Cross-learning workshop
Faecal Sludge Treatment Plants – Ensuring their sustainable operations

Date: 25-26th September 2023
Venue: Dream Square Resort, Mawna, Gazipur, Bangladesh

Proceedings
Faecal sludge treatment plants (FSTPs) play a vital role in effective sanitation management, public health promotion, and safeguarding the environment. However, the operationalization and long-term sustainability of FSTPs present significant challenges that need to be addressed.

Bangladesh is planning to set up 95 FSTPs — 18 of which are already operational and the rest are under construction: it is crucial for the country, therefore, to tackle the operationalization hurdles. FSTPs are now being operated and maintained under the Build Operate and Transfer (BOT) model. To ensure smooth operations, municipalities need to be equipped with the necessary skills and capacities.

Centre for Science and Environment (CSE), India and Water Aid, Bangladesh conducting their cross-learning workshop, which has been designed as a platform to bring together experts, practitioners, policymakers, and stakeholders from diverse backgrounds, with the goal of fostering knowledge exchange, sharing best practices, and discussing strategies for ensuring successful operation and sustainability of FSTPs.

The 2 day workshop aimed at sharing the learnings on FSM and FSTPs from each country. The learnings of CSE from Uttar Pradesh and experience of FSTP implementations from Bangladesh, mainly in terms of operationalization and sustenance of FSTPs was presented at the workshop.

The key highlights of the workshop were as follows:

- Insightful presentations on the role of FSTPs in sanitation management, public health promotion, and environmental safeguarding.
- Sharing of experiences and lessons learnt from the implementation and operation of FSTPs in Bangladesh and Uttar Pradesh, India.
- Interactive sessions to discuss challenges, innovative solutions, and best practices for sustaining FSTPs in the long run.
- Capacity-building to equip municipalities with the necessary skills to effectively handle FSTP operations.
- Networking opportunities to foster collaboration among stakeholders and promote future partnerships.

The workshop aimed at the following:

- **Developing a Global South Perspective and Understanding on sustainability of FSM**
  - Core focus of our work in sanitation in UP
  - Experience sharing from India and Bangladesh
  - To foster discussions, learning, and collaboration on the operationalisation and sustainability of faecal sludge treatment plants (FSTPs).
- **Strengthen a Global South Water and Sanitation Learning Agenda and Platform.**
  - Contribute to the Learning and Sharing at Global platform
Following resource persons participated and shared their experiences and learnings from FSTP implementation from their respective countries.

Day 1 – 25th September

- Md Tahmidul Islam – WaterAid Bangladesh – Opening remarks and welcoming participants
- Dr. Sumita Singhal – CSE India – Opening remarks, Setting the context, learnings and initiatives for FSM in India
- Sanjoy Mukherjee – CWIS-FSM support cell, DPHE, Bangladesh – Opening remarks and country level initiatives
- Sarim Ansari – CSE India – FSM experience in Uttar Pradesh, India

Day 2 – 26th September

- Md Shakhawat Hossain - WaterAid Bangladesh – Recap of Day 1
- Sarim Ansari - CSE India – Challenges in FSSM: Sharing experiences and lessons learnt from Uttar Pradesh
- Ravi Kumar - CSE India – Policy and regulatory framework in creating enabling environment for FSM in India
- Sarim Ansari - CSE India – Experience from UP-Sustainability and Inclusivity in FSM: Economics of desludging services and ESM tool
- Dr. Tanvir Ahmed – ITN-BUET, Bangladesh – FSTP monitoring protocols
- Kalyana Chakravarthy Sama – CSE India - Laboratory protocols and monitoring aspects for sustenance of FSTPs
- Md Shakhawat Hossain – WaterAid Bangladesh – Occupational Health and Safety
- Ravi Kumar – CSE India - Occupational Health and Safety
- Dr. Abdullah Al-Muyeed – CEO – CWIS-FSM Support cell, DPHE, Bangladesh – Closing remarks and comments.

Day 1 – workshop proceedings

The workshop was initiated by welcoming the participants, where each participant described their role at the organisations and activities they are responsible for related to FSM. The opening remarks were made by Md Tahmidul Islam of WaterAid, he introduced the participants with the objective and aim of the workshop, which is to enable the municipal officials to handle and ensure the sustainability of the FSTPs.

