Learning Brief: Alternating Twin-Pit Latrines – A solution to the emerging faecal sludge challenge?

SNV

Unsafe faecal sludge disposal – The new "open defecation"? The use of latrines in rural Cambodia has increased remarkably over the past decade – from 20% in 2007 to 71% in 2017 (1). In the past, most of the rural population defecated in the open. However, after several decades of sensitisation and promotion of sanitation, the use of latrines has finally become the norm. Typically, faecal sludge is being contained underground on a rural household's property – usually in a single or double leach pit(s)[1] that is off-set[2] from the toilet.

Despite this recent and remarkable achievement, some risks remain. Faecal sludge will gradually accumulate within the pit(s) where it is now being contained, causing them to eventually become full. Recent studies have shown that most pits in rural Cambodia will become full approximately between 3 to 10 years after usage begins (2) – depending on the size, design, and number of pits, the number of regular toilet users, and the soil conditions around the pit. How will rural households plan for or respond to such an event? The early indications, from surveys of some households that have already experienced a full pit, do not look promising. Most have had their pit(s) emptied and the faecal sludge has almost always been disposed of back onto the ground – typically in a field or rice paddy. Has the sanitation revolution in Cambodia only delayed the inevitable – that faeces will ultimately end up back in the open environment regardless of whether or not a toilet is used?

SNV has been working with various partners and stakeholders over the past two years through the Sustainable Sanitation and Hygiene for All (SSH4A) programme to understand this emerging challenge and to find and implement potentially viable solutions.

Alternating twin-pit latrines – A solution to the emerging faecal sludge challenge? This brief is the second in a series of learning briefs published by SNV Cambodia on Faecal Sludge Management (FSM) in rural parts of the country. This brief describes the experiences and lessons learnt from an innovative solution to the FSM issue. Alternating Twin-Pits (ATP) are a special pit configuration (Figure 1) that allows for faecal sludge to be treated inside the pits themselves (in-situ) – eliminating the need for removal and external disposal while it is unsafe. The treatment process relies on the porous nature of the pit that allows liquids to seep into the ground, along with biological processes associated with anaerobic digestion and to decompose the excreta over time. Excreta must be allowed to dry in the pit for at least 2 years[3]. The decomposition process eliminates the majority of the potentially disease-causing organisms. Handling or transport only becomes necessary after the faecal sludge has been dried and decomposed.

1 One or two (connected) pits, typically lined with cement rings, but allowing liquids to flow (leach) out of the pit and into the surrounding underground soils.

2 Not directly under the toilet, but off-set from it and connected to a toilet by a plastic pipe.

3 The method is suitable in areas that are not prone to seasonal flooding and do not have a water table higher than the bottom of the pit.

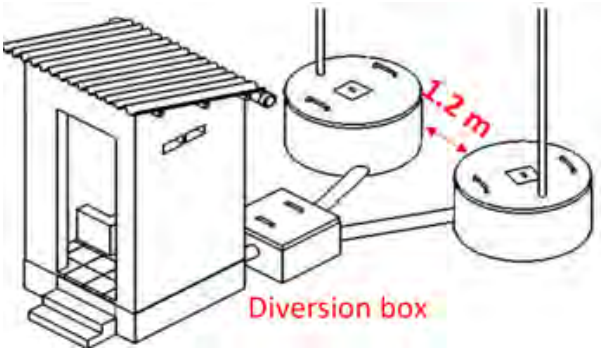

Figure 1 – Alternating twin-pit and diversion box configuration

Once household members begin using an ATP toilet, waste flows directly into Pit A while Pit B remains closed. Once Pit A has become full, flow from the latrine is alternated to Pit B. The contents of Pit A are then left to decompose for at least two years. Once decomposed, the remaining dry materials may be safely used for fertiliser at any time. The direction of waste flow (to Pit A or Pit B) is controlled inside the diversion box, where flow is blocked to the inactive pit using tiles, cement, or a plastic water bottle (Figure 1). Importantly, the ATP design also allows for the continuous use of the latrine once it is discovered that the pit is full. As soon as the diversion box is opened, and the flow of waste is re-directed to the empty pit, the functionality of the latrine is restored.

What did we try? ATP designs. SNV and its partners initially engaged several local latrine producers to explore potential ATP design ideas. The most challenging design issue was the mechanism to control which of the two pits actively receives waste from the latrine. Several concepts were considered, including (a) disconnecting and reconnecting pipes buried underground, (b) turning a valve inside a control box to direct flow, and (c) having a diversion box accept waste from the latrine while blocking one of the two exit pipes to control which pit is active. Cost and ease of use were the most important criteria in the selection of the most appropriate design. Flow control valves were not available in the local marketplace and were found to be prohibitively expensive if delivered from Phnom Penh. Digging up the latrine outflow pipes and reconfiguring the connections manually was considered to be a significant burden for users – and may even require the services of a mason.

