WEDC

MOBILE NOTE 27

Emptying pit latrines

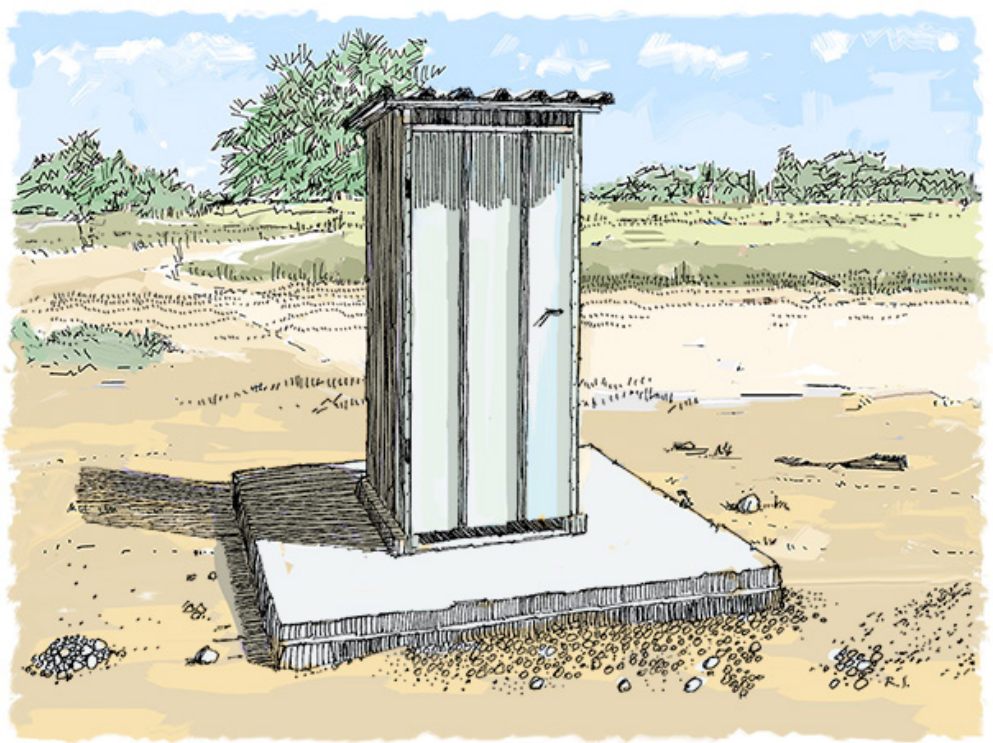
Introduction

Well-managed pit latrines offer an effective, safe and hygienic way of containing excreta at relatively low cost. Excreta decomposes in the pit, which will eventually fill up and need to be emptied. This note considers the principal issues relating to safely removing excreta from a pit.

The note is specifically concerned with dry systems, rather than septic tanks and cesspits.

Loughborough University

Contents



Suitable method

Choosing the most suitable method of emptying excreta from a pit is determined by:

- the actual cost to the household (how affordable it is and therefore how likely it is that the household will pay for the service);
- the relative cost of building a new latrine against the cost of emptying the existing one;
- the health impact on workers;
- the type of latrine to be emptied;
- the type of pit lining; and
- how the excreta will be disposed of.

Avoiding the need to empty pits

Move the latrine

If there is sufficient space, one solution is to construct shallow pits (less than a metre deep) and relocate the latrine

superstructure, or build a new one, when the pit is almost full – rather than empty the pit. With the superstructure and pit cover moved for reuse, or demolished, a tree can be planted in the pit. The tree makes use of the nutrients in the excreta and can yield a good crop. This latrine system is often referred to as an Arborloo.

To be affordable, the superstructure should be either easy to relocate, or made of local materials that are easily replaced.

Bucket latrines

Bucket latrines are not a recommended sanitation option. However, in some circumstances such as short-term emergency response, or in highly flood-prone areas, they may be the only viable short-term option.

