INCLUSIVE URBAN SANITATION

Addressing the Desludging Challenges of Narrow Lanes in Uttar Pradesh

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Maps in this report are indicative and not to scale.

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Contents

LIST OF ABBREVIATIONS

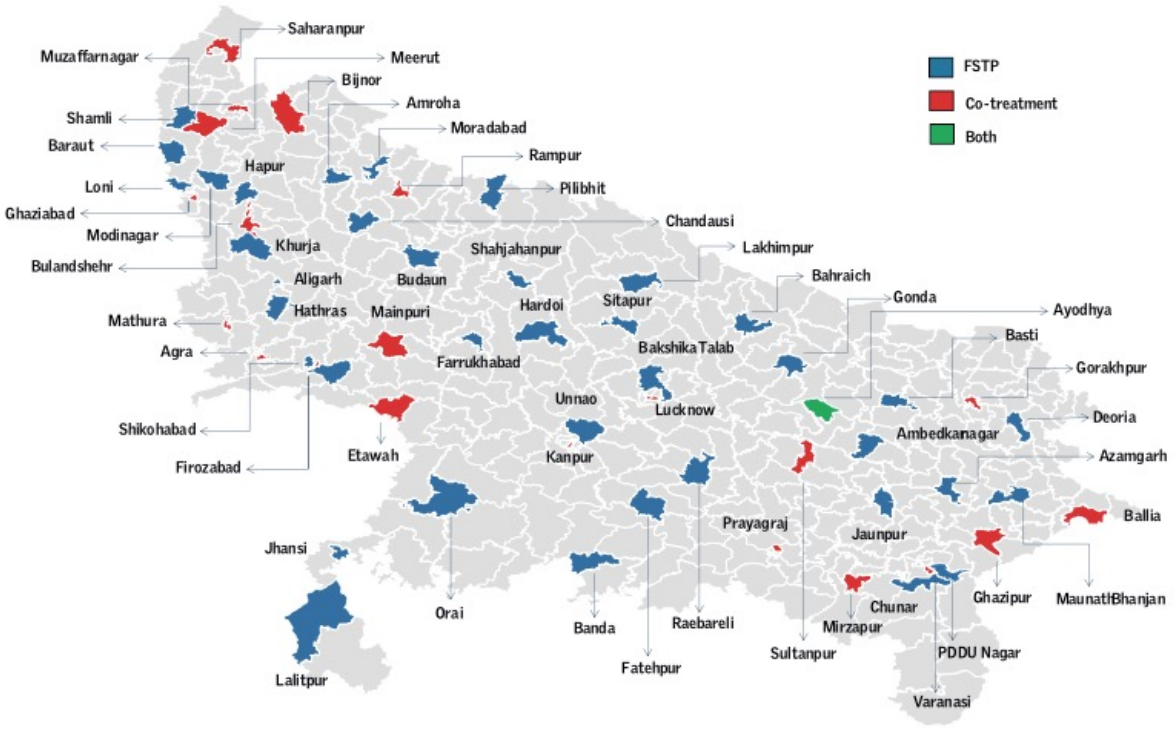
AMRUT	Atal Mission for Rejuvenation and Urban Transformation
FSTP	Faecal sludge treatment plant
KL	Kilolitre
MLD	Million litres per day
NAMASTE	National Action Plan for Mechanized Sanitation Ecosystem
PPE	Personal protective equipment
STP	Sewage treatment plant
SBM	Swachh Bharat Mission
ULB	Urban local body

1. Executive summary

Uttar Pradesh (UP) is the most populated state of India, with 93 per cent of its cities and towns are completely dependent on non-sewered sanitation systems. As per a 2021 Central Pollution Control Board (CPCB) report,[1] out of 8,263 MLD generated used-water in UP only 30 per cent, i.e. 2,510 MLD, is being treated through 99 operational sewage treatment plants (STPs). Out of the total 107 STPs installed in Uttar Pradesh, only 65 STPs, with a capacity of 2114 MLD, meet the compliance standards set by the Central Pollution Control Board (CPCB).

Therefore, sustainable and scientific management of faecal sludge and septage is a priority for UP. As of February 2024, 59 faecal sludge and septage management (FSSM) plants[2] are now ready in Uttar Pradesh. However, the key challenge in making these plants functional is the low desludging frequency of septic tanks. The Ease of Septage Management Survey,[3] conducted in 2023, shows that only seven plants were operating at 20 per cent or more of their installed treatment capacity. Unsafe emptying and low desludging frequency of septic tanks becomes more pronounced in narrow-lane settlements, where accessibility of desludging vehicles is difficult.

Map 1: FSSM projects in Uttar Pradesh



Given this context, a research study was undertaken with the aim of ensuring safe mechanical emptying of septic tanks from households in narrow-lane settlements to prevent unsafe practices of septic tank cleaning, thereby safeguarding the safety and dignity of sanitation workers. The study was conducted in four towns to understand the current desludging practices from households in narrow-lane settlements, identify the gaps, document successful case studies, and recommend pathways for safe mechanical desludging.

