2.65	1.24
150	10.00	3.00	1.24
200	12.00	3.30	1.24
300	15.00	4.00	1.24

Notes:

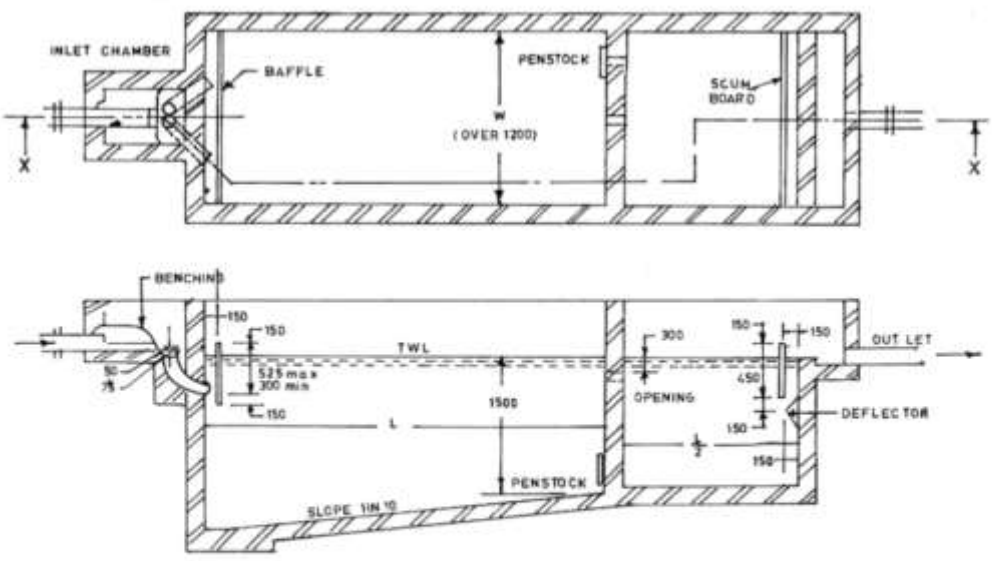
1. CPHEEO Manual and NBC code IS 2470 Part I 1985 may be referred for exact calculations
2. A provision of 300 mm should be made for freeboard.
3. The sizes of septic tank are based on certain assumption on peak discharges, as estimated in IS:2470(Part-1) -1985 and while choosing the size of septic tank exact calculations shall be made.
4. For population over 100, the tank may be divided into independent parallel chambers of maintenance and cleaning.

1. Construction Details

The inlet and outlet should not be located at such levels where the sludge or scum is formed as otherwise; the force of water entering or leaving the tank will unduly disturb the sludge or scum. Further, to avoid short- circuiting, the inlet and outlet should be located as far as possible from each other and at different levels. Baffles are generally provided at both inlet and outlet and should dip 25 cm to 30 cm into and project 15 cm above the liquid. The baffles should be placed at a distance of one-fifth of the tank length from the mouth of the straight inlet pipe. The invert of the outlet pipe should be placed at a level 5 to 7 cm below the invert level of inlet pipe .Baffled inlet will distribute the flow more evenly along the width of the tank and similarly a baffled outlet pipe will serve better than at ee-pipe.

For larger capacities, a two-compartment tank constructed with the partition wall at a distance of about two- thirds the length from the inlet gives a better performance than a single compartment tank. The two Compartments should be inter connected above the sludge storage level by means of pipes or square openings of diameter or side length respectively of not less than 75 mm. Every septic tank should be provided with ventilation pipes, the top being covered with a suitable mosquito proof wire mesh. The height of the pipe should extend atleast 2m above the top of the highest building within aradius of 20m. Septic tanks may either be constructed in brick work, stone masonry or concrete cast in situ or pre-cast materials. Pre-cast household tank made of materials such as asbestos cement / HDPE could also be used, provided they are watertight and possess adequate strength in handling and installing and bear the static earth and superimposed loads. All septic tanks shall be provided with water tight covers of adequate strength. Access manholes /covers (minimum two numbers one on opposite ends in the longer direction)of adequate size shall also be provided for purposes of inspection and desludging of tanks. The floor of the tank should be of cement concrete and sloped towards the sludge outlet. Both the floor and side wall shall be plastered with cement mortar to render the surfaces smooth and to make them water tight. A typical two compartment septic tank is shown in figure below;

Structure of a Septic Tank



TYPICAL SKETCH OF TWO COMPARTMENT SEPTIC TANK FOR POPULATIONS OVER 50 (IS : 2470 (PART 1)-1985)

Source: CPHEEO Manual on Sewerage and Sewage Treatment Systems (Part A Engineering)

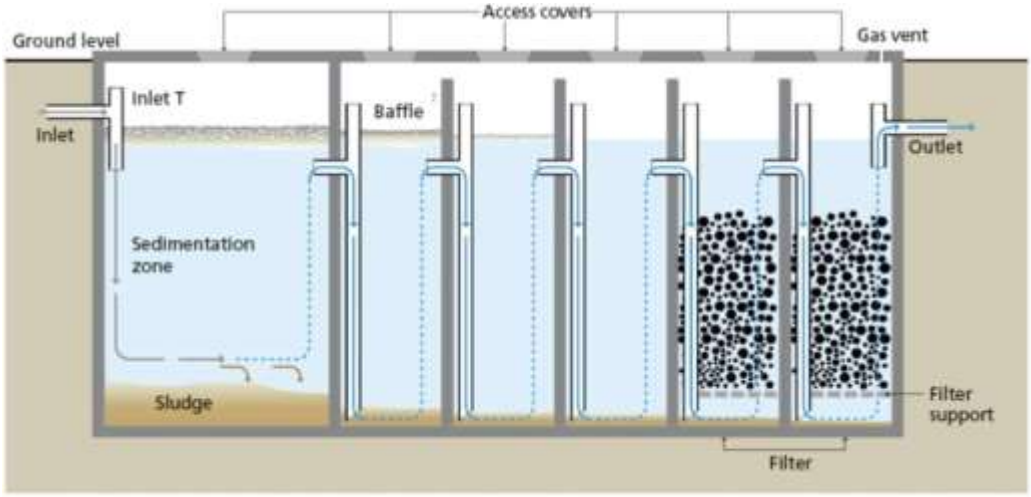
Table 2: Existing Guidelines for Design and Construction of Septic Tanks

Parameters	Existing Guideline	Source	General Observations
Location	Septic tanks are recommended only for individual homes, small communities and institutions whose contributory population size doesn't exceed 300	CPHEEO Manual	While all existing guidelines state that the location of septic tank should be given due consideration, in reality, the location of the septic tanks is practically based on theland availability within the household Vicinity
	A sub soil dispersion system shall not be closer than 18 meters from any source of drinking water, such as well, to mitigage the possibility of bacterial pollution of water supply	NBC, Part 3: Development Control Rules and General Building Requirements	
	Septic tank should be located at a place open to sky, as far away as possible from the exterior of the wall of building and should not be located in swampy areas prone to flooding	IS 2470, Part-1	
Design and Construction	Septic Tank should have minimum width of 750mm, depth of 1 meter below water level and a minimum water capacity of 1 cubic meter. The length of the tank shall be 2 to 4 times the width. The minimum nominal diameter of the pipe shall be 100 mm. Further at junctions of pipes in manholes, direction of flow from a branch connection shall not make an angle exceeding 45 degrees with the direction of flow in main pipe	NBC, Part 3: Development Control Rules and General Building Requirement,	Local masons unaware of the existing design /construction guidelines for construction of septic tanks. The criterion governing the design and construction broadly in the land availability and the funds available with the owner / property builders.
	Every septic tank shall be provided with a ventilation pipe of at least 50mm diameter.	IS 2470, Part 1	
	The liquid depth should be 1-2 m and the length to depth ratio should be 2-3 to 1. The liquid depth of the septic tank should be calculated depending on the cleaning interval of the septic tank (For detail length, breadth and liquid depth for various number of users please refer the Manual) A provision of 300 mm should be made for free board. When served for a population above 100, the septic tank may be divided into independent parallel chambers for	CPHEEO, IS 2470, Part 1	

