LEARNING PAPER (SSH4A)

BEYOND THE FINISH LINE | DECEMBER 2021 | SNV IN LAO PDR

Realising safely managed sanitation in Lao PDR

SNV IRC Water For Women Australian Aid

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About SNV

SNV is a not-for-profit international development organisation that makes a lasting difference in the lives of people living in poverty by helping them raise incomes and access basic services. We focus on the Agriculture, Energy, and Water, Sanitation, and Hygiene sectors and have a long-term, local presence in around 24 countries in Asia, Africa, and Latin America. Our team of more than 1,297 staff is the backbone of SNV.

For more information: www.snv.org/sector/water-sanitation-hygiene

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IRC is an independent, non-profit organisation that drives resilient WASH systems from the ground up. It works with district, country, and international partners. Its mission is to move from short-term interventions to sustainable water, sanitation, and hygiene services. IRC wants every person in the world to enjoy their human right to safe water, sanitation and hygiene, now and forever. With over 50 years of experience, IRC runs programmes in more than 20 countries and large-scale projects in eight focus countries in Africa, Asia, and Latin America. It is supported by a team of about 100 staff across the world.

For more information please visit www.ircwash.org

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For more information visit: https://snv.org/project/ssh4a-lao-pdr

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Photos ©SNV/Bart Verweij: (Cover) Installing a pour-flush toilet for a household | **(P2)** Facilitating informed choice and decision-making processes in the selection of suitable toilets | **(P10)** SNV staff supporting and monitoring quality of masons' construction works | **(P12)** Sensitising communities on the concept of safely managed sanitation and sharing pertinent (cost) information

For more information

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List of abbreviations

BFL	Beyond the Finish Line
FGD	Focus group discussion
HSF	Household sanitation facility
JMP	WHO/UNICEF Joint Monitoring Programme
ODF	Open defecation free
SSH4A	Sustainable Sanitation and Hygiene for All (rural sanitation programme of SNV)
WASH	Water, Sanitation and Hygiene

Background

Beyond the Finish Line (BFL) is a five-year multi-country programme (2018-2022), that is being implemented by SNV in Bhutan, Lao PDR, and Nepal as part of the Australian Government's Water for Women Fund. It builds on the 2008-initiatied Sustainable Sanitation and Hygiene for All (SSH4A) programme.
The programme in Lao PDR is led by SNV together with the Provincial Department of Health and Hygiene Promotion. It is implemented with a district team comprising officials from various district departments (*Nam Saat*,[1] health, education and sport, statistics and planning, women union, and youth union) in collaboration with the Institute for Sustainable Futures, University of Technology Sydney and CBM Australia.

This learning paper will explain the current sanitation situation in the SSH4A programme districts and thereafter explore and discuss options to work towards safely managed sanitation.

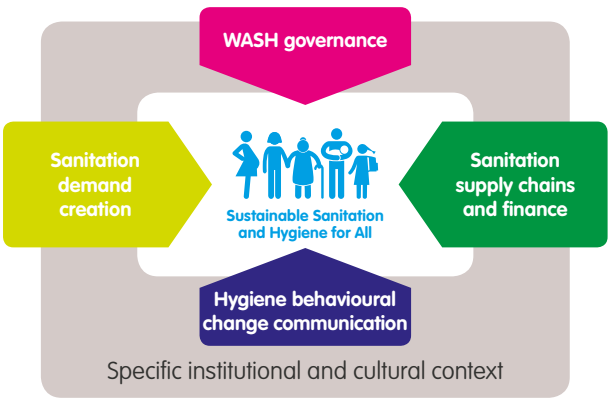
Sustainable Sanitation and Hygiene for All[2]

SNV's Sustainable Sanitation and Hygiene for All (SSH4A) programme supports local governments to lead and accelerate progress towards district-wide sanitation and hygiene services with a focus on institutional sustainability and learning. Developed since 2008, SSH4A is implemented as part of government-led rural sanitation programmes across 19 countries in Africa and Asia.

The SSH4A approach has four integrated components supported by performance monitoring and learning.

In Lao PDR, the programme is implemented in the three districts of Atsaphone, Champhone, and Phalanxay, which are all located in the Savannakhet province.

Figure 1: SSH4A programme model



[1] *Nam Saat* = Department of Environmental Health and Rural Water Supply, Ministry of Health.
[2] Visit the SNV website to learn more about the SSH4A approach: https://snv.org/product/sustainable-sanitation-and-hygiene-all-ssh4a

Introduction

In Lao PDR the Water, Sanitation and Hygiene (WASH) sector is guided by the Government Vision for 'Promoting access to safe and reliable water supply and sanitation for everyone' and the National WASH policy 2019.[3] The elimination of open defecation is the key sector priority. According to the National Strategy for Rural WASH 2019-2030[4] Lao PDR expects to achieve universal access to basic water and sanitation services by 2030. The country's specific sanitation related SDG targets can be summarised as follows:[5]

- Eliminate open defecation by 2025.
- Universal access to basic sanitation services including 70% safely managed.
- 80% of wastewater and 80% of faecal sludge treated to national standards.

Coverage figures for safely managed sanitation are still quite low, mostly because safe faecal sludge management and treatment (before disposal or as final solution in a pit) are not in common use yet.[6]

The capacities of local government partners are improving as demonstrated by the increasing number of open defecation free (ODF) communities. However, services must progress beyond ODF and move towards safely managed services. To respond to the challenges of safely managed sanitation and sustain and build on the sanitation gains (post-ODF) requires further innovative approaches, guidance, and capacity-building efforts.