Key findings and conclusions

- Oversized design of septic tanks (without soak pits) have irregular and low desludging frequency (once in 15–20 or 30 years). This is even more so when septic tanks are merely septage-holding tanks as in many cities of India and UP.

- One of the main hurdles in desludging is the challenge of reaching septage-holding type septic tanks in narrow lanes (with road width below 7–8 feet) of old parts of towns and in unplanned settlements. Twenty to 30 per cent of narrow-lane areas in towns are inaccessible to the available desludging vehicles.

- The City Sanitation Plan shows that approximately 133 small and medium towns do not have any (government or private) desludging vehicles to provide septic tank desludging/cleaning services. As a consequence, households have had to resort to unsafe manual cleaning of septic tanks.

- In the majority of small and medium towns, desludging services are primarily rendered by government-operated desludging vehicles, indicating that providing desludging is a public service.

- In India, many innovative options are available for mechanical emptying of septic tanks from narrow-lane settlements, including double booster pumps, agitator-based Jalodbust (to empty hardened sludge), three-wheeler desludging vehicles etc.

- Until 2022, around 65 towns in UP had partial sewerage networks laid. To cover the narrow-lane settlements in large towns that had sewerage network (partially) laid, the focus should be on laying a small-bore sewer system and connecting it to the nearest existing sewer line.

Ensuring the safe emptying and transportation of sludge and promoting faecal sludge management requires significant investment for procuring desludging vehicles and facilitating safe mechanical emptying of septic tanks. However, the procurement should be guided by a state-level plan for desludging vehicles and requirement for allied equipment.

Recommendations

- A state-level plan for procuring desludging vehicles and allied equipment to determine the specific vehicle requirements for each urban local body (ULB). The plan must factor the town layout and requirements for desludging, based on actual and potential desludging in each town, affordable fee, and the operation and maintenance of new vehicles and allied equipment.

- Each Class 4 town and above should make provision for at least two sizes of desludging vehicles and a double booster pump set with an additional 200-foot pipe for desludging. However, this should not be prescribed as a standard for all towns.

- Profiling of sanitation workers should be the focus under the NAMASTE scheme and linking them to the Swachhta Udyami Yojana of the Ministry of Social Justice and Empowerment, Government of India for purchasing smaller desludging vehicles in small and medium towns.

2. Background

Since the inception of the Swachh Bharat Mission in 2014, there has been an increased focus on toilet construction, which further expanded to treatment and reuse in SBM 2.0. In Uttar Pradesh alone, approximately 9 lakh toilets have been constructed in urban areas till January 2024 (as per the SBM Urban portal,[4] accessed on January 31, 2024 at 1.50 p.m.). As per Census 2011, 47 per cent of urban households in UP relied on septic tanks. Following the implementation of SBM, there has been a significant likelihood that the dependence on septic tanks has increased, particularly considering that only 7–8 per cent of towns in UP have a partial sewerage network system.

For their operation and maintenance, septic tanks typically require emptying every three to four years. However, these septic tanks are often excessively overdesigned, resulting in actual desludging frequencies varying from five to 10–20 years. For the emptying of septic tanks ULBs have procured desludging vehicles through different sources like SBM, AMRUT, and Central/State Finance Commission funds etc. The emptied sludge must be then discharged in a faecal sludge treatment plant or co-treatment plant, with subsequent options for reuse or disposal. To complete this sanitation service chain, desludging plays an important role. Currently, the oversize design of septic tanks not only leads to varying desludging frequencies of 5–10 or 20 years but also poses a risk of groundwater contamination due to improper design and execution. Additionally, existing desludging vehicles face challenges in providing services to all households, particularly the urban poor, who usually live in the narrowest streets. Due to inaccessibility, the households have had to resort to unsafe practice of manual cleaning of septic tanks, posing health and life risks to sanitation workers.

Ensuring safe mechanical emptying of septic tanks is a critical issue for public health and environmental sustainability. In order to protect the welfare and safety of sanitation workers, India has prohibited the practice of manual scavenging under the Prohibition of Employment as Manual Scavengers and their Rehabilitation (PEMSR) Act, 2013. The Act prohibits the engagement of any individual for manually cleaning, carrying, disposing of or otherwise handling, in any manner, human excreta till its safe disposal. Government of India is presenting its determination towards occupational, social and financial safety of workers through national missions and schemes such as Safaimitra Suraksha Challenge and National Action Plan for Mechanized Sanitation Ecosystem (NAMASTE).

The missions aim to formalize desludging operations to ensure that only trained workers are engaged in emptying, and encourage mechanization in all statutory towns so there is no manual entry into sewers and septic tanks.