Parameters	Existing Guideline	Source	General Observations
	operation and Maintenance Baffles are provided at inlet and outlet and should dip 25 to 30 cm into and project15cmabovetheliquid.Theinvert of the outlet pipe should be provided at 5 to 7 cm below the invert level of inlet pipe. The height of the ventilation pipe should extend at least 2 m above the height of the highest building within 20 meters radius	CPHEEO, IS 2470, Part 1	Local masons unaware of the existing design /construction guidelines for construction of septic tanks. The criterion governing the design and construction broadly in the land availability and the funds available with the owner / property builders.
	Improved Septic Tank" - the walls of the conventional septic tank can be replaced with baffle walls to have a multi chambered baffled septic tank. The paper states "This movement of wastewater inside the tank helps in creating the turbulent flow which causes enhanced mixing of the raw sewage with already existing activated sludge and accelerates the decomposition of the solids because of intensive contact between the activated sludge and fresh influent".	CSE Policy Paper on Septage Management in India	

2. Design for improved septic tank- three chamber with Anaerobic Baffled Reactor(ABR)

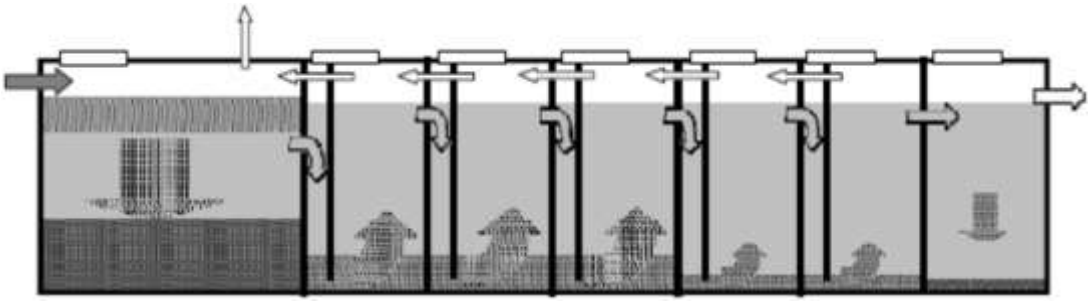
An ABR with filter is an improved septic tank (see Figure below: Anaerobic baffled reactor with filter). ABRs incorporate one or more baffles which force the sewage to flow from the bottom to top until it starts to flow into the next chamber. The up-flow chambers catalyse the sedimentation of solids and digestion of organic matter. BOD may be reduced by up to 90 percent, which is far higher a percentage than a conventional septic tank. The filter



Source: Manual on Sewerage and Sewage Treatment—Part A: Engineering. CPHEEO, 2012

chambers typically remove 50–80 per cent BOD as sewage flows through them.

Anaerobic decentralized waste water treatment systems (DEWATs)



ANNEXURE 2: GUIDELINES FOR CONVERSION OF INSANITARY LATRINES INTO SANITARY TOILETS

Table 1: Existing guide lines for leach pits

Parameters	Existing Guidelines	Source
Size (five members)	Dia. - 1000mm preferred but 750 mm also permitted where space is a constraint, Depth – 1300mm	CPHEEO
Emptying	Single pit – 6 years, Twin pit – 3 years each	CPHEEO
Shape	Circular is preferred; but rectangular, oval and square also allowed where space is a constraint	CPHEEO
Location	Pits should be placed symmetrically at the back side of the pan. Can be located within premises, under foot pat/road/narrow lane. The distance between foundation and pit should be between 0.2 to 1.3m. A minimum distance of 3 to 10m from water source such as tube wells and 3 to 10m from water mains. Water pipe should not cut across the pit	CPHEEO
Design and Construction	The pits should be lined to avoid collapsing. Bricks joined in 1:6 mortar commonly used for lining. Stones or laterite bricks of cement concrete rings could also be used. Lining brick work 115 mm thick (half brick) with honeycombinguptotheinvertlevelofsizeofholes50mmwideupt othe height of brick course pit bottom should be left in natural condition. RCC slab is used for pit cover. Toilet pan is connected to the pit through 1 75- mm brick channel of U shape.	CPHEEO

ANNEXURE 3: FORM FOR APPLICATION FOR THE LICENSE COLLECTION, TRANSPORTATION AND DISPOSAL OF SEPTAGE IN PM

Place Self-Attested Recent Passport Size Photograph

1. Name of the applicant (as per vehicle registration certificate) : Shri /Ms.

1. விண்ணப்பதாரரின் பெயர்(வாகன பதிவேட்டில் உள்ளபடி) திரு/திருமதி _____

2. Details of Employees

2. தொழிலாளர்களின் விபரம்

S.No. வ.எண்	Category of Employee தொழிலாளர்களின் விபரம்	Name பெயர்	Aadhar Number ஆதார் எண்
1.	Driver (ஓட்டுனர்)		
2.	Assistant 1 (உதவியாளர் -1)		
3.	Assistant 2 (உதவியாளர் -2)		
4.	Others (if any) (பிறர்)		

3. PAN Number of the Applicant

3. விண்ணப்பதாரின் பான் எண் _____

4. GST Number of the Applicant

4. விண்ணப்பதாரின் GST எண் _____

5. Bank Account No. of Applicant

5. வங்கி கணக்கு விபரம் _____ Savings ☐ Current ☐

6. Details of Personal Health Insurance

6. மருத்துவ காப்பீட்டு விபரம்

S.No. வ.எண்	Category of Employee தொழிலாளர்களின் விபரம்	Name பெயர்	Number எண்	Validity செல்லுப்படியாகும் காலம்	Name of Insurance Company காப்பீட்டு நிறுவனத்தின் பெயர்
1.	Driver (ஒட்டுனர்)				
2.	Assistant 1 (உதவியாளர் -1)				
3.	Assistant 2 (உதவியாளர் -2)				
4.	Others (if any) (பிறர்)				

7. Whether member of NTR Vaidya Sewa Scheme

7. NTR விதியா சேவா திட்டத்தில் உறுப்பினரா ?

S.No. வ.எண்	Category of Employee தொழிலாளர்களின் விபரம்	Yes (ஆம்)	No (இல்லை)
1.	Driver (ஒட்டுனர்)		
2.	Assistant 1 (உதவியாளர் -1)		
3.	Assistant 2 (உதவியாளர் -2)		
4.	Others (if any) (பிறர்)		

8. Whether covered under PM Chandrana Bhima Yojana

8. பிரதம மந்திரியின் சந்திரா பீமா திட்டத்தின் உறுப்பினரா ?