Regulatory framework

Lao PDR's Constitution of 2015 mandates that the state promotes the protection and restoration of the environment so that it may become abundant and sustainable.

The Water and Water Resources Law of 1996 provides principles, regulations, and measures governing the administration, exploitation, use, and development of water and water resources with the aim to protect and sustain water resources and the natural environment. Article 42 describes that the discharge of waste of any kind into water sources is prohibited if such discharge will lower the quality of the water source. Furthermore, wastewater and waste that exceed the discharge standards must first be treated before being discharged into water sources.

The Law on Hygiene, Disease Prevention and Health Promotion determines the principles, regulations, and measures on activities related to hygiene, disease prevention, and health promotion to maintain the good health, quality of life, and longevity of the people. The law is very general with regards to the management of waste but in Article 11 it mentions that all persons have the obligation to dispose of solid and liquid waste to preserve the cleanliness of water sources, water used for drinking, roads, drains, and public places.

The Environmental Protection Law of 2013 is the principal legal instrument covering environmental matters. The Law specifies necessary principles, regulations, and measures related to environmental management, monitoring of protection, control, preservation, and rehabilitation of the environment. The Law is rather general in nature and faecal waste is not specifically mentioned. Article 68 prohibits the release and discharge of wastewater into canals, rivers, natural water sources, or any sites without treatment based on the technical standards.

The Agreement on the National Environmental Standards of 2009 defines the standards for environmental monitoring and pollution control on water, soil, air, and noise. It provides, amongst others, water quality standards including groundwater standards for drinking purposes and wastewater discharge standards. The provincial Water Resources and Environment Offices are the focal points coordinating the monitoring activities with the local authorities.

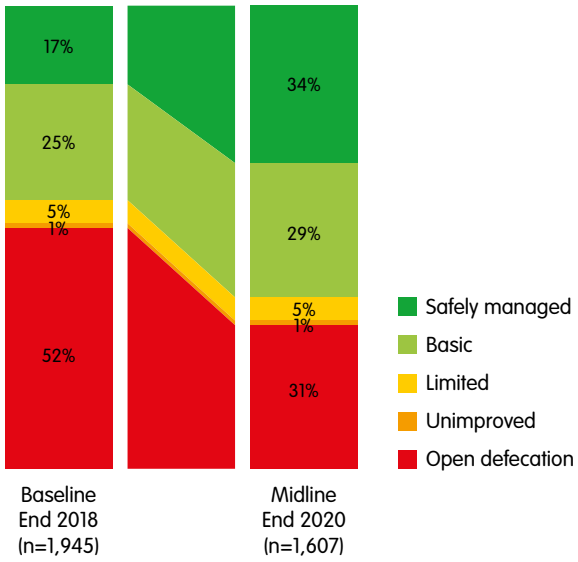
In 2015 the Savannakhet Provincial Department of Natural Resources and Environment issued a regulation on faecal sludge disposal and septage vacuum truck administration. The regulation was issued to manage human waste and by doing so reduce negative impacts on the environment and social health. Although the regulation was developed for urban areas it could easily be adjusted to fit the mostly rural context of Savannakhet province. There are, however, doubts as to whether the regulation is being enforced by the responsible department.

[3] The Lao PDR Country Brief was prepared ahead of the SWA 2019 Sector Ministers' Meeting in Costa Rica held on 4-5 April 2019.
[4] Ministry of Health, *National Strategy for Rural Water Supply, Sanitation and Hygiene for Lao PDR 2019-2030*, Vientiane, Government of Lao PDR, 2019.
[5] The Lao Country Brief was prepared ahead of the SWA 2019 Sector Ministers' Meeting in Costa Rica held on 4-5 April 2019.
[6] Ministry of Health, *National Strategy for Rural Water Supply, Sanitation and Hygiene for Lao PDR 2019-2030*, 2019.

Current situation

At the onset of the programme there was no data available on safely managed sanitation services as defined by the WHO/UNICEF Joint Monitoring Programme (JMP).[7] However, the programme has been monitoring access and use of safely managed sanitation services in the three programme districts since 2018. The situation as per the end of 2020 versus the baseline is depicted in the following figure.

Figure 2: JMP sanitation service levels[8, 9]

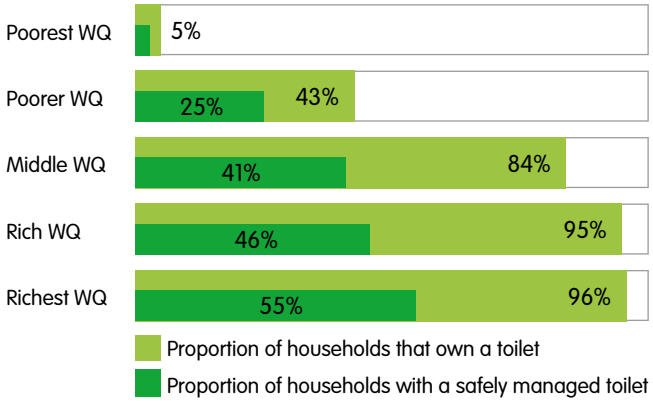


The proportion of households with access to a safely managed or basic level sanitation service increased from 42% at the end of 2018 to 64% at the end of 2020.

Data on asset-based wealth quintiles revealed inequalities in access to sanitation services between rich and poor. Whereas 96% of the richest households owned a household sanitation facility (HSF), only 5% of the poorest households owned an HSF with 91% defecating in the open and 4% using someone else's toilet (sharing).