The team decided to proceed with the diversion box option as it seemed both practical and low-cost. As training and testing were completed in the pilot district of Banteay Meas, it became clear that the masons would benefit from a uniform mould for the diversion box[4]. Next, the team experimented with circular and square diversion box moulds. The circular mould was selected due to its greater strength and ease with which wastewater would flow into the open outlet pipe[5] (Figure 1). It also became clear that the slope of the surface inside the control box had to be at a minimum angle to ensure that wastewater would successfully flow into the assigned effluent pipe and into the active pit. The pits themselves would be a standard 1 meter diameter and a depth of 3-cement rings (1.5 meters).

Figure 3 – Completion of an ATP training

What did we try? ATP promotion and assessment. Through the SSH4A programme, local authorities and latrine producers attempted to introduce and raise demand for ATP latrines. First, the capacity of local latrine producers and masons was developed so that they could meet demand for the new product (Figure 3). A construction manual was produced to support the training of latrine producers and masons on ATP design, operation and construction. Ms. Teth Chanthon and her husband operate a latrine business, and noted: *"We are very happy to see our district achieve ODF status and to be a part of*

4 Rather than ad hoc construction using brick and mortar

5 As opposed to becoming trapped in the corners of a square design.

this success. Thanks to those that built our capacity to produce quality latrines and ATPs that will help people manage their faecal sludge."

ATP demand creation events were conducted in each of the 343 villages across the three programme districts – Banteay Meas and Chumkiri (in Kampot province), and Basedth (in Kampong Speu province). Behaviour change communication materials were developed and refined to support local authorities with the delivery of demand creation activities in their communities. Local authorities were also given training on ATP functionality and operation. Within each village, a minimum of one household was chosen to receive a partially subsidised demonstration ATP latrine. This was done either as an entirely new latrine or an upgrade of an existing one. These ATPs were subsequently used for practical demonstrations linked to the demand creation and marketing campaign.

An ATP upgrade was priced at 240,000 riel ($60 USD) and a new ATP toilet was priced at between 480,000 and 520,000 riel ($120 USD and $130 USD) . One local latrine producer was contracted in each district to construct the demonstration ATP toilets. Local authorities coordinated the recruitment of selected demonstration households and their financial contributions. SNV and local authorities monitored construction quality among latrine producers and masons, and the quality of the marketing campaigns. Demand for ATP latrines was monitored through the regular tracking of new orders among those latrine producers offering upgraded and/or new ATP latrine construction works.

To explore the performance and results of the initiative, qualitative interviews were conducted with 2x Provincial Departments of Rural Development (PDRD), 2x District Sanitation Focal Points (DFPs), 3x Commune Focal Points (CFPs), 3x Village Focal Points (VFPs), 2x latrine producers and masons, 6x ATP demonstration households, and 6x groups of residents in communities where ATPs were promoted (but who did not yet use an ATP themselves). A household survey was also performed in Banteay Meas district before and after the ATP marketing campaign.

ATP programme results. ATP construction activities are summarised in Table 1. In total, there are now an estimated 396 ATPs across the programme area, representing 0.7% of all latrines. Overall, the level of awareness and interest in the ATP concept has been very high – as reported across all stakeholder levels and most importantly, amongst community members themselves.

Table 1 – ATP construction activities

District	Demonstration toilets (SSH4A subsidised)[9]		Full cost in the marketplace			
			Fulfilled orders		Requested but not yet fulfilled[10] by latrine producers (estimation)	
	ATP toilet	ATP up-grade only	ATP toilet	ATP upgrade only	ATP toilet	ATP upgrade only
Banteay Meas	**72**	**33**	**7**	**1**	**0**	**3**
Chum Kiri	**37**	**0**	**7**	**0**	**0**	**0**
Basedth	**218**	**0**	**28**	**0**	**2**	**0**
Total	**327**	**33**	**35**	**1**	**2**	**3**

The household survey revealed that 21% of households preferred an ATP as their first choice solution to experiencing a full pit, and this increased to 30% after the campaign. Notably, most households preferred pit emptying services, such as a pump truck, despite such services typically dumping faecal sludge unsafely onto fields. Overall interest (a binary yes or no question) in the ATP product increased from 66% to 80% after the campaign. However, despite high levels of interest, realised demand for ATP latrines and upgrades has remained very low – with only 36 ATPs having been constructed at full cost in the marketplace. This low level of demand can be explained by several factors, namely:

- Sanitation ownership is already extremely high across the programme area. Some community members have expressed concern that the ATP design was not introduced and made available to customers at the beginning of the programme (Phase I and Phase II) when sanitation coverage was low. Many households reportedly would have preferred that their first latrine was an ATP from the beginning;

6 Commune and village level sanitation focal points
7 Households contributed $30 USD.
8 Price dependent on the district and individual bidding of local latrine producers.
9 At least one ATP in each village.
10 Dozens of orders have been requested in Basedth district but remain unfulfilled due to the latrine producer being fully occupied with the fulfilment of demonstration ATP toilets associated with their contract with SNV.

- A small proportion of households have experienced their pit becoming full since the ATP demand creation activities commenced. Nearly all interested respondents noted that they would not proactively invest in an ATP upgrade, and rather wait until their current pit actually becomes full;
- For many households, their willingness to pay for an ATP latrine or upgrade appears to be significantly less than the actual marketplace cost; and
- The social pressure and added-value associated with stopping open defecation and using a latrine is comparably stronger than for upgrading an existing latrine to an ATP.