S.No. வ.எண்	Category of Employee தொழிலாளர்களின் விபரம்	Yes (ஆம்)	No (இல்லை)
1.	Driver (ஒட்டுனர்)		
2.	Assistant 1 (உதவியாளர் -1)		
3.	Assistant 2 (உதவியாளர் -2)		
4.	Others (if any) (பிறர்)		

9. Medical Fitness Certificate for Employees Available

9. தொழிலாளர்களின் மருத்துவ தகுதி சான்று விபரம்

S.No. வ.எண்	Category of Employee தொழிலாளர்களின் விபரம்	Yes (ஆம்)	No (இல்லை)
1.	Driver (ஓட்டுனர்)		
2.	Assistant 1 (உதவியாளர் -1)		
3.	Assistant 2 (உதவியாளர் -2)		
4.	Others (if any) (பிறர்)		

10. Driver License Number

10. ஓட்டுனர் உரிம எண்

License Number (உரிம எண்)

11. Nature of Vehicle for which license is available

11. ஓட்டுனர் உரிமத்தில் உள்ள வாகன வகை

HCV	LCV	TW

12. Address _____

12. முகவரி _____

_____

13. Telephone No. (O) _____ (Mobile No.)_____

13. தொலைபேசி எண் (அ) _____ (மொபைல் எண்) _____

14. E-mail ID _____

15. Registration No. of Vehicle _____

15. வாகன பதிவு எண் _____

16. Does the Vehicle belong to the applicant ?

16. வாகனம் விண்ணப்பதாரருக்கு சொந்தமானதா?

Yes (ஆம்)	No (இல்லை)

17. Engine Number _____ Chassis Number _____

17. என்ஜின் எண் _____ சேசிஸ் எண் _____

18. Pollution Certificate

18. மாசு கட்டுப்பாடு சான்றிதழ்

Number (எண்)	Validity (காலாவதியாகும் தேதி)

19. Vehicle Insurance Certificate

19. வாகன காப்பீடு

Number (எண்)	Validity (காலாவதியாகும் தேதி)

20. Vehicle Fitness Certificate

20. வாகன தகுதி சான்று

Number (எண்)	Validity (காலாவதியாகும் தேதி)

21. Vehicle fitted with GPS

21. வாகனத்தில் GPS உள்ளதா ?

Yes (ஆம்)	No (இல்லை)

22. Details of the vehicles indicating model, type, capacity (Document proof of any may be enclosed).

22. வாகனத்தின் விபரம்

(a) Model _____

(அ) மாதிரி

(b) Type _____

(ஆ) வகை

(c) Capacity _____

(இ) கொள்ளலவு

I / We certify that above mentioned information given by me / us is true to the best of my knowledge and belief. I also certify that I have read and understood all the attached terms and conditions and agree to abide by them. I agree that if any information furnished by me is found wrong or factually incorrect in license will be liable for cancellation without prior intimation.

நான்/ நாங்கள் மேலே குறிப்பிட்டுள்ள விபரங்கள் அனைத்தும் உண்மை என சான்றளிக்கிறேன். மேலும் அனைத்து நிபந்தனைகளுக்கும் உப்படுவேன் எனவும் என்னால் சமர்பிக்கப்பட்ட விபரங்கள் தவறு என தெரிய வந்தால் என் அனுமதியை திருப்ப பெற்றுக்கொள்ள சம்மதிக்கிறேன்.

Signature(s) of Applicant(s) _____ Thumb Impression _____

No. of Document attached _____ Date _____

PONDICHERRY MUNICIPALITY
TERMS AND CONDITIONS FOR APPLICATION OF THE LICENSE

1. The application to be submitted along with a self-attested photo copy of the Driving License of the Driver, Vehicle Registration Certificate, Adhaar Number, All certificates pertaining to vehicle, identity of assistants and photo of truck from four angles.

1. விண்ணப்துடன் சுய சான்றளிக்கப்பட்ட ஒட்டுனர் உரிமம், வாகன பதிவு சான்றிதழ், ஆதார் எண், காப்பீட்டு நகல்கள், தொழிலாளர்களின் அடையாள அட்டை மற்றும் வாகனத்தின் புகைப்படம் இணைக்கப்பட வேண்டும்.

2. The licensee shall comply with the provision of the Septage Bye-Laws, Operational Guidelines and Standard Operating Procedures of the Greater Pondicherry Municipality Municipal Corporation.

2. விண்ணப்பதாரர், புதுச்சேரி நகராட்சி மற்றும் அரசாங்கத்தால் வெளியிடப்பட்டுள்ள கழிவு நீர் கையாளுவது சம்மந்தமான அனைத்து நடைமுறைகளையும் பின்பற்ற வேண்டும்.

3. The license shall maintain the specified vehicle in good and workable condition so as to avoid any accidents.

3. விண்ணப்பதாரர் வாகனத்தை சரியான முறையில் பராமறிப்பு செய்ய வேண்டும்

4. The license shall employ only trained personnel for performing the licensed activities and provide protective gears to all such personnel.

4. விண்ணப்பதாரர், தொழிலாளர்களுக்கு உரிய பாதுகாப்பு கருவிகள் வழங்க வேண்டும் மற்றும் தேவையான பயிற்சியும் அளிக்க வேண்டும்.

5. This license is not valid for collection of industrial waste of any nature what so ever.

5. இந்த உரிமம் தொழிற்சாலை கழிவுகளை அப்புறப்படுத்து வதற்கான வழங்கப்படவில்லை.

6. The issuing authority reserves the right to vary any of the conditions of this license or impose further conditions from time to time during the validity of this license.

6. விதிகளை மாற்றம் செய்யவும், புதிய விதிகளை அமல் படுத்தவும் நகராட்சி நிர்வாகத்திற்கு உரிமை உண்டு.

7. The operator is required to maintain adequate and correct records of collection, transportation and disposal of septage as required by PM.

7. விண்ணப்பதாரர் கழிவுநீர் அகற்றுவது சம்மந்தமான நடவடிக்கைகளை உரிய முறையில் ஆவணப்படுத்த வேண்டும், தேவைப்படும் போது நகராட்சியிடம் ஒப்படைக்க வேண்டும்.

8. The licensee has to agree with the fees levied by the authority for disposing septage at the designated disposal site. The authority from time to time can review the fees imposed on the licensee and may reduce the charge or increase the charge for such activities.

8. உரிமதாரர் நகராட்சியால் அவ்வப்போது நிர்னையிக்கப்படும் கட்டணத்தை மட்டுமே வசூலிக்க வேண்டும்

9. This license will be issued to dispose the septage only at the designated disposal points as identified by PM. Violation of this or in discriminated disposal of the septage to the environment (land, water bodies or drain) without permission of the authority may call for rejection of license by the authority.

9. இந்த உரிமம், கழிவு நீர் அகற்று வதற்காகவும் அதை நகராட்சியால் அறிவிக்கப்பட்ட இடத்தில் இறக்கவும் மட்டுமே வழங்கப்படுகிறது. இதை மீறி வேறு இடத்திலோ, சுற்றுச்சூழலுக்கு பாதிப்பு ஏற்படுத்தும் விதத்திலோ கழிவு நீரை கொட்டினால் இந்த உரிமம் ரத்து செய்யப்படும்.

