TN US SP
TAMIL NADU URBAN SANITATION SUPPORT PROGRAMME

REPORT

ASSESSMENT OF TRAINING PROGRAMMES CONDUCTED BY TNUSSP PHASE 1

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Assessment of Training Programmes conducted by TNUSSP Phase 1

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Abbreviations

BOD	Bio-Chemical Oxygen Demand
CAPI	Compute Assisted Personal Interviewing
CMA	Commissionerate of Municipal Administration
CMWSSB	Chennai Metropolitan Water Supply and Sewerage Board
COC	Corporation of Chennai
COD	Chemical oxygen demand
DO	Desludging Operator
DRDO	Defence Research Development Organisation
DTP	Directorate of Town Panchayat
FS	Fecal sludge
FSM	Fecal Sludge Management
FSSM	Fecal Sludge and Septage Management
FSTP	Fecal Sludge Treatment Plant
GoTN	Government of Tamil Nadu
NGO	Non-Governmental Organisation
NNP	Narasimhanaicken-palayam
O&M	Operation and Maintenance
OSS	On-site Sanitation System
PNP	Periyanaicken-palayam
SOP	Standard Operating Procedures
TCC	Tiruchirappalli City Corporation
TNA	Training Needs Assessment
TNPCB	Tamil Nadu Pollution Board
TNUSSP	Tamil Nadu Urban sanitation support Programme
TP	Town panchayat
TWAD	Tamil Nadu Water supply and Drainage board
UDDT	Urine Diverting Dry Toilet
ULB	Urban Local Body

Executive Summary

Executive Summary

E1.1. Background

Tamil Nadu Urban Sanitation Support Programme (TNUSSP) supports the Government of Tamil Nadu (GoTN) and cities in making improvements along the entire urban sanitation chain. The full cycle of sanitation refers to the safe containment, conveyance, treatment, disposal and reuse. The TNUSSP aims to strengthen the enabling environment for faecal sludge management (FSM) through capacity building of different stakeholders along the sanitation chain. As part of its capacity building component, TNUSSP facilitated training programmes for different stakeholders such as officers of the GoTN including its engineers, masons and desludging operators (DOs).

E2.1. Objectives

Ipsos, a multinational research company was commissioned by TNUSSP to conduct an assessment of its capacity building initiatives during Phase I of the programme with an objective to

1. Conduct an independent assessment of the effectiveness of the training, / orientation, or /workshop in order to make informed recommendations to strengthen its design and delivery (including materials, methodologies, indicators and logistics).

2. Conduct an independent assessment of the impact of the knowledge and skills development resulting from training, orientation or workshop among different stakeholders across the sanitation chain.

3. To identify the gaps and strengthen the evidence base for future programming.

E3.1. Methods

Key informant interviews were held with all categories of stakeholders including masons, DOs and GoTN officers and engineers, to carry out the assessment. Additionally, interviews were also held with five respondents from TNUSSP who were involved in design and implementation of the training programmes. Structured interviews were conducted for masons and DOs using Computer Assisted Personal Interviewing (CAPI), with questions administered in Tamil. Case studies of three masons and three DOs were also done. In-depth interviews were conducted with engineers and officers across three locations. These interviews were facilitated by IIHS teams and were conducted either as face-to-face interviews or telephone interviews depending on participants' preference in either English or Tamil.

Attempts were made to contact all programme participants across all categories. All training programme participants who were available, recalled the training, and consented to it were included in the survey. Based on this, the assessment reached out to 14 of the 55 GoTN officers who attended Fecal Sludge and Septage Management (FSSM) training, 18 of the 37 officers who attended the domestic exposure visit to Devanahalli, and seven engineers who participated in the training. Participants of the

international exposure visits were not included in the survey. Among masons, 73 of 126 and 43 of the 51 DOs who were trained were interviewed.

E4.1. Key findings: Masons Assessment

The masons' training was also designed based on the Training Needs Assessment (TNA) in the two project sites of Tiruchirappalli and Coimbatore with a sample of 70 masons. The assessment revealed that among the sample of masons, none had undergone any vocational training. Masons reported constructing oversized containment structures which were unsafe. They lacked features such as watertight compartments, vent pipe and water outlets; and were sealed, plastered and covered without access for desludging. In this context, their training was appropriately designed to sensitise them on the proper methods of constructing various containment structures, consequences of building improper structures, and their role in the sanitation chain. The mason's' training assessment was specifically designed to assess whether these objectives were met.

Despite the lag between the training and impact assessment, all the respondents could recall most of the topics covered in the training programme, especially about design and construction of septic tank and the role of masons in sanitation. The majority of the masons reported that the training provided them with practical knowledge for constructing septic tanks and twin pits. More than three-fourth of them agreed that the training material, discussions, and language and time period was adequate.

Although most masons had considerable years of experience in the construction of On-site Sanitation (OSS), they reported that they got more clarity on the 'design of twin-pit' and 'do's and don'ts' in the construction of OSSs in the training programme. A considerable proportion of the respondents also reported that they learnt new concepts like Urine Diverting Dry Toilet (UDDT) and Defence Research Development Organisation (DRDO) designed anaerobic bio toilet in the training programme organised by TNUSSP.

When probed on the specifics of septic tank construction practices, majority of the masons responded correctly to three of the six aspects. However, they were unable to respond correctly to two aspects - 'minimum height of the vent pipe', 'twin-pit cleaning frequency' and 'safe distance between containment'. In six of the nine aspects of constructing twin-pit, septic tank and soak pits, most masons had good understanding. However, on the three remaining aspects namely 'impact of septic tank size on desludging', 'minimum land required for twin pit construction' and 'following honeycomb structure for construction of twin pit' their awareness ranged between 27 and 42 per cent.

Almost all respondents felt that 'building safe containment structure and creating public awareness on safe OSSs construction' were the most important parts of their jobs. The masons also conveyed sanitation related messages to the households. Almost everyone could recall all the stages of the sanitation chain, albeit not in the correct order. Majority of the masons also reported learning about

major problems caused due to poor sanitation. They also reported that they shared knowledge gained in the training programme, with their peers.

During the course of the training they had fully understood their role in building safe containment structures. Post training, masons reported about their role in creating public awareness on safe sanitation structures and had shared relevant information with the public. This information included the need for safe distance between the water source and pit, need for easily openable covers for desludging and the importance of not throwing plastic, cloth napkins and other things in the toilet. However, the key challenge expressed by masons in implementing their learnings was the lack of support from contractors, builders and households in building appropriate containment structures. It is important to note that the training was not designed for stakeholders like contractors or builders and hence masons have not yet been fully translate their knowledge into practice.

E4.2. Key Findings: Desludging Operators Assessment

For DOs training assessment aimed to assess if the orientation had helped them gain understanding of the Standard Operating Procedure (SOP), and if they are specifically applying these practices of safe collection, transportation and disposal. The orientation programme and content was designed based on ground level observation and secondary research and not on the basis of a TNA. Hence, there were no baseline of practices to compare the results of the assessment with.

Over 80 per cent of DOs felt that the training provided on desludging operation was relevant and useful. They also added that the training programme was participatory, clear and understandable. However, they felt that the time period for training was not sufficient (23 per cent). Two thirds of the operators reported being aware (prior to training) of various good practices such as checking water level and back flow of the tank before desludging and washing hoses and tank lids after cleaning. In 20-30 per cent of the cases, they reported that these practices were new learnings or that they gained better clarity. Key learning reported by DOs from the training was mainly on the effects of poor sanitation such as health hazards, social inequality, economic losses and loss of dignity. Post training their awareness of sanitation chain had improved and about 60 per cent of the operators reported sharing their knowledge gained with peers.

In terms of perception of their roles, all DOs said that safe disposal of sludge was an important part of their job. Further, 63–79 per cent of the DOs were aware about operational requirements such as ‘disinfecting using lime or bleach’, ‘checking water level to know tank condition’, before the training. However, a notable proportion said that they had learnt ‘checking back flow into tank’ and ‘checking water level to know the tank condition’ newly from the training. Over 90 per cent of the operators reported systematic preparation for transportation of sludge after the training. This included checking for permits and licenses, checking road type before planning transportation of sludge, checking spill removal equipment, and sludge management equipments. They also reported disposing sludge in dedicated disposal sites as discussed during the training, although exceptions remain.

Majority of the operators reported learning various problems caused because of poor sanitation practices, especially the health hazards. Unlike masons, 41 per cent of the operators could mention the correct sequence of sanitation chain. More than half of the operators had shared the learnings from training with their peers. The sharing with peers was mainly about technical aspects of safe desludging practices

Majority of the DOs rated their training experience as excellent. The training helped the DOs to understand type of transportation, safe disposal, occupational safety, roles and responsibilities and use of desludging equipment. They also reported that the training had helped them ensure occupational safety for them and for their team members. The distance from household to the emptying site and non-availability and improper fit of personal protective equipment (PPE) were found to be significant challenges for most DOs. About a quarter of the respondents reported forcible entry into septic tank as a challenge. Majority of the DOs requested for additional training, especially related to occupational safety and advanced techniques in handling the desludging process. While the assessment confirms that the practices of DOs are largely aligned with safe desludging and occupational practices, the absence of a baseline meant that the scale of improvement could not be measured.

E4.3. Key Findings: Officer's and Engineers Training Assessment

TNUSSP has designed the training programme for officers based on a training needs assessment (TNA). The study revealed limited awareness on fecal sludge treatment and reuse at different levels within the Urban Local Bodies (ULBs). Further, lack of sufficient competent personnel to carry out the tasks required for proper planning, implementation, and maintenance management of sanitation facilities, especially in human excreta management was noted in the TNA.

Training programmes for officers of GoTN included a two-day orientation programme on various aspects of Fecal Sludge and Septage Management (FSSM) and Operative Guidelines on Septage Management'. Additionally, a one-day workshop was also done for officers of Tiruchirappalli City Corporation (TCC) to help focus on practical aspects of planning, implementation and monitoring elements of the full cycle of sanitation. Domestic exposure visits to the Fecal Sludge Treatment Plant (FSTP) in Devanahalli, Karnataka, was organised to expose participants to technology, design and operations of an FSTP. The TNA for officers and engineers mainly aimed to take their feedback on training, the extent to which it impacted their capabilities, whether they were able to put their learning into action and if so what the challenges were. Their inputs for future trainings were also collected. However, their knowledge on specific training topics was not assessed.

Officers and engineers who participated in the impact assessment reported that they liked the overall training content, training delivery methods and presentation on the sanitation chain. The overall rating was a score of 4.6 on a scale of 1 to 5, (5 being very much liked and 1 being did not like at all). They also agreed that the training had provided better understanding on the sanitation chain and issues associated with it. They mentioned that they got clarity on safe collection, storage and transportation.

All respondents were asked if the training built their capacity on various aspects such as ‘sanitation chain’, ‘issues across the sanitation chain’, ‘dealing with challenges in fecal sludge management’, ‘understanding treatment process’ and ‘reuse methods’. An overwhelming majority of the respondents reported improved understanding across all themes mentioned above.

In the one year after training, 31 officers reported taking action for improving sanitation in the city. The range of efforts varied across the respondents, including planning for FSSM in their areas and approval of 49 FSTPs in Tamil Nadu. Officers also reported building awareness on individual toilet construction through the Swachh Bharat Mission subsidy and importance of building proper septic tanks. Specifically, officers reported spreading further awareness to relevant stakeholders such as DOs in the sanitation chain - such as DOs safe collection and transportation. DOs asked not to dump in non-designated sites and were warned that for any violation their vehicle will be seized. Meetings were held with licensed surveyors, builders, contractors and key masons. In these meetings, instructions were given to follow the design norms for septic tank size and build them as per the capacity requirements of the type of building constructed. Challenges in implementation include getting access to land and funds for FSTP construction, getting public to convert unsanitary latrines and access to techniques for toilet construction in small spaces.

E4.4. Key Findings: Trainers

The Trainer’s’ reported selecting relevant participants across the sanitation chain to maximise effectiveness of the programmes. Towards this, masons were selected as they were directly associated with construction and maintenance of containment structures; DOs were selected as they play a crucial role in the collection, transportation and disposal of fecal sludge. Further, capacity building was done for government officers and engineers given that the former were responsible for safe function at each stage of the sanitation chain, and the latter were involved in design and implementation of treatment plants and approvals for containment structures. Content development for both officers and masons was done on the basis of a TNA. Training modules were designed based on the specific information needs of each category of stakeholders and included content on technical aspects, policy aspects and best practices.

E5.1. Recommendation

The study findings derived from the different stakeholders revealed that at an overall level the capacity building programme had served the intended purpose of creating sufficient knowledge and skills among the stakeholders. However, the following are some suggestions based on the findings for improving the programme further.

E5.1.1. Masons

- Both the trainers and the masons were of the opinion that more practical training should be organised. Hence, instead of using prototypes for training onsite, practical construction should

be demonstrated for the masons. Further, videos should be used for twin-pit and septic tank construction for masons.

- One of the key constraints for construction of containments, especially in urban areas is the availability of land. Hence, the masons should be provided with advanced technical inputs for designing the containments in the given land.

E5.1.2. Desludging Operators

- Desludging operators were of the opinion that the training time was short. Given that they are relatively free during summer, a detailed in-house training can be planned for them. Practical demonstration of best practices would be more effective. If that is not possible then videos should be recorded and played in the training programmes.

- One of the important concerns raised by most of the operators in the case study was the way they were treated by people. TNUSSP's efforts to valorise their work should be sustained for a meaningful change in their image and perception of their role in the society.

E5.1.3. Officers and Engineers

- Given that engineers approve design at the planning stage, trainers expressed the need to provide awareness to engineers on the basics of safe, sustainable, environment friendly and economic containment construction.

Few masons and desludging operators expressed their willingness to become peer educators, which is particularly useful in this segment. Peer educators can be identified during the training session and they can be groomed for training their peers.

Further, trainers expressed the need to conduct needs assessment and understand current levels of knowledge and practices for all stakeholders to design an appropriate training module.

Training modules could also be organised for surveyors and contractors to help create an enabling environment for masons to operate in.

Innovative models of toilet construction which address space constraints need to be developed and implemented.

Behavioural change campaigns designed to make households understand the need for safe containment and regular and safe desludging needs to be conducted.

Introduction

1. Introduction

1.1. Background

Lack of adequate sanitation poses one of the greatest barriers for Tamil Nadu in achieving the full development potential and ensuring high standards of public health for citizens of the state. While sewerage and treatment plants have received policy attention and investments in larger cities, on-site systems, that are the predominant household arrangement across the state, have received limited attention. Pits and septic tanks are not built as per the norms; hence fecal matter leaks out untreated from these structures into drains, water bodies and open areas and also affects the groundwater. These septic tanks are also not desludged regularly, creating major health and environmental hazards.

Limited data is available on the coverage and effectiveness of these desludging services as these are mostly operated by the informal sector. The sludge collected from septic tanks is often disposed into either natural storm water drainage systems or a nearby surface water body, especially in the absence of any treatment facilities. Sewerage or underground drainage systems in many locations suffer from problems of maintenance; the sewage generated does not reach the treatment plants in many instances, and the existing sewage treatment plants (STPs) are unable to treat the wastewater received. Finally, Urban Local Bodies (ULBs) and other urban sector agencies have not recognised the full cycle of sanitation, especially on-site installation, as an item needing their attention.

Indian Institute for Human Settlements (IIHS) is a national education institution committed to the equitable, sustainable and efficient transformation of Indian settlements. In Tamil Nadu, IIHS primarily focuses on effecting improvements along the entire urban sanitation chain through Tamil Nadu Urban Sanitation Support Programme (TNUSSP) and by demonstrating innovations in two model urban locations: Tiruchirappalli City Corporation (TCC) and the two town panchayats of Periyanaicken-Palayam (PNP) and Narasimhanaicken-Palayam (NNP). In both locations, TNUSSP is implementing projects and interventions along the full sanitation cycle, and city sanitation and investment plans are being prepared, in consultation with all stakeholders. In addition, TNUSSP aims to strengthen the enabling environment for fecal sludge management (FSM) through capacity building of different stakeholders along the sanitation chain. As a result, various training programmes were conducted for officers of the Government of Tamil Nadu (GoTN), ULB officers, engineers, masons and desludging operators (DOs) in Tiruchirappalli and Coimbatore.

1.2. Capacity Building Programmes

1.2.1. Programmes for Government Officers

The programmes for government officers comprised of orientation programme, domestic and international exposure visits.

Orientation Programme

A two-day orientation and training programme was targeted at 51 officers working in state-level agencies, ULBs (corporations, municipalities, and town panchayats), and selected water and sanitation parastatals and utilities. Building on the developments for promotion of sanitation, the programme also drew upon national and international examples and experiences to help participants understand the operational and practical aspects of planning, implementing and monitoring the different elements of the full cycle of urban sanitation that involves safe containment, conveyance, treatment, disposal and reuse. While the over-arching framework was that of total sanitation across the chain, selected sessions of the training focussed on Fecal Sludge and Septage Management (FSSM) as a comprehensive solution for small and medium towns, and as a complementary solution for larger urban areas. Additionally, a one-day orientation was also carried out for 14 Tiruchirappalli City Corporation (TCC) officers, which focussed on comprehensive solutions for small towns and operational and practical aspects of planning, implementing and monitoring elements of the full cycle of urban sanitation.

Domestic exposure visits

A series of domestic exposure visits to the Fecal Sludge Treatment Plant (FSTP) in Devanahalli, Karnataka, was organised to expose participants to technology, design and operations of an FSTP. Over 40 government officers, including state officers from various departments were a part of the exposure visit.

International exposure visits

In order to demonstrate and improve the understanding of successful models of FSM, an exposure visit to Malaysia, where septage management solutions have been successfully promoted was organised. Eleven senior officers of the Government of Tamil Nadu (GoTN) participated in this.

Annexures 1-3 present the list of participants in the officers' training programmes.

1.2.2. Programmes for Engineers

The one-day training programme for engineers was held in Tiruchirappalli for a group of eight engineers. It emphasised on the city's current practices of co-treatment of fecal sludge and sewage. It also included components of an FSTP including feasibility, design, implementation, Operation and Maintenance (O&M) aspects and new treatment options.

Annexure 4 presents the list of participants in the engineer's training programmes.

1.2.3. Programmes for Masons

Four workshops extending over one or two days were organised in Tiruchirappalli and Coimbatore, for 126 masons who were involved in the construction of on-site sanitation (OSS) systems, i.e. twin pits and septic tanks. They sensitised the masons on the importance of sanitation and on their role in the

sanitation chain. The programme covered the basic design and construction of septic tanks and twin pits, including dos and don'ts and the importance of designing containment structures as per standards.

