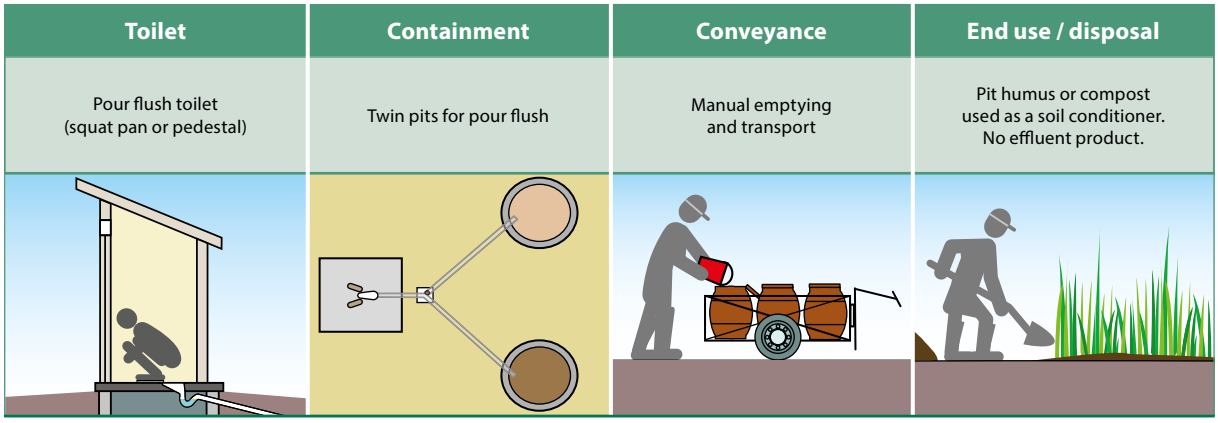
World Health Organization

Fact sheet 3

Flush toilet with onsite treatment in twin pits



Summary

This is a water-based system utilizing the pour flush toilet (squat pan or pedestal) and twin pits to produce a partially digested, humus-like product, that can be used as a soil conditioner.

Inputs to the system can include faeces, urine, flushwater, cleansing water, dry cleansing materials and greywater. The toilet technology for this system is a pour flush toilet. A urinal could additionally be used. The blackwater output from the pour flush toilet (and possibly greywater) is discharged into twin pits for containment.

The twin pits are lined with a porous material, allowing the liquid to infiltrate into the ground while solids accumulate and degrade at the bottom of the pit. While one pit is filling with blackwater, the other pit remains out of service. When the first pit is full, it is covered and temporarily taken out of service. It should take a minimum of two years to fill a pit. When the second pit is full, the first pit is re-opened and emptied.

After a resting time of at least two years, the content is transformed into pit humus (sometimes also called ecohumus), a nutrient-rich, safer, humic material which is safe to excavate for end use as a soil conditioner, or disposal. The emptied pit is then put back into operation. This cycle can be indefinitely repeated.

Applicability

Suitability: This system is suited to rural and peri-urban areas with appropriate soil that can continually and adequately absorb the leachate. It is not appropriate for areas with clayey or densely packed soil. This system is well-suited for cleansing with water. If possible, dry cleansing materials should be collected and disposed of separately because they may clog the pipe fittings and prevent the liquid inside the pit from infiltrating into the soil.

Cost: For the user, this system is one of the least expensive in terms of capital cost. The only maintenance costs will be for cleaning of the toilet, upkeep of the superstructure and arranging for periodic emptying of containers [2, 3]; and it produces an end product that the user may be able to use or sell.

Design considerations

Toilet: The squat pan or pedestal should be made from concrete, fibreglass, porcelain or stainless steel for ease of cleaning and designed to prevent stormwater from infiltrating or entering the pit [2, 3].

Containment: As leachate from twin pits directly infiltrates the surrounding soil, this system should only be installed where there is a low groundwater table. If there is frequent flooding or the groundwater table is too high and enters the twin pits, the dewatering process, particularly in the resting pit, will be hindered.