Sanitation service levels improved in all wealth quintiles except for the poorest wealth quintile. It is assumed that these positive changes are due to the successful introduction and promotion of low-cost toilet designs. However, these low-cost toilet designs are still out of reach for the poorest households.

Figure 3: Toilet ownership by wealth quintiles (WQ)[10]



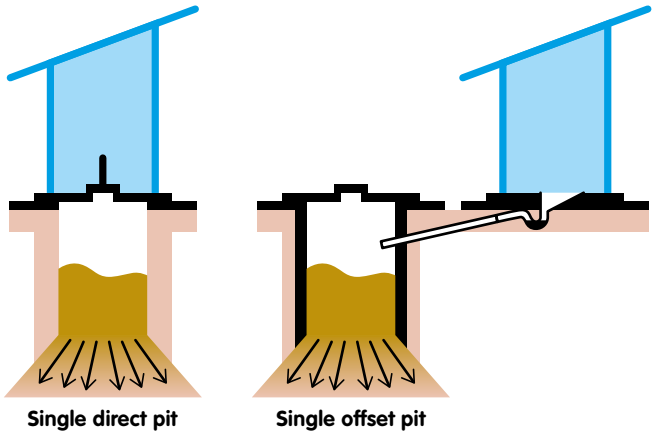
Female-headed households were doing marginally better than male-headed households with respect to toilet ownership (68% versus 63%) as well as sanitation service levels, with a higher proportion of basic and safely managed HSF (66% versus 61% respectively).

In general, toilet ownership among households with a person with a disability was lower than among households with no one having a disability (56% versus 65%).

The survey also found that by 2020:

- 96% of the HSF in the three districts were pour-flush toilets.

Figure 4: Single pit configurations

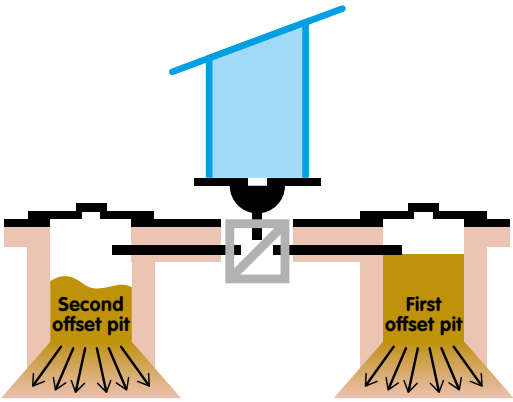


- 93% of the HSF were connected to one or two pits: 47% were connected to double (alternating) offset pits, 22% to a single offset pit, 13% to a single direct pit, 6% to two sequential pits, and 5% to a watertight pit.

[7] WHO/UNICEF, 'Sanitation', *WHO/UNICEF JMP website*, https://washdata.org/monitoring/sanitation, (accessed 3 October 2021).
[8] SNV in Lao PDR, 'Mid-Term Performance Monitoring in Lao PDR', *Part A: Impact Indicators Households, Schools and Health Centres*, Vientiane, SNV in Lao PDR, 2019.
[9] SNV in Lao PDR, *Part A: Impact Indicators Households, Schools and Health Centres*, Vientiane, SNV in Lao PDR, date of publication, 2019.
[10] SNV in Lao PDR, *Part A: Impact Indicators Households, Schools and Health Centres*, 2019.

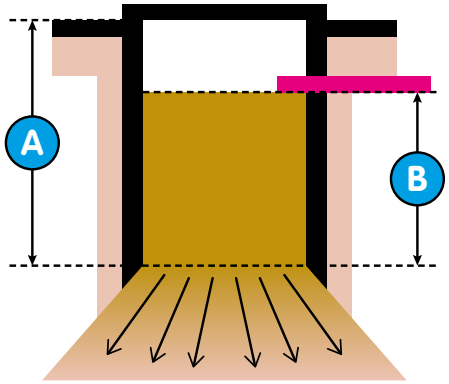
- An additional 5% of the HSF were connected to a watertight holding tank.

Figure 5: Alternating twin pit configuration



- The average age of the HSF was 6.7 years with one out of every six HSF (17%) being more than 10 years old. Averages per district varied from 4.2 years in Phalanxay to 4.7 years in Atsaphone and 7.9 years in Champhone.
- The average depth (marked as A on figure 6) of the pits was some 2.0 metres with only relatively small differences between the districts. The effective depth (B) was expected to be around 1.75 metres.

Figure 6: Pit dimensions



Pit emptying occurrences

Some 10% of the pits/tanks had been emptied by the end of 2020 (114 out of the total sample of 1,114 toilets). Most of these emptied pits (95 out of 114) were in Champhone district.

On average, the 114 pits were emptied some 1.5 years ago. This information, however, does not provide insight into how long it took for the pits/tanks to fill up as no information is available about possible earlier pit emptying occurrences.

In 87% of cases, the pits or tanks were emptied by a person other than the house owner or tenant. The data does not provide information on who did the emptying. It might be either a sweeper or service provider with the latter being more likely. The data for Champhone district requires validating as it includes 51 double alternating offset pits emptied by a service provider whereas it was expected that the house owners would do it themselves.

Of the households whose pit/tank was emptied: 81% claimed that no one had to enter the pit when emptying it; 66% claimed that all desired safety equipment was used when emptying the pit; and 61% claimed that the faecal waste was taken away from the premise (by the service provider) in a closed container or tanker.

