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Implications of inappropriate containment on urban sanitation and environment: a study of Faridpur, Bangladesh

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Several initiatives have been undertaken by agencies to tackle the second generation sanitation challenge of safe management of faecal sludge. A situation analysis of an on-going initiative identified inappropriate containment at source is one of key problems, with multiple implications for people's access to decent, safe sanitation and for the environment. Inappropriate containment is the manifestation of the lack of knowledge, guidelines, awareness at the city level and has not been prioritised in the rush to achieve basic sanitation coverage. As a result, urban dwellers constructed intermediate solutions to containment and sludge management which pollute the overall environment. The current study of Faridpur city will shows the impact of inappropriate containment on sanitation and the environment in Faridpur, Bangladesh.

Introduction and background

Bangladesh is facing a second-generation challenge in the sanitation sector now that the country has achieved 99% access to sanitation which is mostly covered by on-site sanitation systems like septic tanks, improved and unimproved pit latrines. That challenge is the safe management of digested human excreta The 2015 WHO-UNICEF Joint Monitoring Programme shows that 61% of people are using improved sanitation, 28% use shared latrines and 10% use un–improved latrines (totally 99%). The Bangladesh National Building Code (BNBC) has made it mandatory to construct a soak well along with the septic tank (GoB 2014). But due to a lack of proper design and installation of these technologies- and no collection and treatment facilities-all most all faecal sludge is being disposed into the environment (SNV 2015). Several initiatives by SNV Netherlands, Practical Action, WSUP, DSK, WaterAid and Department of Public Health Engineering Department are on-going to tackle faecal sludge management by replacing the manual emptying and treatment of collected sludge in big cities and secondary towns. These pilots faced some critical challenges which include inappropriate size and location of pits/tanks in houses/buildings which was not considered during the building design and construction, and faulty construction. Municipal capacity is inadequate to address the standard containment issue at implementation level (PAB 2014). According to Bangladesh Building Construction Rules 1996, municipal authority is responsible to look into the use of structure, land use and implementation of set-backs rules during building plan approval. Municipality also checks are on whether there are adequate options for toilets, but the detailed designs of toilet are not requested in the application, being treated as a deprioritised component (PAB 2014).

There is a lack of knowledge on standard containment, and no guideline to monitor hygienic and de-sludging status of toilets. Due to the lack of enforcement and de-sludging options most of the citizens connect their containment outlet with the nearest drain or water body. Also septic tanks receive less attention to the citizens and results into a sub-standard construction of containment and become non–functional. Thus, resulting in disposal of untreated faecal matter into the environment increasing public health risk (PAB 2014).

Faridpur, a secondary city in Bangladesh, out of its 129,000 people 94% have access to sanitation. To pilot a city-wide Faecal Sludge Management (FSM) system, in 2014 a detail situation analysis was conducted on the entire value chain and service chain of FSM aimed (a) to analyse Faridpur's existing sludge management system and value & service chains (sludge collection, transportation, disposal and treatment) and (b) to prepare a detailed vision for a city-wide sustainable market system of results-based service contracts to deliver consistent and environmentally responsible sanitation coverage across that whole city and reaching 100% of its inhabitants. It is found in the city that, currently there is a limited scale de-sludging service exist which also dispose of the emptied sludge into the open environment. And unsafe containment or inappropriate containment at source has been identified as the first problem of current FSM system of the city. The current paper focuses on how inappropriate containments are degrading urban sanitation systems and polluting environment.

Study objectives

The study has been conducted as the part of the Faecal Sludge Management (FSM) situation analysis and FSM Business Plan for Faridpur municipality during March to December, 2014. Based on the FSM situation analysis findings and business plan, this study is trying to establish the dimension and linkage of inappropriate containment and its negative impacts on urban sanitation and environment, particularly the following:

1. To study the dimensions of inappropriateness of the containment situation in Faridpur; and
2. To explore the level of pollution is causing due to inappropriate containment in Faridpur.

Methodology

This study is a cross-analysis of the FSM situation analysis and business planning process findings.

Situation analysis

The situation analysis process covered all dimensions of the current FSM service chain and value chain like, sanitation system of the city, households and intuitional level sanitation facilities including types of sanitation facilities, problems associated with sanitation facilities, current practices of sludge management, level of de-sludging services, willingness of availing de-sludging services, municipal capacity, pollution level of storm drainage, possible faecal sludge treatment technologies considering local context and immediate treatment capacity required, process of involving private sectors to improve the FSM system, etc. For household level assessment a semi-structured questionnaire was designed covering all these aspects and surveyed 666 households using a randomised sampling strategy. Also 18 focus group discussions conducted as part of the information collection process. A number of sharing sessions organised both at locally and nationally to validate the collected information. A lab investigation of 5 samples (3 from storm drainage where connection of containments exist, 1 from containment and 1 treated wastewater from septic tank) has done with the laboratory of Khulna University of Engineering and Technology to investigate the level of pollution when sludge containment is connected to storm drainage.