According to the Ministry of Social Justice and Empowerment, however, there have been 1,035 deaths associated with the hazardous cleaning of sewers and septic tanks across India since 1993. Of these, 339 deaths occurred in the last five years. Uttar Pradesh has the highest number of fatalities, followed by Tamil Nadu, Delhi, and Haryana.

Uttar Pradesh, the most populous Indian state, has approximately 93 per cent of its cities and towns entirely depending upon non-sewered sanitation systems. The state has about 600 towns with population below 50,000. Around 300 of these towns have populations below 20,000. The dominance of narrow-lane settlements and congested areas is more in small and medium towns, which further increases the risk of unsafe septic tank cleaning practices due to the limited technological solutions available for narrow lanes.

Given the aforementioned challenge due to inaccessibility, ULBs are struggling to provide desludging services. As a result, households are forced to find alternative methods for emptying their septic tanks, including the dangerous practice of manual emptying that puts the lives of sanitation workers at risk.

Aim of the study

Ensuring the safe mechanical emptying of septic tanks from households in narrow-lane settlements to prevent unsafe practice of septic tank cleaning, thereby safeguarding the safety and dignity of sanitation workers.

Objectives of the study

- To examine the current desludging practices from households in narrow lanes settlements;
- To understand the capacity and preparedness of urban local bodies for providing desludging services in these settlements;
- To document the successful case studies from India that have effectively addressed the challenge of septic tank emptying in narrow-lane settlements; and
- To identify the gaps and recommend pathways for safe mechanical desludging.

Methodology of the study

To understand the desludging practices from narrow lanes, four towns were selected (two municipal corporations and two municipal councils). During the visits, data was collected from different stakeholders through semi-structured interview, focus group discussion and consultation:

- **Semi-structured interview and FGDs with households residing in narrow lanes:** To understand the type of containment system, average desludging frequency, mode of desludging, frequency, charges;

- **Interaction with desludging service providers:** Challenges in accessing the septic tanks in terms of accessibility, desludging request/demand from such areas, current practice of emptying; and

- **Discussion with ULB officials.**

The city visits were conducted during the month of November and December 2023. On November 17, 2023, a consultation workshop was organized with officials of ULBs, Jal Nigam and state; sector experts; and technology providers to present and discuss the challenges of emptying septic tanks from narrow lanes. During the workshop, the ULB officials mentioned that they are unable to provide desludging services in congested and narrow-lane areas due to accessibility issues and the absence of suitable desludging machines.

Consultation workshop under the chairmanship of Director, SBM and Directorate of Urban Local Bodies, Uttar Pradesh

Discussion on 'Challenges in mechanical desludging from households in narrow lanes'

Key research questions

1. What is the current practice of desludging of septic tanks from narrow lanes in small and medium towns?

2. What are the challenges faced by the desludging service providers?

3. What are the feasible options for safe mechanical emptying of septic tanks from such areas?

3. Understanding the challenge

To understand the desludging challenges on ground, four towns were visited and documented:

1. Case of Jhansi

Jhansi is city with a current population of approximately 6.5 lakhs. Due to rocky strata and undulated terrain, it is difficult to lay an underground sewerage network in the city. Consequently, all households in the city rely on septic tanks as a containment system. The city possesses a variety of desludging vehicles with different capacities, including one with a 6 KL capacity, two with 4KL capacities, and one each with 2 KL and 1KL capacities.

However, desludging operators often face difficulty in providing services due to inaccessibility issues. According to officials and operators, approximately 25–30 per cent of households are situated in areas with road widths less than 7 feet, making them inaccessible for desludging. The lengths of these roads vary from 150

Narrow-lane settlements in Jhansi

metres to 400 metres, encompassing locations such as Taliya area, Kasai Mandi area, Narayan Bagh Road, Shivaji Nagar, Purana Sahar, Itwari Ganj, etc.

Because of being difficult to reach, households resort to unsafe practices for emptying their septic tanks. Households mentioned they usually engage drain cleaners for the cleaning the septic tank. A group of two to four individuals manually handles the task of emptying the septic tanks, charging approximately Rs 5,000–7,000 for their services. The emptied sludge is then discharged into either an open drain or open land. The frequency of desludging is in the range of 15–20 years, with some households avoiding desludging for 25–30 years due to excessive overdesign of septic tanks. Low desludging frequency results in highly concentrated effluent flowing into open drains. Households said that the whole process of cleaning septic tanks is being done without any personal protective equipment (PPEs) or safety gear.