Greywater can be co-managed along with the blackwater in the twin pits, especially if the greywater quantities are relatively small, and no other management system is in place to control it.

However, the water table level and groundwater use should be taken into consideration in order to avoid contaminating drinking water. If groundwater is not used for drinking or alternative cost effective sources can be used, then these options should be explored before assuming that groundwater contamination by pit latrines is a problem. Where groundwater is used for

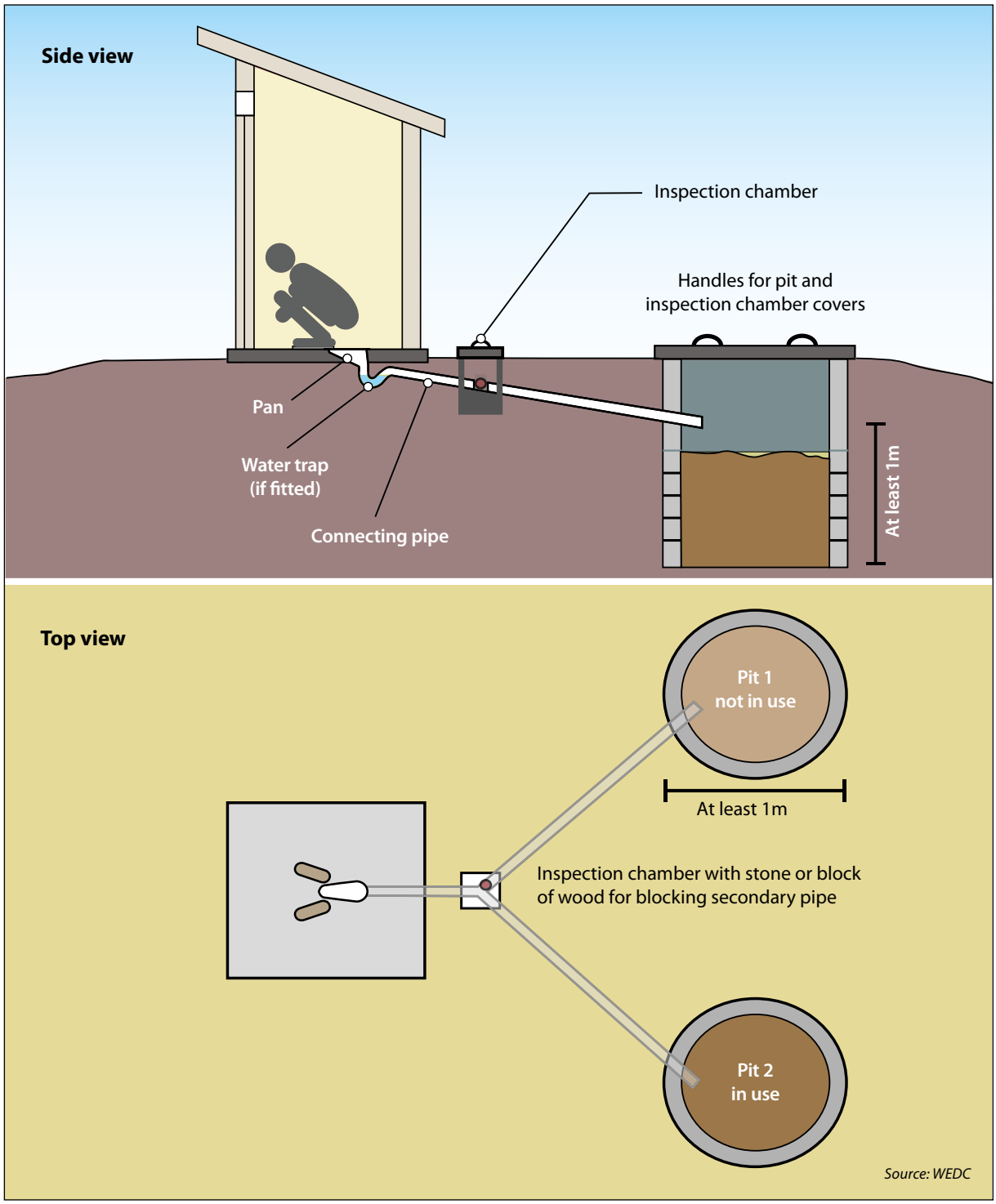


Figure 1. A twin-pit, pour flush latrine

drinking and to prevent its contamination, the bottom of the pit should be at least 1.5m [3] above the water table.

In addition, the pit should be installed in areas located down gradient of drinking water sources, and at a minimum horizontal distance of 15m [4].

End use/disposal: Any non-degradable solid waste removed from the pit, needs to be disposed of properly, for example through a regulated solid waste management service or, where this is not available, through burial.

Operation and maintenance considerations

Toilet and containment: The user is commonly responsible for the construction of the toilet and pit, although they may pay a mason to carry out the work.

The user will be responsible for cleaning of the toilet and are most likely to be responsible for removing the pit humus, although they may pay a labourer or service provider to do this [2].

At shared facilities, a person (or persons) to clean and carry out other maintenance tasks (e.g. repairs to superstructure) on behalf of all users needs to be identified.

End use/disposal: As the excreta in the resting pit is draining and degrading for at least two years, the resulting pit humus needs to be manually removed using shovels – vacuum truck access to the pits is not necessary.

The pit humus removed should be in a safe, useable form, although workers must wear appropriate personal protection during removal, transport and end use.

Mechanisms for protecting public health

Toilet and containment: The toilet separates users from excreta and the pit isolates the excreta and pathogens within it from physical human contact.