Several service providers based in the provincial capital provide (professional) emptying services in the three districts. However, accessibility is an issue and therefore these truck-based mechanised services are not able to reach every household in the three districts. Furthermore, long distances make these services expensive and thus unaffordable for a significant proportion of the population (especially those belonging to the poorer and poorest wealth quintiles).

Interviews with the Savannakhet based service providers revealed that they charge somewhere between LAK 300,000 to LAK 500,000 (US$ 27 to US$ 45) to empty one pit or tank. An additional LAK 150,000 (US$ 13) may be charged for pits located up to 100 km away from Savannakhet town, which means that pit emptying costs may exceed US$ 55.

Another problem is the fact that there are no sludge treatment facilities or dedicated places where the collected faecal sludge can be disposed of safely. In the absence of any suitable options, the fresh and untreated sludge is disposed of indiscriminately into the environment by the service providers. For example, it is common practice to dump the faecal waste in open water bodies and forests, or on common public land, or agricultural fields.

What do we know?

The programme makes use of a detailed monitoring system that collects and analyses information on a range of indicators that provide insight in whether the facilities are safely managed or not. One could therefore assume that it is relatively easy to calculate the volume of sludge that accumulates in a pit or tank during the design life of an HSF. However, the situation in practice is more complex.

The rate at which sludge accumulates in a pit is determined by i) the number of users, ii) the amount of material entering the pit (human waste as well as other (non-degradable) material), iii) the conditions in and around the pit allowing liquids and degraded material to leach into the soil surrounding the pit, and iv) the rate and extent to which the sludge degrades through aerobic and anaerobic processes.

The volume of the sludge that will accumulate over the design life of the HSF can be calculated with the following formula: **Vs = R x P x N**

Where:

- Vs = approximate volume of sludge that will be produced (in m^3)
- R = estimated sludge accumulation rate per person per year
- P = the average number of people using the toilet over its design life
- N = the design life of the pit (in years)

If the pit size is known the same formula can also be used to calculate the time it takes for the pit to fill up.

When using the data collected during the midline survey at the end of 2020, the calculated pit filling times come to somewhere between 3.8 and 6.9 years. This is based on a pit of 1.37 cubic metres (1 metre internal diameter and an effective depth of 1.75 metres), an average family size of 5 to 6 people, and a sludge accumulation rate of either 40 or 60 litres per person per year (l/p/y).

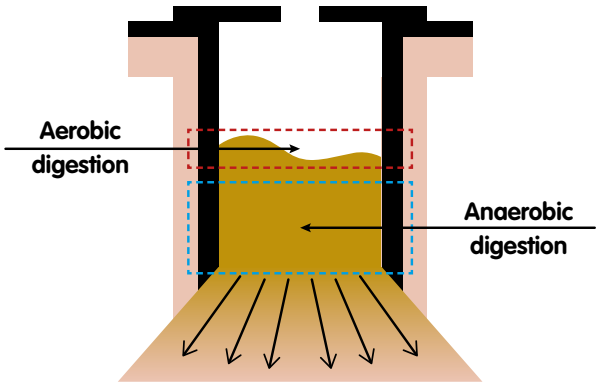
Still and Foxon[11] compared several studies showing a range of median pit filling rates, from as low as 21 l/p/y to as high as 64 l/p/y.

Sludge accumulation rates

If it is assumed that the average person produces approximately 100 litres of faeces every year (250-300 grams per day). This is much greater than the average accumulation rate in the pit latrines of 40-60 litres per person per year. This means that a significant degree of volume reduction occurs in the pit latrines as a result of biological breakdown, compaction, and leaching.

Both aerobic and anaerobic processes contribute to the breakdown and removal of biodegradable organic matter in faecal sludge. Aerobic digestion occurs in the top layer of a pit where the faecal sludge is in contact with air. Anaerobic digestion occurs in deeper layers of the pit where the faecal sludge is not in contact with air. As older pit contents are covered over by new layers of sludge, oxygen supply is limited and anaerobic biological processes dominate.

Figure 7: Aerobic vs anaerobic digestion zones



They concluded that a pit filling rate of 40 l/p/y is reasonable, and that designing pit emptying cycles for a maximum of 60 l/p/y is conservative.

The average age of an HSF found in the three districts was close to 7 years, hence, the plausible reason that most of the pits have not filled up to date. The average age of pits that were emptied was 11.1 years. As the average time that lapsed since the last time the pits were emptied was 1.6 years the average age of the pits at the time of emptying was some 9.5 years.

[11] D. Still and K. Foxon, Tackling the Challenges of Full Pit Latrines. *Volume 2: How fast do pit toilets fill up? A scientific understanding of sludge build up and accumulation in pit latrines*, Pretoria, Water Research Commission, 2012, https://www.ircwash.org/sites/default/files/1745_volume_2.pdf, (accessed 10 November 2021).

Reverse calculations show that the sludge accumulation rate would be 26 litres per capita per year (family size of 5.5) for an average pit of 1.37 cubic metres to last 9.5 years. However, the midline data implies that most HSFs fill up much slower than this. Although 14% of the HSF were older than 10 years, only 3% of them had been emptied.

It is a rather complex science to determine accurate sludge accumulation rates as this is influenced by a wide range of factors. User behaviour affects the composition of faeces, the amount of urine that goes into a pit, the presence of solid or liquid waste in the pit and the presence of chemical or biological agents that could suppress or enhance degradation. A range of geophysical and climatic factors as well as biological processes influence sludge accumulation and degradation. Furthermore, sludge accumulation rates appear to decrease over time. All these factors mean that it's incredibly hard to predict when a pit needs emptying.