1.2.4. Programmes for Desludging Operators and Workers

The half-day orientation programme for desludging operators was attended by 67 workers and operators across Coimbatore and Tiruchirappalli. The programme aimed at sensitising both operators and workers on the full cycle of sanitation and their central role in ensuring that fecal waste is disposed in the facilities provided by the government. The programme included discussions on vehicle design, different kinds of equipment used for desludging, safe collection and transportation, occupational safety procedures and health implications of incorrect practices. Table 1.1 presents an overview of the training, learning outcome, total participants trained, and days of training for each level.

Table 1.1: **Overview of Training, Learning Outcome, Total Participants Trained, and Days of Training for Each Level**

Training	Topics Covered	Learning Objective	Participants	Number of participants	Days of training
For engineers–training programme on FSSM	Engineering and technology aspects of FSM. Planning, implementing and monitoring elements of the full cycle of urban sanitation.	1. To create awareness on the policies, guidelines and practices about FSSM from international best practices and experiments in India and Tamil Nadu (including OGSM) 2. To develop an understanding of different technological options (along the chain, but focusing on treatment) 3. To understand the decision-making criteria for technological selection 4. To understand different managerial aspects of FSM particularly procurement and O&M management 5. To understand the data requirements and different approaches for planning FSM solutions	Engineers working in the TCC	8 engineers	2 days 08–09 December, 2017
For governmen t officers–Orientation and training programme	Promotion of sanitation; total sanitation across the chain; selected sessions of the training	1. To create awareness about the policies, guidelines and practices about FSSM from international best practices and	Officers including the Principal Secretary, Deputy Commissioner and Chief Engineer, officers working in state-level	Two-day orientation–38 participants 4.	2-day programme 10–11 January, 2017

Table 1.1: **Overview of Training, Learning Outcome, Total Participants Trained, and Days of Training for Each Level**					
Training	**Topics Covered**	**Learning Objective**	**Participants**	**Number of participants**	**Days of training**
for GoTN on FSSM	focused on FSSM. All components of the sanitation chain, and the Operative Guidelines for Septage Management (OGSM) of Tamil Nadu	experiments in India and Tamil Nadu 2. To enable participants to discuss the key issues and constraints in prioritising and promoting solutions and innovations for urban sanitation in Tamil Nadu, and help them develop recommendations 3. To help participants develop action plans at the state and regional levels focussing on identified ULBs	agencies, ULBs (corporations, municipalities, and town panchayats), and selected water and sanitation parastatals and utilities from Chennai districts For one-day programme: Officers of TCC, including special officer and commissioner, assistant commissioner and assistant engineer	One day Orientation – 14 participants	1-day programme – 16 March, 2018
For government officers– Domestic exposure visits to FSTP for GoTN officers	Implementation of sustainable sanitation solutions including the promotion of full-cycle septage management.	1. To promote full-cycle septage management as a sustainable value-for-money option for most of the urban areas of the state, and as a necessary complement to network-based UGD systems in larger cities, to achieve the vision of total sanitation	a. State government officers and engineers in the Commissionerate of Municipal Administration (CMA), Directorate of Town Panchayat (DTP), Tamil Nadu Water Supply and Drainage Board (TWAD), Corporation of Chennai (COC), Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) and Tamil Nadu Pollution Control Board (TNPCB). b. Regional Director of Municipal Administration (RDMA), Assistant Directors of Town Panchayat (ADTPs) and Municipal Commissioners of Trichy and PNP and NNP TPs (Coimbatore). c. Executive officers, assistant	42 officers in 5 batches	1-day programme in 5 batches: 3 and 8 February 3, 2017; 14 July ,2017; 12 August, 2017 and 22 June, 2018

Table 1.1: **Overview of Training, Learning Outcome, Total Participants Trained, and Days of Training for Each Level**					
Training	**Topics Covered**	**Learning Objective**	**Participants**	**Number of participants**	**Days of training**
			and junior engineers, Trichy district sanitary officers and other administrative officers of Trichy, PNP and NNP TPs (Coimbatore). e. Representatives of NGOs and educational institutions as nominated by GoTN.		
For government officers–international visit to Malaysia	Septage management in Malaysia and associated policy and regulation; meetings with Water Konsortium Sdn. Bhd (IWK) officials and understanding its structure, roles and functions; field visit to STP and management systems for septage; review of financial aspects including capital expenses and O&M.	1. To obtain an overview of concepts and practices in the full cycle of sanitation participants 2. To gain practical understanding of all elements of septage management, FSM systems including legal, financial, monitoring, capacity building, behavioural aspects through field visits	Senior officers of the GoTN of the rank of Regional Director, Executive Engineer, executive officers	11 officers	5 day visit: 17–22 July, 2016
Masons' training	Correct design and construction of septic tanks; understanding flaws of the current practices. Implementation level challenges of building septic tanks and twin	1. To create awareness on the significance of usage and construction of toilets and their impact on environmental protection by eliminating open defecation 2. To provide masons with technical knowledge and skills on the design, principles, construction norms and	Masons involved in construction of OSS	126 masons in 4 batches	2-day workshop in Coimbatore: 19-20 December, 2016 1-day workshop in Coimbatore: 17 May, 2016

Table 1.1: **Overview of Training, Learning Outcome, Total Participants Trained, and Days of Training for Each Level**

Training	Topics Covered	Learning Objective	Participants	Number of participants	Days of training
	pits for the mason's. Standard of practice vs current practices, the basic practical construction knows how as well as an understanding on common errors.	specific requirements of OSS systems such as twin-pits and septic tanks 3. To stress on the importance of O&M of OSS systems			1-day workshops in Tiruchirappalli: 18 November, 2016 and 15 June, 2017
Desludging operators and workers orientation session	Collection, transportation and disposal of fecal waste. Information on the standards of practice as per OGSM vs. the current practices for pumping and disposal of human waste. Basic understanding on the vehicle design, equipment's and occupational safety procedures. Importance of their role in the sanitation cycle.	1. To operate as per SOPs required under OGSM. 2. To apply safe collection, transportation and disposal practices 3. To recognise the importance of their role in the sanitation cycle and contribute to improving safe sanitation in the state	Desludging operators and workers	51 operators and workers in 3 batches	2-4 hours orientation session Tiruchirappalli –1 August, 2017 Coimbatore –16 May, 2017 and 17 July, 2016

Source: TNUSSP, 2016 and 2017

1.3. Objectives of the Study

Ipsos, a multinational research company was commissioned by TNUSSP to conduct an assessment of its capacity building initiatives during Phase I of the programme. The overall objective of this study was to measure the effectiveness of the training programmes, and to assess if the training had translated into practice and decision-making.

The specific objectives of the assessment were:

1. To conduct an independent assessment of the effectiveness of the training, orientation or workshop in order to make informed recommendations to strengthen its design and delivery (including materials, methodologies, indicators and logistics).

2. To conduct an independent assessment of the impact of the knowledge and skills resulting from training, orientation or workshop among different stakeholders across the sanitation chain.

3. To identify gaps and strengthen the evidence base for future programming.

1.4. Study Methodology

To assess the various orientation and training programmes, different approaches were adopted for different categories of stakeholders. Initially, in-depth interviews with five IIHS trainers and/or training administrators were conducted to understand the conceptualisation, delivery, and participants' feedback on the training.

With masons and desludging operators, structured interviews were conducted using Computer Assisted Personal Interviewing (CAPI). The questions were administered in Tamil by the interviewer and wherever required images were shown. In addition, case studies were carried out with three masons and desludging operators each, based on practices reported during the structured interviews. The objective of these case studies was to understand how trainings have enabled them to incorporate learnings in their role as masons and desludging operators, thus demonstrating the impact of the trainings.

Figure 1.1: **Interviewer with Desludging Operators**

Source: TNUSSP Survey, 2018

In-depth interviews were conducted with engineers and officers across three locations who participated in trainings except those who attended the international exposure visits. These interviews were facilitated by IIHS teams and were conducted either as face-to-face interviews or telephone interviews depending on participants' preference for either English or Tamil.

1.5. Sample

The assessment study was carried out in three locations—Tiruchirappalli, Coimbatore, and Chennai and participants included state government officials, ULB officers, engineers, masons and desludging operators and their workers who had attended the training programmes. The assessment was designed to interact with all training participants in each category and understand their perspectives on the training. Hence, all participants were contacted and based on their recall of training, availability, and consent, they were interviewed. Table 1.2 presents the sample characteristics along with planned versus actual interviews conducted.

Table 1.2: **Number of Participants Trained Versus Actual Sample**			
Training	**Participants' Category**	**Total participants trained**	**Completed no. of interviews**
Training programme FSSM	Engineers working in the office of CMA and DTP, TWAD Board, ULBs, and other GoTN officers	8	7
Orientation and training programme for GoTN on FSSM	Engineers working in the office of CMA and DTP, TWAD Board, ULBs, and other GoTN Officers and selected water and sanitation parastatals and utilities from Chennai, Madurai, Vellore, Tiruppur, Tirunelveli, Trichy, Kanchipuram, Theni, Tuticorin	55	15
Domestic exposure visit on FSTP for GoTN officers	State government officers and engineers, RDMAs, ADTPs and municipal commissioners Executive officers, assistant and junior engineers Sanitary officers and other administrative officers Representatives of NGOs and educational institutions	37	19
Masons training	Masons involved in construction of OSS (Trichy and Coimbatore)	126	73
Desludging operators and workers' orientation session	Desludging operators and workers (Trichy and Coimbatore)	51	43
Source: TNUSSP Survey, 2018			

Masons and desludging operators' interviews were conducted at residence, worksite and congregation points as per their convenience. For scheduling appointments, they were called in advance where contact numbers were available. In most cases, more than one visit was made to meet and interview the masons and desludging operators. Field work was carried out between 12 November and 11 December 2018.

1.6. Challenges

The time lag between training and actual impact assessment had considerable implications while tracing the trainees. Following were some of the other challenges faced and key strategies followed by Ipsos for tracing masons, desludging operators and officers for conducting interviews:

- The database of masons, desludging operators and officers who attended the training along with their contact numbers was shared with Ipsos. However, the database did not have detailed addresses. Hence, a team of enumerators were oriented and deputed to call up all the contacts and determine the feasibility of reaching the respondents. Through this process few

appointments could be fixed but there were issues of phone not being reachable and few respondents could not remember the training.

- The team also visited congregation points of masons and desludging operators during afternoons as meeting them in the morning and evening did not work.

- To remind the respondents (masons and desludging operators) about the training, the team also referred to names of the implementing partners: Gramalaya (Trichy) and Key Stone Foundation (Coimbatore).

- The team also contacted contractors under whom desludging operators were working to reach out to the operators and workers.

- IIHS team facilitated scheduling of interviews with available officers and Ipsos verified with the officials about their availability and conducted interviews at the scheduled time slots.

1.7. Limitations of the Study

The capacity building programme for different stakeholders were conducted more than a year before (2016-17) the assessment was done. It had considerable implications on the respondents' ability to recollect training content. Thus, the responses may be influenced by recall bias.

Chapter one, set out the context, objectives, methods and sample for this assessment. Chapter two presents the key findings from the masons' training assessment; chapter three presents the key finding of desludging operators' assessment; chapter four presents the key findings from assessment of officers' and engineers' training; chapter five presents the trainers' perspectives; and chapter six presents discussions and recommendations.

2

Training Assessment: Masons

2. Training Assessment: Masons

This chapter presents the key findings from the assessment of trainings for masons.

2.1. Masons' Training Needs Assessment

At the start of the programme, towards designing a suitable training module for masons a TNA was conducted by TNUSSP in the two project sites of Tiruchirappalli and Coimbatore with a sample of 70 masons. The assessment revealed that among the sample of masons, none had undergone any vocational training and are either continuing with their family profession or had learnt the skill on the job. Majority of the masons reported constructing both the super structure and sub-structure of toilets and reported that the type of structures were not decided by technical aspects but by factors such as space and water availability, affordability, geographical conditions and owner preferences.

The sampled masons had prior experience in building different types of containment structures—90 per cent had built septic tanks, 19 per cent had built off-set single pits, 11 per cent had built a pit below the toilet. Half the masons reported building off-set twin pits. As per standards, the size of septic tanks is to be determined based on the household size and desired desludging frequency, but in practice masons build oversized septic tanks, often at the behest of the house owner. Masons also reported connecting the septic tank overflow to soak pits, open drains or not providing any outlets at all. Containment structures were reported to be plastered and sealed in about half the cases thus making regular cleaning difficult. Masons reported constructing pit walls without lining (29 per cent) and base without lining (30 per cent). A majority of the participating masons reported willingness to participate in trainings if offered.

2.2. Objectives, Themes and Expected Outcomes of Masons Training Programmes

Based on the results from TNA, masons' training programme was designed with the following objectives:

- To create awareness on the significance of usage and construction of toilets and their impact on environmental protection by eliminating open defecation.
- To provide masons with technical knowledge and skills on the design, principles, construction norms and specific requirements of OSS systems such as twin-pits and septic tanks
- To stress on the importance of O&M of OSS systems

During the training, masons were introduced to the full cycle of sanitation and sensitised on the importance of their role in building safe containment structures. Masons were specifically trained on the need of designing septic tanks according to standards, including the necessity of constructing watertight compartments, building partitions, providing air vents and connecting water outlets to draining trenches or soak-pits. Twin-pit technology and the circumstances under which this should be chosen were also discussed. Classroom training sessions were reinforced with participatory practical sessions. Reference

hand-outs with design and cost estimates for proper toilet construction, with dos and don'ts were provided.

Upon completion of the one-day programme, it was envisaged that the masons would be able to develop proficiency in basic design and construction of septic tanks and twin-pit latrines and gain an understanding of the problems with the current construction practices.

2.3. Findings from Masons' Training Assessment

Masons' training assessment aimed to assess if the masons have gained knowledge and awareness as per the objectives stated above. Interview was designed to ask questions on various aspects such as training recall; knowledge and practice; role clarity; learnings and knowledge sharing; training method and rating, challenges and training needs.

The training impact was conducted more than a year after the trainings were administered. So initially participants were asked an open-ended question and their responses were recorded. Subsequently, they were prompted to possible response options and their responses were recorded. Both spontaneous responses and guided (prompted) response are reported separately.

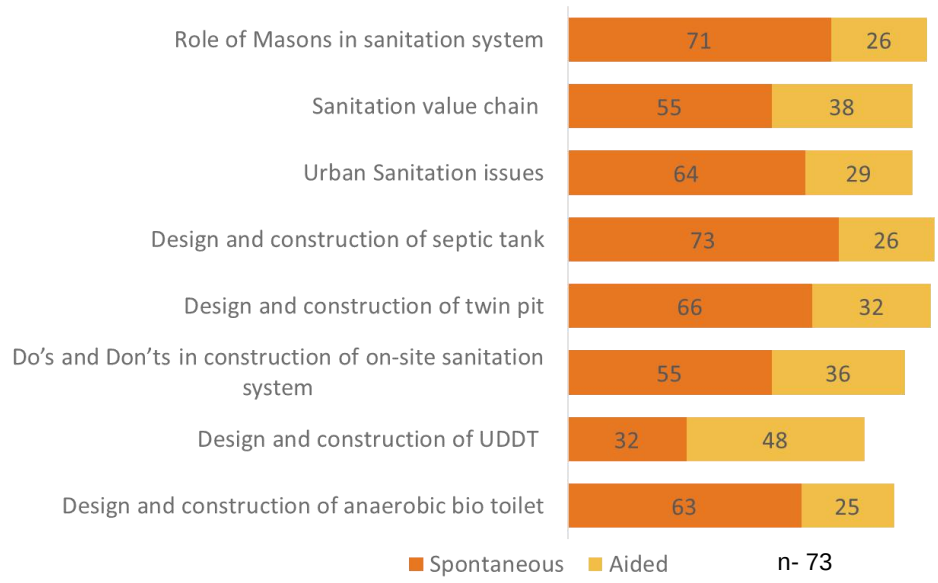
2.3.1. Profile of Masons Interviewed

The average reported age of the 73 masons in the sample was about 41 years with the average experience of about 16.5 years in the construction of OSS systems (septic tank, twin pit and soak pit). The average monthly income reported by masons was about Rs. 13,415. Of the 73 masons, 46 masons reported that they constructed septic tanks and twin-pits in the last 6 months.

2.3.2. Training Recall

Respondents were asked if they remembered the topics covered in the training programme. In the first instance spontaneous responses were recorded and when topics not mentioned, topics were prompted, and responses recorded. Almost all masons recall some topics covered in the training spontaneously (Figure 2.1). The two topics which had the highest spontaneous recall among masons were 'design and construction of septic tank' (73 per cent) and 'role of masons in sanitation system' (71 per cent), followed by 'design and construction of twin-pit' (66 per cent) and 'urban sanitation issues' (64 per cent). Among the topics which masons remembered after prompting were 'design and construction of UDDT' (48 per cent), 'sanitation chain' (38 per cent) and 'dos and don'ts of septic tank construction'.

Figure 2.1: **Recall on Topics Covered during the Training**

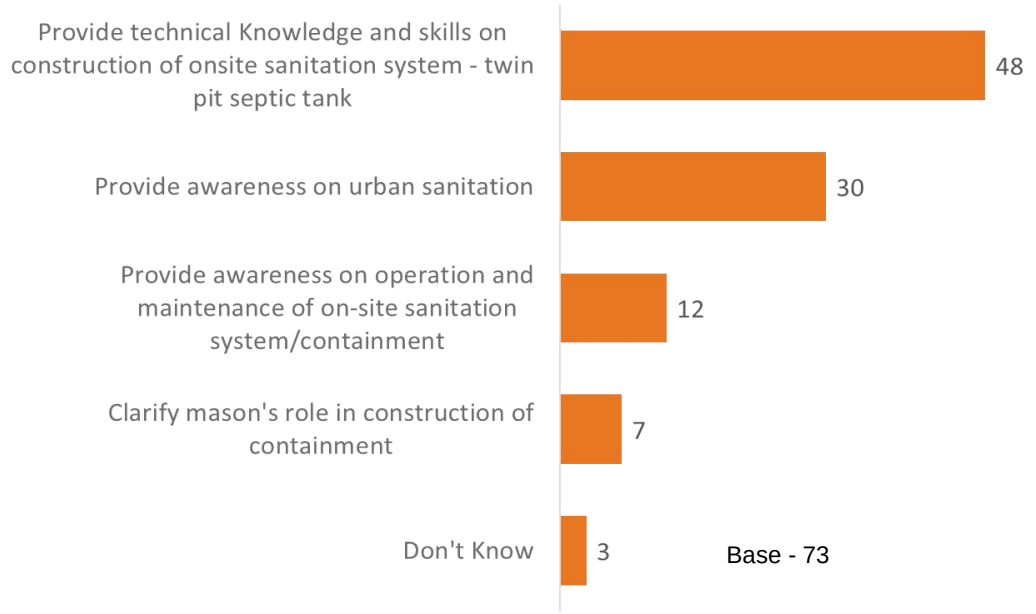


Source: TNUSSP Survey, 2018

2.3.3. Planned Objectives and Perceived Objectives

The planned objectives of the masons' training have been started above. Respondents were asked about their perception of the objectives of the training programmes. Almost half of the respondents reported that 'providing technical knowledge and skills on construction of OSSs: twin-pit or septic tank' was one of the key objectives of the training programme attended by them. (Figure 2.2) This was followed by 'providing awareness on urban sanitation' (30 per cent) and 'providing awareness on operation and maintenance of OSS system' (12 per cent).