The main mechanism for pathogen reduction is through long storage time. The conditions in the pit are not favourable for pathogen survival, which die off over time. Leachate permeates from the pit into the surrounding soil and pathogens contained in the liquid are filtered out, adsorbed onto particles, or die off during their slow travel through soil.

During rains, the toilet and the pit contain fresh excreta and prevent it from being washed away into surface water bodies, while squat-hole covers or lids can reduce disease transmission by preventing disease carrying vectors from entering and leaving the pit [2, 3].

Treatment: Since it has undergone significant dewatering and degradation, pit humus is much safer than raw, undigested sludge. Therefore, it does not require further treatment in an offsite treatment facility. If there are concerns about the pathogen level or quality of the pit humus, it can be further composted in a dedicated composting facility before it is used (see Fact sheet 5).

End use/disposal: Pit humus has good soil conditioning properties and can be applied in agriculture [5]. If there is no end use for the product, it can be permanently disposed of.

References

The text for this fact sheet is based on Tilley, et al. [1] unless otherwise stated.

1. Tilley E, Ulrich L, Lüthi C, Reymond P, Schertenleib R, and Zurbrügg C (2014). *Compendium of Sanitation Systems and Technologies. 2nd Revised Edition.* Swiss Federal Institute of Aquatic Science and Technology (Eawag).

2. Brikké F, and Bredero M (2003). *Linking Technology Choice with Operation and Maintenance in the Context of Community Water Supply and Sanitation. A reference document for planners and project staff.* Geneva, Switzerland.

3. Reed R A, Scott R E, and Shaw R J (2014). *WEDC Guide No. 25: Simple Pit Latrines.* WEDC, Loughborough University, UK.

4. Graham J, and Polizzotto M (2013). *Pit latrines and their impacts on groundwater quality: A systematic review.* Environmental Health Perspectives.

5. Strande L (2017). *Introduction to Faecal Sludge Management.* Online Course available at: www.sandec.ch/fsm_tools (accessed March 2017). Sandec: Department of Sanitation, Water and Solid Waste for Development Eawag: Swiss Federal Institute of Aquatic Science and Technology.