Considering the above, the following conclusions can be drawn:

- Most families (96%) use a pour-flush latrine.
- Most toilets (88%) are connected to a single or double seepage pit.
- Only 10% of pits have been emptied so far.
- On average pits are emptied after 9.5 years however only 3% of toilets older than 10 years have been emptied.
- There are a number of pit emptying service providers based in the provincial capital, but these are expensive and cannot reach every village in the province.
- People are reluctant to empty their own toilets as it is socially unacceptable.

In the absence of affordable emptying services and a strong averseness by families to empty their own toilets, alternatives will have to be considered.

What do we not understand?

Why is it that only 1% of all HSFs had been emptied at the time of the midline survey? Considering that some 14% of the HSFs were older than 10 years and that calculations reveal that pits are expected to fill up somewhere between 4 and 7 years, one would expect that a larger proportion of the HSF would have been emptied at least once.

Two main questions needed to be answered:

- Why has a larger proportion of pits not filled up so far?
- How long will it take for the majority of pits to fill up?

In discussions with the SNV in Lao PDR WASH team it was decided to try and obtain additional information. Professional pit emptying service providers based in Savannakhet were to be interviewed to get insight into the types of services they provide, the costs of these services, and their outreach. Unfortunately, only two entrepreneurs agreed to be interviewed.

Furthermore, focus group discussions (FGDs) with toilet owners were to be conducted in several villages to get a better understanding of what people do when their toilets fill up. But, due to continued COVID-19 related travel restrictions these FGDs could not be conducted.

Safely managed sanitation

Safely managed sanitation is defined as the use of an improved sanitation facility that is not shared with other households and where human excreta are safely disposed of onsite or transported and treated offsite.

Safely managed sanitation services may be provided via piped sewer systems or onsite facilities such as pit latrines or septic tanks. There are three main ways to meet the criteria for having a safely managed sanitation service:

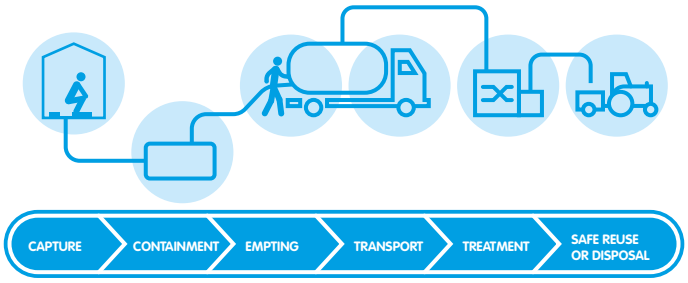
1. Human excreta are treated and disposed of in situ (safely disposed in situ);
2. Human excreta are stored temporarily and then emptied and transported for treatment offsite; or
3. Human excreta are transported through a sewer with wastewater and then treated off-site.

It is still recommended to collect additional information during the remaining period of the programme. For example, a survey on how villagers deal with pits that fill up or a quick study of pit volumes to gain a better (more reliable) insight into pits and pit fill rates. The outcomes of these studies would be very valuable to the programme, Lao PDR, and the broader global sector discourse.

Safely managed sanitation

According to UNICEF, human waste needs to be safely managed across the entire sanitation service chain. However, the extent of the sanitation service chain varies widely per context: in urban settings, the full chain may be required, with emptying, transport, treatment, and disposal of faecal sludge; whereas in remote rural settings, pits are often covered and replaced when full, with no requirement for the other parts of the sanitation service chain.[12]

Figure 8: Sanitation services chain[13]

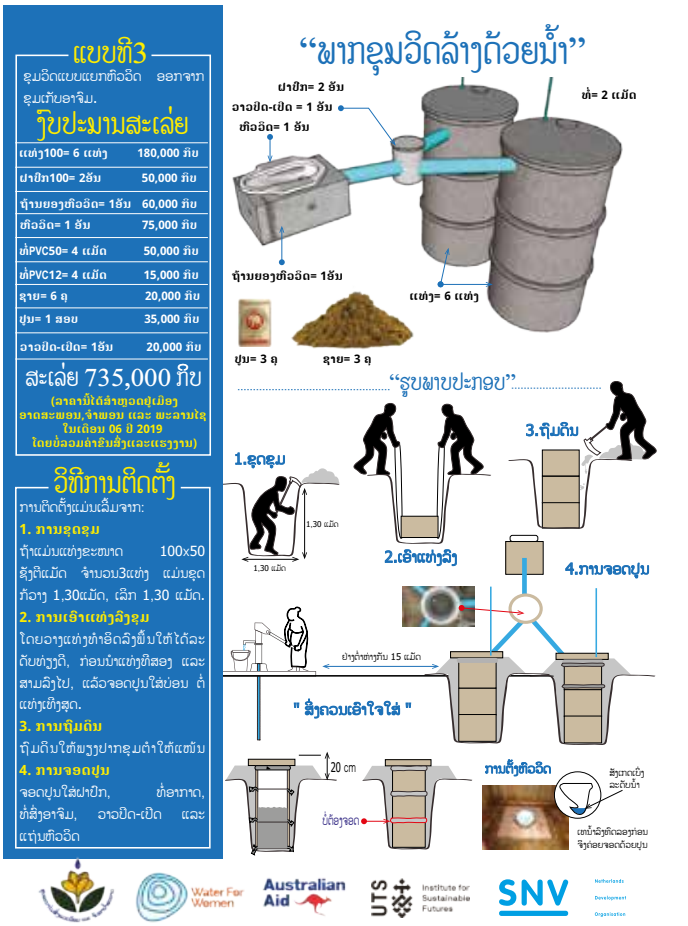


The safe management of faecal waste such as emptying, transport, treatment, and disposal are challenging in many rural areas. For that reason, different options will have to be explored. Where pit emptying services are available and affordable option 2 (human excreta is stored temporarily and then emptied and transported for treatment offsite) can be promoted. However, it is expected that for the foreseeable future, safely managed sanitation in most of rural Lao PDR can to a large extent only be realised by exploring and promoting option 1 (human excreta is treated and disposed of in situ).