2. Case of Shahjahanpur

The current population of Shahjahanpur is approximately 4.5 lakhs. While the installation of a sewerage network is underway in Shahjahanpur, many households both within and outside the core city will continue to rely on septic tanks due to the limited sewerage network. The desludging-cum-FSTP operator informed that they get six to eight sludge load per day from the households. However, on a weekly basis, they have to decline seven to 10 desludging requests due to inaccessibility. Consequently, households resort to manual cleaning of septic tanks. Households said that they usually engage drain cleaners/sweepers for cleaning septic tanks. Groups of three or four sanitation workers/manual scavengers undertake the cleaning, usually during night-time to avoid objections from neighbours concerning foul smells and splashes. The emptied sludge is discharge into open drain with continuous washing of water to ensure sludge flows down. They charge around Rs 3,000–5,000 rupees for the cleaning work. In Shahjahanpur, the desludging frequency is 20–30 years.

Narrow-lane settlements in Shahjahanpur

3. Case of Amroha

The current population of Amroha is approximately 2.7 lakhs, with around 90 per cent of households relying on septic tanks. The city possesses two desludging vehicles with a capacity of 4 KL each and one vehicle with a capacity of 1 KL. Approximately 30 per cent of households in Amroha are situated in narrow lanes, measuring up to 7 feet wide. The length of these lanes is 200–500 metres from the main road. The septic tanks in these households are inaccessible by the available small suction machine with a 1-KL capacity, which has a width of around 6.5 feet.

Due to this inaccessibility, households resort to unsafe practices for septic tank emptying, involving two to three sanitation workers/manual scavengers who charge around Rs 2,000–2,500 for their services. The emptied sludge is discharged into an open drain or nearby open land, depending on accessibility. The desludging frequency from these households is in the range of 15–20 years.

Narrow-lane settlements in Amroha

4. Case of Farrukhabad

Farrukhabad also faces a similar challenge, with all the households dependent on septic tanks. The municipal authority provides the desludging service at the rate of Rs 1,000 per trip. The desludging operators reported that they had to refuse two to three desludging requests per week from households in narrow lanes. After conversations with households residing in narrow lanes, they said due to narrow road-width, cleaning through machines is not possible so they engage drain sweepers in the job of septic tank cleaning. Groups of three to four workers take the job and charge a total of Rs 3,500–4,000 for manually cleaning the septic tanks. Mostly, the work is done at night. The septage from the tanks is usually discharged into open drain.

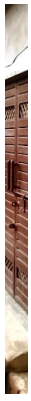
Narrow-lane settlements in Farrukhabad

4. Government initiatives for safe mechanical desludging

In 2019, the Ministry of Housing and Urban Affairs prepared a directory titled 'Sewer, faecal septage & drain cleaning equipment manufactured in India'[5] to help state and local governments with procuring of desludging vehicles. The directory provides details of a range of desludging and desilting machines, PPEs and details of vendors. However, all the machines detailed in the directory, particularly the smaller vehicles, are not enlisted on the GEM portal for procurement.

Aligned with the national commitment to ensure safety of sanitation workers, UP government has been also focussing on mechanization of septic tank cleaning services. Under AMRUT 1.0 mission, desludging vehicles have been procured in all the AMRUT towns. All the AMRUT towns have three to eight desludging vehicles (ULB owned) of different capacities ranging from 0.5 to 6 KL. The smaller vehicles of 0.5 KL capacity were procured in large towns, but their applicability and requirement was more in small and medium towns given the prevalence of narrow lanes here. During the discussion, ULBs reported that there are areas where due to narrow width of road they cannot provide the septic cleaning services. Also mentioned, they are not aware of how those septic tanks are being cleaned. ULB officials said that they are not responsible if a private-property owner engages someone for manually cleaning the septic tanks without their consent or information.

With the launch of SBM 2.0 and increased emphasis on mechanization, the state government is focussing on other ULBs to procure desludging vehicles. As per the City Sanitation Action Plan (CSAP) prepared under SBM 2.0 by 663 ULBs, 133 ULBs do not have even a single desludging machine (government or private), and this includes towns with a population of 45,000 and below. The remaining 530 ULBs have a total of 607 desludging vehicles (mostly of 3-KL capacity), out of which 49 are private and the remaining are government vehicles.



Around 350+ desludging vehicles have been planned to be procured under SBM 2.0. Instead of purchasing large vehicles, however, the government should focus on ensuring the right combination of vehicles of different capacities as these 663 ULBs are small and medium towns with a dominance of congested areas.

Desludging vehicles with capacity 3 KL and 1 KL in Jhansi

Desludging vehicle with 1.2-KL capacity in Shahjahanpur

Desludging vehicle with 0.5 KL in Prayagraj

5. Key findings and observations

1. Low frequency of desludging (every 15–20 or 30 years) the septic tanks (without soak pits) is very prevalent in UP towns, leading to ground- and surface-water contamination.

2. Unsafe manual cleaning of septic tanks is frequently practised in small and medium towns of Uttar Pradesh. Inadequate urban planning has resulted in the development of unplanned and densely populated settlements with road width less than 7–8 feet. As a result, mechanical cleaning of septic tanks is not feasible by means of the currently available desludging vehicles.