Figure 2.2: **Perceived Primary Objective of the Training (%)**



Source: TNUSSP Survey, 2018

Box 2.1: **Mason Case Study 1**

'I have built more than 100 containment structures about half of which were septic tanks and 10 were twin-pits. The training programme helped me understand the importance of toilet, closet packing and twin-pit. I have followed the important aspects I learnt during the training and also guided my friends on the specifications of twin-pit construction as they were not aware about it. In one instance the contractor insisted on building only single pit due to lack of space, but I explained the importance of twin-pit and use of junction chamber to him and the householder. I also suggested the size of the pit by understanding the availability of area and number of household members. I want to learn more new techniques for safe containment construction in town areas where people have space constraints.' — 50 year old mason, Tiruchirappalli

Source: TNUSSP Survey, 2018

2.3.4. Feedback on Training Elements

The respondents were asked to rate their overall training experience on a 0-5 scale where 0 stands for poor and 5 stands for excellent. The majority of the respondents (92 per cent) gave a rating of either 5 or 4 for their training experience. Certain elements of the training were read out for the respondents; their response options for these elements included 'agree', 'disagree', 'not sure', 'don't know' or 'refuse to respond'.

Almost 93 per cent of the respondents agreed that the training had provided them 'practical knowledge for constructing septic tank and twin-pit' (Figure 2.3). More than three-fourth of the respondents had agreed with almost all the training elements such as it offered 'practical methods of learning', 'was clear and understandable', the 'time was sufficient' and that the training 'explained their role clearly'.

Figure 2.3: **Feedback on Training elements (%)**

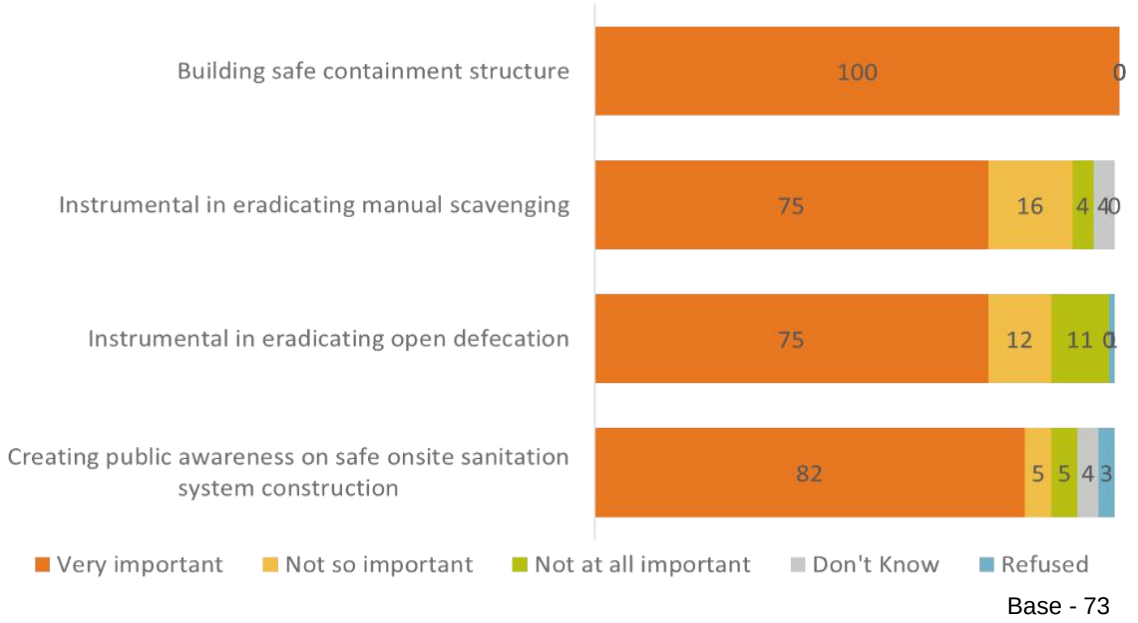
Source: TNUSSP Survey, 2018

2.3.5. Masons' Perception of their Role

Role of Masons

In order to understand the perception of the respondents about their role, a few statements were read out to them and they could rate it as 'very important', 'not so important', 'not at all important', 'don't know' or 'refuse to respond' (Figure 3.4). All respondents felt that 'building safe containment structure' was most the important part of their job, followed by 'creating public awareness on safe OSS construction' (82 per cent). Three-fourth of the masons thought they were 'instrumental in eradicating manual scavenging' and 'instrumental in eradicating open defecation'.

Figure 2.4: **Perceived Role of Masons**



Source: TNUSSP Survey, 2018

2.3.6. Key Learnings

The respondents were exposed to a set of six statements to understand their knowledge of various technical aspects of construction of septic tank, twin-pit and soak pit (Table 2.1). This included a question on distance between the pit and drinking water, based on the water table; height of the vent pipe; diameter of the inlet and outlet pipe for septic tank; chamber sizes and pit emptying frequency. The respondents were asked to state whether the statements were true or false. An overwhelming majority of the masons reported correct knowledge and scored over 90 per cent for three out of the six statements. However, they were not able to point out that two statements were false— 'minimum height of vent pipe should be 4 feet to avoid bad odour' and 'minimum pit emptying frequency in case of twin-pit should be 4 years'. In one statement on the distance between the pit and drinking water source, there was lack of clarity on the safe distance to be maintained.

Table 2.1: **Masons' Knowledge on Technical Aspects of OSS Construction**

Technical statements seeking true or false responses	**Statement**	**Correct identification (%)**
The horizontal distance between pit and drinking water source should be minimum 5 m away if water table depth is 2 m or less (False)	False	3

Table 2.1: **Masons' Knowledge on Technical Aspects of OSS Construction**		
Technical statements seeking true or false responses	**Statement**	**Correct identification (%)**
If the water table depth is 2 m or more, the horizontal distance between the bottom of the soak pit and drinking water source should be at least 3 m.	True	90
The minimum height of vent pipe should be 4 feet to avoid bad odour (False)	False	12
For inlet and outlet in septic tank 4 inches diameter pipe should be used	True	96
Minimum pit emptying frequency in case of twin-pit should be 4 years (False)	False	10
In septic tank the length of second chamber should be half of the first	True	96
Source: TNUSSP Survey, 2018		

Further, they were exposed to two sets of nine statements - one set correct and the other incorrect and they were asked to choose the correct statement (Table 2.2).

Table 2.2: **Statements Used to Assess the Masons' Understanding of OSS Construction**	
Statement 1	**Statement 2**
Both the pits in twin-pit should be filled at a time.	When one pit is filled, next should be used in twin pit.
Honeycomb bond should be followed while constructing twin-pit wall.	There should not be any hole in twin-pit wall.
Septic tank can be constructed in swampy area.	Septic tank cannot be constructed in swampy area.
Minimum land required for twin pit is 20 sq. ft. to 40 sq. ft.	Minimum land required for twin pit is 40 sq. ft. to 60 sq. ft.
Over designing of pit does not have any effect on desludging.	Overdesigning of pit will cause inconvenience at the time of desludging.
Septic tank should not be plastered inside.	Septic tank should be plastered inside.
Septic tank should be completely water sealed to avoid bad odour.	Septic tank should not be completely water sealed to avoid bad odour.

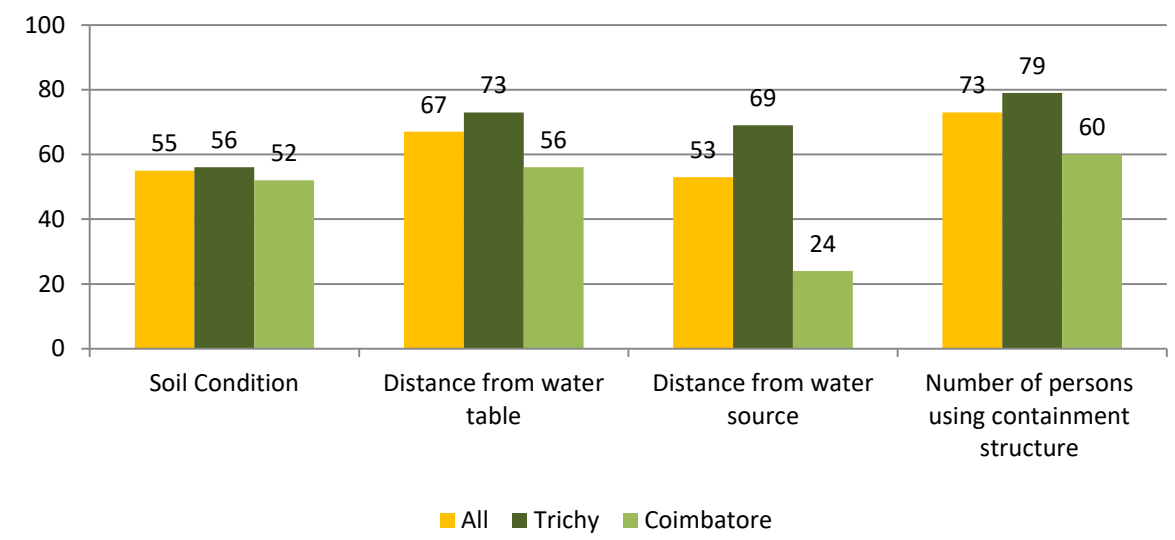
Table 2.2: **Statements Used to Assess the Masons' Understanding of OSS Construction**	
Statement 1	**Statement 2**
Soak pit should not be lined and plastered at the bottom and should be left in natural condition.	Soak pit should be lined and plastered at the bottom.
Diversion chamber in twin-pit helps FS to flow into pit.	Diversion chamber is used to hold both the pits in the twin-pit system.
Source: TNUSSP Survey, 2018	

Among the respondents, 88 per cent reported correctly that the 'second pit should be used after the first pit fills up'. Just 45 per cent of the masons correctly reported that 'honeycomb bond should be followed while constructing twin-pit wall', (with 52 per cent of the masons reporting in Trichy as opposed to 32 per cent in Coimbatore). In the sample, 89 per cent of the masons reported correctly that 'septic tank cannot be built in a swampy area'. Of the sampled masons, 42 per cent reported correctly that the 'minimum land required for twin-pit construction was 40 to 60 sq. ft.' (52 per cent of Coimbatore masons reporting the same as opposed to 38 per cent Trichy masons).

Just 27 per cent of the masons felt that 'overdesigning septic tank can cause inconvenience at the time of desludging' (44 per cent of the masons in Coimbatore reported the same as opposed to 19 per cent in Trichy). Further, 88 per cent of the masons correctly reported that the 'septic tank wall should be plastered from inside', while 67 per cent of the respondents correctly reported that 'septic tank should be completely water sealed to avoid bad odour'. In the sample, 78 per cent of the respondents were able to state correctly that 'soak pit should not be lined and plastered at the bottom' (88 per cent of Trichy masons reported the same as against 60 per cent in Coimbatore). Further, 66 per cent of the masons mentioned correctly that the diversion chamber in twin-pits helps fecal sludge to flow into the pit, with more Trichy masons reporting the same (83 per cent) as opposed to Coimbatore masons (32 per cent).

Masons were asked if they took the following factors into consideration while constructing a septic tank: soil condition, distance from water table, distance from water source, number of people dependent on containment tank (Figure 2.5). Among the masons, 55 per cent reported taking soil conditions into consideration, with no major difference between Trichy and Coimbatore. Further, 67 per cent reported that they take into account 'distance from water table' (73 per cent in Trichy as compared to 56 per cent in Coimbatore), 53 per cent take in to account 'distance from water source' (69 per cent in Trichy as compared to just 24 per cent in Coimbatore). About three-fourth of the masons reported that they consider 'number of persons using containment' with more masons reporting the same in Trichy (79 per cent) as opposed to Coimbatore (60 per cent).

Figure 2.5: **Factors Considered while Designing a Septic Tank (%)**

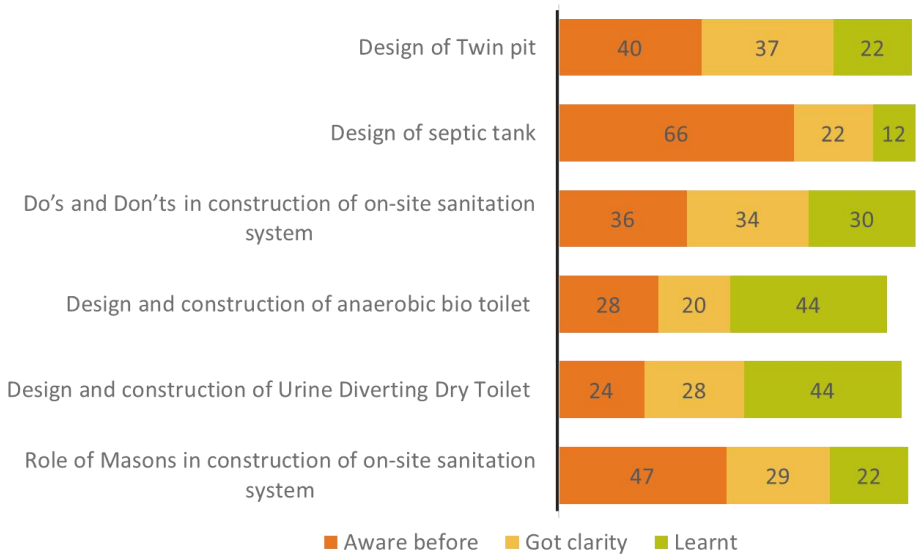


Source: TNUSSP Survey, 2018

Potential list of topics learnt from the training programmes was read out to the respondents. To each theme, they could respond as 'aware before', 'got clarity' or 'learnt from training' (Figure 2.6). On the question of 'design of septic tank', 66 per cent of the masons reported being 'aware before', 22 per cent reported 'gaining clarity' and 12 per cent reported 'fresh learning'. However, on the issue of 'dos and don'ts of construction of OSSs', 34 per cent reported 'gaining clarity' and 30 per cent reported fresh learning'. Thus, it can be inferred that, although masons were earlier constructing OSS systems as expected of them, they gained further clarity and new understanding of the same through the training.

The topics to which majority of the respondents reported fresh learning' is the 'design and construction of anaerobic bio toilet' (44 per cent) and 'design and construction of UDDT' (44 per cent). About half the masons reported being aware of the 'role of masons in the construction of OSS systems' (47 per cent). On the construction of twin-pits, 37 per cent of the respondents reported that they 'got more clarity', while 40 per cent were 'already aware' of it and 22 per cent report fresh 'learning'.

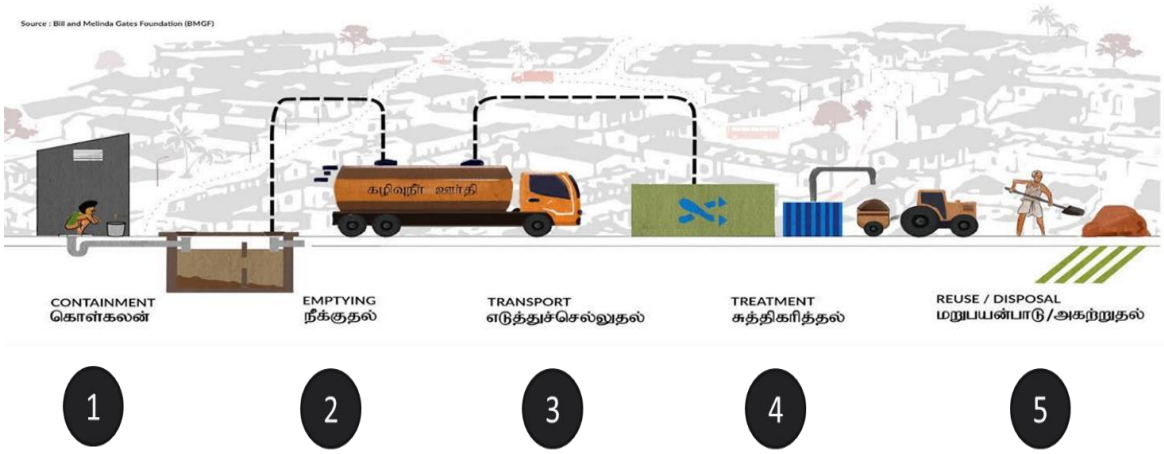
Figure 2.6: **Learnings on Aspects of OSS Construction (%)**



Source: TNUSSP Survey, 2018

During their training, respondents were trained on the full cycle of the FSM cycle and its five stages - containment, emptying, transport, treatment and reuse or disposal (Figure 2.7). Although masons play a key role in the first two stages, they were taken through the entire FSM chain to make them understand the complete cycle and to understand how important their role was.

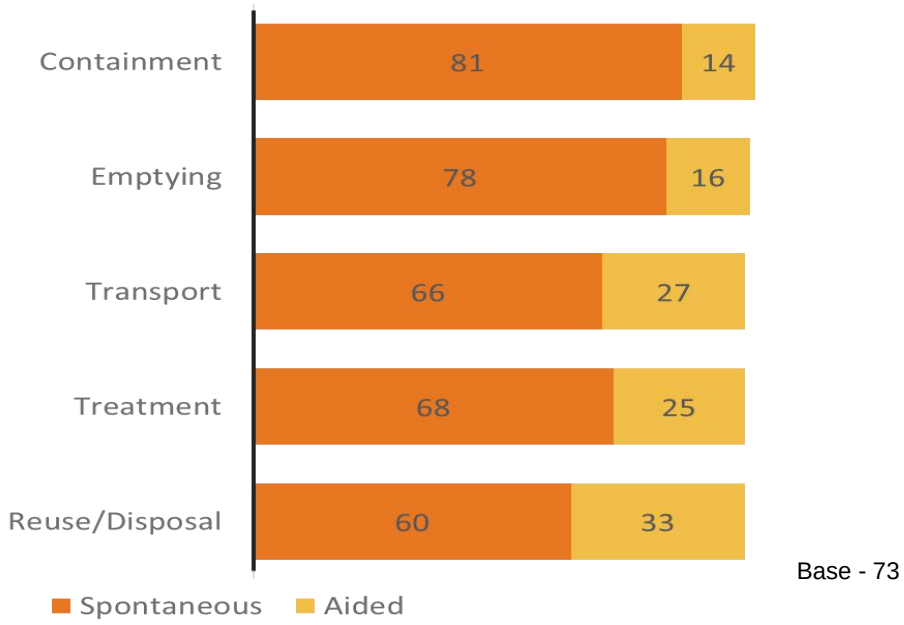
Figure 2.7**: Fecal Sludge Management Chain**



Source: Adapted from BMGF, 2012

The awareness of respondents on the stages of FSM chain was recorded on both spontaneous as well as aided level. Over 90 per cent of the respondents could recall all the stages of FSM chain either spontaneously or when prompted (Figure 2.8). However, only three masons could mention the stages of FSM chain in the correct sequence.

