

## Faecal Sludge Management (FSM)

A factsheet about the Shit Flow Diagram as well as technology and treatment options for FSM.

### The Shit Flow Diagram

Before starting to plan a proper Faecal Sludge Management information needs to be collected about the existing sanitation situation, as well as the faecal sludge and excreta generated in a city, village or community and if/how single stages of faecal sludge value chain are already covered. To keep these factors in mind and take them into account for FSM, a Shit Flow Diagram (also often described as Excreta Flow Diagram) is a tool to understand and communicate/visualize how excreta physically flows through a city or town. The Shit Flow Diagram below shows how excreta is or is not contained (WC, On-site facility, Open defecation/ Open discharge). Finally the fate of all generated excreta can be identified and therefore it sets a suitable FSM delivery context for further planning.<sup>1</sup>

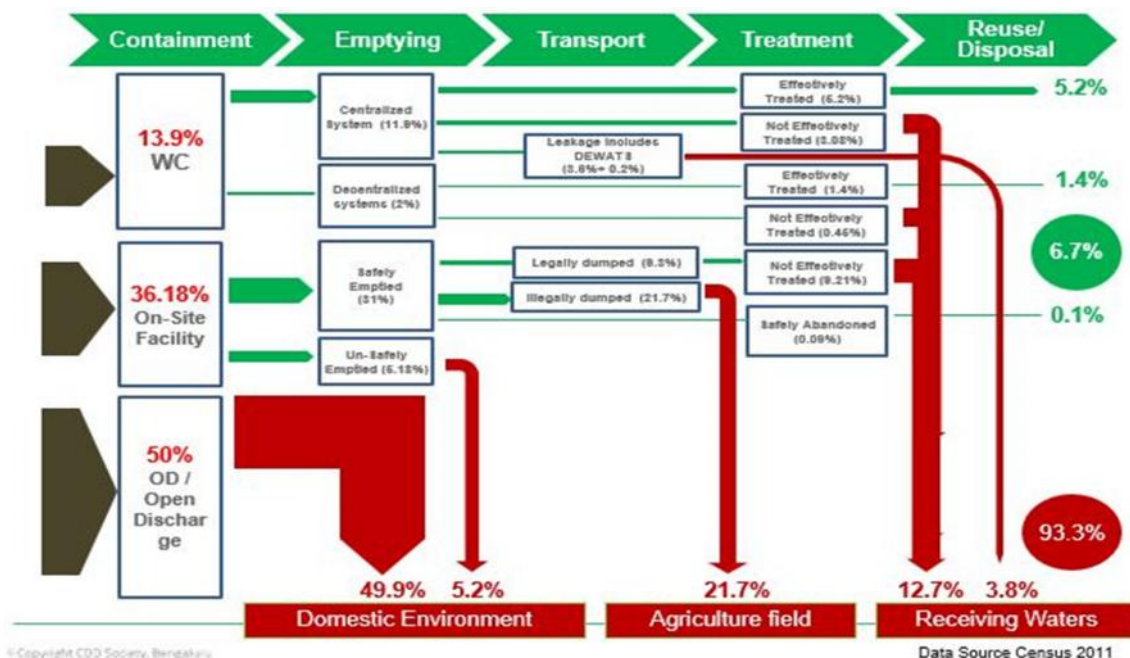


Fig. 1: Shit Flow Diagram for India

### FSM technology options for every stage

While talking about FSM technology options there are four main areas that should be focused on: the On-site sanitation with its User Interface & Containment, the stage of emptying and transportation, the treatment as well as the stage of reuse/use.

#### User Interface

The technology options for the user interface range widely and can be understood by the separation of different toilet types concerning its general utilization. These can be e.g.:

- Individual Toilet (Used by single household)
- Shared Toilet (Used by more than one household)

<sup>1</sup> <http://sfd.susana.org/>

- Community Toilet (Used by cluster of households)
- Public Toilet (Used by floating population or public area)
- Mobile Toilet (Used at large gathering)

Moreover it can be divided as well by the toilets slab and superstructure:

- Pre-cast concrete toilet
- Pre-fabricated toilet
- Semi-permanent toilet
- In-situ masonry toilet

Another focus can be on the wash-up system:

- No flush – dry toilet
- poor flush toilet
- cistern flush toilet (Squatting pan, western water closet, combination toilet)
- Vacuum flush toilet
- Urine diverting dry toilet, Urine diverting flush toilet

Furthermore latrine accessories can be taken into account:

- anal cleansing materials
- a place to dispose of menstrual hygiene products
- Handwashing station etc.