PONDICHERRY MUNICIPALITY

DECLARATION CUM PERMIT CERTIFICATE ON ACCOUNT OF ENVIRONMENTAL SANITATION CLEARANCE CUM SANITARY PERMIT

I Shri/Ms. _____ on individual capacity hereby solemnly declare that I will abide to all the rules, regulations and standard operating procedures framed by PM and will undertake the work of de-sludging, transportation and disposal in most appropriate and sanitary means and will carry out my duties as set forth in the standard operating procedure during the possession of the license.

I understand that this permit is given for the period of validity of the license. I further understand that this is a supporting document to the license and fail to produce this document whenever asked may debar myself in carrying out intended activities in PM area.

Applicant Signature with Date :

Name (In Capital letter) :

Thumb Impression :

FOR OFFICE USE ONLY

This is to certify that Shri/Ms._____ is hereby given permit on account of environmental sanitation clearance and sanitary permit in respect to his/her declaration for the period of _____ to _____. Misconduct or misuse of this permit is liable for legal action on the operator. This permit given is non-transferable in any case. Loss or theft of this document must be brought to the notice of the Chief Medical Officer Health, PM immediately for reissue after following due process.

Commissioner

Pondicherry Municipality

ANNEXURE 4 : LICENSE FOR COLLECTION AND TRANSPORTATION OF SEPTAGE

Place Self-Attested Recent Passport Size Photograph

In accordance with all the terms and conditions of the By-laws/Operational Guidelines/Regulations, Pondicherry Municipalities Act rules, the special license conditions accompanying this license and applicable rules and laws of Government of Puducherry, the permission is hereby granted to:

NAME OF LICENSEE _____

NAME OF THE OWNER OF VEHICLE (if different from Licensee) _____

PERMIT NUMBER _____

ADDRESS _____

For the disposal of septage from septic tanks in PM

This license is based on the information provided in the Form for Application for the License of Collection, Transportation and Disposal of Septage in PM Area and further to compliance to the Standard Operating Procedure set forth by the Authority. This license is effective for a period set forth below.

EFFECTIVE DATE –

EXPIRATION DATE –

The license may be suspended or revoked for Condition of Non-Compliance of any Acts, Rules and Regulations, Operational Guidelines, Standard Operating Procedures and is not transferable. The original license shall be kept on file in the Licensee's office. A copy of this license shall be carried in every registered vehicle used by the License.

Commissioner

Pondicherry Municipality

ANNEXURE 5: SAFE REUSE AND DISPOSAL OF TREATED SEPTAGE

MSW Rules (2016) recommended the quality for compost as referred to Table 1 below.

Table 1: Compost Quality as per MSW Rules, 2016

Parameter	Concentration not to exceed (mg/kg dry basis. Except for pH and carbon to nitrogen)
Arsenic	10
Cadmium	5
Chromium	50
Copper	300
Lead	100
Mercury	0.15
Nickel	50
Zinc	1000
C/N ratio	<20
pH	6.5 – 7.5
Moisture percent by weight, maximum	15 – 25
Bulk Density	<1
Total Organic Carbon	12
Total Nitrogen (as N) percent by weight, minimum	0.8
Total Phosphate (as P_2O_5) percent by weight, minimum	0.4
Total potassium (as K_2O) percent by weight, minimum	0.4
Colour	Dark brown to black
Odour	Absence of foul odour
Particle size	Minimum 90% material should pass through 4.0mm IS sieve
Conductivity (as dsm – 1), not more than	4

1. Use of treated output

The treated output could find many uses in different climatic and use zones, subject to following norms and guidelines governing the respective uses. A snapshot the same is indicated

a) Compost (final product) exceeding the above stated concentration limits shall not be used for food crops. However, it may be utilized for purposes other than growing food crops. The FCO norms for quality of compost needs to adherence and approval prior to application and use.

b) For dewatered septage/sludge can be used as fertilizer in agriculture application, it should satisfy the following criteria of Class-A Bio-solids of US EPA: A faecal coliform density of less than 1000 MPN/g total dry solids, Salmonella sp. density of less than 3 MPN per 4 g of total dry solids. WHO (2006) suggests Helminth egg concentration of < 1/g total solids and E coli of 1000/g total solids in treated septage for use in agriculture.

c) Properly treated sludge can be reused tore claim parched land by application as soil conditioner, and/or as a fertilizer. Deteriorated land areas, which cannot support the plant vegetation due to lack of nutrients, soil organic matter, low pH and low water holding capacity, can be reclaimed and improved by the application of treated septage. Septage sludge with lime stabilization has pH buffering capacity that is beneficial for the reclamation of acidic soils. Treated septage contains nutrients in considerable amounts, which supports the growth of plants.

d) Drip irrigation is the preferred irrigation method for settled septage effluent when irrigation is feasible. Crops which could be safely grown are corn, fodder, cotton, trees including fruit trees, eucalyptus and poplar.

e) Aquaculture can be practiced for settled septage effluent when freshwater is available to achieve dilution to ensure dissolved oxygen is above 4mg / l. Fish species of tilapia and carpare preferred since they tolerate low dissolved oxygen. Both drip irrigation and aquaculture need land and are feasible at city out skirts.

[2] Source: Advisory note: Septage Management in Urban India, Ministry of Urban Development, Government of India. (2013), SWM Rules - 2016 and Guidelines for septage management in Maharashtra. (2016)

ANNEXURE 6: PROTECTIVE GEAR FOR PERSONNEL

Protection gear is essential for occupational health and safety of personnel involved in the cleaning and treatment services for septage treatment and management. It is ideal that at all times functional gear are available for each truck/emptier. The list of items, specifications and images are presented in the table below.

Item Description	Specifications	Image
1. Safety Helmet	• ISI Mark: IS2925 • MOC: PVC Safety Helmet • Colour: White / Yellow /Blue • Helmet with Rachet band, fully adjustable • Sweat band and nylon chinstrap	
2. Safety Goggles	• EN 166:2001approved • ANSI Z 87.1approved • MOC: Impact resistant polycarbonate • Scratch resistant (should have scratch resistant coating) • 100 % polycarbonate lens with 100% UV protection • Adjustable temples • Chemical splash proof (side and front impact protection) • Provide protection against flying particles, dust, spark and glare • Extremely light weight and soft nose pads. • Should have side shield and brow bar must fit snugly to forehead for extra application.	
3. Nose Mask (Reusable)	• ISI Mark: IS8522 • Nose mask with elastic headband • Filtering Efficiency: As per ISI requirement (confirming to EN 149 FFP1 / FFP1S requirement) • Efficiency: Filters dust 85% to 90% upto3 microns size of dust • Made of cotton • Filter media should be on whole respirator surface	