3. The existing small desludging vehicles (width: 6.1 foot) can navigate through roads that are up to 8–9 feet wide and have a suction pipe 100–150 feet long. Therefore, households situated in narrow lanes (less than 7–8 feet) further than 150 feet away become inaccessible for desludging service.

4. The charges for manually cleaning the septic tanks vary from Rs 2,500 to Rs 7,000, depending upon the class of town. The work is usually done by drain cleaners/ sweepers during the night, without the information/consent of ULB officials.

5. Smaller vehicles of 500-litre capacity have been procured in large cities such as Lucknow, Varanasi, Prayagraj, Agra and Kanpur. However, their requirement was more in smaller and medium towns, where concentration of households in narrow lanes is high.

6. A total of 133 small and medium towns do not have any (government or private) desludging vehicles to provide septic tank cleaning services. As a consequence, households have had to resort to unsafe manual cleaning of septic tanks.

7. A limited number of private desludging operators in small and medium towns indicates that desludging remains primarily a public service and it is the responsibility of ULBs to provide desludging service.

8. The innovative small-sized suction machines are not listed in the Government e Marketplace (GEM) portal for procurement.

6. Case studies of desludging in narrow lanes

1. Case of double boosting pump in Leh

The double boosting pumping system is a low-cost, easy-to-use desludging system. It increases desludging distance and accessibility, of double boosting pump, allowing the operator to serve users in narrow lanes. While the town's residents benefit from this system, especially the poor who usually live in the narrowest of streets, it also provides an option to local governments who need these solutions to maximize the sanitation service coverage.

Leh, at an altitude of 13,000 feet, has a population of 45,000. The Municipal Committee of Leh (MCL) was looking for the solution to safely manage faecal sludge and septage. The MCL thus invested in a faecal sludge treatment plant (FSTP). The FSTP is based on a simple treatment chain of planted drying beds-based DEWATS. The Leh Committee engaged Hoolock Technologies Private Limited, a private limited company on a private-public partnership (PPP) model for end-to-end faecal sludge management (FSM) services for five years. The desludging fee is Rs 3,500 per trip as fixed by the Municipal Committee of Leh. The committee also passed a notice making it mandatory for all commercial establishments to have their septic tanks desludged once a year in order for them to be eligible for commercial license renewal. This notice had a two-fold effect: it assured regular desludging and (as a result) prevented groundwater pollution through faecal contamination.

Due to the low head created by the vacuum pump (the truck could only empty from a horizontal distance of 20 feet and a vertical height of 5 feet) and inaccessibility of the truck to narrow streets, the operator was unable to service 62 per cent of the calls received despite there being a demand for desludging. Due to low accessibility, the process involved manual scavenging, i.e. people entering into the septic tanks and cleaning the sludge using buckets and shovels.

To address the inaccessibility and manual scavenging issue, a private operator developed a technology called double boosting pumping station. The technology is a simple low-cost method for emptying septic tanks in very narrow streets. It is easier to transport and requires less manpower. Currently, the suction range of desludging vehicles is 100–150 feet. The double boosting pump eliminates the

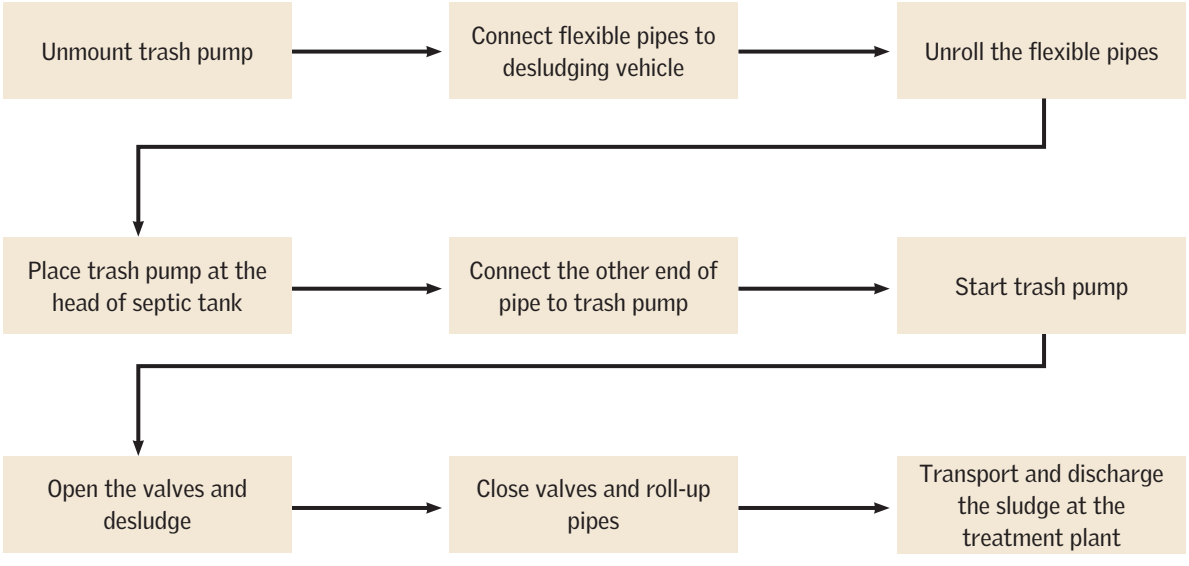
need for manual scavenging, increases accessibility to narrow streets and enables desludging from distances of up to 500 feet (from main streets) and a height of more than 15 feet. It cost around Rs 50,000.