Mechanised faecal sludge emptying service providers are available, but these services may only be affordable in easy to reach villages within a relatively short distance from the provincial capital where the service providers are based. In a majority of the more remote villages in the three districts it will be next to impossible to remove the faecal waste from onsite facilities and transport it for treatment and disposal elsewhere. Furthermore, for safety reasons the manual emptying of human excreta should be avoided as much as possible.

Technology options

The project, together with *Nam Saat*, developed a sanitation informed choice manual with a range of appropriate sanitation technologies. This is shown below.

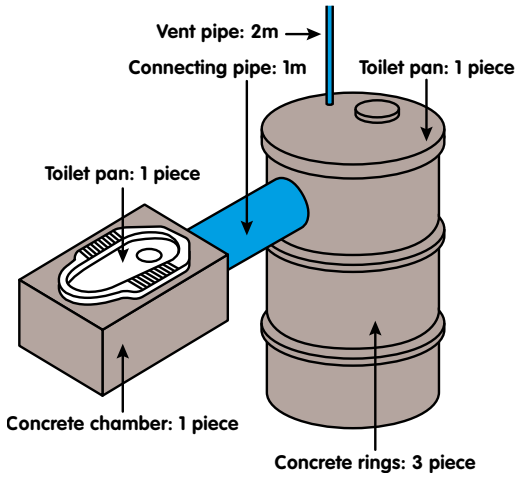


[12] UNICEF, 'What do safely managed sanitation services mean for UNICEF programmes?', *Wash Discussion Paper*, 2020, https://www.unicef.org/media/91321/file/2020-DP3-UNICEF-SMSS-Discussion-Paper.pdf, (accessed 10 November 2021).

[13] IRC, 'IRC's Faecal Waste Calculator', *IRC website*, The Hague, IRC, https://www.ircwash.org/tools/faecal-waste-flow-calculator, (accessed 10 November 2021).

The manual provides information on five different toilet types, including required materials, installation tips, and tentative costs of the sub-structure. The toilet with a single offset pit is the preferred option for most rural households as this option is relatively cheap. The complete set of materials required to construct the sub-structure and user interface comes at some LAK 500,000 (US$ 45) as shown in figure 9.

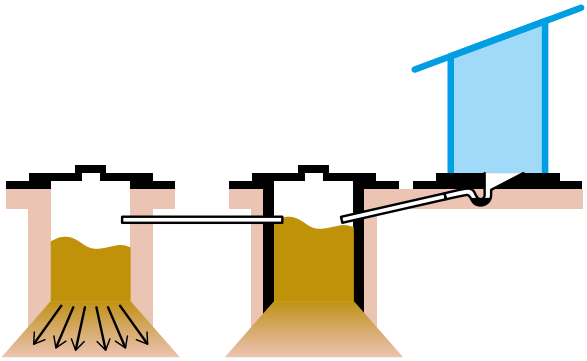
Figure 9: DIY set for a single offset pit



In many locations, installing a new concrete-lined and covered pit will be cheaper (US$ 46) than hiring a professional service provider to come and empty a pit that has filled up (around US$ 56).

Toilets with two offset pits are considered by households with sufficient disposable income and enough land around the house. However, instead of installing alternating twin pits (double offset pits used alternately) they often opt for double offset pits linked in series as shown in figure 10.

Figure 10: Double offset pits linked in series



Pits linked in series do not allow for safe emptying of the faecal waste by the household as the waste has no chance to dry and (partly) decompose. This pit configuration is therefore not preferable.

Safe containment options

According to WHO containment refers to the container, usually located below ground level, to which the toilet is connected.[14] These include containers that are designed for either:

- containment, storage, and treatment of faecal sludge and effluent (e.g., septic tanks, dry- and wet-pit latrines, composting toilets); or
- containment and storage (without treatment) of faecal sludge and wastewater (e.g., fully lined tanks, container-based sanitation).

The key principle is that the products generated from the toilet are retained within the containment technology and/or discharged into the local environment in a manner that does not expose anyone to something that can cause harm to human health. Sludge and liquid effluent (blackwater) should not enter the environment where it could directly expose users and the local community to faecal pathogens.

With regards to containment options, there is no one-size-fits-all technology. They need to be context specific, taking into consideration population density, hydrological conditions (e.g., likelihood of flooding, dangers associated with groundwater contamination), life-cycle costs combined with affordability considerations and financing options, operation and maintenance requirements, and the availability of pit emptying services.

Groundwater contamination because of human waste leaking or seeping into the subsoil is a potential danger. In the three programme districts, groundwater is used as a source for drinking water. Particularly in Atsaphone (77%) and Phalanxay (65%), most households use groundwater for domestic purposes. The corresponding figure for Champhone is just 12% as 82% of the households reported that they use bottled water. Given the high costs of bottled water, it is likely that groundwater will be used for domestic purposes other than drinking.