Item Description	Specifications	Image
	• Head bands: twin head bands having very good elastic retention properties with good face seal throughout the usage of life.	
4. Nb PVC Rubber Hand Gloves	• Acid alkali proof hand gloves • Propylene rubber hand glove • Should be made of acrylic propylene latex with soft 100% cotton flock for added comfort which absorbs perspiration and adds insulation • Should have excellent chemical resistance to heavy hydrocarbons, hydrocarbon derivatives, aromatic solvents, alcohols, oil greases • Size: 12 to 18inches	
5. Acid Alkali Proof Suit	• MOC: PVC • Acid alkali resistant suit should be made of PVC with nylon reinforced laminated material • Consist of acid alkali proof coat, pant and full-face mask(separately) • Have higher tensile strength &good chemical resistance • Have full opening from chest for easy wearing and double flap in front to prevent / protect liquid entry splashed on it while use • Lined with reflecting tape	
6. Gum Boot	• IS:12254 • Steel toe material 10” /14” • Excellent fitting and grip as per Indian fit sizes • 100% virgin soft and flexible PVC in the upper for comfortable walk	
7. Safety Lite / Torch	• As per ISI Mark • 0.5 km range	-

ANNEXURE 7: TECHNOLOGICAL OPTIONS FOR TREATMENT

This section presents an overview of the mechanisms on which faecal sludge (FS) treatment processes are based, and highlights those on which the treatment technologies are discussed in subsequent sections. Many FS treatment technologies are based on those developed for wastewater and wastewater sludge treatment, but have limitations for direct transfer and use. FS characteristics greatly differ from wastewater, and have a direct impact on the efficiency of treatment mechanisms (Spellman, 1997; Kopp and Dichtl, 2001). Important properties of the sludge to consider include stabilisation, organic load, particle size and density, dissolved oxygen, temperature, pH, water content and viscosity. The current understanding of physical, biological and chemical mechanisms in FS management (FSM) is limited and has been acquired via empirical observations over the years.

1. Treatment Mechanisms

1.1 Physical Mechanism

Physical mechanisms include dewatering, drying and volume reduction. One of the most important treatment mechanisms in FSM is dewatering. FS mainly comprises of water, the proportion of which is dependent on the type of onsite technology. Water is heavy and expensive to transport, and discharging this polluted water to the environment has significant negative impact. Dewatering is also necessary prior to resource recovery for applications such as composting, or combustion as a fuel and is mostly based on physical processes such as evaporation, evapotranspiration, filtration, gravity, surface charge attraction, centrifugal force and pressure.

1.2 Biological Mechanism

In FSM, biology is essential for the achievement of treatment objectives through transformation of organic matter and nutrients, including an understanding of pathogen reduction. Biological mechanisms allow the removal and transformation of organic constituents, nutrients and pathogens via the activity of microorganisms. Biological treatment harnesses the metabolism and growth rate of microorganisms in naturally occurring processes and employs them in controlled situations to optimise the desired outcomes. As the microbes grow, they dynamically alter the system by modifying forms of organic matter and releasing & binding up nutrients. They also release gases and other by products that can affect the environment.

1.3 Chemical Mechanism

Chemical mechanisms involve employing additives to optimise and control desired reactions, and are mainly used for disinfection and enhanced dewatering. Chemicals can be mixed with FS to improve the performance of other physical mechanisms (e.g. addition of a cationic polymer to increase the flocculation and the settling efficiency), or to inactivate pathogens and stabilise FS. The addition of chemicals can represent a

significant increase in the overall cost of treatment, and the benefits therefore need to be carefully weighed.

There are different treatment facilities that are available, but each technology has different fields of application. They can be used for the treatment or co-treatment of undigested FS (e.g. from public toilets), or digested or pre-treated FS. Given the high content of coarse wastes such as plastics, tissues and paper in the discharged FS, preliminary screening is needed for most treatment technologies. Also, the characteristics of FS collected at industrial and commercial facilities should be checked as they can be contaminated with metals, have high concentrations of fats, oil and grease, or other concerns. That should be segregated and treated separately. After treatment, three types of end products can be distinguished – screenings, treated sludge and liquid effluent. Therefore, selection of the technologies, or combinations thereof, should be done considering local context, existing regulations and the end use goals.

2. Established Faecal Sludge Treatment Technologies

2.1 Co-composting of faecal sludge

Composting is a biological process that involves microorganisms that decompose organic matter under controlled predominantly aerobic conditions. There sultingend product is stabilized organic matter that can be used as a soil conditioner. It also contains nutrients which can have a benefit as a long-term organic fertiliser. There are two types of composting systems, open and closed, of which open systems are lower in capital and operating costs but typically require more space. In an open composting system, raw organic matter is piled up into heaps (called windrows) and left for aerobic decomposition. To increase space efficiency, the heaps of waste can also put into walled enclosures which are called box composting. If untreated waste feedstock is placed in a closed container this is called in-vesselor closed drum composting and is considered in the category of closed systems.

Ptential advantages and constraints of co-composting: The main advantage of co-composting is formed by the thermophilic conditions and the resulting pathogen inactivation. The output of co-composting is a good soil conditioner which provides potential for income generation depending on the demand for compost.However, operating a co-composting plant and generating a safe product with value requires technical and managerial skills, which can be limiting if not available.

2.2 Co-treatment in Waste Stabilization Ponds

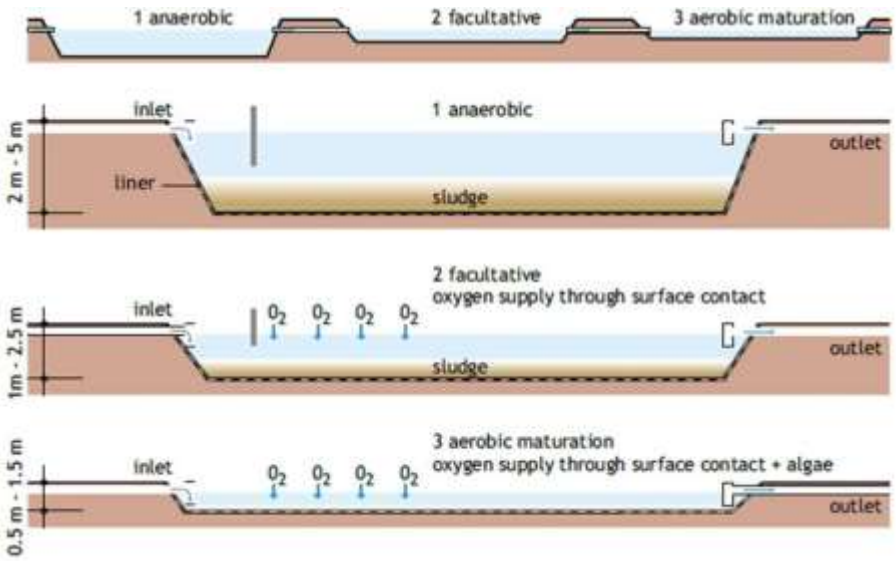
Waste Stabilization Ponds (WSPs) are widely used for the treatment of municipal waste water. The mechanisms for stabilization are based on natural processes that occur inaquatic eco systems. WSPs are considered as good options for wastewater treatment in low-income countries when adequate land is available, particularly in tropical climates. WSPs consist of several ponds having different depth sand retention times. A combination of three types of ponds in a series is frequently implemented in waste water treatment:

a) Anaerobic ponds that are two to four meters deep are used for settling of suspended solids and subsequent anaerobic digestion. The effluent flows to the facultative pond.

b) Facultative ponds that are 1 to 1.8m deep allow for remaining suspended solids to settle. In the top layer of the pond dissolved organic pollution is aerobically digested, while anaerobic conditions are prevalent at the bottom.

c) Maturation ponds that are 1 to 1.5 m deep allow for pathogen reduction and stabilisation. The ponds are mainly aerobic. Oxygen is supplied through algae and diffusion from the air. Pathogen reduction occurs via UV rays from the sun.