*Figure 1: Md Tahmidul Islam - Technical Lead, WaterAid Bangladesh - welcoming the participants at the workshop*
Followed by this, Dr. Sumita Singhal – Programme Manager, CSE-Water Programme, provided insights about CSE and its water program. She explained about the initiatives namely SBM, AMRUT, Swachta Survekshan, Niti Aayog taken by the Government of India in expanding the sanitation sector starting from 2014, and achieving ODF in 2019 and the journey forward. Interception and Diversion (I&D) used for tapping nalas to mitigate river pollution was explained. She emphasised CSE aims ‘to promote sustainable development with equity, participation and democracy’ through bridging the gap between information and knowledge. CSE’s water program is divided into 4 main segments of work which are: action research, advocacy, capacity building and cross-learning. She elaborated the components of FSSM laboratory which is part of Environment Monitoring Laboratory (EML) at CSE, the laboratory undertakes the works pertaining to characterisation of faecal sludge and septage, conduct performance evaluation of FSTPs, wastewater treatment systems, conducts training programmes to various stakeholders including laboratory personnel, researchers, Government officials, FSTP/STP operators and lab technicians, NGO officials, academicians, students etc., research activities related to resource recovery from FS. Dr. Sumita further provided insights into CSE-water program teams and their focus areas; Inclusive sanitation, sustainable water supply and safe sanitation practices in rural areas, wastewater and biosolids – reuse and recycle, and technical support to state of Uttar Pradesh on Faecal Sludge Management. Further, the collaborations with CSE and WaterAid Bangladesh was elaborated, the partnership has been in place since 2010. The areas of collaboration were on topics such as; preparation of SFDs, Decentralised Wastewater Management, Rainwater harvesting and FSSM.

The presentation was concluded with strategic sanitation (CWIS) priorities in the global south context, these are;

- FSM by default, is not inclusionary: Need to define Inclusion, Gender & Safety: Baseline and Goals
- Accountability and Responsibility: Addressing Deeper, Long Term Barriers
  - Institutional bias (social base of institutions- gender and caste profile)
  - Political economy of sanitation infrastructure – preference for large capital investment in centralized sanitation systems vs. Decentralized and Non Sewered Sanitation Systems.
- Sustainability: Environmental and Climate change challenges
  - River and ground water pollution
Intensification of water use – water scarcity and flooding impacts on sanitation systems
• Nutrient recovery and re use priority
• “Excreta Matters”: Greater Awareness for Decentralized and NSS Solutions

Mr. Sanjoy Mukherjee, Social Development Expert – CWIS-FSM support cell, DPHE, Bangladesh presented the country level initiatives and learnings from Bangladesh. He started his presentation by giving insights into major milestones achieved by Bangladesh in the era of Millennium Development Goals (MDGs) until 2015. Post MDG the focus on SDGs was taken up by partners and governments in achieving the targets. The journey towards SDGs 2030 especially focusing on goal 6 started with publication of Institutional Regulatory Framework (IRF) for FSM for which National Action Plan was prepared in 2020 along with establishment of CWIS-FSM support cell. The focus started from setting up containment systems until achieving the SDG 6.2.1 emphasising the need for safely managed sanitation. At the national level in Bangladesh, the basic sanitation access increased from 47% in 2015 to 54% in 2020, accordingly the safely managed sanitation facilities increased from 34% in 2015 to 39% in 2020. The CWIS-FSM support cell with coordination, collaboration and advocacy plans to achieve the SDG 6.2 (sanitation for all) in the country. The CWIS-support cell will work to enable CWIS functions of responsibility, accountability, resource planning and management at National/State/City level. CWIS-FSM support cell is working to enable systematic change within DPHE to deliver inclusive sanitation in partnership with DFIs. Policy support Branch of LGD, I/NGOs, FSM network, MAD, GWSC, and ITN-BUET (CWIS Ecosystem). The cell is doing strong advocacy within DPHE and Municipalities to answer queries and provide strategic guidance to implement CWIS in Bangladesh. The support cell facilitate engaging the governments to build political will on achieving SDG 6.2 by CWIS approach, strengthen regulations, and institutions, and increase investments in inclusive sanitation.