Currently, 84%, 85%, and 86% of households in Banteay Meas, Chum Kiri, and Basedth have their own latrine, respectively. The market potential for new ATP latrines is low, but the potential for the upgrade of traditional latrines to an ATP is very high. However, the upgrading of existing latrines to ATPs has proven challenging to-date, for a variety of reasons. For some households, there is a lack of available land for an additional pit. For others, there is too short a distance between the original latrine and pit[11] . Additionally, there is some reluctance on the part of the masons to commit to doing the "dirty" work associated with pit upgrades[12] .

The advantages, disadvantages, and limitations associated with the ATP design and marketing approach, are presented in Table 2. Results of the assessment are presented in Table 3, using a traffic light style ranking system: green (high); yellow (medium); red (low); black (not applicable).

Table 2 – Advantages, disadvantages, and limitations associated the ATP latrine and its promotional approaches

Component	Advantages	Disadvantages	Limitations
ATP technology and design	- Easy emptying (decomposed sludge is dry and easier to handle) - Benefit associated with having fertiliser for free - Prevent negative impacts to the environment - Do not need to spend money every time for pit emptying - Durable and long-term solution to FSM	- High cost makes the option unaffordable for many households - Misunderstandings or incorrect construction among some masons	- Some households have small plots of land and insufficient space for multiple pits - ATP upgrades of existing toilets are challenging for masons
ATP promotion programme	- Strong commitment from local authorities and quality implementation - Strong coordination between government and private sector - Clear communication and demand creation materials - Reoccurring training of latrine producers and masons on construction and installation techniques provided a strong foundation of knowledge	- Only traditional single and double pit latrines have been promoted by latrine producers until now, and communities question why ATPs were not promoted from the beginning - Some coordination issues and late delivery of products by latrine producers - Occasional poor quality construction by masons, identified during monitoring - High turnover among masons	- Decision-makers within the household are not always available to participate in community promotion events - Poor road conditions impede installation activities – particularly in rainy season - Few masons are available and willing to support due to outward migration

11 Making the installation of the diversion box very difficult.

12 As the piping and pits have already been in contact with faeces.

Table 3 – Qualitative analysis of ATP programme

Criteria	PDRD	DFP	CFP	VFP	Latrine producer	ATP beneficiary	ATP community
Perceived that ATPs were the best FSM solution							
Felt knowledgeable about ATPs and their functionality							
Felt knowledgeable about the ATP marketing programme							
Were satisfied with demand creation activities							
Perceived the initiative to have been a success							

Representing: green (high); yellow (medium); red (low); black (not applicable)

Several households that had procured an ATP toilet were not fully aware of its correct operation. They also had misunderstandings relating to the alternating function of the pits, use of the control box, or the duration of time required for complete decomposition. Monitoring and follow-ups are needed to achieve consistent and correct understanding on operation, particularly at the beginning of any promotional programme. Knowledge of the ATP programme, satisfaction with demand creation activities, and perceptions towards the success of the initiative were high across the range of stakeholders interviewed.

Stakeholders at all levels consistently expressed that the ATP design is the best option currently available to solve FSM issues in rural Cambodia. However, some community members who used a traditional latrine were unsure whether ATPs were the best option – likely due to promotional activities not reaching all families. There were moderate levels of agreement among stakeholders as to whether ATPs would become the most common long-term FSM solution.

PDRD representatives believe that their role in supporting the promotion of ATPs involves technical support to local stakeholders, dissemination of information at Provincial Working Group (PWG) meetings, and sharing experiences across districts. PDRD representatives view the lack of financial and technical support from higher levels as a potential barrier. Local authorities view it as their role to integrate ATP related activities into their District and Commune Investment Plans, promote ATPs within their communities, and ensure that the private sector is continuing to supply such products. Local authorities view the potential lack of technical support from PDRDs as a potential barrier, particularly in potential absence of any externally supported sanitation programme.

Conclusions. Are ATPs a viable solution to the emerging rural FSM issue? They appear to be a solution. However, given that sanitation coverage is already high, and that affordability and feasibility of upgrades to existing latrines present particular barriers, ATPs are likely be one of among several emerging FSM solutions into the future. Manual pit emptying and usage of pump truck services are likely to continue as well, and require equal attention and management by local authorities.

Local authorities in all three districts remain committed to promoting ATPs as the best solution for FSM. More time is needed to determine how many ATP orders will be fulfilled at full cost, and the proportion of ATP owners that correctly, safely, and successfully manage their faecal sludge. The efficacy of the 2-year decomposition process in an ATP requires further study in the Cambodian context, to ensure that adequate levels of pathogen reduction are achieved in local conditions. The risks associated with groundwater aquifer contamination, and the impact that high water tables and seasonal flooding have on the decomposition process also require exploration.

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Authors

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Contact information

Sunetra Lala

WASH Sector Leader

SNV-Cambodia

slala@snv.org

http://www.snv.org/sector/water-sanitation-hygiene

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