Figure – Design and principles of the three types of ponds constituting waste stabilization ponds



Potential advantages and constraints of waste stabilisation ponds: WSPs are simple to build and require relatively low O&M requirements. The technology is appropriate for tropical climates, and achieves relatively high pathogen removal in the effluent. Constraints include land availability, high rate of solids accumulation if preliminary solids separation is not performed, and potential inhibition due to high salt and ammonia concentration. The removal of sludge that accumulates in the anaerobic ponds may require heavy mechanical equipment.

2.3 Deep Row Entrenchment

Deep row entrenchment is a technology that can be considered as both a treatment and end use option. Deep row entrenchment consists of digging deep trenches, filling them with sludge and covering them with soil. Trees are then planted on top, which benefit from the organic matter and nutrients that are slowly released from the FS. In areas where there is adequate land available, deep row entrenchment can present a solution that is simple, low cost, has limited O&M issues and produces no visible or olfactory nuisances. Benefits are also gained from the increased production of trees. However, the availability of land is a major constraint with deep row entrenchment, as is the distance/depth to clean ground water bodies. Deep row entrenchment is considered most feasible in areas where the water supply is not directly obtained from the ground water source and where sufficient land is

available, which means the sludge would have to be transportable to rural and peri- urban areas.

Potential advantages and constraints of deep row entrenchment: The main advantage of deep row entrenchment is that very little is needed for it no expensive infrastructure or pumps that are very susceptible to poor maintenance. In addition, growing trees has many benefits such as extra CO2 fixation, erosion protection, or potential economic benefits. Constraints are that sufficient land has to be available in an area with a low enough groundwater table and, moreover, legislation still needs to catch up in many countries to allow for this technology.

2.4 Transferred sludge Treatment Technologies

Activated sludge wastewater treatment produces waste sludge that needs treatment. Technologies that are typically applied there may be transferable to application in FSM. The benefit of these technologies is that they have generally been applied for many years and much knowledge is present regarding design, operation and maintenance. The difficulty is however that the application of these technologies to FS has not been researched in much detail yet, which is key for successful long-term implementation.

2.4.1 Anaerobic Digestion

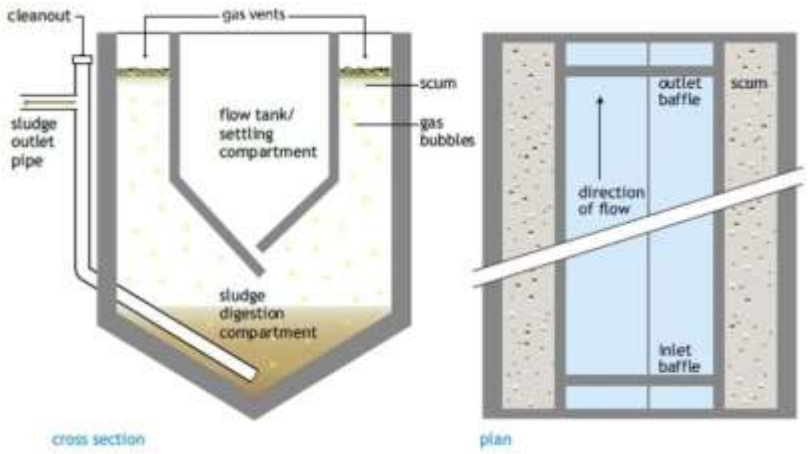
During anaerobic digestion, organic matter is converted into biogas and the remaining sludge is referred to as slurry or digestate. Biogas is a mixture of mainly methane and carbon dioxide and the digestate is relatively biologically stable and can be used as a soil conditioner. Anaerobic digestion treats organic waste in airtight chambers to ensure anaerobic conditions. Anaerobic digestion has been widely applied in centralised waste water treatment facilities for the digestion of primary sludge and waste activated sludge, typically with plug flow (PFR) or continuously stirred reactors (CSTRs). Anaerobic treatment technologies also include up flow anaerobic sludge blanket (UASB) reactors, anaerobic baffled reactors (ABRs) and anaerobic filters. Anaerobic treatment is also well known and developed for industrial wastes and highly loaded wastewater treatment plants.

Potential advantages and constraints of anaerobic digestion for faecal sludge management: Anaerobic digestion has the potential to produce biogas while stabilising FS, reducing sludge volume and odours. However, operation and maintenance (O&M) of anaerobic digesters requires a relatively high level of skilled operation. Inhibition of digestion *needs* to be considered due to the inconsistent nature of FS, and also detergents and heavy metals should be addressed at the household level. A constraint of anaerobic digestion as a technology for FS treatment is that, despite the vast amount of knowledge on anaerobic digestion, it has not yet been proven for FS alone in semi-centralised to centralised treatment in urban areas. Hence, further research is needed, and pilot scale facilities need to be installed prior to full scale implementation in order to learn more about the safe and sustainable application of this technology.

2.4.2 Imhoff Tank

An Imhof ftank is a compact sized tank that combines the effect of a settler and an anaerobic digestion system in one. It is a compact system which is well-known for waste water treatment. Imhoff tanks are most often used as a primary treatment technology in waste water treatment where it serves as a solid-liquid separation system including partial digestion for the settled sludge. The same considerations for sludge characteristics that were described under anaerobic digestion apply here.

Btential advantages and constraints of Imhoff tanks: The main advantages of Imhoff tanks compared to settling-thickening tanks are the small land requirement, the possibility of operating only one tank, and the physical separation between the settled sludge and the liquid fraction. The main constraints compared to settling thickening tanks are the increased operational complexity, slightly higher costs as the Imhoff tanks require an additional elevation to accommodate the inclined baffles, and the risk of damage to the sludge draw- off pipe in case of an inadequate draw-off frequency. Operation and maintenance of an Imhoff system is not as complex as some technologies, but it requires skilled operators. Cleaning of flow paths, the sides of the tank as well as the removal of scum is very important.



2.4.3 Sludge Incineration

Incineration of sludge is a form of disposal which involves the burning of sludge at temperatures between 850- 900°C. It does not typically take advantage of the potential for resource recovery; however, energy can be captured from the incineration of sludge. The ash that is produced from incineration could potentially be used, for example as a cover material for urine diversion dry toilets or in construction, or it can be disposed of in landfill sites. Depending on the source of sludge, the ash may contain high concentrations of heavy metals. Sludge needs to be dewatered prior to combustion, but stabilization treatment is not necessary as it decreases the volatile content of the sludge. Commonly used incineration systems are multiple-hearth incineration, fluidised-bed incineration and co-incineration with municipal solid waste.

Potential advantages and constraints of sludge incineration: Disadvantages include potential emission of pollutants; the need for highly skilled operating and maintenance staff, high capital and O&M costs; and residual ashes. Advantages are substantial reduction in sludge volume and pathogens removal.

2.4.4 Mechanical Sludge Treatment

Mechanical dewatering or thickening can be carried out prior to, or following other treatment steps. Dewatering and thickening are important for reducing the volume of sludge that needs to be further treated or managed. After the sludge thickening process, additional reduction of the water content is necessary, and this can be done either naturally or by machine processes such as centrifugation or pressing. Four technologies that are widely used for dewatering WWTP sludge are the belt filter, the centrifuge, the frame filter press, and the screw press. Only few examples are available in the literature for the implementation of these technologies to FS, but theoretically the technology is transferable.