Cross analysis

The situation analysis findings identified inappropriate containment is one of the key problems in the study area. The dimension of inappropriateness of the containment like type of containment, capacity of the containment, illegal connection of the containment, wastewater discharging process form containments have been cross-analysed with the lab test finding on pollution level in the drainage system to generate this current study.

Findings

Inappropriate containment scenario

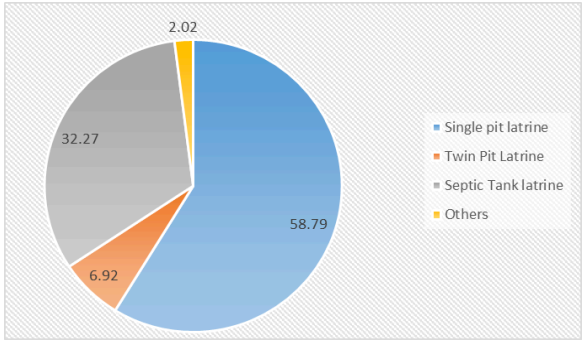

Figure 1. Containment technologies in Faridpur

Source: Situational Report on Faecal Sludge Management in Faridpur, Bangladesh

The situation analysis revealed that around 66% toilets use pits and 32% use septic tanks with 2.02% other types of containment, in other words, around two third of households use the simplest form of containment. In Faridpur the ground water level is 12-20 feet (3.7-6.1meter) (DPHE 2012), while it is suggested that a vertical distance of ≥ 3–4.5 m between the bottom of the pit and the water table would maintain safe groundwater quality (Kligler IJ. 1921). Therefore the groundwater contamination possibility is very high considering the water table and safe vertical distance between bottom of pit and water table.

Table 1: containment capacity

Containment capacity	Average containment size (m3)	Percentage
up to 1.00 m3	0.58	6.96
1.01 to 3.00 m3	1.97	35.25
3.01 to 5.00 m3	3.83	20.27
5.01 to 8.00 m3	6.12	13.16
8.01 to 12.00 m3	9.35	10.89
12.01 to 20.00 m3	15.26	8.47
20.01 to 30.00 m3	23.42	3.18
more than 30 m3	58.19	1.82
Total	Grand Average = 4.63 m3	100.00

Source: Situational Report on Faecal Sludge Management in Faridpur, Bangladesh

In terms of capacity which measured during the situation analysis, 62.48% of containment is below 5.0 cubic meters, with an average of 4.63 cubic meters, which is likely to require emptying or de-sludging more frequently. These toilets should have soak wells incorporated to appropriately manage the liquid fraction of sludge, however it is found (table 2) that more than two thirds of the containment have no soak pit. Many residents illegally connect their toilet outlets to storm drainage (30% of individual households are thought to do this) to manage this liquid portion which is an illegal and offense according the Pourashava Act 2009.

It is also revealed that the some disadvantaged groups mainly the slum dwellers and low-income communities (defined by Pourashava Development Plan 2010) have no access to storm drainage or pit emptying services, so their toilets simply overflow with faeces leading to filthy and very unhygienic conditions. This drives them to abandon their toilets, ultimately leading back to the construction of new toilets and in some cases to open defecation, believed to stand at 6% in the city, further contributing to polluting the environment and deteriorating public health and raising sustainability concerns.

Wastewater generation scenario and discharge pattern

The generation of wastewater depends on the quantity of water needed for sanitary purposes depended on the type of sanitation facilities. The requirement is minimal for people using pit latrines and water requirements increase for pour-flush latrines, and water borne Small Bore System (SBS) and sewer systems (Ahmed & Rahman 2010).

Although there is no such study on the use of water for sanitary purpose and frequency of defecation for Bangladesh context, but comparing the different organisational estimation including the estimation of UNICEF and DPHE in Bangladesh for water utilization for personal hygiene maintenance and the SPHERE standards on the same (Sphere Project 2011), it is estimated that the secondary urban setting where prevalence of pour flush is comparatively low, people generally defecate twice and urinate 3-5 times and utilise 4-6 liters water per day to manage personal hygiene including anal washing and flushing and pass thorough containments.