The technology involves a trash pump (Honda SWT 30) connected to the inlet of the suction truck through means of valves, fixtures and flexible pipes. The suction truck is parked at the head of the main street that it cannot enter. The trash pump is then dismounted and taken to the location of the desludging in a wheelbarrow; the location may be up to 500 feet from the street head. The trash pump is then placed at the head of the septic tank to be desludged and is connected to the inlet of the vacuum truck through a flexible pipe. The fixtures and valves ensure no leakage of sludge at the pipe and the valve joints. The trash pump is then switched on. It then sucks the sludge through its inlet and transfers it to the vacuum truck through its outlet. Once desludged, the trash pump is turned off and remounted on the truck after transporting back on the wheelbarrow. The collected sludge is transported and discharged by the vacuum truck at the FSTP for treatment and reuse. The pump has a foot valve, which prevents entry of large solid waste. The system has been tested to a distance of 300 feet from the main road/suction truck.

The operator reported that the service coverage increased from only 38 per cent of the requests serviced earlier to 87 per cent using the double boosting system. The system has been used in Leh since March 2018.

Method of deployment

The steps involved in using the system are as follows:



Deployment of double boosting pump

Technical specification of the pump

Type: Trash pumps SWT 30	Inlet sizes mm (inch): 80 (3)
Outlet sizes mm (inch): 80 (3)	Total head (m): 26
Suction head (m): 8	Max. discharge (lit./min): 1,300
Self-priming time (sec. at 5 m): 95	Engine model: Honda GX 200 / 4-stroke OHV
Displacement (cc): 196	Net power (hp / rpm): 4.5/3600
Fuel tank capacity (petrol): 3.6 (L)	Starting system: Recoil starter
Dimensions (L x W x H) (mm): 560 x 440 x 440	Net weight (kg): 37.0

2. Case of Jhansi: Empowering and supporting sanitation workers through Swachhta Udyami Yojana

Given the rocky terrain, households in Jhansi are dependent on septic tanks for containing toilet waste. Jhansi has truck-mounted 6-KL, 2-KL and 1-KL capacity vehicles which cannot provide desludging services in narrow lanes. The septic tank cleaning is being done manually by drain cleaner/sweepers.

To provide better employment and livelihood opportunities to workers and ensure safe mechanical cleaning of septic tanks, Jhansi Municipal Corporation organized a loan mela to facilitate access of workers to the Swachhta Udyami Yojana of the National Safai Karamcharis Finance & Development Corporation (NSKFDC). The corporation facilitated the financing for the procurement of small desludging

Small desludging vehicle procured in Jhansi under Swachhta Udyami Yojna

vehicle, which can access households in narrow lanes. All the sanitation workers engaged with ULBs were eligible to avail the benefits of the scheme.

AFC India Limited (formerly, Agricultural Finance Corporation Limited) with support of NSKFDC and Jhansi Municipal Corporation organized the loan mela on January 17, 2023, which was attended by 30 sanitation workers. Fifteen workers shown interest to avail the benefits but only 11 were eligible as per the CIBIL score and documents required. Jhansi Municipal Corporation provided the certificate

and assurance letter, required for processing and approving the loan amount, to the bank. Seven applications are in process and out of which one sanitation worker received the desludging vehicle of 700-litre capacity. The width of the vehicle is around 5 feet. The machine was locally fabricated due to its unavailability on the GEM portal. The cost of the suction machine amounted to approximately Rs 9 lakh. Under the Swachhta Udyami Yojana, the sanitation worker who received the vehicle availed of a capital subsidy of Rs 3.5 lakhs. The sanitation worker is required to pay the remaining amount at a subsidized interest rate of 4 per cent over a tenure of seven years.

The vehicles was delivered in December 2023 and the corporation is in the process of providing the license (after due diligence) required for providing the desludging services within the city. The desludging rate is fixed at Rs 1,000 per trip by the municipal corporation. Due to small capacity of the suction tank, however, the number of trips would be more and this will lead to additional financial burden on households.