Figure 4: Mr. Sanjoy Mukherje, Social Development Expert of CWIS-FSM cell explaining the initiatives taken up in Bangladesh

Sarim Ansari, Programme Officer, CSE- Technical support at Uttar Pradesh shared his experiences pertaining to FSSM from the state. The major challenges which were portrayed were; sustainability, equity, affordability, safety and operational. He provided information into FSSM projects undertaken by UP government, there are 62 FSSM projects in 59 Urban Local Bodies (ULBs), which includes 40 FSTPs and 22 Co-treatment plants with total investment of Rs. 220 crores. The challenges pertaining to FSM were categorised as per the phases of construction; during pre-construction – the major challenges were across tendering process, site selection and contraction; during construction – the challenges faced were across institutional, Quality control and other unforeseen challenges such as COVID-19; post construction – the
challenges were pertinent for awareness, O&M, capacity building and pre-commissioning tests and checks. There are current challenges which are faced for scaling up of FSM in the state, these challenges are: Handover of plants to ULBs, Inadequate septage at the FSTPs, unregulated private desludging, lack of regulatory frameworks, lack of awareness, technical issues at the plants and approach roads. The strategy to address the challenges are summarised in the table below:

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Strategy to address the challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not a priority issue in the town</td>
<td>city level meetings; Formation of City Sanitation Committee; Regular tasks to the cities and follow-up</td>
</tr>
<tr>
<td>Weak capacity / awareness</td>
<td>Onsite training; Mentoring support at the city level; State level trainings; IEC activities</td>
</tr>
<tr>
<td>Weak regulation and management</td>
<td>FSSM Bye-laws; Handover of the plants to the ULBs; Addressing UPJN rural/urban issues</td>
</tr>
<tr>
<td>Weak desludging mechanism</td>
<td>Registration of operators; Fixing of desludging fee; Finalizing desludging business model</td>
</tr>
<tr>
<td>Last mile challenges in the plants</td>
<td>Technical issues; Management issues</td>
</tr>
</tbody>
</table>

The presentation ended by providing the strategy on how to get more sludge to the FSTPs. The strategy is divided into three components; schedule desludging, demand based desludging and demand based on priority desludging.

The day 1 of the workshop ended with participants working on the group exercise wherein they detailed out the current challenges faced at their municipalities pertaining to FSTP operations, these challenges were across three categories; financial, technical and regulatory. The participants were asked to present the challenges post group discussions.

Figure 5: Sarim Ansari of CSE sharing the experiences on FSTP implementation in UP
Day 2 – workshop proceedings

The day 2 of the workshop began with recap of the day 1, the participants were asked to summarise the pointers. Shakwat Hossain of WaterAid, Bangladesh moderated the session.
The day 2 cross learning sessions started with Mr. Sarim Ansari of CSE sharing the planning process for FSM implementation in the state of UP. He started by sharing a roadmap of milestones where in CSE was engaged with UP in preparation of City Sanitation Plan in 4 cities in the year 2016, this engagement with the state has currently enabled the state to construct FSTPs and setup co-treatment plants in 54 ULBs by 2023. The future plan is to move towards sustainable and inclusive sanitation for all in the state. The major catalyst for engagement of CSE with Ministry of Urban Development, UP was signing of Memorandum of Understanding in the year 2018 with Government of UP which focused on Faecal Sludge and Septage Management (FSSM). He mentioned that, SFDs were used in identifying and advocating the government regarding gaps in sanitation chain. FSTPs/STP cotreatment constructed in 2 cities of UP, Chunar and Bijnor and the complete management carried out by CSE for their sustainable operation was explained which included deep row entrenchment, providing training to masons for proper construction of containment systems, training to sanitation workers, FSTP construction, framing and formation of byelaws etc. Challenges faced during FSTP construction in Unnao, septage mangement in Jhansi which were published were mentioned. The awareness campaigns like ‘MalAsur: Demon of Defecation’ campaign enabled engagement of citizen group in creating awareness regarding the need for proper FSSM in the state.