Figure 2.8**: Awareness on Stages of FSM Chain (%)**



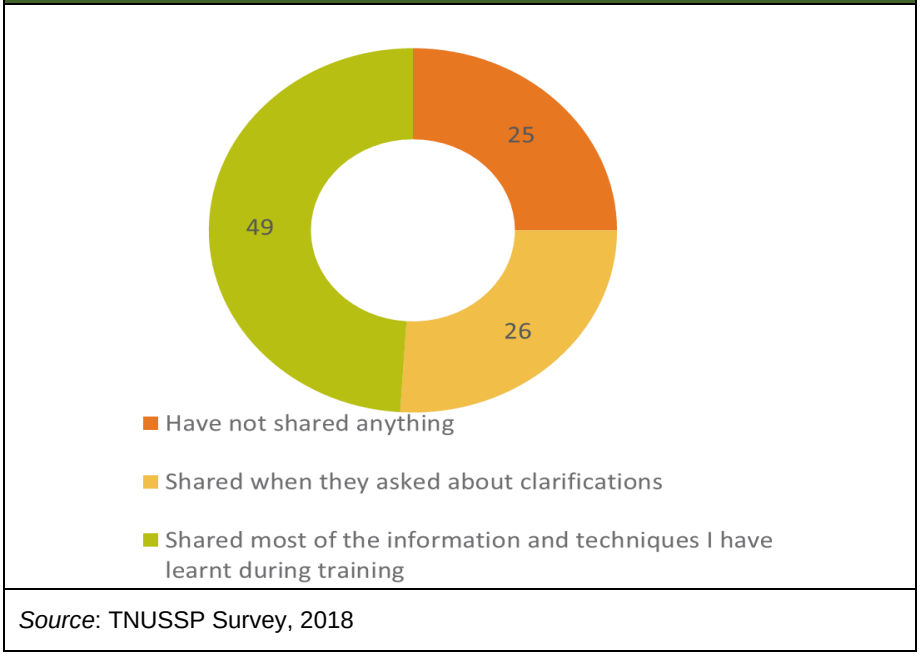
Source: TNUSSP Survey, 2018

Masons were asked about the problems of poor sanitation practices they learnt during the training. More than half of the respondents reported that from the training they learnt that bad odour, health hazards and mosquito breeding were the major issues of poor sanitation practices. Ground water contamination (44 per cent) and environment pollution (36 per cent) were also reported as problems of poor sanitation. Other issues mentioned included economic loss, increase in manual scavenging practice, unsafe sanitation for women and girls, loss of dignity and loss of privacy.

2.3.7. Knowledge Sharing

Masons were asked if they shared the knowledge gained during training with their peers. About three-fourth of the study respondents reported that they had shared the knowledge gained from training with their peers (Figure 2.9).

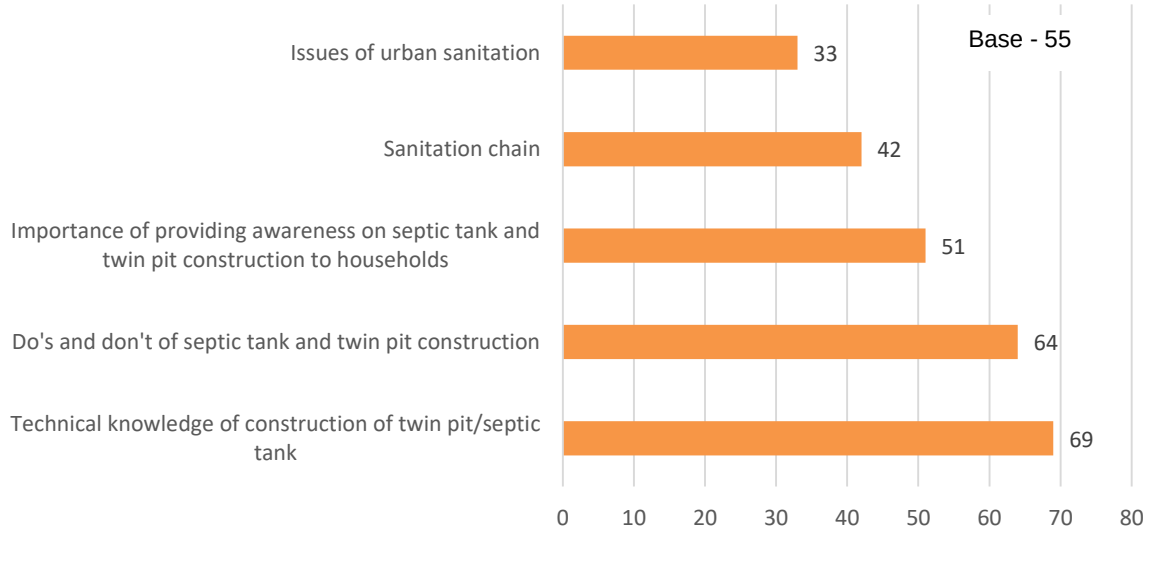
Figure 2.9: **Shared the Learning with Peers (%)**



Source: TNUSSP Survey, 2018

The study also tried to understand the range of information that participants shared with their peers (Figure 2.10). It was reported that 'technical knowledge on construction of twin-pit or septic tank' was the most shared topic by majority of the respondents (69 per cent), followed by 'dos and don'ts of septic tank and twin-pit construction' (64 per cent) and 'awareness on septic tank and twin-pit construction' to the households (51 per cent). Other topics discussed include sanitation chain and issues of urban sanitation.

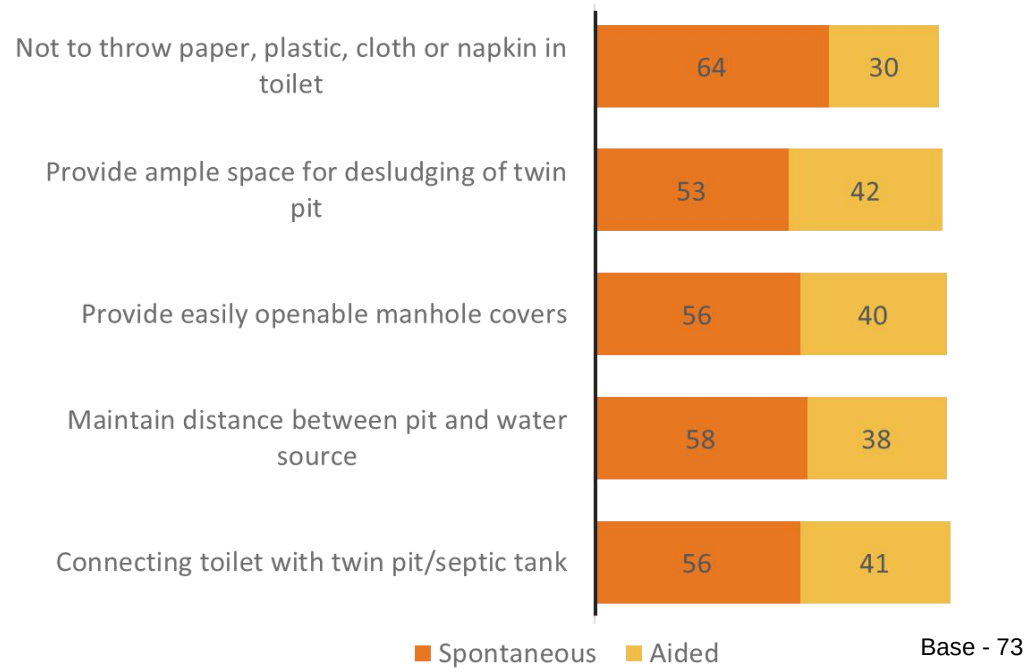
Figure 2.10: **Type of Information Shared with Peers (%)**



Source: TNUSSP Survey, 2018

Respondents were also asked about the messages they shared with the public and households. Participants could respond on a spontaneous basis and were subsequently prompted with answer options through cards (Figure 2.11). The messages that were most often shared were 'not to throw paper, plastic, cloth or napkin in toilet' (64 per cent), 'maintaining distance between pit and water source' (58 per cent), 'providing openable manhole covers' (56 per cent), 'connecting toilet with twin-pit or septic tank' (56 per cent), and 'providing ample space for desludging town pits' (53 per cent). About two-third of the respondents also believed that majority of the people were following their advice related to sanitation.

Figure 2.11**: Sanitation Related Messages Conveyed to the Public and Households (%)**

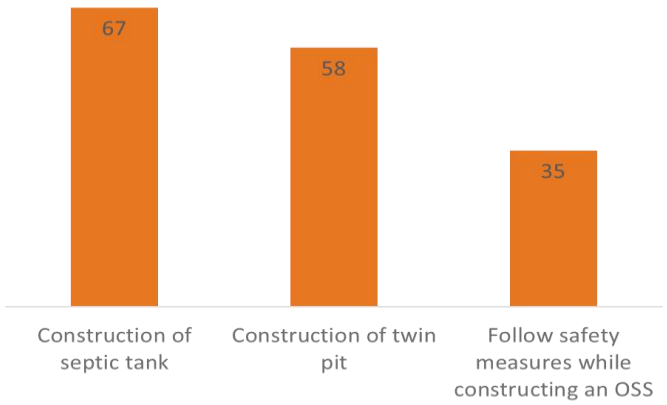


Source: TNUSSP Survey, 2018

2.3.8. Practices

It was envisaged that all masons who had attended the training should be able to practice the knowledge and skills gained through the training. However, only about two-thirds of the respondents (n=48) reported that they had practiced the methods they were trained on. Among the respondents who had reported practicing these methods, about two-thirds reported using knowledge gained in 'construction of septic tank' followed by 'construction of twin-pit' (58 per cent) (Figure 2.12). More than one-third of them reported following the 'safety measures taught during the training'.

Figure 2.12**: Methods Practiced Post-Training (%)**



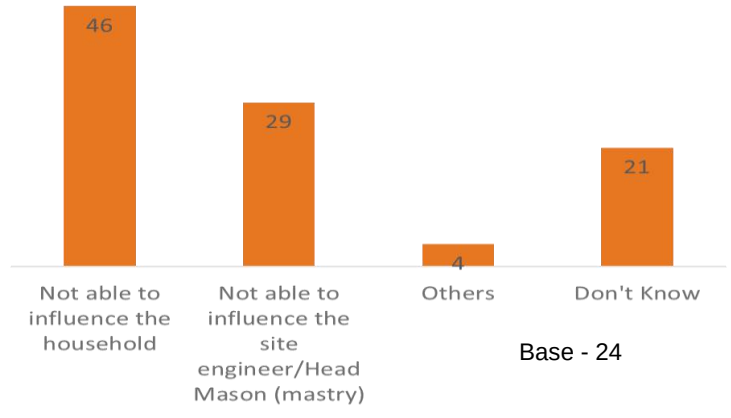
Source: TNUSSP Survey, 2018

Box 2.2: **Mason Case Study 2**

'I have over ten years' experience in toilet construction and I started my work from Pulivalam village. I have constructed around 138 twin-pits post-training by IIHS on construction of on-site sanitation system. It was very useful in understanding the specifications of pit construction, maintaining safe distance between pit and water body, importance of the junction chamber in twin-pits and constructing toilets economically. I have also shared the methods of twin-pit construction with other masons who have not attended training. I want to make the junior masons working under me experts in constructing twin-pits and want to see them successful'—Mason, twin-pit expert

Source: TNUSSP survey, 2018

Figure 2.13**: Challenges in Practicing (%)**



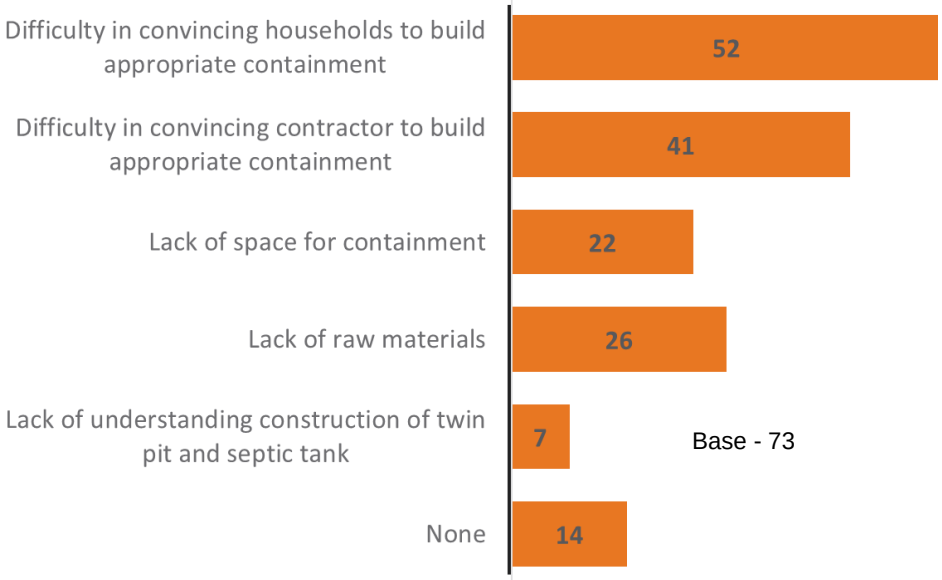
Source: TNUSSP Survey, 2018

Among the respondents who reported not being able to practice the skills learnt in the training programme (n=24), about 46 per cent said that they were 'not able to influence the household' followed by their 'inability to influence the site engineer or head mason' (29 per cent) (Figure 2.13).

2.3.9. Challenges

All respondents listed a set of challenges they faced in constructing OSS systems and asked to choose what was applicable to them (Figure 2.14). More than half the respondents reported that 'convincing the household for building appropriate containment' was a major challenge followed by 'convincing the contractors' (41 per cent). One-fourth of the respondents also reported 'lack of raw materials' as one of the challenges in constructing OSS and 22 per cent reported 'lack of space for containment' as a constraint. Seven per cent of the masons reported 'lack of understanding of construction of twin-pit and septic tank'.

Figure 2.14: **Challenges Faced by Masons (%)**



Source: TNUSSP Survey, 2018

2.3.10. Future Training Needs

Respondents were asked about their future training requirements (Figure 2.15). Almost all respondents reported that more trainings should be organised for them and their peers on OSSs. Further, topics for future learning were read out to them and they could agree or disagree. More than 80 per cent of the respondents asked for 'practical training on septic tank construction' and 'building low cost toilets'. Other important topics preferred were 'practical training on soak pit construction' (79 per cent), 'modern technology in construction '(79 per cent) and 'handling space constraints' (74 per cent).

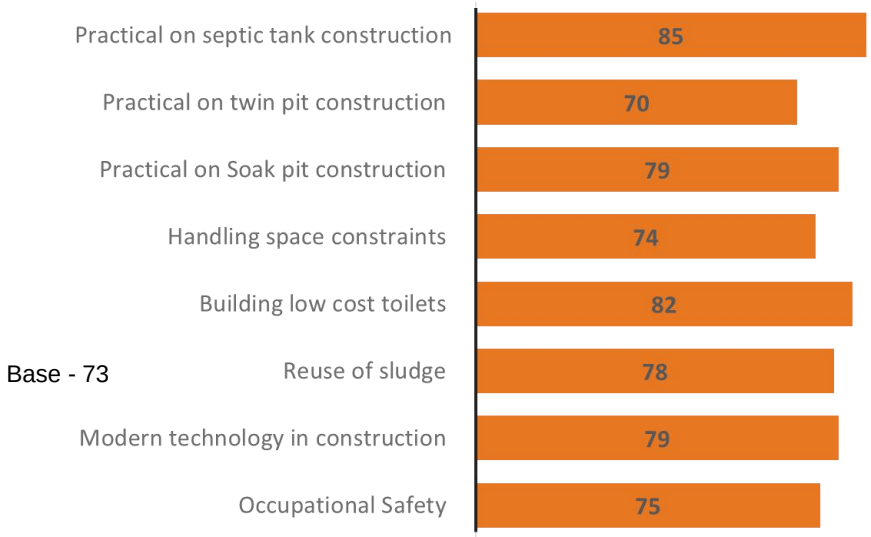
Box 2.3: **Mason Case Study 3**

'I have worked as a mason for 35 years. I have used the learnings from the training conducted by IIHS on construction of sanitation system to construct more than 100 septic tanks. Although lack of space in town areas is a challenge to convince people for twin-pits and constructing three chambers for septic tank, I continue sharing this learning with households and peers. I do explain to the households about the importance of considering the number of household members while deciding the size of septic tank for proper maintenance.

For me the training was very encouraging and informative. I learnt about construction of four different types of onsite sanitation systems including the functioning of Ecosan toilet. I want to learn more about different toilet models so that I can explain the suitable model for construction to households, after considering the physical and financial barriers they have. I also hope to become a trainer to provide training on toilet construction'- Senior mason from Coimbatore.

Source: TNUSSP Survey, 2018

Figure 2.15**: Topics for Future Training (%)**



Source: TNUSSP Survey, 2018

3 Training Assessment: Desludging Operators

3. Training Assessment: Desludging Operators

This chapter describes the trainings done for desludging operators (DOs). Three orientation programmes on the importance of FSM were organised for DOs and workers in Tiruchirappalli and PNP with objectives to:

i. Orient the septage transport operators (owners and workers) about the full cycle of sanitation.
ii. Discuss their current practices and best practices around the country.
iii. Impress upon them their importance and role as DOs.

It is important to note that no TNA was conducted for DOs prior to the orientation programme. It was designed based on ground level observation and secondary research. Sessions focused on orienting DOs on the full cycle of sanitation and their central role in ensuring that fecal waste is disposed in the facilities or sites provided by the government. Relevant discussions were held on vehicle design, different kinds of equipment to be used for desludging, and safe collection and disposal practices. Discussions also focussed on occupational safety procedures, health implications of handling human waste without protective gear and steps to be taken in case of an accident. The operators were told about the abolition of manual scavenging and asked to stop entering septic tanks, even if they are forced to by customers. Good practices such as checking vehicles and equipment such as hose and couplers, before and after disposal of sludge, and leaving the last layer of sludge in the tank were discussed. Further procedure to be followed in the event of accidents with the desludging vehicle, such as informing the nearest police station, transfer of septage to another vehicle and cleaning of spillage were also discussed.

On completion of the orientation session, it was envisaged that the DOs and workers:

i. Operate as per SOPs required under OGSM.
ii. Apply safe collection, transportation and disposal practices.
iii. Recognise the importance of their role in the sanitation cycle and contribute to improving safe sanitation in the state.