This implies that the leaching of faecal matter into the subsoil may lead to bacteriological contamination of drinking water sources, particularly if these are shallow wells or

[11] WHO, Guidelines on sanitation and health, Geneva, World Health Organization, 2018, https://www.who.int/publications/i/item/9789241514705, (accessed 10 November 2021).

boreholes. The programme's monitoring system does not provide details on the types of water sources. It is therefore impossible to carry out a risk analysis to determine the probability of occurrence of groundwater pollution.

Considering the above, the use of a permeable technology, such as a wet pit that leaches faecal matter directly into the subsoil, might not be an acceptable option in all locations.

Manual pit emptying of fresh (wet) faecal waste should be avoided as much as possible as untreated sludge poses very high risks to people's health and the environment. Even though single pits (direct as well as offset pits), that ensure hygienic separation of human excreta from human contact are classified as improved sanitation by JMP, they are unpleasant and potentially hazardous to empty manually.

Some relevant considerations:

1. Encourage and support the construction of toilets that are appropriate to local conditions.
2. Promote toilet designs that meet 'basic' sanitation criteria but that over time can be easily upgraded to meet safely managed sanitation criteria (e.g., from single pit to alternating twin pits).
3. Do not promote toilets that require frequent emptying in areas where affordable mechanised pit emptying services will not become available in the foreseeable future.

4. Promote alternative toilet designs, such as the alternating twin pits, that can be safely emptied by the owner supported by appropriate communications and/or guidance.

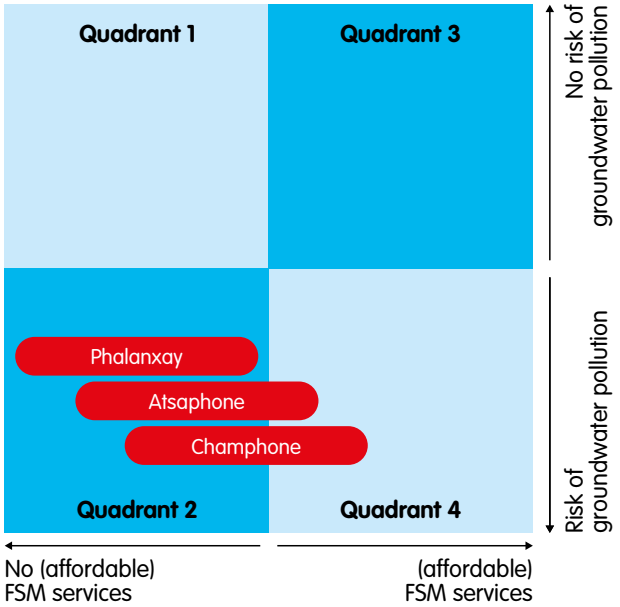
Intervention logic

The choice for a suitable onsite sanitation technology is dependent on many factors, however, for the sake of simplicity it is suggested to use the following two critical determinants:

1. Availability of (affordable) pit emptying services; and
2. Risk of groundwater pollution.

This could result in the services versus risk matrix shown in figure 11. The three districts fit for the most part in quadrant 2: risk of groundwater pollution and no pit emptying service available. However, it is likely that there will be differences within the three districts and possibly even within the villages. The ability of rural households to pay for mechanised pit emptying services is expected to be a determining factor.

Figure 11: Intervention matrix



Another factor is the accessibility of the villages by vacuum trucks. Although most villages are accessible during the dry season, this changes drastically during the rainy season. This is particularly a problem in Atsaphone where 50 out of the 70 villages cannot be reached due to unpassable roads.

Figure 12 provides an overview of the types of onsite sanitation technologies that fit the situation depicted in the four quadrants.

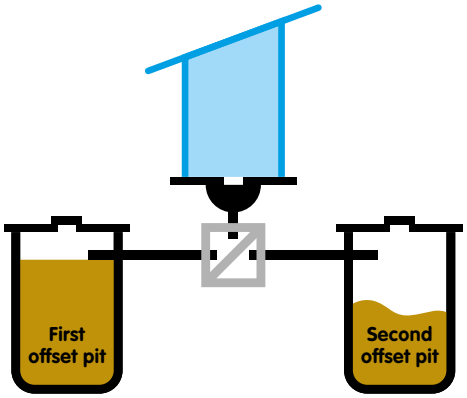
The preferred options for a majority of the households in the three districts are identified in the second column (quadrant 2). The main principle for the selection of appropriate sanitation technologies is to avoid the need for emptying of fresh human excreta and avoid the digging of deep pits that may exerbate the leaching of faecal waste into shallow groundwater aquifers.

Except for sequential twin pits and septic tanks, which both require 'frequent' emptying, most other technologies would be fit for purpose in the districts. The alternating twin pits configuration comes up as the most appropriate option.

Alternating twin pits

The alternating twin pits technology consists of a pour-flush toilet connected to two offset pits. The blackwater (faeces, urine, and water used for flushing) is collected in one pit and allowed to slowly infiltrate into the surrounding soil.

Figure 13: Toilet with alternating twin pits



When the first pit is full, it is sealed and the contents left to decompose, and the second pit is used. By the time the second pit is full the content of the first pit should be safe enough to be removed manually and reused, much like compost, to improve soil conditions. The two pits can be conservatively sized (less than 1 metre in depth) as under normal conditions the (decomposed) content of a pit can be safely removed after two years.

