

# Quality and Quantity Study for Faecal Sludge in Sircilla, India

Estimation of qualities and quantities (Q&Q) of faecal sludge (FS) plays a very crucial role in designing Faecal Sludge Management (FSM) solutions for a city or town. Assessing Q&Q helps to understand what quality and how much of faecal sludge will need to be managed; and this has a bearing on infrastructure design and financial resource requirement. However, FSM as a systemic intervention strategy for Indian conditions, has been recognized very recently, this data is not completely available.

This research thus aims to fill this gap by understanding Sludge Accumulation Rate (SAR) in

## Technical definitions

#### SAR

**Sludge Accumulation Rate** is a measure of FS-solid fraction accumulated in a containment system over a period of time until the containment system is desludged.

**different containment types** in households, commercial and institutional establishments; and simultaneously field test the recently developed approach for determining FS i.e. the Q&Q approach developed by EAWAG.

By providing insights on the Q&Q of faecal sludge in containment systems, this study - the first to be conducted specifically for the Indian context - will throw light on **how treatment systems can be better designed;** helping make better estimations for FSM interventions in India. Ultimately, this aids to frame better policies and programmes to improve activities along the sanitation value chain.

#### DFSR

**Desludged Faecal Sludge Rate** is a measure of FS – liquid and solid fraction accumulated in the containment system during the time of desludging. It is an indication of the quantity of FS to be treated in the FSTP.

#### Sircilla: An Overview

Area : 15.25 Sq. Kms Population : 82,257 (as per Sircilla Municipal data 2018) No. of households : 16,451

#### • Sircilla, Telangana

Sircilla was declared Open Defecation Free in 2019

#### Why was Sircilla selected?

- Sircilla is representative of a medium-sized town in India
- CDD Society had been engaged with the Municipality since 2017 for a City Sanitation Plan as well as the setup of a Faecal sludge Treatment Plant
- The Municipality was co-operative; and supported the entire process of setting up base and initiating the study

#### **Study Objectives**

- Estimation of Sludge Accumulation Rate (SAR) for onsite sanitation systems (OSS) in Sircilla using the Q&Q methodology
- Determination of factors that influence values of SAR
- Characterisation of faecal sludge accumulated in OSS

#### Sircilla: Sanitation Value Chain





### Study Methodology

The Q&Q methodology calls for a spatially uniform sample distribution across the city. Hence samples have been selected using SPA-DET\* (Spatially analyzable Demographic, Environmental and Technical data) to create a data set that is representative of Sircilla.

### SET OBJECTIVES CONDUCT SFD COLLECT SPA-DET CITY SPECIFIC SAMPLING PLAN QUESTIONNAIRE 30 HH Elliptical Septic Tank study 183 Mixed Containment Systems study

DATA COLLECTION

DATA ANALYSIS

**FAECAL SLUDGE** 

**QUANTITIES AND QUALITIES** 

Sampling Strategy

Schematic diagram of steps in Q&Q determination

#### SPA-DET includes :

Demographic data

Environmental data

Technical data

Population densityIncome level

Population trend (floating/permanent)

Groundwater level
 Elevation

- Soil type
  - Type of containment system
  - Presence of outlet from the containment
  - Type of toilet & flush system
  - Type of toilet cleaning material

#### How sludge height is measured?



#### How samples were collected?



Collection of a composite sample from the desludging vehicle

FS sample from the desludging vehicle is collected by opening the release valve at three intervals to collect a representative sample

Heads	30 HH Elliptical Septic Tank study	183 Mixed Containment Systems study
Sample Size	30 (5 Control)*	183
Nature of Sample	Residential Slum/ non-slum	153 Residential; 30 Commercial/Institutional Containment systems Slum/ non-slum
OSS Typology	Elliptical-shaped lined tanks	<ul> <li>Septic Tank with/without baffle walls and outlet</li> </ul>
Measurements	<ul> <li>Periodic sludge height measurement</li> <li>Periodic sample collection</li> </ul>	<ul> <li>One-time sludge height measurement at the time of desludging</li> <li>One-time sample collection for quality analysis at the time of disposal</li> </ul>

\*The containments desludged at the start of the study. SAR was measured in the onsite containment systems of these HHs 6 times in 8 months.

### Key Findings

Heads	30 HH Elliptical Septic Tank study	183 Mixed Containment Systems study
<b>FS Quantity</b> (median values have been presented)	SAR 1. SAR for the elliptical tanks has been found to be ~30.58 L/cap·year DSFR Not determined	<ul> <li>SAR</li> <li>1. SAR for the onsite containment systems is 16.6 L/cap·year*.</li> <li>2. This is comparatively lower than the values for the Indian Standard Code for septic tanks and pits, which is 76.7 L/cap·year and 65.7 L/cap·year respectively (considering the systems are water tight and have to be desludged once in 3 years).</li> <li>3. The SAR for the different types of containment systems in this study: • Elliptical and Rectangular Tanks: 16.61 L/cap·year • Pits: 17.69 L/cap·year</li> <li>DFSR</li> <li>4. DFSR for the onsite containment systems is ~53.2 L/cap·year</li> <li>5. The DFSR for the different types of containment systems in this study: • Elliptical Tanks: 54.14 L/cap·year</li> <li>Pits: 57.47 L/cap·year</li> </ul>
<b>FS Quality</b> (median values have been presented)	1. FS quality has been analysed for 15 HHs out of a total of 30. The values are: a. Total Solids: 6,300 mg/L b. Volatile Solids: 4,300 mg/L c. VS:TS: 0.65 d. COD: 10,411 mg/L	<ol> <li>FS quality has been analysed for 183 residential and commercial OSS. The values are:         <ul> <li>a. Total Solids: 26,000 mg/L</li> <li>b. Volatile Solids: 17,000 mg/L</li> <li>c. VS:TS: 0.6</li> </ul> </li> <li>COD: 33,000 mg/L (This has a moderately strong correlation with total solids values for the septic tanks and very weak correlation for total solids values for pits.)</li> </ol>
Factors	Volume of OSS has been found to have significant correlation with SAR Number of users of the OSS has been found to have a significant correlation with TS.	<ul> <li>8 external factors have been found to influence the value of SAR in the 183 Q&amp;Q study. The factors are: <ul> <li>No. of users</li> <li>Domestic water usage in L/day</li> <li>Source of water</li> <li>Reason for last desludging</li> <li>Presence of outlet</li> <li>Containment type</li> <li>Containment shape</li> <li>Age of containment</li> </ul></li></ul>

#### **Conclusions & Recommendations**

\*litres/person/year

- Statistical analysis of the data obtained from this study revealed that the characteristics of Faecal sludge are influenced by DFSR but not by SAR. Also, Q&Q of FS is influenced by OSS being lined or unlined and also the age of the FS inside the OSS.
- 2. Estimated SAR values are a direct Indicator for planning scheduled desludging for a town as it considers only the sludge blanket in the OSS. On the other hand, estimating DFSR using Q&Q methodology gives near accurate FS Quantity and



 Survey No.205 (Opp. Beedi Workers Colony), Kommaghatta Road, Bandemath Kengeri Satellite Town, Bangalore 560 060, Karnataka, India. Quality which helps in sizing and designing of the FS treatment facility for the town.

- 3. Selection of samples would also interfere by various factors under Q&Q methodology, hence it requires continuous adaptation in the sampling strategy specific to project location.
- 4. While replicating the SAR Study in other towns, the study should be controlled and spread over a longer period of time to determine more accurately the trend in accumulation rate.

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