The training assessment was designed to assess if these intended outcomes were achieved. The questionnaire included sections on training recall, knowledge, practices and role clarity and training impact. This section presents the findings from interactions with 43 DOs, their understanding of objectives, feedback and effectiveness of training in terms of clarifying their roles, knowledge and skills on safe sanitation practices. The details on the case study with DOs' interviews were presented in the sub-sections. In this report the word 'operators' has been used to represent both owners of desludging vehicle and their workers.

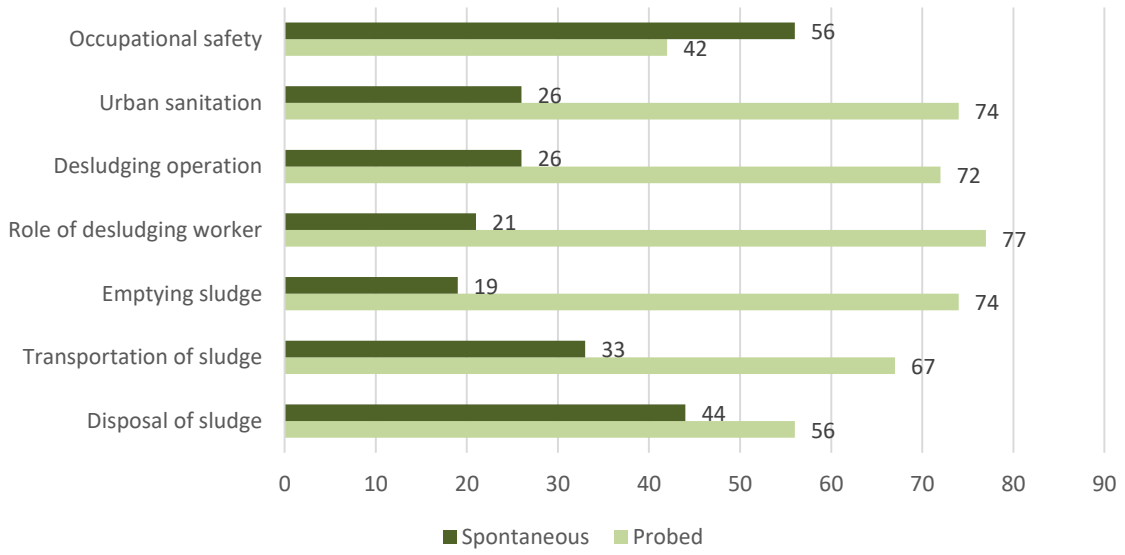
3.1. Profile of Desludging Operators

The average reported age of the DOs was 34 years with the average experience of about 9 years in the desludging operation. The average monthly income of the DOs was about Rs. 13,488.

3.2. Training Recall of Desludging Operators

Three orientation programmes on the importance of FSM were organised for 68 DOs and workers in Tiruchirappalli and PNP. DOs were asked about the topics covered in the training. The responses were captured spontaneously first and then probed to know whether the operators recalled other topics which were covered during the training (Figure 3.1). The purpose was to understand the topics which operators could remember post-training. More than half of the operators promptly mentioned 'occupational safety' and 'disposal of sludge' as topics covered in the training. When probed, almost everyone could mention that training covered 'role of desludging workers' (77 per cent), urban sanitation (74 per cent), sludge emptying (74 per cent) and transportation of sludge (67 per cent).

Figure 3.1: **Desludging Operators' Recall of the Training Topics (%)**

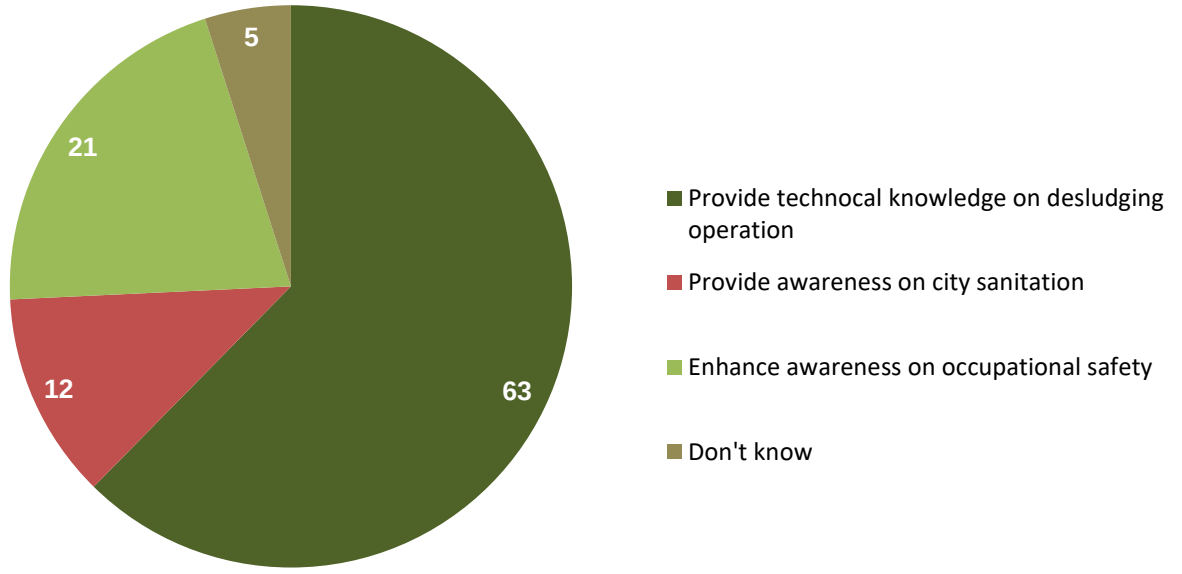


Source: TNUSSP Survey, 2018

3.3. Planned Objectives Versus Perceived Objectives

Respondents were asked about their own perception of the objectives and few options were read out. 63 per cent of respondents mentioned 'providing technical knowledge on desludging operations' as the primary training objective, 21 per cent mentioned training intended to 'create awareness on occupational safety' and 12 per cent reported 'providing awareness on city sanitation (Figure 3.2). However, none of the DOs from Coimbatore had highlighted 'awareness on occupational safety' as the primary objective of training.

Figure 3.2: **Desludging Operators' perception on Objectives of the Training (%)**



Source: TNUSSP Survey, 2018

Desludging workers were asked about their opinion of the training. Majority of the DOs felt that the training provided by IIHS was workable (that it can be translated into practice, 91 per cent) and useful (88 per cent) (Figure 3.3). They also agreed that during the training 'discussion was encouraged' (86 per cent) and 'training session was participatory' (86 per cent). Operators found the training material 'clear and easy to understand (84 per cent). While 75 per cent of the respondents felt that the 'time period of training was sufficient', the rest of the operators did not agree to the statement. Figure 3.3 presents the DOs' opinions of the training elements, which shows that a majority of the participants felt the training was useful, participatory, easy to understand, and covered all areas of sanitation in sufficient time.

3.4. Feedback on Training Elements

When asked to rate the training programme, on a scale of 0 to 5, (0 being very poor and 5 being excellent), 65 per cent of the DOs rated their training experience as excellent, 14 per cent gave a rating of 4, 9 per cent gave it a rating of 3, 7 per cent gave a rating of 2. DOs in Trichy found the training experience better (average rating was 4.7) than the operators in Coimbatore (average rating 3.3). This could possibly be explained by the fact that the first training was held in Coimbatore in the morning which did not suit the operators. In the subsequent trainings the timing was changed and this fostered better participation among operators.

Figure 3.3: **Desludging Operators' Opinions on Training Elements (%)**

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Source: TNUSSP Survey, 2018

Further, specific questions were asked about how the training helped them (Table 3.1). Eight out of ten operators agreed that the training had enabled them to understand type of transportation, safe disposal, occupational safety, roles and responsibilities, and use of desludging equipment. However, 21 per cent disagreed that the training had helped them learn about the FSM chain.

Table 3.1: **Desludging Operators' Perception of Training Impact (%)**

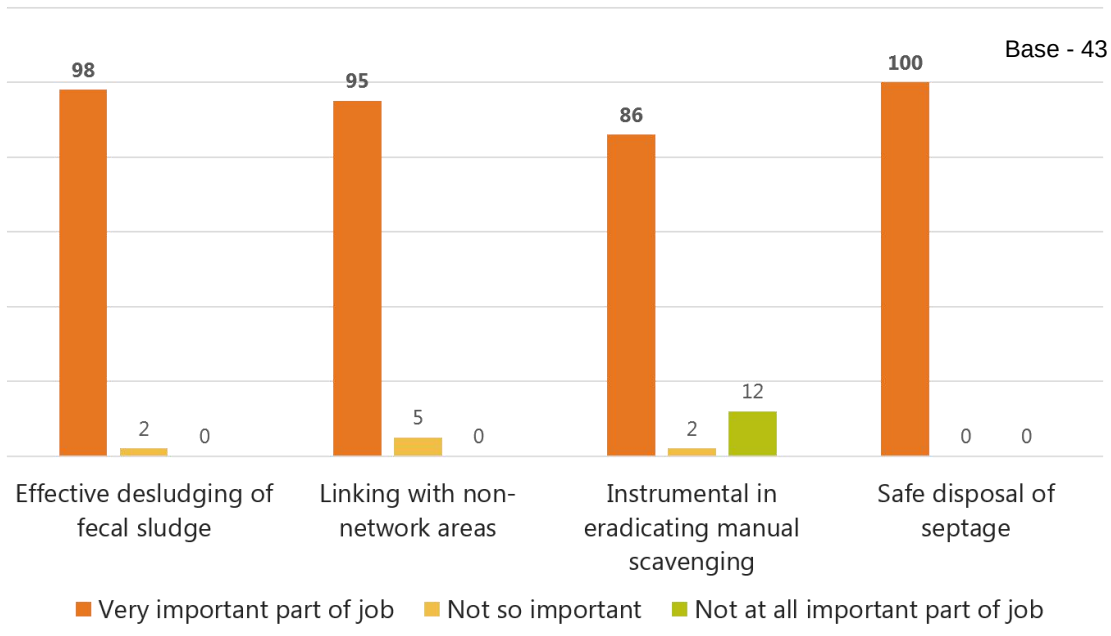
Items	Agree	Not sure	Disagree
The training helped me learn the types of transportation in FSM.	84	0	16
The training helped me learn the importance of safe disposal of fecal sludge	84	0	16
The training helped me learn the best practices in FSM	84	0	16
The training helped me learn about occupational safety	84	0	16
As a result of attending training, I feel better informed about the safety measures to be followed while working	84	0	16
Training helped me to gain more clarity on my roles and responsibilities	84	0	16
The training helped me learn the working procedure at the pre-empting stage	81	2	16

Table 3.1: **Desludging Operators' Perception of Training Impact (%)**			
Items	**Agree**	**Not sure**	**Disagree**
As a result of attending training, I am able to use the desludging equipment effectively	81	0	16
The training helped me learn about FSM	81	0	19
The training helped me learn about the FSM chain	79	0	21
Source: TNUSSP Survey, 2018			

3.5. Desludging Operators' Perception of their Role

A few options were listed for the respondents and they were asked which one signified the importance of their role in sanitation chain. All operators mentioned that they were accountable in ensuring 'safe disposal of sludge' (Figure 3.4). 98 per cent of the operators felt that 'effective desludging of fecal sludge' was an important part of their job. 95 per cent of the DOs thought they 'help linking with non-network areas'. While 86 per cent of the respondents thought their 'work contributes to eradicating manual scavenging', 12 per cent of the operators mentioned 'eradication of manual scavenging' was not at all an important part of their job. This could possibly be explained by the fact that although they are not required to desludge manually, their entry into the OSS depends on various other factors such as design of pit, lack of materials to clean hard sludge and requests by the households.

Figure 3.4**: Opinion on Importance of Role of Desludging Operators (%)**

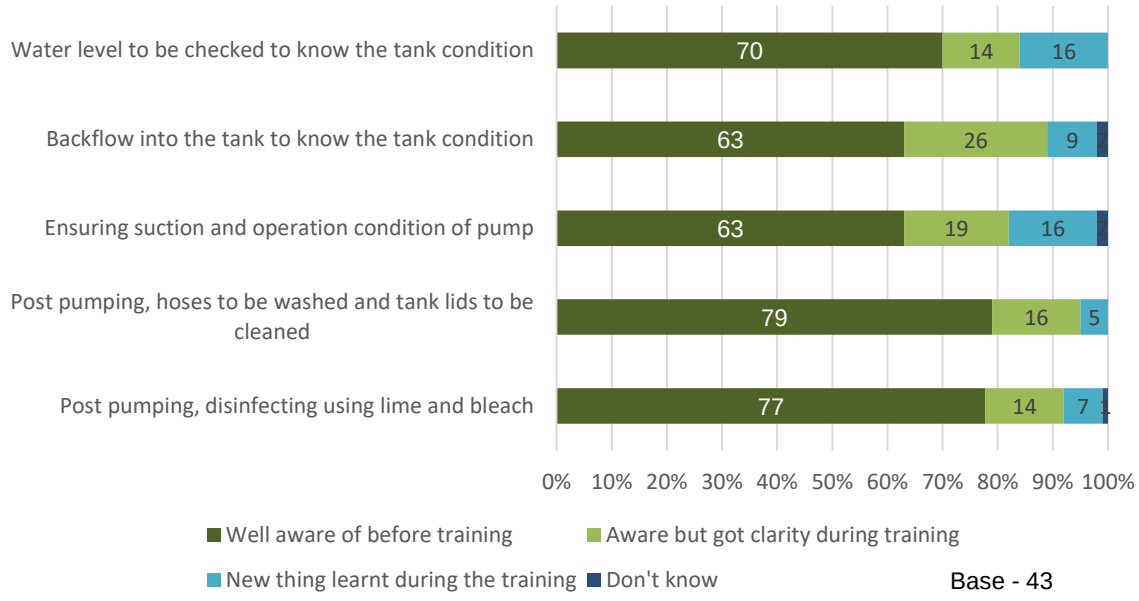


Source: TNUSSP Survey, 2018

3.6. Key Learnings

Respondents were asked about various aspects of desludging to check their awareness and their answer options included 'well aware before training', 'aware but got clarity during training', 'new learning' and 'don't know' (Figure 3.5). Operators reported being aware of many aspects of desludging prior to training such as 'cleaning hoses and replacing tank lid post pumping' (79 per cent), 'disinfecting using lime and bleach' (77 per cent), and 'checking water level to know the tank condition' (70 per cent). One-third of the respondents reported gaining clarity or learning about the need to check 'backflow into the tank during pumping' and 'ensuring suction and operation condition of the pump'.

Figure 3.5: **Awareness on Desludging Operation (%)**



Source: TNUSSP Survey, 2018

For about 16 per cent of the operators 'ensuring suction and operation condition of pump' and 'checking water level to know the tank condition' were new learnings in the training. About 26 per cent of the DOs mentioned that they were aware about 'checking backflow into tank while pumping' prior to training but got better clarity on the same during the training. Only 2 per cent of the DOs reported not being aware about the requirement and process of 'disinfecting using lime post pumping and checking backflow into tank' while pumping even post training.

Box 3.1: **Desludging Operator Case Study 1**

I have ten years' experience in desludging operation and own thee vehicles and provide employment to 12 persons. My workers are sincere and follow correct procedure during desludging operation. They maintain distance from the pit, use safety equipment, follow proper procedure for transportation and dispose at allotted location. We never let any worker enter the pit to clean it. All my staff members are also insured.

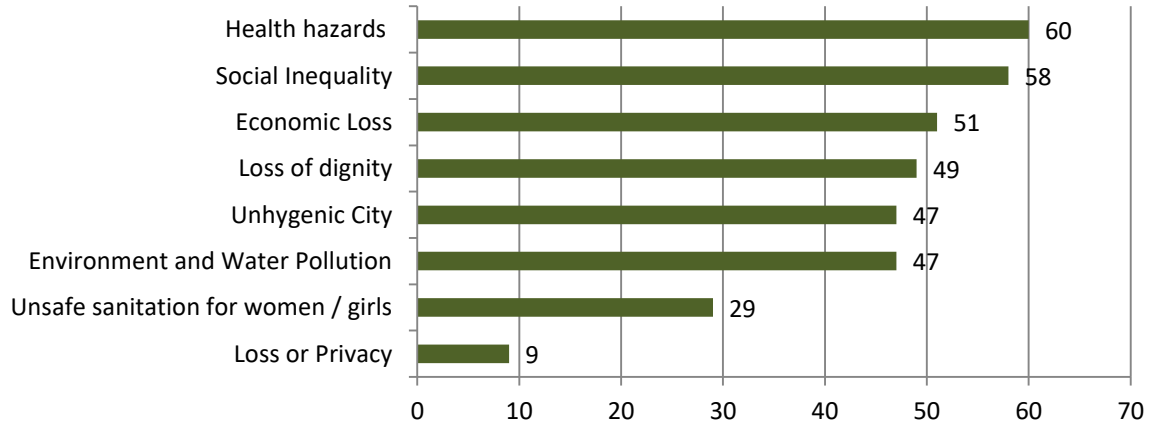
The training provided by IIHS helped us understand the health hazards of this their profession and sanitation practices they need to follow. We share the information not only with the staff but also with community members.

I like my job and am not bothered about how others treat me. However, I do worry about the sustainability of the profession. During summer season, we do not get work regularly. Further, although we are doing community service, we need to pay vehicle tax like other vehicles. I plan to organise all our vehicle operators and instruct them on better service. However, we need technological support from the government.

Source: TNUSSP Survey, 2018

DOs were asked about the various aspects of poor sanitation practices learnt during the training (Figure 3.6). From the training, majority of the DOs reported learning about health hazards (60 per cent) caused because of poor sanitation practices. About half the operators reported that they had learnt about various effects of poor sanitation such as 'social inequality' (58 per cent), 'economic loss on account of poor sanitation' (51 per cent) and 'loss of dignity' (49 per cent). 'Lack of privacy' and 'unsafe sanitation for women and girls' were mentioned by only about 9 per cent and 26 per cent operators respectively.