As bucket latrines are emptied on a frequent basis (often daily or weekly), the

fresh excreta must be handled extremely carefully. This is an unpleasant and unhealthy task.

Additives

Certain chemical and biological additives claim to enhance decomposition of excreta, but this only extends the time between emptying pits, rather than addressing the challenge of emptying pits altogether.

Warning!

Additives must be handled with extreme care.

Emptying alternating pits

Alternating 'twin-pit' pit latrines make use of the same pits on a rotational basis. This means that a permanent superstructure can be used. Two pits are dug, each sized to store about two year's worth of excreta. Each pit has a removable cover slab, providing access to the pit.

One pit only is put into use and filled over time. Once this pit is full, it is closed off for storage, while the second pit is used. As the second pit fills, the first pit is emptied and put back into use (Figure 1).

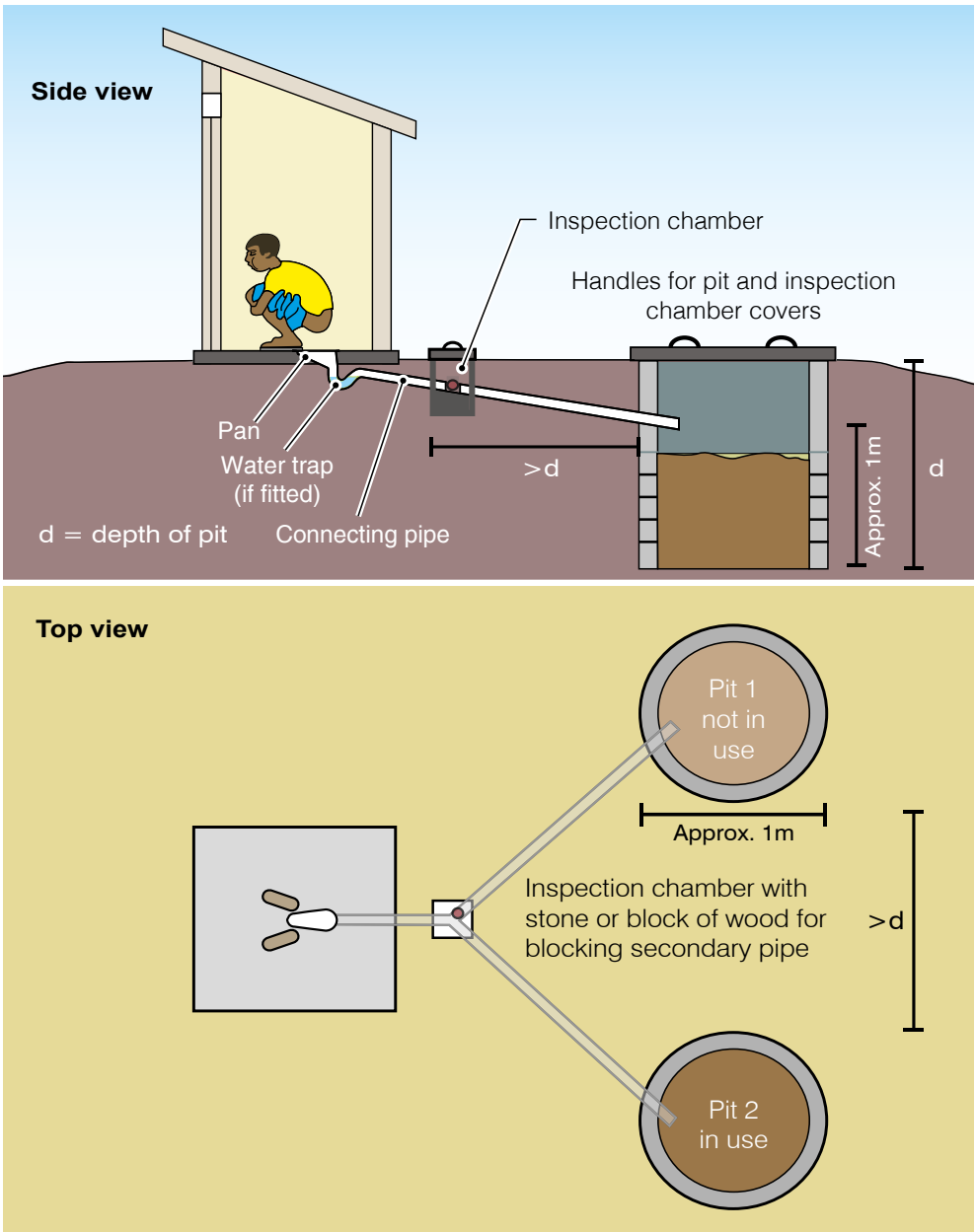


Figure 1. Twin-pit latrines

Given the right conditions of temperature, moisture content and pH, after 2 years storage the excreta will have decomposed and the disease-causing organisms died off sufficiently that the excreta to be manually handled. The stored excreta may look like soil, but it should still be handled carefully to minimize health risks associated with any incorrect use of the latrine.

Manual emptying often involves someone entering into the pit, so they should be equipped with ladders, ropes, protective clothing, shovel and buckets as a minimum.

Composting and dehydrating latrines

Latrines can be designed and used in a way that speeds up excreta decomposition and makes emptying easier. Examples are composting and dehydrating latrines. Two pits are typically used in a composting latrine, with one left unused for the excreta to

decompose while the other is in use. With dry material (such as wood ash or soil) added to the faeces they can decompose, and the pathogens die-off more rapidly. Composting latrines require more day-to-day management by the user and usually have to be emptied more frequently than simple pits, but emptying tends to be easier, with reduced (but not removed) associated health risks.

In dehydrating latrines, urine is diverted away from the pit into a separate collecting vessel, or to a soakaway (Figure 2). The removed faeces can be used, with care, as a soil conditioner for certain crops.

Both types require excreta reuse to be socially acceptable, with the faeces carefully removed and transported to the field and correctly applied to the land, ideally where children do not play (WELL, 2006a).