The session 2 was delivered by Mr. Ravi Kumar from CSE, he presented the policy and regulatory framework which enabled the implementation of FSM in India. He presented the FSM journey in India from the first step taken in 2016 by NFSSM alliance in developing primer for FSSM, the release of National Policy on Faecal sludge and septage management which rolled out in 2017. He detailed out the 2017 national policy on FSSM. He explained the institutional and regulatory framework in India; wherein he explained the roles and responsibilities of various institutions involved in enabling FSSM in the country. He later spoke about the bye-laws for FSSM in Uttar Pradesh, the components of the bye laws are across; user interface/collection/storage, emptying/desludging, conveyance/transport, treatment/disposal and reuse, monitoring and penalties, and administrative measures. The presentation ended with the speaker mentioning the pointers the country is still lacking in terms of policy and regulations.
The next session was taken up by Sarim Ansari from CSE on Experience from UP-Sustainability and Inclusivity in FSM: Economics of desludging services and ESM tool. He started the presentation with the genesis of the study on economics of desludging- fixation of desludging fees in the town level FSSM byelaws. He highlighted, based on the outcomes from the field level study conducted in 15 towns of UP, a desludging cost calculator was developed. The calculator would enable the municipality to reach a desludging fees based on certain assumptions and local context specific data. Further, he enlightened upon the monitoring tool prepared on request of the Department of Urban Development- Ease of Septage Management tool. The tool, incorporating indicators from Citywide Inclusive Sanitation (CWIS) framework, was essentially a simple Star Rating Tool that incentivizes towns and cities to improve their septage management services in an incremental manner, to attain higher level outcomes, in a way that equity in access of sanitation services could be achieved. He also mentioned that the tool is currently being implemented in 56 towns of UP.

The workshop proceeded with the presentations on topics of Laboratory protocols and monitoring for sustenance of FSTPs, the session was delivered by Dr. Kalyana C Sama from EML, CSE and Dr. Tanvir Ahmed of ITN-BUET.

Dr. Kalyana C Sama from Environment Monitoring Laboratory (EML) provided information on the instruments and facilities available at EML to assess various parameters. He explained the activities conducted by EML and what they do, the major FSM related activities undertaken by EML are; FSTP technology and performance evaluation; STP-co-treatment technology and performance evaluation; Faecal sludge and biosolids characterisation; wastewater analysis and analysing the treatment efficiency of the DEWATS system. He presented the findings from the evaluation of treatment efficiency of FSTPs and STP cotreatment systems across India, and biosolid characterization and reuse status in FSTPs in India. In total 47 FSTPs and 22 STP cotreatment systems were studied across 7 and 5 states respectively, the following were the major findings of the studies:

- **DEWATS** is the most common technology used in 33 FSTPs. Different technologies were used for FS treatment in Telangana state. The mean % removal of COD, BOD, and TKN were >85% in Geotube, electrocoagulation, and pyrolysis with packaged STP, and were >=65-70% in DEWATS and MBBR FSTP technologies. The pH, BOD, and faecal coliform in the final treated water are within the MoEF&CC (2017) standard limit whereas COD (21 FSTPs) and TKN are above the limit (50 mg/L for COD) in majority of the FSTPs. Most non-compliant plants were found to be within the COD range of 50-200 mg/L. The key problem noted is that most of the FSTPs are working below their designed treatment capacity and facing difficulty in getting faecal sludge daily or even weekly for some plants. This is also affecting performance. In some plants visited, the situation is so dire that the process of treatment remains incomplete and there is no outlet effluent available for testing.

- **SBR** is the most common technology used in 11 STP cotreatment systems. Among the STP cotreatment technologies, the mean % COD, BOD (~ 90%) and TKN (62-91%) removal were higher in ASP, SBR and MBBR technologies compared to WSP and UASB (COD, BOD: 65-77%; TKN: 46-54%). BOD is within the standard limit of MoEFCC, 2017 (<30 mg/L) in all the 22 STP cotreatment plants. However, COD (16 STPs), TKN (13 STPs) and FC (15 STPs) exceeded the standard limits of MoEFCC (2017) in most of the STPs with cotreatment.