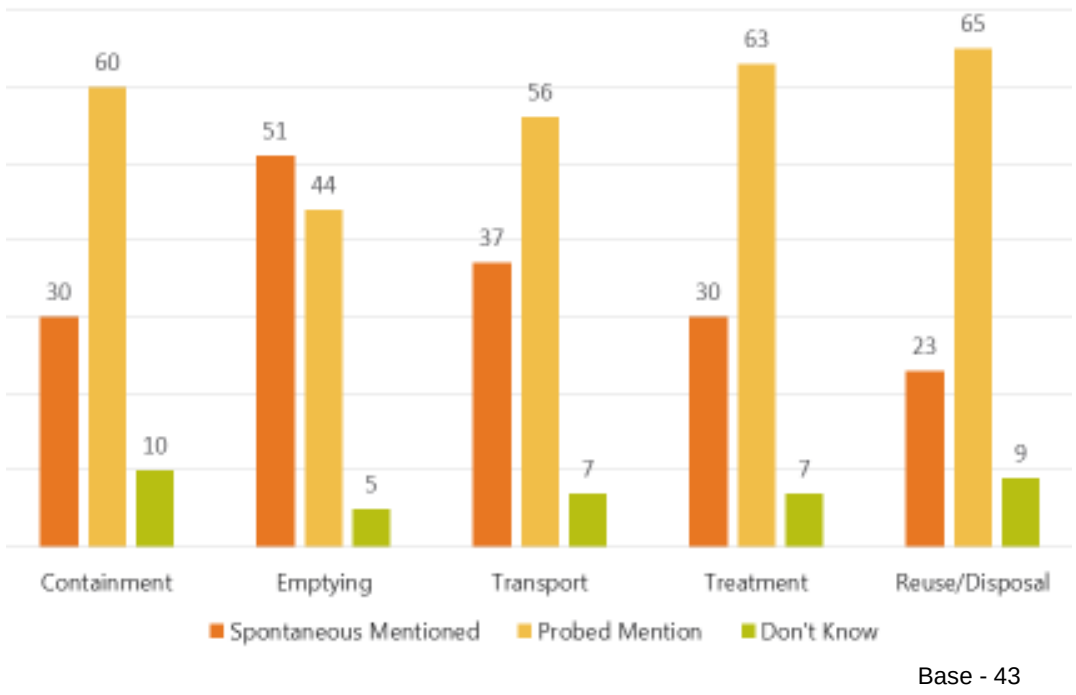
Figure 3.6**: Effects on Poor Sanitation Practice Learnt During Training (%)**



Source: TNUSSP Survey, 2018

The full cycle of sanitation constitutes containment, emptying, transport, treatment and reuse or disposal. Spontaneously, about half of the operators mentioned 'emptying' as part of the sanitation chain, followed by 'transport' (37 per cent), 'containment' and 'treatment' (30 per cent each) (Figure 3.7). Recall percentage for containment, treatment and reuse was over 60 per cent when probed. Importantly, only 41 per cent of the respondents correctly mentioned the order of the sanitation chain from containment to disposal when probed.

Figure 3.7**: Awareness on Sanitation Chain (%)**



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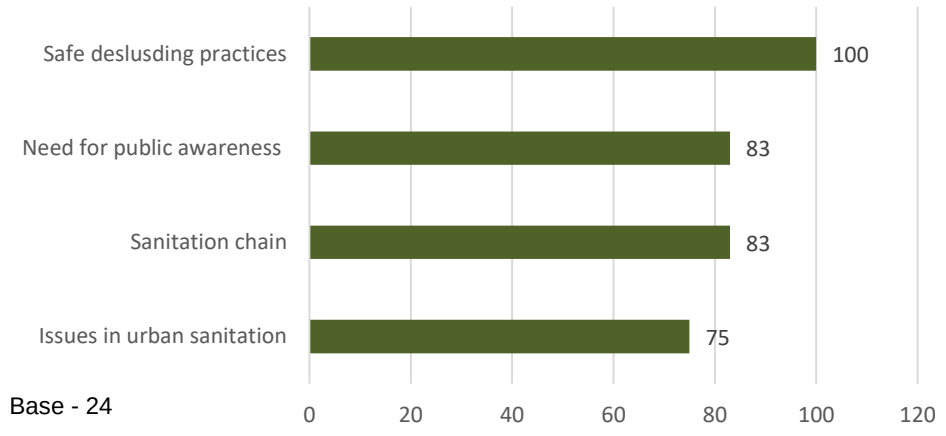
Source: TNUSSP Survey, 2018

3.7. Knowledge Sharing

When asked about knowledge sharing with peers 44 per cent reported not sharing any knowledge learnt during training with peers. While 42 per cent reported sharing most of the learning, 14 per cent shared their learnings only when clarifications were sought. Among those who reported sharing, all had shared about safe sludge disposal practices, while other topics discussed included the need for public awareness, sanitation chain and issues of urban sanitation (Figure 3.8). Reasons cited for not sharing included being busy (79 per cent), while 11 per cent did not feel the need to share the information.

Figure 3.8: **Information shared (%)**



Source: TNUSSP Survey, 2018

3.8. Practices

Respondents were asked what methods they used for emptying the pit by reading out some options. Majority of them reported mainly using 'honey sucker' for emptying faeces from the pit. However, in two instances in Trichy and Coimbatore operators mentioned that they continued to use 'bucket system'. A few statements related to safe desludging practices were read out to the operators and asked whether they followed them ***post*** training. Over 80 per cent of the respondents mentioned 'Checking disinfectant and spill control equipment', 'checking function of equipment before emptying' and 'checking function of vaccum emptier in pre-emptying stage' as practices that they followed (Table 3.2). More importantly, 30 per cent of the respondents only sometimes 'leave the last layer of sludge in the tank', which is typically recommended. Further, 28 per cent of the respondents sometimes 'check for personal protective equipment before emptying' and more than a fifth of the respondents sometimes 'check for damage in the septic tank'.

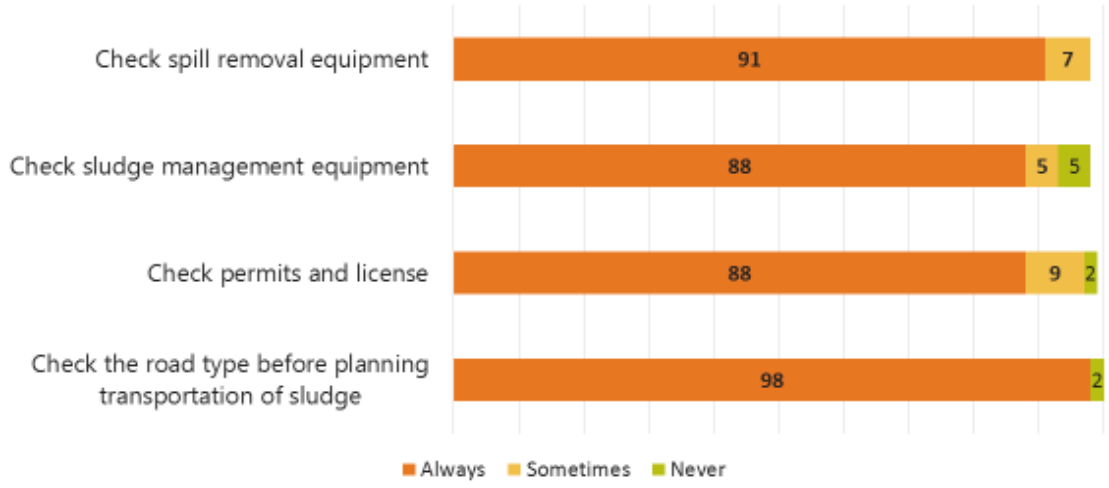
Table 3.2: **Steps Followed for Safe Desludging Post-Training (%)**

	Always	**Sometime**	**Never**
Check the function of vacuum emptier in pre-emptying stage	84	16	0
Check the function of equipment before emptying	84	14	2
Check personal protective equipment before emptying	72	28	0
Check disinfecting and spill control equipment	86	14	0
Use protective gear	79	19	0
Inspect hoses for cracks and wear	79	16	2

Table 3.2: **Steps Followed for Safe Desludging Post-Training (%)**			
	Always	**Sometime**	**Never**
Check septic tank if there is any damage in the structure	72	23	5
Leaving a last layer of sludge in the tank	65	30	2
Source: TNUSSP Survey, 2018			

DOs were asked if post-training they were carrying out some specific activities to ensure safe transportation. They reported that they did systematic preparation for transportation of sludge (Figure 3.9). They reported that they always 'check the road type before transportation of sludge' (98 per cent), 'check the spill removal equipment' (91 per cent), check the 'sludge management equipment' (88 per cent) and check 'permits and license' (88 per cent). They also reported always checking the transport station.

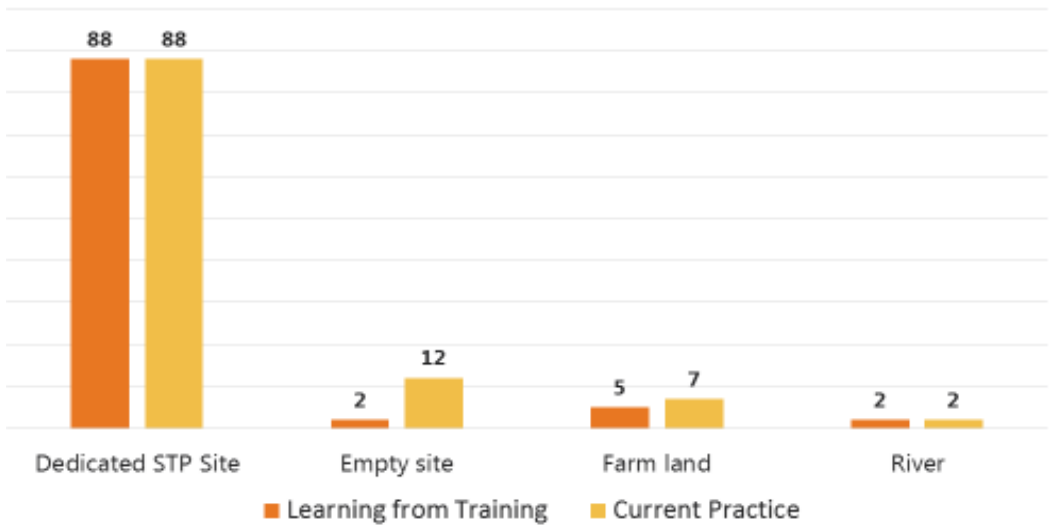
Figure 3.9**: Steps Followed for Safe Transportation (%)**



Source: TNUSSP survey, 2018

Majority of the operators (98 per cent) recognised that informing police would be important if the tanker filled with sludge met with an accident and also recognised that it would be necessary to clean the slippage. Respondents were asked about disposal sites of the fecal sludge in an open-ended manner. Majority of the respondents (88 per cent) said that they disposed the sludge in dedicated disposal sites as discussed during the training (Figure 3.10). Small proportion of the operators also reported continuing unsafe disposal of sludge at an empty site (12 per cent), farmland (7 per cent) and in the river (2 per cent).

Figure 3.10: **Sludge Disposal Practices (%)**



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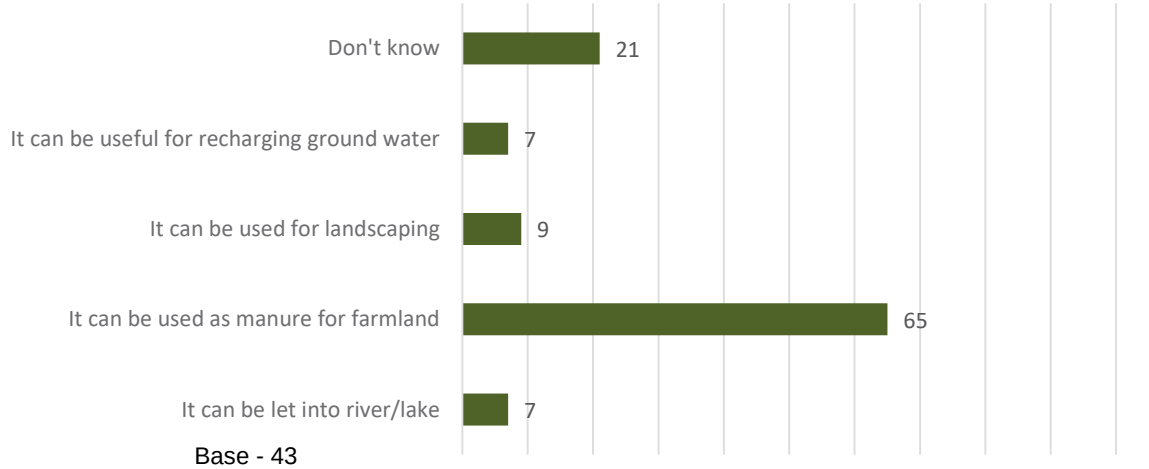
Source: TNUSSP Survey, 2018

Respondents were asked about the usages of sludge and all but one respondent from Coimbatore reported that that treatment of sludge was necessary (Figure 3.11). Two-thirds of the respondents (93 per cent in Trichy and 13 per cent in Coimbatore) mentioned that the sludge can be best used as manure at the farmland. About one-fifth of the DOs in Coimbatore mentioned that treated sludge could be let into the river or lake. In Trichy, 93 per cent operators said that treated sludge could be used as manure for farmland. A majority of operators in Coimbatore (60 per cent) reported being unaware about the usages of treated sludge.

Figure 3.11: **Uses of Treated Sludge (%)**



Base - 43

Source: TNUSSP Survey, 2018

3.9. Health and Occupational Safety

Majority of the DOs (84 per cent) felt that their work environment was safe, while the rest felt it was somewhat safe (mostly in Coimbatore). Just three operators in Tiruchirappalli reported facing heath issues. Major health hazards reported in their profession included respiratory diseases (88 per cent), skin diseases (63 per cent), eye infection (42 per cent), hepatitis (9 per cent), and leptospirosis (7 per cent).

DOs were asked what safety steps they followed post-training (Table 3.2). Mainly they reported safety steps such as 'allowing ventilation of the septic tank by keeping the cover open for sufficient time before operation' (98 per cent), 'hand washing immediately after contact with septage' (98 per cent), 'having first aid kit in the vehicle' (98 per cent), 'completely avoiding entry into septic tank' (95 per cent) and 'using personal protective equipment' (93 per cent). However, only half of the operators mentioned having gas detection lamps and having fire extinguishers in the vehicles.

Table 3.3: **Occupational Safety Followed by Desludging Operators**

Occupational Safety Steps	**%**
Ventilate the septic tank by keeping cover open for sufficient time before starting the operation.	98
Wash their hands immediately after contacting with septage or septage handling tools and equipment	98
Have first aid kit in the vehicle	98
Not entering septic tank	95
Use Personal Protective Equipment (PPE)	93
Have gas detection lamp in the vehicle	51
Have fire extinguisher in the vehicle	49
Source: TNUSSP Survey, 2018	

Box 3.2: **Desludging Operator: Case Study 2**

I am in this profession for 10 years now; I own 3 vehicles and 12 staff work for me. I accompany my team during desludging operation and ensure safety measures. We make sure householders stay away from the pit while desludging.

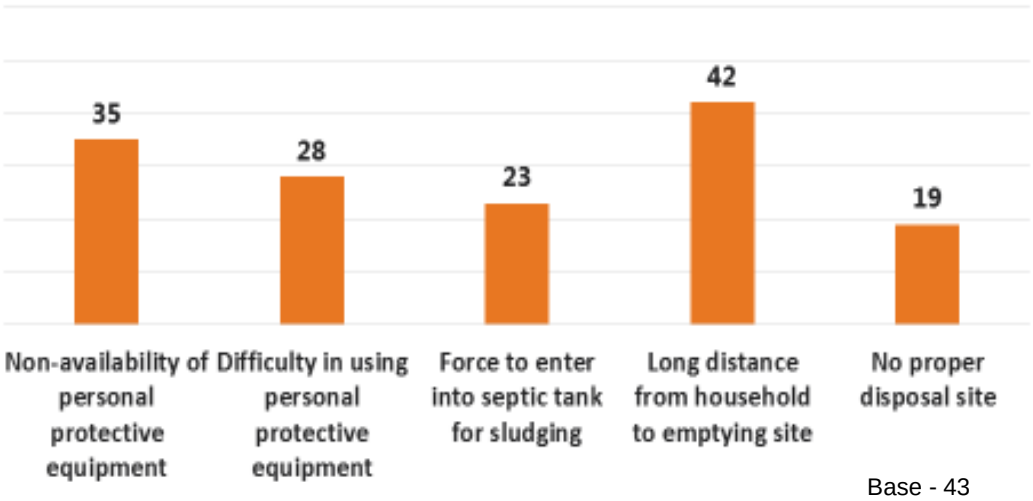
After training, we make sure we avoid leakages at the hose and compressor joints and use buckets. We ensure proper cover to avoid bad odour while transporting sludge and never stop the vehicle at any point once it has started for disposal from the collection location. Previously we used to dispose the sludge at other location at night but now completely stopped it and dispose the sludge only at the

Box 3.2: **Desludging Operator: Case Study 2**
allotted place. We make sure all our workers use masks and gloves even if the households deny providing money for safety equipment. Our workers are insured to safeguard them from any mishap. However, there is no recognition for our work and we feel inferior when people treat us disrespectfully. Even our children avoid sharing about our profession with their friends. Recognition from the corporation would encourage us, who are working in this field.
Source: TNUSSP Survey, 2018

3.10. Challenges

When asked about the challenges faced in their operations in an open-ended manner, the most commonly reported issue was the 'distance from household to emptying site' (42 per cent) as it typically adds to their cost (Table 3.12). About a third reported 'non-availability of personal protective equipment' as a challenge, while 28 per cent reported difficulty in use of PPE. Importantly, 23 per cent mentioned that they were forced to enter septic tanks for desludging which was very hazardous. One in every five operators reported lack of proper disposal site as the problem.

Figure 3.12**: Challenges Faced by Desludging Operators (%)**



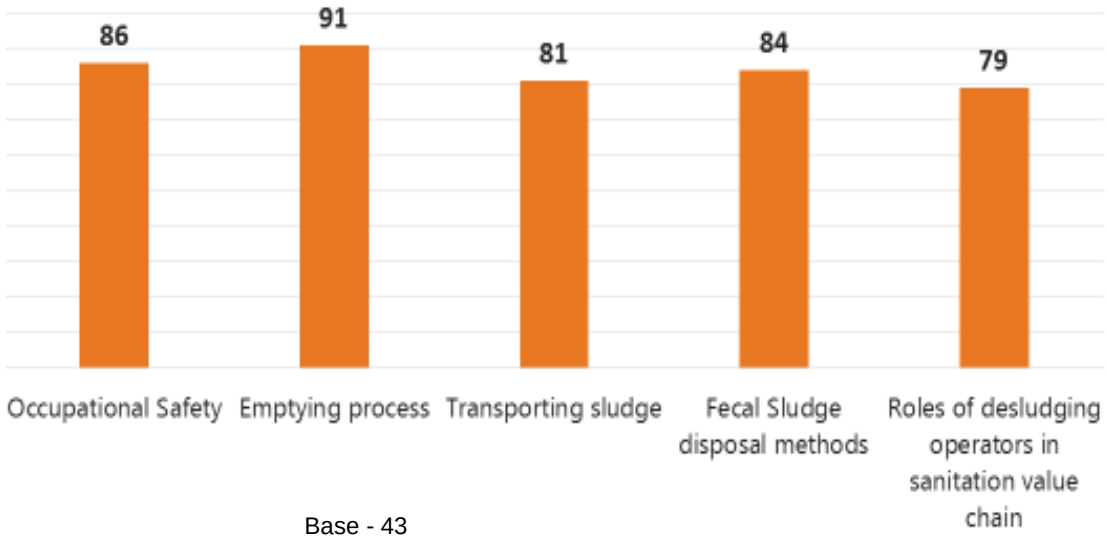
Source: TNUSSP Survey, 2018

3.11. Training Needs

Majority of the DOs reported the need for more training. When specifically asked operators reported further need to understand the 'emptying process' (91 per cent), 'occupational safety' (86 per cent),

'fecal sludge disposal methods' (84 per cent), 'sludge transportation' (81 per cent) and their 'role in sanitation chain' (79 per cent).