Figure 12: Overview of onsite sanitation technologies

	Quadrants			
	Quadrant 1	**Quadrant 2**	**Quadrant 3**	**Quadrant 4**
Emptying services	No	No	Yes	Yes
Groundwater pollution	Low risk	High risk	Low risk	High risk
Principles	Avoid emptying	Avoid emptying & avoid deep pits	Empty when full	Empty when full & avoid deep pits
Sanitation technologies				
Direct pit latrine	√ Seal in situ when full	√ Seal in situ when full		
Single offset pit	√ Upgrade to twin pit configuration	√ Upgrade to twin pit configuration	√√	√
Pour-flush to biogas	√	√√		
Alternating twin pits	√√	√√		
Sequantial twin pits			√	√
EcoSan	√	√√		
Urine-diverting dry toilet	√	√√		
Septic tank			√	√√

Upgradeable offset pit latrine

A more affordable option is to construct a toilet with a single pit but with enough space to add a second alternating pit at a later stage. Before the initial first pit completely fills up a second pit is installed and connected to the same toilet. Then it functions the same as a toilet with alternating twin pits.

In this way initial investment costs are lower and therefore more manageable. This is also a great way to upgrade and extend the life of the existing 84% of toilets connected to single offset pits. It is a relatively easy and cost-effective way to move from basic to safely managed sanitation.

Alternative scenarios

Although the majority of the households in the three districts are expected to fit in quadrant 2 (lack of affordable emptying services and high risk of groundwater pollution), households in some locations will have to consider the technology options provided in quadrant 4 (availability of affordable emptying services and high risk of groundwater pollution). Quadrant 4 is likely to be particularly relevant in parts of Champhone and Atsaphone districts.

In certain parts of those districts, households tend to raise their toilets somewhat above groundlevel to avoid problems that may be caused by seasonal flooding.

Figure 14: Adding a second pit

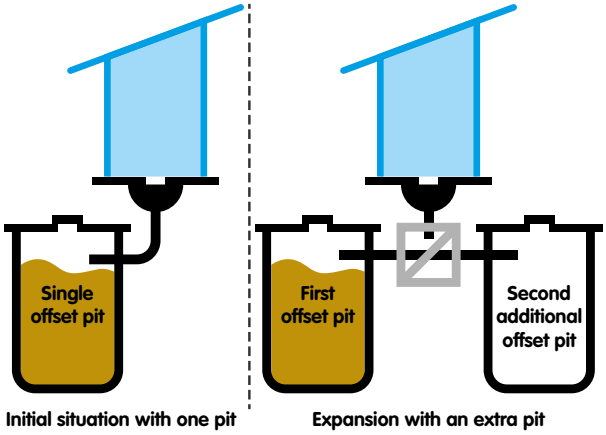
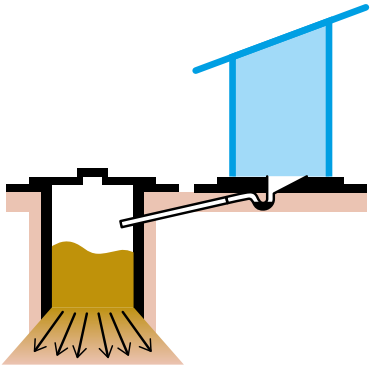


Figure 15: Raised single offset pit



Ensuring that rural households have the right amount of information to be able to make informed decisions is critical. More may have to be done to increase the knowledge of rural households on appropriate and affordable technology options. This is to be done during or immediately after demand creation interventions. Apart from the rural households, the knowledge of other relevant actors will need to be increased as well, for example, concrete producers, sales agents, and local masons or artisans.

What else?

It takes more than just a few technology options to achieve safely managed sanitation. On top of what is already being done, other crucial elements of the WASH system will require strengthening, such as:

Policy and legislation: Time-bound targets need to be set for universal access to improved (basic) and safely managed sanitation services. Legislation is needed for the management of onsite sanitation (including FSM and wastewater discharges) as this would provide the required clarity needed to deal with the faecal waste captured in onsite sanitation facilities.

Monitoring: Government monitoring on sanitation should be in line with JMP definitions and methodologies so that it is known what proportion of the population has access to safely managed sanitation. Ideally, sanitation monitoring provides insight into the final destination of the faecal waste. This information will support realistic target setting and the development of appropriate intervention strategies.

Changing behaviour and practices: There is a need to increase knowledge and awareness among local authorities, village leaders, and the general public about safely managed sanitation and of the potential dangers associated with onsite sanitation including the unsafe handling of faecal sludge. Rural households need to understand the concept of safely managed sanitation and what it takes to get there. They should also be aware of future requirements and associated costs when pits fill up before investing in HSF. Behaviour change campaigns should be embedded within tailor-made district strategies.

Safe faecal sludge management practices: More will have to be done to ensure that safe practices are followed along the entire sanitation service chain. The lack of safe disposal sites means that currently faecal sludge, emptied by pit emptying service providers, could end up anywhere in the environment. All the elements beyond capture and containment – emptying, transport, treatment, and safe reuse or disposal – need to be examined thoroughly. Thereafter, appropriate solutions will need to be considered and promoted.

Pro-poor mechanisms: Without external support the poorest households, who simply do not have the resources, will not be able to afford an improved type of toilet. For that reason, a Leave No-One Behind (LNOB) strategy is to be developed that builds on the work carried out as part of the disability inclusion and LNOB learning topics. Without such as strategy, the goal to realise equitable and universal access to sanitation services and thus create three ODF districts will not be achieved in the foreseeable future.

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