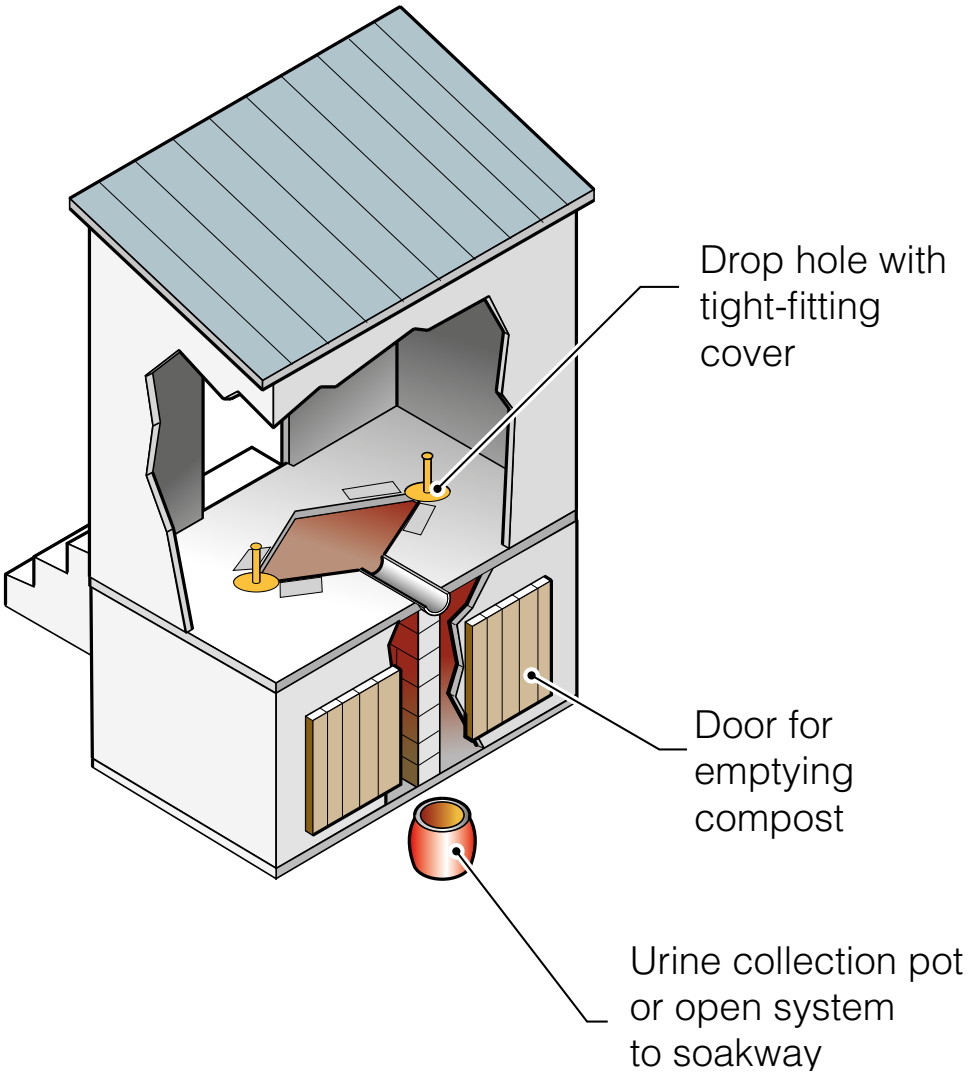


Figure 2. Twin-pit urine-diverted composting latrine

Emptying a single pit latrine

Where a single pit that is continually in use is to be emptied, two techniques can be used: *mechanical pumping* and *manual emptying*. The pit should be fully lined,

especially where mechanical emptying is to take place, as the removal of the semi-liquid material may cause unlined pits to collapse.

A single shallow pit will need emptying more frequently than a more expensive deep pit, but this may suit the finances of the household – who may be reluctant to save up for many months to pay for the evacuation of a deep pit.

Regular emptying of shallow pits however needs to be supported by a responsive service, especially in urban areas (WELL, 2006b).

Mechanical pumping

Mechanical emptying systems exist that are both technically and financially viable, but these are typically the services provided by local sewage operators in the more formal areas of towns and cities, using large conventional vacuum tankers to empty both pits and septic tanks (Figure 3).