Potential advantages and constraints of mechanical sludge treatment: The main constraints of these technologies in comparison to non-mechanical options are the investment costs, the O&M requirement, the need to add flocculants and the dependency on electricity. The general advantages are the compactness, and the speed of the process. To transfer these types of technologies to treat FS, information from manufacturers, laboratories, and pilot-scale tests is necessary.

2.4.5 Lime Addition

Lime is used for wastewater sludge treatment to achieve the reduction of pathogens, odours, degradable organic matter, apart from being a sludge conditioner to precipitate metals and phosphorus. The process of pathogen reduction during alkaline stabilisation is based on an increase of pH, temperature (through exothermic oxidation reactions) and ammonia concentration. Its effect is enhanced by a longer contact time and higher dosing amount. An added benefit of lime is that heavy metals can precipitate with the lime. However, the pathogen removing effect of lime also affects desired microbial processes such as composting and other soil processes. Moreover, safety is very important: as lime is corrosive to the skin, eyes and lungs and proper personal protection equipment (PPE) is crucial. Furthermore, protection from fire and moisture must be ensured.

Potential advantages and constraints of lime treatment: The main disadvantages of this technique are the requirement of consumables (lime), and a dry storage area. Pathogen regrowth is also a concern. Lime is an alkaline material which reacts strongly with moisture and high risks of hazard to the eyes, skin and respiratory system are observed. Therefore, skilled staff is required who must follow health and safety procedures and make use of good protective equipment.

2.5 Innovative technologies for Faecal Sludge Treatment

There is currently a great deal of research being conducted on innovative FS treatment technologies.

2.5.1 Vermi Composting

Earthworms are a member of the oligochaetes sub-class and they appear to be very effective in organic waste reduction. An example is the “vermi-filter”, which treats diluted domestic wastewater sludge in a system inoculated with earthworms. Interestingly, the earthworms seemed to function in synergy with bacterial communities within the filter. Worms cannot survive in fresh faeces and need support in the form of layers of soil and vermi compost. Vermi composting is not a reliable method to ensure adequate pathogen removal. However, when carried out under proper conditions the technology of vermin composting can lead to a complete removal of coliforms.

Potential advantages and constraints of vermin composting: In general, the advantages and constraints for vermin composting are similar to composting. However, vermin composting cannot be carried out at the thermophilic temperatures of co-composting. Therefore, if adequate pathogen reduction is not achieved during treatment, further treatment steps are required. Constraints are that the technology is still under development; the worms can be susceptible to toxic components (or higher concentrations in general), and the time span until matured compost is reached can belonger than for thermal composting. The production of worms can be beneficial provided there is a market for them.

2.5.2 Ammonia Treatment

Ammonia treatment can be applied for pathogen reduction. Pathogen inactivation by uncharged ammonia (NH3) has been reported for several types of microorganisms, bacteria, viruses and parasites. The principle of pathogen reduction with ammonia is based on ammonia (NH3) enters cells, takes up intracellular protons for the formation of ammonium (NH4+) and as a charged ion disturbs the functioning of organisms. Ammonia addition to sludge has been applied for wastewater sludge, where it is commonly referred to as alkaline stabilisation. More recently, investigations have been conducted on using the ammonia from excreta for pathogen reduction in Faecal Sludge. This can be done by collecting urine separately, and then mixing it with FS, as urine has high ammonia concentration. For sludge with low ammonia concentration, additional ammonia in the form of the synthetic urea can be added to enhance the treatment.

Potential advantages and constraints of ammonia treatment: In comparison to lime treatment, ammonia requires less stringent storage conditions. It seems particularly applicable in areas with urine diverting dehydrating toilets (UDDTs). In the cases where synthetic urea needs to be applied, the costs become higher, which may limit the economic feasibility and sustainability of the technology. Another constraint is the stability of nitrogen in treatment end products, and whether the full nutrient benefit can be achieved.

2.5.3 Thermal drying and Pelletising

Thermal drying allows the removal of all types of liquids from FS. It has been applied in the management of wastewater sludge for many years, and the technology has been taken up and improved from its original application in other industries (e.g. paper industry). Several types of technologies exist, all based on the ability of evaporating water with heat. The end products are stable and in a granular form allowing easier storage or transport.

Potential advantages and constraints of thermal drying and pelletising: Thermal drying

results in a significant reduction in volume as well as pathogen content. Dried sludge is easy to handle and to market ,and can be used in agriculture. The main constraints are the expense, high energy requirements, the potential risks of fire or explosion due to the gas and dust in the system, and the high maintenance requirements. Pelletising combines mechanical dewatering and thermal drying technologies. The dried pellets can then be used as an energy source or soil conditioner, and are relatively easy to transport.

2.5.4 Solar Drying

A special form of drying is applied in solar sludge driers. They also have been used on a large scale since the nineteenth century in Europe and USA for the treatment of wastewater sludge. This technology is generally constructed in greenhouse structures with transparent covers, concrete basins and walls. Sludge is disposed into these basin sand processed for about 10 to 20days. Options exist for batch or continuous operation, with devices to control the conditions in the greenhouses (e.g. ventilation, air mixing, temperature). The main factors influencing the evaporation efficiency in these systems are the solar variation, the air temperature and the ventilation rate, with initial dry solid content of the sludge and air mixing also influencing the process

Ptential advantages and constraints of solar drying: The main advantages of this option are the low energy requirements, the limited complexity of the technology and low investment costs, and the high potential dewatering efficiency. The main constraints are the space requirements and the need for mechanical means to turn the sludge, as well as to ventilate the greenhouses. Although pilot tests are being carried out for the moment, no information is available on the use of this technology for the treatment of FS in low-income countries or on design and operating parameters that need to be considered for this purpose.

ANNEXURE 8: BUILDING ON EXISTING SYSTEMS: CO-TREATMENT WITH SEWAGE TREATMENT PLANT (STP) WITH PPP ENGAGEMENT IN PONDICHERRY MUNICIPALITY

1. Background

A sewage treatment plant (STP) is often a convenient and an environmentally sound location for septage disposal. The city has four major STPs that cater to the need of treating the daily sewage generated. These plants can be modified to receive and treat septage effectively along with sewage. Septage addition, however, can have a significant impact on plant operations or performance if receiving facilities are not properly designed or not having adequate reserve capacity to take extra load. Septage handling increases plant operation and maintenance (O & M) costs in proportion to the amount of septage received. However, if effectively designed and operated they perform as expected, during the planning stage of the plant without causing any affect to the plant operation.

1.1 Estimating Plant Capacity

Determining the ability of a plant to handle septage and estimating the amount of material that can be effectively handled are complex processes. The lists the potential impacts of septage addition to a STP are as below.