Figure 3.13**: Training needs (%)**



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Source: TNUSSP Survey, 2018

Box 3.3**: Desludging Operator – Case Study 3**

I am a National Trade Certificate holder from Industrial Training Institute (ITI). My father was in this profession for 30 years and I joined it 4 years back. We own a desludging vehicle and operate it with the help of three workers, who are paid Rs. 8000 per month as salary and Rs. 150 per day for daily expense.

Once we reach a household we first locate the septic tank because in many households, members were not aware of the location of the septic tank and sometimes it was constructed in the car parking area. We are well aware about the hazardous gases in the septic tank, hence we check the colour of the sludge to understand the gas formation and wait for 15 minutes after opening the cover slab of the tank. Sometimes we use kerosene, phenyl or soap oil to avoid bad odour from the tank. We always use a sucker to empty the tank. While placing the sucker into the septic tank, we take due care to hold the hose. To avoid any accidents, we keep children and outsiders away from the tank during emptying process. We understand the bad effects of the sludge on the environment and so we dispose the sludge in the dedicated locations in Tiruchirappalli, which have connectivity with the underground sewerage system.

The training provided by IIHS on FSM was very useful, especially the information related to occupational safety. Post-training, we used a bucket at the point where the valve joins the hose pipe to avoid leakages. We would like to know more about the new technologies available in FSM.

Our role is very important in ensuring safe environment, preventing diseases and supporting households. We are very particular about our safety and use personal protective equipment—gloves, masks, shoes and helmets to the extent possible; we practice hand wash and take preventive care by taking ‘tetanus injection’ in regular interval.

Although we follow standard procedures and ensure sanitation, we are not happy with our work, mainly because of the lack of dignity. There is no motivation or recognition for our work. Due respect from households will be a great source of motivation for us. We want our children to go to school and do better jobs.

Source: TNUSSP Survey, 2018

4 Training Assessment: Officers and Engineers

4. Training Assessment: Officers and Engineers

This chapter discusses the findings of the interactions with officers and engineers.

4.1. Officers' Training Needs Assessment

Prior to designing an orientation programme for officers and engineers, a TNA was conducted for administrators, engineers, and other implementing personnel concerned with public health in ULBs, and at the state level. The study revealed that there is a limited awareness on fecal sludge treatment and reuse at different levels within the ULBs. While sanitation roles and responsibilities form the core of municipal and ULB functions, there is a lack of sufficient competent personnel to carry out the tasks required for proper planning, implementation, maintenance and management of sanitation facilities, especially in human excreta management. Limited capacities and resources in the ULBs have resulted in poor regulation over regular emptying and cleaning of septic tanks and pits. The organisation and supply of desludging services in many places is far from adequate. The TNA also revealed that capacities needed to be built afresh to address the emerging challenges and opportunities in the area of FSSM.

4.2. Orientation Programme for Officers

The two-day programme was targeted at officers working in state level agencies, ULBs, and selected utilities. The programme drew upon international and national examples and experiences; it drew upon developments in the state to help participants understand the operational and practical aspects of planning, implementing and monitoring the different elements of the full cycle of sanitation. The training focussed on FSSM as a comprehensive solution for small and medium towns, and as a complementary solution for larger urban areas

Learning Objectives:

1. To create awareness on the policies, guidelines and practices about FSSM from international best practices and experiments in India and Tamil Nadu.

2. To enable participants, discuss key issues and constraints in prioritising and promoting solutions and innovations for urban sanitation in Tamil Nadu, and help them develop recommendations.

3. To help participants develop action plans at the state and regional levels focussing on the identified ULBs.

In addition, domestic exposure visits to Devanahalli and international exposure visits to Malaysia were held for officers with an objective of studying the O&M of the FSTP in Devanahalli and the role of ULBs in the full cycle of sanitation.

The engineers' training was carried out with objectives:

1. To create awareness on the policies, guidelines and practices about FSSM from international best practices and experiments in India and Tamil Nadu (including the Operative Guidelines for Septage Management).
2. To develop an understanding of different technological options (along the sanitation chain, but also focusing on treatment).
3. To understand the decision-making criteria for technological selection.
4. To understand different managerial aspects of FSM, particularly procurement and O&M management.
5. To understand the data requirements and the different approaches for planning FSM solutions.

Upon completion of the one-day programme, engineers were expected to understand the difference between sewage and faecal sludge and the approach for treatment, have knowledge of various treatment methods, understand the components of a FSTP, design a planted drying bed for sludge treatment, manage contracts and be able to procure services and goods related to FSM.

4.3. Findings of Officers' and Engineers' Training Assessment

The training assessment for officers and engineers mainly aimed to take their feedback on training, the extent to which it impacted their capabilities, whether they were able to put their learning into action and if so what the challenges were. Their inputs for future trainings were also collected. However, their knowledge on specific training topics was not assessed.

4.3.1. Profile of Participants

Three types of training were held for officers and engineers: exposure visit, FSSM orientation for officers of the state and city, and training on FSM for engineers. Ipsos managed to interview 37 officers of which 51 percent (19) officers participated in exposure visit, 19 per cent (7) officers participated in FSM training and 41 per cent (15) officers participated in FSSM training (Table 4.1). Out of 37 officers interviewed, 22 officers from Commissionerate of Municipal Administration (CMA) and 9 from Directorate of Town Panchayat (DTP), 4 were from Tamil Nadu Water supply and Drainage Board (TWAD), and 2 from Chennai Metro Water Supply and Sewerage Board (CMWSSB).

Table 4.1: **Training Wise Representation of Participants**

Training Type	**Total Number of Participants**	**Number of Participants Interviewed (n=37)**
Exposure Visit	37	51% (19)
Engineers training on FSM	8	19% (7)
FSSM training for officers	38	41% (15)

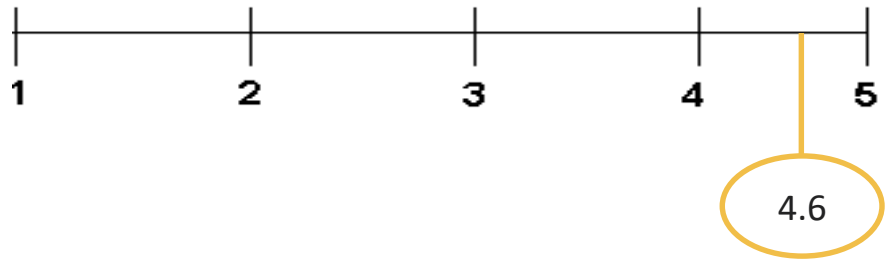
Table 4.1: **Training Wise Representation of Participants**		
Training Type	**Total Number of Participants**	**Number of Participants Interviewed (n=37)**
Both Engineers training on FSM and Exposure visit	1	3% (1)
Both FSSM and Exposure visit	6	8% (3)
Source: TNUSSP survey, 2018, (Numbers may not match with Table 1.1 on account of repetition)		

4.3.2. Officers' and Engineers' Feedback on Training

All respondents were asked about the extent to which they remembered the training. Of the 35 officers who responded to this question, 19 reported remembering the training 'to a large extent' and 15 remember the training 'to some extent' and one respondent remembered very little about the training.

Officers and Engineers' were specially asked if the liked specific aspects of the training programme they attended – training content, training delivery methods and presentation along sanitation chain (Table 4.2). They were asked to rate it on a scale of 1 to 5, 1 being 'did not like at all' and '5' being liked very much. Respondents reported that they liked the overall training content, training delivery methods and presentation on the sanitation chain. They gave an average rating of 4.6 on a scale of 1 to 5 (Figure 4.1).

Figure 4.1**: Feedback on Overall Training in a Scale of 1 to 5**



Source: TNUSSP Survey, 2018

Officers were asked to rate specific aspects of the training they attended, and the details are presented in Table 4.2. The scores assigned by officers who participated in the exposure visit ranged from 4.7–5, with the highest score of 5 being assigned to 'guided tour on sanitation exhibition'. Ratings of officers trained in FSSM ranged from 4–4.5, while engineers participating in FSM rated training components from 4–4.6.

Table 4.2: **Feedback on Specific Trainings**		
Training Elements	**Average Rating Scale (1-5)**	**Remarks**
Exposure Visit		
Presentation of case study on FSTP in Devanahalli	4.8	n=17, (1 official could not remember the case study presentation)
Visit to FSTP site	4.7	n=18
Guided tour of sanitation exhibition in 'Consortium for DEWATS Dissemination' (CDD) Society campus	5	n=12, (5 officials mentioned that they did not go for visit and 1 did not remember)
Community field visit	4.7	n= 9, * 6 officials mentioned that did not go for visit and 2 did not remember
FSSM Training for Officers		
Group discussion on key issues in desludging practices and recommendations to solve the issues	4	n=14
Experience sharing by international invitees on sanitation system	4.5	n=13 (1 official could not remember case study presentation)
Sharing best practices in sanitation in India	4.5	n=13 (3 official could not remember case study presentation)
FSM training for Engineers		
Video on FSM in Wrangle and Devanahalli	4.3	n=9
Discussion on new technologies in FSM during classroom session	4.4	n=9
Training hand-outs on treatment technology	4.6	Base=9
Case study materials on best practices in septage management and sanitation (Ghana, Leh, Cochin, Sri Lanka, Malaysia, Vietnam)	4	Base=8 (1 official could not remember case study presentation)
Source: TNUSSP Survey, 2018		

Box 4.1: Officers Remarks on How the Training Helped Them
"I was thinking fecal sludge removal means the ugly and bad aspects. But this training changed my mindset, I learnt to handle it systematically and scientifically". *"I learnt about the guidelines for septic tank design, frequency of cleaning, and safe transport".* *'It is useful in enhancing our knowledge and identifying locations for sites. It is also useful for preparing proposals for FSTP, which will benefit 73 villages in our region'.* *"The consequences of the parameters (pH, Bio-chemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD)), solids, helminths and nutrients should have been explained more".*
Source: TNUSSP Survey, 2018

4.3.3. Training's Effect on their Capacities

All respondents were asked if the training built their capacity on various aspects such as 'sanitation chain', 'issues across the sanitation chain', 'dealing with challenges in FSM', 'understanding collection, transport and treatment process' and 'reuse methods'. An overwhelming majority of the respondents reported improved understanding across all themes mentioned above.

Engineers were further asked about capacities built in understanding 'factors influencing characteristics of fecal sludge', 'requisites for septic tank and twin pit', 'O&M requirement to ensure safe working condition' and 'policy goals of sanitation'. All the participating engineers responded positively to all aspects.

Officers were asked if the training impacted their understanding of 'city sanitation plan', 'setting up FSTP', 'conducting a feasibility study', 'estimation of financial and procurement in FSM project', 'roles and responsibilities in ensuring sustainable city sanitation', 'the importance of SOPs and guidelines at ULB for each stage of sanitation'. Majority of the responding officers (11 out of 13) reported gaining from trainings on all the above aspects.

Specifically, they reported understanding that FSTP and FSM are cost effective alternative systems to network based systems. Also, many participants reported on receiving clarifications on the technical aspects of FSTP. The visit to Devanahalli FSTP was also reported to be very useful in gaining practical experience of how the system works. They specifically mentioned that they got clarity on safe collection, storage and transportation.

Box 4:2: Officers' and Engineers' Remarks on the Effect of Training on their Capabilities
'We already knew technically about FSSM, but this exposure visit gave us an opportunity to see the working model. Based on the learning from the exposure visit we have proposed FSTPs in 49 ULBs'. 'The training explained in simple language. Well planned training methods were used and we have new information on safe fecal sludge disposal'. 'It was helpful in designing the project implementation at Karunguzhi'.
Source: TNUSSP Survey, 2018

4.3.4. Action Taken in the Field of Sanitation

Officers were asked if they undertook any actions for improving sanitation in the city in the last one year post-training and 84 per cent reported positively. The range of efforts varied across the respondents. Officers from Chennai have continued planning for FSSM in their areas and 49 FSTPs have been approved in Tamil Nadu for which efforts are in the planning stage. Officers also reported to raise awareness of individual toilets through the SBM subsidy and the importance of building proper septic tanks. Some officers from town panchayats and Chennai have been involved in Karunguzhi FSTP planning and implementation.

Specifically, officers In Trichy reported spreading further awareness to relevant stakeholders in the sanitation chain such as to DOs about the safe collection and transportation of fecal sludge and to avoid its illegal disposal. They were asked not to dump in non-designated sites. They were also informed that in case of violation, their vehicle will be seized. Meetings were held with licensed surveyors, builders, contractors and key masons in Trichy. In these meetings, instructions were given to follow the design norms for septic tank size and masons were told to build as per the capacity requirements of the type of building constructed. Video clippings of toilet and septic tank construction were played in the meetings.

4.3.5. Challenges

One of the challenges reported by officers is the lack of land for construction of FSTP and associated funding issues. With regard to the functioning FTSP in Karunguzhi, maintenance staff is needed on a full-time basis to operate the plant and monitor the collection and disposal. Computer operators need to be trained to monitor the flow, collection and other aspects of data management.

Officers' reported that there is a problem of insanitary latrines and that people think that it is the government's responsibility to upgrade such facilities free of cost. At the household level, it is important

to build public awareness on building safe toilets, containment structures and regular and safe desludging.

Box 4:3: Challenges faced by Officer
'A number of insanitary latrines exist among the public. They think that it is the government's responsibility to provide them free of cost. This has to be changed and the public should be sensitised that it's a shared responsibility and it involves minimal contribution from the user. To overcome this, we have planned to split the cost involved for two years, so that users will have to pay less and pay in intervals.'—Officer, GoTN.
Source: TNUSSP Survey, 2018

Further, many households are willing to build septic tanks but lack space. In such instances, they expressed the need for new technology like 'MAK Biodigester' to solve this issue, which is said to be operational in Coimbatore. Officers felt that the concept of FSTP needs to be explained to the public and they should be encouraged to desludge regularly by explaining the health and environmental impacts.

4.3.6. Suggestions for Training

The following suggestions were offered by the officers:

- Include field exposure visits in all training programmes.
- Share challenges faced during the initial stages in implementing the Devanahalli project along with methods used for neighbouring communities' interaction.
- Visit to an FSTP within city limits would be useful to understand challenges and approaches to problem solving.
- Observe functioning of a smaller FSTP and learn about biogas production.
- FSTP module should include inputs such as BOD, COD and laboratory testing so that O&M aspects are fully understood. Further details are needed on the types of challenges faced and the means to manage them.
- Comparison of FSTP and underground sewerage networks needs to be explained to a wider set of stakeholders.
- Training is needed on how to deal with the public and how to gain their cooperation. Further, it would be useful to involve key opinion leaders in such trainings.

Table 4.3: **Suggestions for Future Training**		
Contents/Information	**Methods**	**Target Participants**
• Technical aspects like BOD, COD values, lab testing • Process of data management for FSTP • O&M • Treatment aspects • Public awareness and community support	• Audio-visual • Community field visit • Exposure visit • Case studies • Officer strained as master trainers to enable them to train junior staff	• Engineers • Town panchayat and ULB officers • Sanitary supervisor • Maintenance person/fitter • Operators • NGOs • Public representatives • Computer operators on the process of data management
Source: TNUSSP Survey, 2018		

Box 4.4: **Suggestions for Future Trainings Stated by Officers**
'Advanced technology of training to Executive Officers as they are the implementing officers at the town panchayat level'. *'Training citizen groups (lead NGOs, persons or groups in the community) will be helpful to create awareness among the people and to enhance project outcome'.* *'Resident welfare association representatives need to be trained'.* *'Short documentary films can be used as a medium to educate all levels of people involved in FSM. IEC materials can be developed to reach all workers'.*
Source: TNUSSP Survey, 2018

5 Findings: Trainers

5. Findings: Trainers

Five trainers who were involved in different capacities in planning and executing the trainings for officers, engineers, masons and desludging operators on FSSM were interviewed. The key objective of the interaction was to get insights on the conceptualisation, content development, training method and delivery of training. Inputs on the background of training and the trainers' views on relevance and expected training outcome, challenges during the training and suggestions for future training were also captured. This section highlights the key points discussed on stakeholder selection, material development, expected outcome of training, and suggestions for future training.

5.1. Identifying Stakeholders and Defining Training Outcomes

For the whole sanitation chain to function effectively, training for key stakeholders was vital as their roles not only influence city sanitation but are also complementary. The training programme was designed keeping in mind the specific stakeholders who are involved at each stage in the sanitation chain.

5.1.1. Containment

Masons were associated with construction, maintenance of toilet and containment which constitutes the initial part of the sanitation chain where the sludge is collected. Providing training to masons on the construction of OSSs was important as they can ensure improved toilet accessibility and safe containment structures. At the end of the training programme, masons were mainly expected to know the do's and don'ts of the construction of twin-pits and septic tanks and to follow procedure while constructing containment structures post-training. Masons were also expected to influence the public to take the right decision by providing them adequate information on features of toilet construction.

5.1.2. Collection and Conveyance:

DOs play a key role in collecting sludge from the containment, transporting it to the disposal site safely and disposing the sludge properly. Post-training, DOs were expected to follow safety measures to ensure safe collection and disposal of sludge as well as use PPE to ensure occupational safety.

5.1.3. Safe Functioning at Each Stage of the Sanitation Chain

ULB officers' and engineer's role is to ensure effective functioning of the sanitation chain to ensure city wide safe sanitation. Formulation of guidelines, implementation and monitoring for correct practices at each step of the chain also falls under their purview. Hence, providing practical experience on the function of a treatment plant through exposure visits, providing knowledge on policy and technical measures to be adopted for city sanitation were important for officers and engineers.

The officers and engineers were expected to understand and be aware of:

- The importance of the sanitation chain.
- The difference between fecal sludge and sewage.

- The parameters: Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), and Ammonium-Nitrogen among others, for studying fecal sludge characteristics.
- The Operative Guidelines on Septage Management
- Focus on operation and management for effective functioning of components of the sanitation chain.
- Different technologies to be used for treatment.