- **Biosolids** were characterized from 46 FSTPs in 6 states, but, reuse was observed only in 16 FSTPs. pH, EC, moisture content, carbon nitrogen content, Faecal coliform & E.coli varied within and across technologies. Variation in heavy metal concentration were observed to be irrespective of the technologies. Helminth eggs were observed in most of the biosolids samples. Biosolids obtained after different treatment technologies in India can be used as organic manure after minor post-treatment. Reducing the moisture content, co-composting or conversion to biochar are resourceful options for pathogen reduction in faecal sludge. Calorific value obtained for biosolids is comparable to that of other biomass calorific value. It can be considered for solid fuel applications provided drying is properly done.
Dr. Tanvir Ahmed started his presentation by mentioning the IRF-FSM publication in 2017 which calls for establishing faecal sludge treatment solutions of urban areas in Bangladesh. He provided the list of FSTPs upcoming under different projects in Bangladesh, there are in total 120 FSTPs planned to be built in Bangladesh. There are two types of FSTPs which are operational in Bangladesh, these are unplanted drying beds and planted drying beds. He emphasised on the sampling points which are crucial at FSTPs. He mentioned about the different test categories such as on-site measurement, solid and organic content, nutrient content, pathogens. He provided information on standards followed for liquid discharge in Bangladesh. Dr. Tanvir Ahmed provided insights about FS laboratory which is setup in ITN-BUET, the faecal sludge testing protocol followed and trainings conducted.

<table>
<thead>
<tr>
<th>FSTP products</th>
<th>ECR 2023 (Schedule-3: sewage discharge)</th>
<th>BDS ISO 31800: 2020</th>
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<tbody>
<tr>
<td><strong>Effluent</strong></td>
<td>Temperature (°C): 30</td>
<td>Temperature (°C): ≤45</td>
</tr>
<tr>
<td></td>
<td>pH: 6-9</td>
<td>pH: 6-9</td>
</tr>
<tr>
<td></td>
<td>BOD5 (mg/l): 30</td>
<td>BOD5 (mg/l): ≤25</td>
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<tr>
<td></td>
<td>COD (mg/l): 125</td>
<td>COD (mg/l): 100</td>
</tr>
<tr>
<td></td>
<td>SS (mg/l): 100</td>
<td>TSS (mg/l): 30 mg/l</td>
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<tr>
<td></td>
<td>Oil &amp; Grease (mg/l): 10</td>
<td>-</td>
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<tr>
<td></td>
<td>NO3 (mg/l): 50</td>
<td>Total nitrogen (mg/l): ≤15</td>
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<tr>
<td></td>
<td>PO4(mg/l):15</td>
<td>Total phosphorous (mg/l): ≤15</td>
</tr>
<tr>
<td></td>
<td>Total Coliform (CFU/100 ml): 1000</td>
<td>E. Coli (CFU/l): 100</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Viable Helminths ova (#/l): &lt;1</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Coliphase (PFU/l): 10</td>
</tr>
<tr>
<td></td>
<td>-</td>
<td>Cryptosporidium (CFU/l): &lt;1</td>
</tr>
<tr>
<td><strong>Solid</strong></td>
<td></td>
<td>E. Coli [CFU/g (dry solids)]: 100</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Viable Helminths ova [#/g (dry solids)]: &lt;1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Coliphase [PFU/ g (dry solids)]: 10</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Cryptosporidium [PFU/ g (dry solids)]: &lt;1</td>
</tr>
</tbody>
</table>

Figure 11: Standards for treated wastewater discharge in Bangladesh
The workshop proceeded with the session on Occupational Health and Safety by Md Shakhawat Hossain of Water and Mr. Ravi Kumar from CSE. The session highlighted the importance of Personal Protection Equipment while handling the FSTP operations, the experience on sanitation safety plan from WaterAid was presented.

Md Tawhidur Rahman from CWIS-FSM support cell, DPHE explained that there are two common types of FSTPs in Bangladesh which are Unplanted and Planted drying beds, the technology selection on the CAPEX and OPEX, and to maintain the operations at minimal. The scalability is more convenient with the nature based systems due to ease of operations. He explained the FSTP evaluation framework and service level benchmarks adapted in Bangladesh.

The workshop was concluded with the remarks from Tahmidul Islam of WaterAid, Dr. Sumita Singhal from CSE, Dr. Abdullah Al-Muyeed, Chief Operating Officer, CWIS-FSM support cell, DPHE; Selim Jahangir – Mayor, Paikgacha; Partha Hefaz Shaikh – Director, Programmes and Policy Advocacy, WaterAid; Dr. Tanvir Ahmed – ITN-BUET; Engr Eheto Shimul Russel Khan – Project Director, DPHE.