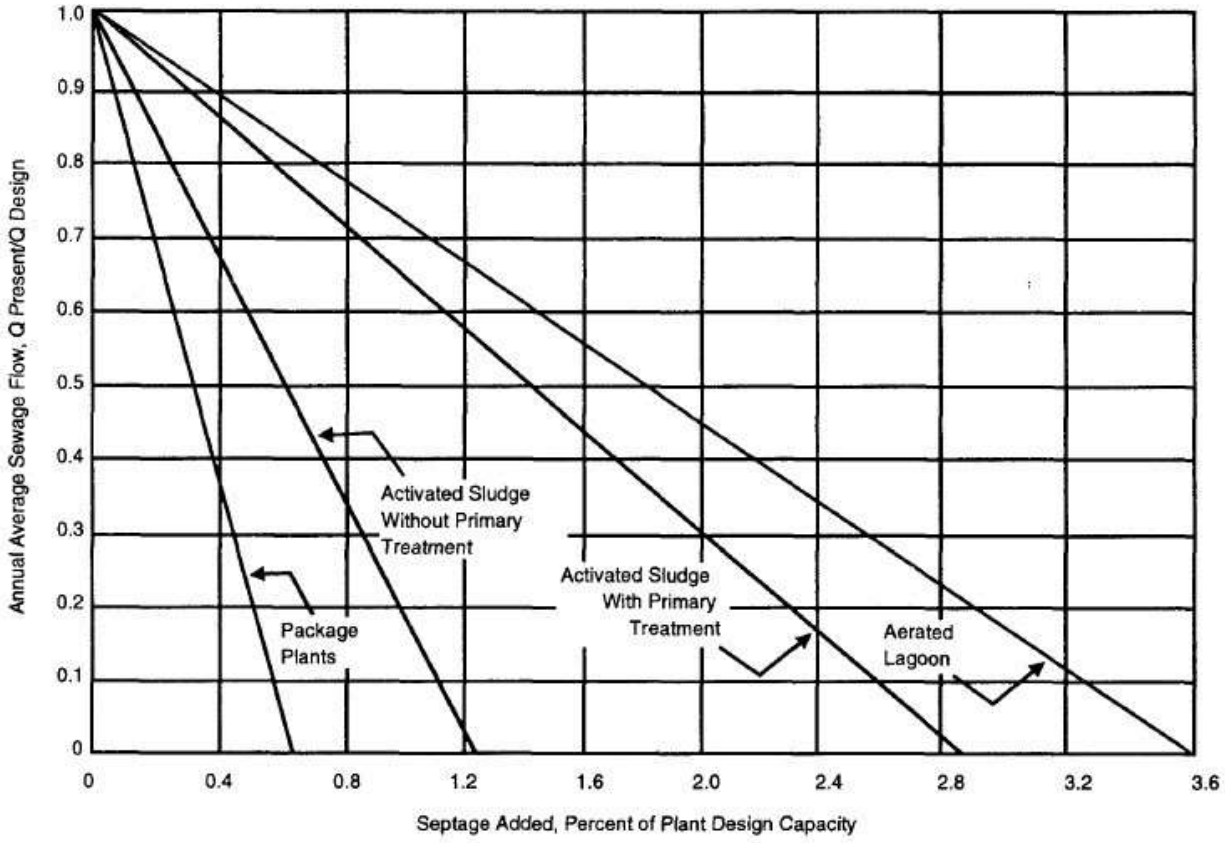
Impact of Septage addition in STP

- Increased volume of screenings and grit requiring disposal
- Increased order emissions from head works
- Scum accumulation in clarifiers
- Increased organic loadings to the biological process
- Potential order and foaming problem in aerated basins
- Increased loading to sludge handling process
- Increased sludge volume requiring final disposal
- Increased house keeping requirements

Figure below provides a method to estimate the allowable rates of septage addition, assuming that a holding tank is provided and that septage is added to the sewage flow on a semi-continuous basis. This chart takes into account the current loadings to the plant compared with its design loadings. Package plants or other activated sludge processes that do not employ primary treatment are the least a menable to septage handling. Allowable septage volumes may be reduced due to septage characteristics, treatment plant operations, and sewage flow patterns. A factor of safety should be included in establishing allowable septage volumes.

If septage is added to the solids handling train, allowable loadings must be estimated based on site-specific information and will vary depending on both the existing solids handling processes used at the plant and their design *ca*pacity. First, information on current versus design hydraulic and solids loadings must be compiled for those processes that will be employed to cotreat septage-sludge mixtures. Such processes may include

thickening, aerobic or anaerobic digestion, dewatering, chemical stabilization and composting. Then, conservative estimates of the volumes of septage that could be processed without exceeding the design capacity of each unit process can be developed.



Allowable septage loadings to a sewage treatment plant having a septage holding tank (1).

1.2 Present Proposal

The present study is to scientifically dispose the faecal sludge generated from household level in the city to the existing sewage treatment plant. Considering that PM is planning for construction of UGD network in future for the entire city, it is important that until such services are in operation, an alternative arrangement is in well in place. PM will undertake technical feasibility study of the all STPs in the city and will identify their ability to take septage load. In this context, a guiding document called Technical Feasibility Guideline will be prepared by PM, which shall consist of general guidelines as well as a Field and Desk survey form. Data of the existing STPs will be collected and the septage load will be calculated with use of the graph shown in above Figure. Based on the density of the septic tank in a particular area the nearest pumping station will be designated for disposal for septage coming from that area however if needed some septage may be allowed to dispose from the neighbouring area as well.

With these available information, a Detailed Project Report will be prepared, which will discuss the demand estimation, CAPEX, OPEX, recovery of O&M cost, VTO market size and implementation frame work to carryout the up-gradation work at selected Sewage Treatment Plant (STP) for disposal of septage.

1.3 Operation and Maintenance

There are several important factors to be considered while planning co-treatment of faecal sludge with the existing sewage treatment plant or by setting up a new Faecal Sludge Treatment Plant (FSTP) which has direct impact on O & M and monitoring. Since O & M aspects are important for overall long-term success of the programme, O & M planning, including the financial provision of funds should be included in the terms of references(ToR)fordesigningsuchfacilities.FurthermoreO&Mshouldbereviewedandapproved alongwith engineering designs and specifications by including operation and maintenance cost. The following points should be kept in mind for developing such a facility;

- Location of disposal sites and its proximity to the residential areas.
- Volume and schedule of FS collection.
- Degree of mechanization of technologies.
- Final end use or disposal of end product.
- Recovering the money by the way of user charges.
- Running it on PPP mechanism and charging the household with a septage tax or on number of trips made by vacuum trucks.

REFERENCES

1. Jharkhand Faecal Sludge & Septage Management Policy,2017
2. National Policy on Faecal Sludge and Septage Management (FSSM), February2017
3. Guidelines for Septage Management in Maharashtra, February2016
4. Operative Guidelines for Septage Management for Local Bodies in Tamil Nadu,2014
5. Manual on Sewerage and Sewage Treatment, CPHEEO, MOUD,2013
6. Pondicherry Municipality, India, Sanitation Assessment, Final Report by USAID
7. Faecal Sludge Management, Systems Approach for Implementation and Operation, IWA Publishing
8. Faecal Waste Management in Smaller Cities across South Asia: Getting Right the Policy and Practice, Centre for Policy Research, NewDelhi
9. Sandec Training Module 1.0 – Module 5, Faecal Sludge Management(FSM)
10. FSSM Policy of Greater Viskhapatnam Municipal Corporation

NODAL OFFICER, SWACHH BHARAT MISSION
PONDICHERRY MUNICIPALITY
PUDUCHERRY