3. Other innovations: Jalodbust

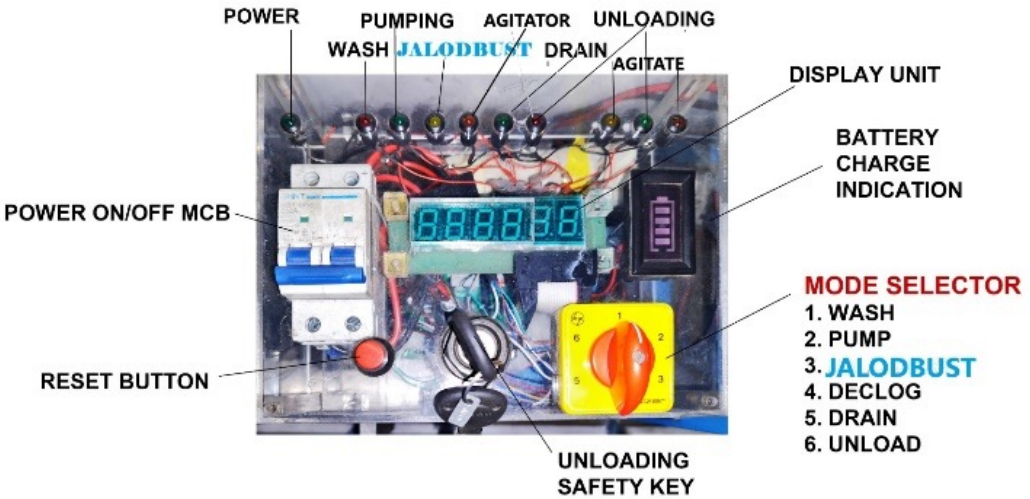
Looking at the challenges on the ground many innovators are also focusing on technical innovation, using engineering intervention, to solve this problems. One such innovation is Jalodbust, developed by Cherries Engineering and Innovation India Pvt. Ltd in 2019. The name is derived from Jalodbhava, a demon mentioned in a mythological story who lived in water.

Jalodbust is a portable, battery-operated agitator-based sludge-handling machine designed for cleaning of septic tanks in narrow lanes. It is mostly suitable for emptying the settled and hardened sludge at the bottom of the septic tank. Jalodbust liquefies the settled sludge, a task that the current machines often struggle with, leading to instances of manual scavenging.

The equipment operates on the piston pump principle with a 24-volt 40 AH battery and a 200–500 watt motor. This equipment, along with a sludge holding tank with a capacity of 1000 litres, is mounted on a Tata Ace vehicle. The overall length and width of the vehicle is 7 x 4.7 feet. The machine has a suction capacity of 200 feet horizontally and 30 feet vertically. The overall cost of Jalodbust, including the vehicle, is approximately Rs 13 lakhs.

Many ULBs across states have taken a trial run of this machine, but the actual implementation on the ground is still to happen.

Agitator-based desludging vehicle Jalodbust



4. Other innovations: Three-wheeler suction machine—Gully Man

Gully Man is a three-wheeler auto-based desludging vehicle designed by Ahmedabad-based Maniyar & Co. As the name suggests, the vehicle can easily provide service in narrow lanes with road width up to 5 feet. A suction tank of 500-

Three-wheeler desludging vehicle Gully Man

litre capacity has been mounted on a three-wheeler auto. The width of the vehicle is around 3.5 feet.

The machine is capable of creating a high degree of air pressure which breaks the silt sedimentation that gets accumulated at the bottom of the cesspit, cesspool and manhole chambers. It can pump particles up to 40–50 mm diameter along with sludge from a distance of 100 feet and depth up to 25 feet. Imported siphon filter, safety pressure release valve and quick-release coupling are a few features among safety instruments, which ensure that the equipment operates with safety and minimizes chances of occurrence of accidents. The machine costs around Rs 6 lakhs, including vehicle.

Technical specifications:

Suction tank capacity: 500 litres
Free air flow: 156 cum/hour
Max pressure: 1.5 bar absolute
Compound gauge: 100 mm dial, pressure ranger: 0–4 kg/cm^2, vacuum: 0–760 mm of Hg
Suction range: Horizontally 100 feet, vertically 25 feet

7. Conclusions

1. **Irregular and low desludging of septic tanks:** This is a major health and pollution hazard, more so when septic tanks are merely septage-holding tanks as in many cities of India and UP. One of the main hurdles in desludging is the challenge of reaching a septage-holding tank in narrow lanes of old parts of a town and in unplanned settlements. Opening the septage-holding tank and cleaning is also difficult as these are mostly sealed tanks. The cost incurred in desludging a septic tank is another major factor for households resisting regular desludging.

2. **Desludging of septic tank is a public service:** Due to limited number of private desludging operators in small and medium towns, desludging service is provided mainly by ULBs. Providing desludging service in narrow lanes by means of vehicles of small size and capacity means multiple trips and additional cost. To make it affordable for the households and urban poor, ULBs needs to subsidize desludging fees through city-level differential pricing strategy. There are examples where urban poor receive subsidies[6] as high as 50 per cent for desludging fees.