### Containment

The technology options for the stage of Containment are very multifarious. Existing collection and storage systems are<sup>2</sup>:

- Single pits
- Settling tanks
- Septic tanks
- Anaerobic baffled reactors, Anaerobic filters

Some collection and storage systems can also follow the function as a (semi-)centralized treatment units at the same time. These are for example:

- Waste stabilization ponds
- Aerated ponds
- Trickling filters
- Up flow anaerobic sludge blanket
- Activated sludge reactor
- Anaerobic biogas reactor

### Emptying & Transportation

The two main options for container pit (pit, tank etc.) emptying are *manual emptying* & *mechanical emptying*. Manual emptying can be done in different ways: The waste/sludge is emptied by hand using buckets and shovels (1) or by a portable, manually operated pump system (2).<sup>3</sup>

The manual emptying is therefore related to a lot of unsafe handling of faecal sludge and a lack of personal protection and safety equipment which may lead to a high number of contacts with faecal sludge and its harmful pathogens for the desludging staff.

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<sup>2</sup> Eawag/Sandec (2008): Sandec Training Tool 1.0 – Module 5. Faecal Sludge Management (FSM), p.12

<sup>3</sup> EAWAG/SANDEC (2008): Sandec Training Tool 1.0 – Module 5. Faecal Sludge Management (FSM), p.13

Concerning mechanical emptying most pits or septic tanks are emptied by vacuum trucks or tankers equipped with a pump and a storage tank. During the process the pump is connected to a hose, which is lowered down into a septic tank or pit, and the sludge is pumped up into the tank. Generally, the storage capacity of a vacuum tanker ranges between 4 and 6 m<sup>3</sup>.<sup>4</sup>

### Treatment

While talking about the fourth stage, a technology option which is focusing directly on the treatment of faecal sludge is the Faecal Sludge Treatment Plant. The main treatment steps followed in a FSTP are solid-liquid separation, stabilization and dewatering of sludge and pathogen removal. The separated liquid component is also treated to meet discharge standards. The faecal sludge is conveyed to the FSTP through a cesspool vehicle. The treatment modules for solid components are: Feeding Tank with Screen Chambers, Biogas Digester, Stabilization Tank, Sludge Drying Bed, Percolation pit and for liquid components are: Integrated Settler, Anaerobic Baffled Reactor with filter chambers, Planted Gravel Filter and Collection Tank. The treatment system also consists of a co-composting unit where the dried sludge from the Sludge Drying Bed can be composted with municipal solid waste.

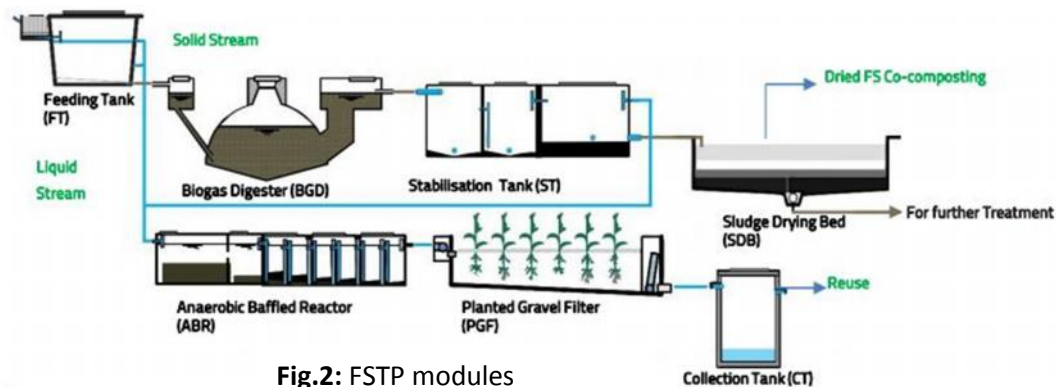


Fig.2: FSTP modules

### Reuse/Use

To return for example bio solids to agriculture for soil conditioning and fertilization the faecal sludge the solid and liquid parts of Faecal Sludge need to be separated, which happened already in the stage of treatment. To finally use the preprocessed faecal sludge from the sedimentation ponds or drying beds the sludge itself needs to be mixed with e.g. with soil and cow dung to apply it on the fields or the faecal sludge can be co-composted to increase the value of nutrients. Through composting is not always mandatory. Focusing on co-composting mixing ratios for co-composting of faecal sludge and organic material can range from 1:2 to 1:10, depending on the faecal sludge characteristics and water content. The optimal mixing ratio of organic waste and faecal sludge as well as the ideal process specifications for production of hygienically safe compost are still being investigated. For co-composting itself two different main systems are existing: the open system and the cost-intensive closed “in-vessel” or “reactor” system.<sup>5</sup>

The open system includes in total three methods:

- Windrow, heap or pile composting
- Bin composting
- Trench and pit composting

<sup>4</sup> Eawag/Sandec (2008): Sandec Training Tool 1.0 – Module 5. Faecal Sludge Management (FSM), p.13

<sup>5</sup> Eawag/Sandec (2008): Sandec Training Tool 1.0 – Module 5. Faecal Sludge Management (FSM), p.20-21