Officers and engineers were expected to understand the function and relevance of FSTP as an alternative solution for sludge management in non-network areas. The trainings were aimed to make them realise that the mechanism is possible and help them take necessary action in their respective locations based on need and feasibility.

5.2. Participant Selection and Content Development

TNUSSP partner organisations—Key Stone Foundation and Gramalaya—supported to identify masons and desludging operators for the training. The officers and engineers were selected based on their designation, role and availability. There was no conscious effort made to involve female participants as the training was more role-specific.

The training materials were developed by reviewing secondary documents on methods, technical aspects of the sanitation chain, policy guidelines and best practices in the field of FSM. Additionally, for developing the curriculum for officers of the GoTN, a TNA was conducted targeting administrators, engineers, and other implementing personnel concerned with public health in ULBs, and at the state level. Similarly, a TNA was conducted for masons in Tiruchirappalli and Coimbatore. The materials for masons' training developed by CDD was improved and used. To develop training materials for desludging operators, secondary documents were reviewed and ground level observation was done to understand existing practices.

According to the trainers, factors which were important for the successful delivery of training were:

- The trainer's knowledge on the subject
- The trainer's understanding on ground reality
- Participatory training methods

6

Discussion and Recommendations

6. Discussion and Recommendations

Trainings organised by TNUSSP during Phase I of its programme targeted a range of stakeholders across the sanitation chain. The selection of stakeholders such as masons. desludging operators and their workers, government officers and engineers was done to maximise the effectiveness of the programme. Despite the lag between orientation or trainings and the actual training assessment, majority of participants had a reasonably high recall of the training content, and reported that the training was very relevant, well-structured and useful.

Masons, are an important link in the sanitation chain, and are directly responsible for construction of the containment structure and are a direct point of interface with the households. Their training was conducted based on the TNA which revealed current practices in building containment structures which were not always in compliance with the norms for construction. Importantly, none of the masons had reported having gone through any formal training for toilet construction. In this context, their training was appropriately designed to sensitise them on the proper methods of constructing various containment structures, consequences of building improper structures, and their role in the sanitation chain. Masons' training assessment was specifically designed to assess whether these objectives were met.

Despite majority of the masons in the assessment having considerable experience, the training helped them gain clarity and new learning on various aspects including 'twin-pit construction', 'dos and don'ts of OSSs construction', and 'UDDT and anaerobic bio-toilet'. Various assessments to test their knowledge on OSS construction also revealed reasonable levels of knowledge. However, scope for further improvements in specific aspects exists especially in terms of safe distance between the water source and containment based on the water table and the consequences of oversizing septic tanks. All masons reported the need for further trainings to include practical aspects of constructing septic tank, twin-pit and soak pit. A need for training modules for building 'within space constraints' and 'with cost constraints' along with 'occupational safety' were expressed. Masons expressed the need to take this training to their peers and further trainings to include real time construction models.

During the course of the training they fully understood their role in building safe containment structures. Post-training, masons reported about the awareness of their role in creating public awareness on safe sanitation structures and also reported sharing relevant information with the public. These included the need for safe distance between the water source and pit, the need for easily openable covers for desludging and the importance of not throwing plastic, cloth, and napkins in toilets among others. However, the key challenge expressed by masons in implementing their learnings was the lack of support from contractors, builders and households in building appropriate containment structures. It is important to note that training was not designed for these set of stakeholders and hence, masons have not been able to fully translate their knowledge into practice.

For desludging operators, the training assessment aimed to assess if the orientation had helped them gain understanding of SOPs, and if they are specifically applying these safe collection, transportation and disposal practices. The orientation programme and content were designed based on ground level observation and secondary research and not on the basis of a TNA. Hence, we do not have a baseline on the practices with which to compare the results of the assessment.

Majority of the participants felt that training material was relevant, participatory and covered all areas of the sanitation chain. While two-thirds of the operators reported being aware (prior to training) of various good practices such as checking water level and back flow of the tank before desludging, washing hoses and tank lids after cleaning. In 20–30 per cent of the cases, they reported these topics as new learnings or that they gained better clarity. Key learning reported by operators from the training was mainly on the effects of poor sanitation such as health hazards, social inequality, economic losses and loss of dignity. Post-training their awareness of the sanitation chain has improved and about 60 per cent of the operators have reported sharing their knowledge gained with peers.

Post-training majority of them reported following safe collection and transportation practices such as checking for critical equipment and their functioning, necessary permits prior to collection and transportation. However, some aspects such as ‘use of PPE’, ‘checking the septic tank structure prior to cleaning’ and ‘leaving the last layer of sludge’ needs improved compliance.

Majority of the operators are practising occupational safety such as ‘keeping the septic tank open prior to desludging’, ‘hand wash after contacting fecal sludge’, and ‘not entering septic tank’. However, only half of them reported having ‘gas detection lamp’ and ‘fire extinguisher’ in the vehicle. About 90 per cent operators reported dumping in designated dumping sites, although farmlands, riverbeds and empty land continue to be used post-training in a few cases. Distance to the dumping facility is the key challenge reported by operators. Other important challenges mentioned include ‘non-availability of PPE’ and ‘difficulty in using PPE’. Importantly, 23 per cent reported being ‘forced to enter septic tank’. In-depth interviews with operators pointed to a lack of respect for their profession within the community.

While the assessment confirms that the practices of desludging operators is largely aligned with safe desludging and occupational safety practices, the scale of improvement cannot be measured in the absence of a baseline.

Training assessment was done with officers who attended the FSSM orientation programme, domestic exposure visits and with engineers who participated in the FSM workshop. The assessment did not seek to measure their levels of knowledge but to take feedback on the training and understand how key learnings were translated into action along with associated challenges. Their training was designed on the basis of a TNA which revealed limited awareness on fecal sludge treatment and reuse at different levels within the ULBs. To that extent the training fully served their information needs on FSSM, which are particularly high given that officers were required to operationalise the septage management

guidelines. The training was designed keeping in mind the specific information needs of each category of participants and this was well appreciated by the responding officers who rated the overall training and the component modules highly. This also translated into tangible action with a number of FSTPs being approved in Tamil Nadu. However, challenges of land identification and funding remain. Further, officers reported conversion of insanitary latrines to sanitary latrines as a huge challenge on account of the attitude of the public. The issue of space constraint for toilet construction needs to be addressed innovatively.

Trainers felt that the programme participants and its design were identified and developed considering the roles they play in the sanitation chain. The training materials were prepared by referring to various materials related to the sanitation chain. Further, post-training, their understanding of various aspects of building safe containment structure improved.

6.1. Recommendations

The study findings derived from different stakeholders of the sanitation chain revealed that at an overall level the capacity building programme had served the intended purpose of creating sufficient knowledge and skills among the stakeholders. However, following are some suggestions based on the findings for improving the programme further.

6.1.1. Masons

- Both the trainers and the masons were of the opinion that more practical training should be organised. Hence instead of using prototypes for training, on-site practical construction should be demonstrated. Further, videos should be used for twin-pit and septic tank construction for masons.

- One of the key constraints for construction of containments, especially in urban areas is the availability of land. Hence, masons should be provided with advanced technical inputs for designing containment structures in the given land size.

6.1.2. Desludging Operators

- Desludging operators were of the opinion that the training time was short. Given that they are relatively free during summer a detailed in-house training can be planned for them. Practical demonstration of best practices would be more effective. If this is not possible, then videos on best practices should be recorded and played in the training programmes.

- One of the important concerns raised by most of the operators in the case study was the way they were treated by people. TNUSSP's efforts to valorise their work should be sustained for a meaningful change in their image and perception of their role in the society.

6.1.3. Officers and Engineers

- Given that engineers approve design at the planning stage, trainers have expressed the need to provide awareness to engineers on the basics of safe, sustainable, environment friendly and economic containment construction.

Few masons and DOs expressed their willingness to become peer educators, which is particularly useful in this segment. Hence, peer educators can be identified during the training session and they can be groomed for training their peers.

Furthers, trainers expressed the need to conduct TNAs and understand the existing levels of knowledge and practices for all stakeholders to design appropriate training modules.
Training modules could also be organised for surveyors and contractors to help create an enabling environment for masons to operate.

Innovative models of toilet construction which address space and cost constraints need to be developed and implemented.

Behavioural change campaigns designed to make households understand the need for safe containment and regular and safe desludging needs to be conducted to create an enabling environment.

Annexures

Annexure 1: FSSM Workshop: GoTN Officers Participants' List

Table A1.1: **GoTN Officers Participants' List on Two-Day Workshop in January 2017 on FSSM**

Names of Officials	Designation	Organisation
Thiru. K. Phanindra Reddy, I.A.S	Principal Secretary to Government of Tamil Nadu	MAWS
Thiru.RajendraRatnoo, I.A.S	Director	TNIUS
Tmt. M. Vijayalakshmi I.A.S	Deputy Commissioner (Health)	Chennai Corporation
Thiru. G. Prakash, I.A.S	CMA	CMA
Thiru.K. Maharabushanam, I.A.S.	DTP	DTP
Thiru. R. Ranganathan	Superintending: Solid Waste Department	Chennai Corporation
Thiru. R. Srinivasan	Chief Engineer: Buildings	Chennai Corporation
Thiru. R. Venkatachalam	CE	CMA
Tmt. M. Shanthi	AEE	CMA
Tmt. M. Senthamarai	AEE	CMA
Thiru K. Seenuvasan	AEE	CMA
Thiru M Vaitheeswaran	EES	CMA
Tmt. J. Arokia Anbarasi	AE	CMA
Tmt. S.Jagadha	AE	CMA
Tmt. P. Janaki Raveendran	RDMA, Madurai	CMA
Thiru. K.Ravi	EE (R), RDMA Vellore and Chengalpet	CMA
Thiru. S. Venkatesh	EE (R), Tiruppur	CMA
Thiru. A Kanagaraj	EE (R), Madurai	CMA
Thiru. D. Anbazhagan	EE (R), Tirunelveli	CMA
Thiru. N Ravichandran	Commissioner, Trichy	CMA
Thiru B. Selvam	EE, Trichy	CMA
Thiru S, Kannan	AEE, Trichy	CMA

Table A1.1: **GoTN Officers Participants' List on Two-Day Workshop in January 2017 on FSSM**		
Names of Officials	**Designation**	**Organisation**
Thiru.S.M.Malayaman Thirumudikari	JD (Schemes)	DTP
Thiru M.A.Subramaniyan, Joint Director	JD (General)	DTP
Tmt. M.Meenakshi,	Asst. Director (Schemes)	DTP
Thiru.N.Natarajan	Executive Engineer	DTP
Thiru. S. Kannan	ADTP, Kacheepuram	DTP
Thiru M.K.Sathish	ADTP, Trichy	DTP
Thiru S.Sethuraman	ADTP, Theni	DTP
Thiru. M.Mahin Abubekhar	ADTP - Tirunelvelli	DTP
Thiru. P.Manoharan	AEE, Kacheepuram	DTP
Thiru.S.Govindarajan	AEE, Trichy	DTP
Thiru.K.R.S.Karuppaiah	AEE, Theni	DTP
Thiru. N.S.SeethaMohan	AEE, Thoothukudi	DTP
Thiru.K.Kanagaraj	EO, Periyanaickerpalyam	DTP
ThiruV.Rajendiran	EO, Karunkuzhi	DTP
Thiru. Elumalai,	AE, Karunkuzhi	DTP
Thiru.Murugan	EO, Alwarthirunagar	DTP
Thiru.D.Balaji	JE, Alwarthirunagar	DTP
Thiru. Ramanujaswamy	AEE, PDC, Head Office	TWAD Board
Thiru. N. Ugendar	AEE, RWS Division, Kanchipuram	TWAD Board
Thiru. K. Vivekandan	Joint Engineer, (PDC) Head Office	TWAD Board
Thiru.RajendraRatnoo, I.A.S	Director	TNIUS
Dr.N.Muthusamy	Faculty	TNIUS
Thiru. K. Vivekandan	Joint Engineer, (PDC) Head Office	TWAD Board

Table A1.1: **GoTN Officers Participants' List on Two-Day Workshop in January 2017 on FSSM**		
Names of Officials	**Designation**	**Organisation**
Thiru. N Ugendar	AEE, RWS Division, Kancheepuram	TWAD Board
Thiru. Raja Munuswamy	AEE, PDC, Head Office	TWAD Board
Thiru R. Srinivasan	Chief Engineer: Buildings	COC
Thiru. R Ranganathan	Superintending: Solid Waste Department	COC
Thiru.N.Rajendran	EE	CMWSSB
Thiru. Jayaratchagan	EE	CMWSSB
S.Damodaran	Project Director	Gramalaya
S. Md Sheriff	Monitoring Officer	Gramalaya
Madhan Kumar	Hand in Hand	Hand in Hand
Priscilla Marline	Project Manager	Keystone Foundation
SasankaVelidandla	CDD Society	CDD Society
Andrews	CDD Society	CDD Society
Praveen	CDD Society	CDD Society

Annexure 2: International Exposure Visits: GoTN Officers Participants List

Table A2.2: **GoTN Officers' List for International Exposure Visit**		
Names of Officials	**Designation**	**Organisation**
Dr. M. Elangovan	Regional Director of Municipal Administration Salem	CMA
Dr. M. Vaitheeswaran	S.G.Assistant Engineer	CMA
Mrs. S. Amuthavalli	City Engineer	TCC
Mr. S. Kannan	Assistant Executive Engineer	TCC
Mr. S. Malayaman Thirumudikari	Joint Director (Schemes)	DTP
Mr. Subramaian	Asst. Exe.Engineer, Coimbatore Zone	DTP
Mr. K. Kanagaraj	Executive Officer Periyanaicken-Palyam Town Panchayat	DTP
Mr. R. Ravi	Executive Officer, Narasimhanaicken – Palayam Town Panchayat	DTP
Mr. V. Rajendran	Executive Officer, Karunguzhi Town Panchayat	DTP
Mr. M. Gnanasekaran	Executive Engineer	CMWSSB
Mr. A. Kathiravan	Assistant Executive Engineer, Madurai	TWAD Board

Annexure 3: Domestic Exposure Visits: GoTN Officers Participants' List

Table A3.3: **Devanahalli Exposure Visit Participants List**		
Names of Officials	**Designation**	**Organisation**
Thiru. K. Maharabushanam, I.A.S	Director of Town Panchayat	DTP
Thiru. S. M. Malayaman Thirumudikari	Joint Director (Schemes)	DTP
Thiru. G. Rajendran	Superintending Engineer	DTP
Thiru. A. SakthiKumaran	Executive officer (Admin)	DTP
Thiru. S. Kannan	ADTP, Kancheepuram	DTP
Thiru. P. Manoharan	AEE, Kancheepuram	DTP
Thiru. Ganeshram	ADTP, Coimbatore	DTP
Thiru. Subramani	AEE, Coimbatore	DTP
Thiru. V. Rajendran	Executive officer, Karunkuzhi	DTP
Thiru. Kanagaraj	Executive officer, Periyanaicken-Palayam	DTP
Tmt. Renuka	Executive officer, Narasimhanaicken-Palayam	DTP
Thiru. S. Palaniswamy	Director, Town Panchayat	DTP
Thiru. S.M. Malayaman Thirumudikari,	Joint Director, STP	DTP
Thiru. G.V. Seenivasan,	Engineer	DTP
Thiru. G.Prakash.IAS	CMA	CMA
Thiru. R.Venkatachalam	Chief Engineer	CMA
Thiru. D. Anbazhagan,	Superintending Engineer	CMA
Dr. M. Vaitheeswaran	EES	CMA
Thiru. K. Seenuvasan	AEE	CMA
Thiru. N. Krishnamoorthy	AEE	CMA
Tmt. J. Arokia Anbarasi	AE	CMA

Table A3.3: **Devanahalli Exposure Visit Participants List**		
Names of Officials	**Designation**	**Organisation**
Dr. Elangovan	RDMA, Chengelpet	CMA
Thiru. V. Murugesan,	ME, Tamabaram Municipality	CMA
Thiru. V. Srinivasan,	ME, Avadi Municipality	CMA
Thiru. Ravichandran	Commissioner, Trichy City Corporation	CMA
Thiru. Nagesh	City Engineer, Trichy.	CMA
Tmt. G. Vasanthal	Deputy Chief Engineer, Head Office Chennai.	TWAD board
Thiru. Er. K. Munibabu	Assistant Executive Engineer, RWS Division, Thiruvallur	TWAD board
Thiru. N. Ugendhar	Assistant Executive Engineer, RWS Division, Kancheepuram.	TWAD board
Thiru. J.Kumaravel	Assistant Engineer, RWS Division, Vellore	TWAD board
Thiru. D. Viyayakumar	Junior Engineer, Sewerage Division, Vellore.	TWAD board
Thiru. S. Ramachandran	Executive Engineer, (STP) Chennai South.	CMWSSB
Thiru. D. Manoharan	Assistant Executive Engineer, (STP) Chennai South.	CMWSSB
Thiru. Sivakumar	Executive Engineer,	CMWSSB
Thiru. Satheesh,	Assistant Engineer	CMWSSB
Tmt. S.Amudhavalli	Executive Engineer (East)	TCC
Tmt. B. Alli	Medical Officer and ACHO (I/c)	TCC
Thiru. S. Kannan	Assistant Executive Engineer	TCC
Thiru. A. Rajesh Kanna	Junior Engineer	TCC
Thiru. S. Reguraman	Junior Engineer	TCC
Thiru. K. Ibrahim	Junior Engineer	TCC
Thiru. K. Jegajeevanram	Junior Engineer	TCC

Annexure 4: Engineers' Training on FSM Participants' List

Table A4.4: **Engineers' Training on FSM Participants' List**

Name	Designation	Organisation	Email	Contact Number
S. Amudhavalli	City Engineer	TCC	ammupandi18@gmail.com	9443326648
K. Giridhara Gopal	Junior Engineer	TCC	srirangamgiri1@gmail.com	9894031373
K. Srinivasan	Junior Engineer	TCC	srinivasanje68@gmail.com	9626866236
I. Albert	Junior Engineer	TCC	albertisac1963@gmail.com	8608201062
B. Joseph Raj	Junior Engineer	TCC	joseph1965raj@gmail.com	9443646630
L. Pushparani	Junior Engineer	TCC	pusharanilakshmanantcc@gmail.com	9842804685
R. Balamurugan	Junior Engineer	TCC	rbm1969tcc@gmail.com	9843053600
A. Ganesh Babu	Junior Engineer	TCC	ganeshsixone@gmail.com	9789539239

TN US SP
TAMIL NADU URBAN SANITATION SUPPORT PROGRAMME

Tamil Nadu Urban Sanitation Support Programme (TNUSSP) supports the Government of Tamil Nadu and cities in making improvements along the entire urban sanitation chain.
The TNUSSP is implemented by a consortium of organisations led by the Indian Institute for Human Settlements (IIHS), in association with CDD Society, Gramalaya and Keystone Foundation.

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