Table 2: Destination of estimated wastewater from containment

Sl. No.	Where goes the water from containment	Percentage distribution	Estimated Volume of Wastewater disposal (litre/day)	
			@4 litre/day	@6 litre/day
1	Water bodies and natural drainage	43.92	226,627.2	339,940.8
2	Soak Pit	33.65	173,634	260,451
3	Nearby places	16.9	87,204	130,806
4	Municipal drainage	5.53	28,534.8	42,802.2
Total		100	516,000	774,000

Source:Percentage distribution data is from Situational Report on Faecal Sludge Management in Faridpur, Bangladesh

The discharging of wastewater from containments in Faridpur primarily goes to the water bodies and natural drainage system and the estimated volume of discharged wastewater from containment ranges from 226,627 to 339,940liters/day which is 44% of total wastewater generated from personal sanitation related hygiene management. Wastewater also discharged in the nearby places is 17% and municipal drainage system is around 6%. One third of the wastewater processed within the toilet systems which have soak pits. So, overall two thirds of the wastewater returns to the environment without any treatment.

Pollution level

Measuring level of environmental pollution contributing by the wastewater of latrine facilities was a challenging task. Because in the municipal areas other sources of wastewater are mainly the domestic wastewater, wastewater from butcher shops, markets and surface run off. Considering the level of development and limited light industrial development in the main Central Business District (CBD) of Faridpur, wastewater from sanitation facilities and the domestic wastewater are presumed the main sources of pollution of the city's water bodies.

Photograph 1. Direct discharge of sludge from containment

Source: Situational Report on Faecal Sludge Management in Faridpur, Bangladesh

Table 3: Level of pollution of storm drainage system connected with containment

Sl. No.	Sample Type	Testing Parameters							
		pH	Total Solid (mg/l)	Biochemical Oxygen Demand (mg/l)	Chemical Oxygen Demand (mg/l)	Dissolved Oxygen (mg/l)	Total Coliform (N/100ml)	Faecal Coliform (N/100ml)	E.Coli (N/100ml)
01.	Treated wastewater	7.43	1,450	30	1,072	7.34	810	780	590
02.	RAW Sewer water	6.25	15,235	193	2,240	0.21	3,360	1,910	1,590
03.	Drainage Water-1	6.56	3,350	354	2,720	0.67	4,135	2,550	2,270
04.	Drainage Water-2	6.50	2,750	390	1,920	0.45	3,770	2,120	1,960
05.	Drainage Water-3	6.75	5,090	396	2,880	0.65	4,010	2,950	2,510
Bangladesh Standard for Sewerage Discharge (ECR 1997)		--	--	40	--	--	--	1,000	--

A laboratory investigation was conducted at Khulna University of Engineering and Technology (KUET) with 5 samples collected from different locations: 3 from storm drainages where illegal connection with containments exist, 1 from septic tank, and 1 is treated sewage liquid. The results confirmed that intensity of pollution is highest in the water samples collected from storm water drainage connected with containments and found more polluted than the sample collected from septic tank. In Bangladesh, according to Environmental Conservation Rules 1997, the BoD standard for discharging sewage water is 40 mg/l and Faecal Coliform is 1,000 nos/100 ml. But the pollution level found in drainage water are 354 mg/l, 390mg/l and 396 mg/l for BoD (average 380 mg/l) and Faecal Coliform are 2,270 nos/1000 ml, 1960 nos/ 100 ml and 2,510 number/ 100 ml (average 2246 nos/ 100 ml) which is even far worse than the pollution level of septic tank's sewage water. The outfalls of these storm drainages are the Kumar River which located in the middle of the city and thus polluting the river water.

Conclusion and recommendation

The prevalence of inappropriate containment in terms of small size and improper design and limited scale emptying without having larger scale treatment facility forces dwellers to connect their containment with the storm drainage and natural drainage system. The current de-sludging services also dispose of the emptied sludge indiscriminately. Pollution levels of wastewater from the drainage system show high levels of presence of BoD, CoD, Total Coliform, Faecal Coliform and E.Coli in the drainage system because of

discharging more than two thirds wastewater from inappropriate containment which are illegally connected with drainage system along with lack of des-sludging services. Therefore enforcement of standard containment design following the Bangladesh National Building Code is necessary by the municipality to improve the overall containment standard of the city. Containment standardisation process will help to reduce the overall environment pollution level in the city which will also reduce the risk of contamination of ground water of Faridpur. Additionally, capacity building of the municipal authority to enforce the containment standardisation process and regular vigilance action along with the city-wide faecal sludge management service are simultaneously required to improve the overall situation.

The current study revelled the level of pollution of drainage system of the city due to inappropriate containments, however to determine the level of impacts on the environment due to inappropriate containments and thus presence of higher level of pollutions in the drainage system, needs a further systematic study.

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