3. **Analysing the feasibility of small-bore sewer system in sewered town:** To cover the narrow-lane settlements in large towns where sewerage network (partial) is laid, the focus should be on laying of small-bore sewer system and connecting it to the nearest existing sewer line. As per UP Jal Nigam, until 2022 there were around 65 towns where partial sewerage network has been laid. A city-level study needs to be carried out to map all the inaccessible areas and to analyse the feasibility of small- bore sewer system.

4. **Continued focus on increasing desludging demand:** The current desludging frequency varies from 15–20 to 30 years due to overdesigned septic tanks. The effluent from the septic tanks flows into open or closed drains instead of a soak pit. The insufficient inflow of sludge/septage at the treatment plants also has an adverse effect on their operational efficiency. ULBs need to ensure regular desludging from institutional buildings and also increase demand for desludging by raising public awareness.

5. **Need of research and development in technology:** The available technological options can only solve the problem partially. Households that

reside in narrow-lane areas with road width less than 5 feet will still have to depend on unsafe practice of manual cleaning of septic tanks. There are also ongoing exploration for cleaning of sewer and septic tanks by means of robotics and other alternative solutions such as Mobile Treatment Units (MTUs).[7] However, there is a need for further research and development to implement advanced technologies in desludging vehicles that can efficiently navigate through narrow lanes and perform mechanical emptying without human entry into septic tanks and ensure safety of sanitation workers.

6. **Regulatory measures:** Enforce regulations and set up monitoring protocols that mandate the use of safe mechanical methods for septic tank emptying, promoting the overall safety of sanitation workers and the community. The current practice of illegally discharging emptied sludge into open drains must stop. Emptied sludge must be safely discharged into treatment plants (i.e. FSTP or co-treatment plants) for treatment and reuse of end products.

8. Recommendations

1. State support for town-level plan for desludging vehicles and allied equipment

A state-level plan for procuring desludging vehicles and allied equipment needs to be prepared. The plan must factor the town layout and requirements for desludging based on actual and potential desludging in each town, affordable fee and the operation and maintenance of any new vehicles and allied equipment.

The study found that 20–30 per cent of narrow-lane areas (with road width below 7–8 feet) in towns are inaccessible by available desludging vehicles. There are a few innovative approaches that can partially solve the problem such as double booster pumps, which can extend the pumping range from 100–150 feet to 300–500 feet.

The state needs to come up with an analysis to determine the specific vehicle requirements for each ULB. There are different sizes of vehicles available in the market. The decision for procuring a particular size of vehicle will depend on various factors such as type of town, area and length of narrow lanes, financial implications while using small-capacity vehicles, and whether a booster pump can replace small-sized vehicles etc.

It is recommended that each Class 4 town and above makes provision for at least two sizes of desludging vehicles and a double booster pump set with additional 200 feet pipe for desludging. This should not be prescribed as a standard for all towns.

2. Procurement of small vehicle through NAMASTE[8] scheme

To provide desludging services in narrow-lanes in AMRUT and other small and medium towns, government should focus on profiling of sanitation worker under NAMASTE scheme and linking them to Swachhta Udyami Yojana for purchasing smaller desludging vehicles. This will empower sanitation workers and build sustainable livelihood options for them. Additionally, occupational safety should be ensured by providing required PPEs. Under the scheme, ULBs can also procure desludging vehicles, where 90 per cent share would be borne by NSKFDC.

Notes and references

1. https://cpcb.nic.in/openpdffilephp?id=UmVwb3J0RmlsZXMvMTIyOF8xNjE1MTk2MzIy X21lZGlhcGhvdG85NTY0LnBkZg==

2. Construction of one plant has not commenced due to land-related issues.

3. https://www.cseindia.org/ease-of-septage-management-11972

4. https://sbmurban.org/state-detail?id=UP&i=9 (accessed on January 31, 2024)

5. https://static.pib.gov.in/WriteReadData/userfiles/SBM%20Directory%20-%20A4%20Horz.pdf

6. https://iwa-network.org/wp-content/uploads/2022/08/7-Faecal-sludge-emptying-in-Kampala-and-Lusaka.pdf

7. https://www.washinstitute.org/project-full-view.php?pview=NQ==

8. https://nskfdc.nic.in/en/content/home/namaste (accessed on January 31, 2024)

This report highlights the challenges of irregular and low frequency of desludging of septic tanks, especially unsafe practices involved in cleaning of septic tanks and difficulties in accessing septic tanks in narrow-lane settlements of small and medium towns in Uttar Pradesh.

It presents multiple case examples and innovative technical options practised across India to promote safe emptying of septic tanks in narrow-lane settlements. Additionally, it offers recommendations for requirements of city-level desludging vehicles and highlights upcoming challenges. The report lays the pathway for safeguarding the safety and dignity of sanitation workers.

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