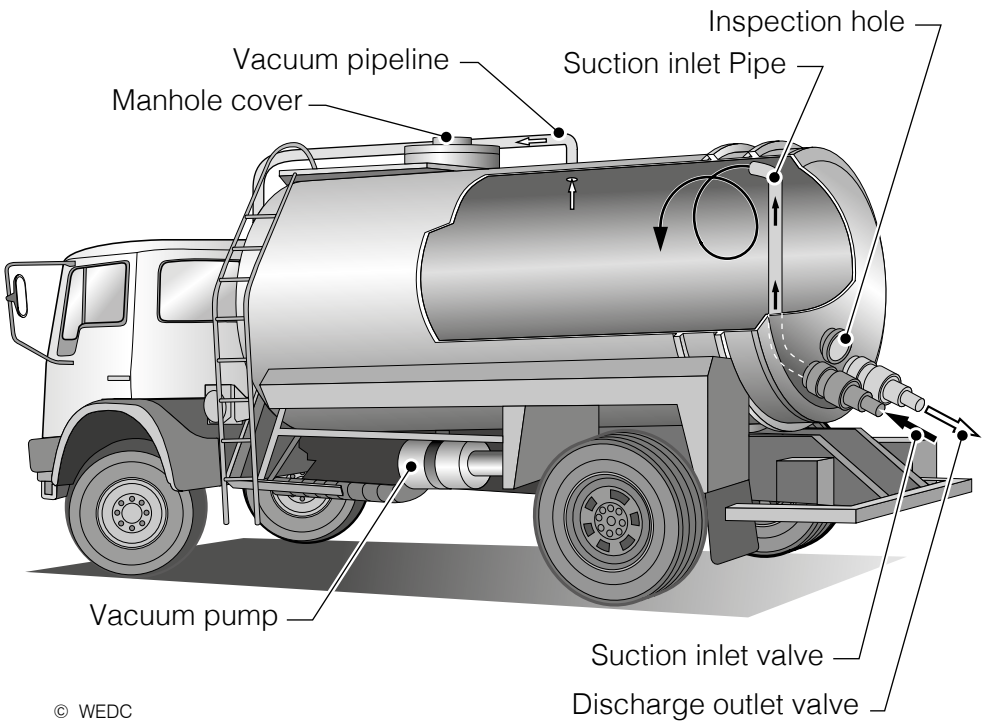


Figure 3. A conventional vacuum tanker

To address the challenge of providing mechanized pit emptying services in informal areas and slums, a low-cost technical solution has had to be developed.

The solution is portable vacuum tankers, specifically designed for use in slums and other areas that are difficult to reach with a conventional vacuum tanker.

Portable tankers are currently used in informal settlements and slum areas of Dhaka (Bangladesh), Nairobi (Kenya), Maputo (Mozambique), Dar es Salaam (Tanzania) and other cities (Figure 4).

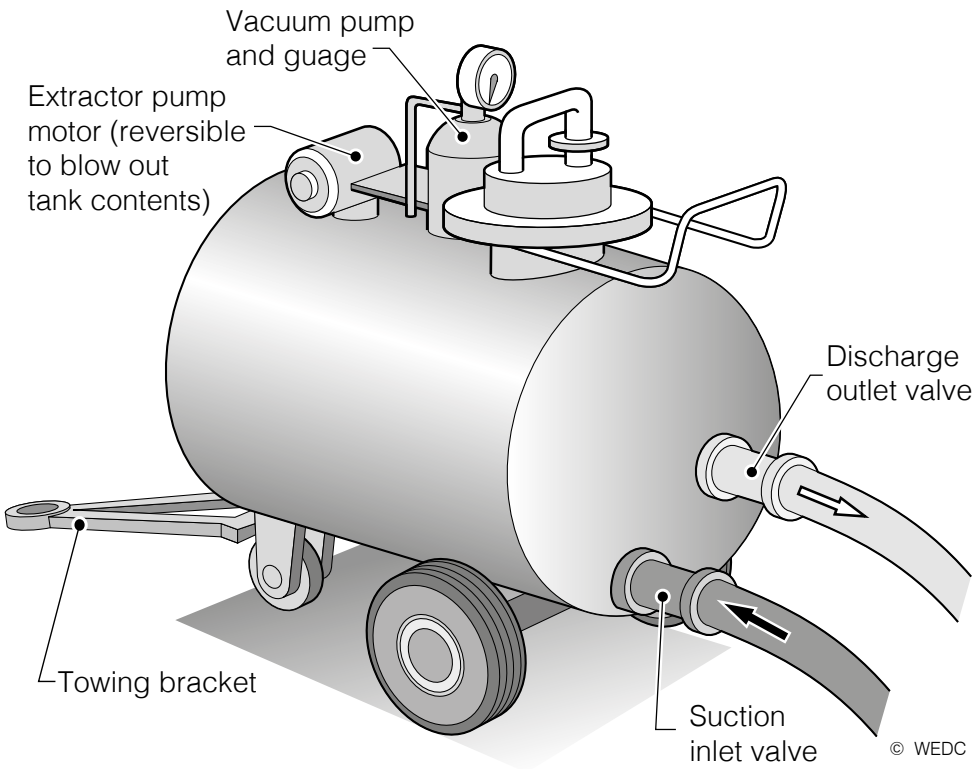


Figure 4. Features of a portable vacuum tanker

One of the most successful attempts in recent years to develop hand-operated machines for pit emptying was in Tanzania.

The tankers were made of local materials based on the standard oil drum.

To date, results have been promising but they have only been used for wet pits containing no solids (Figure 5).

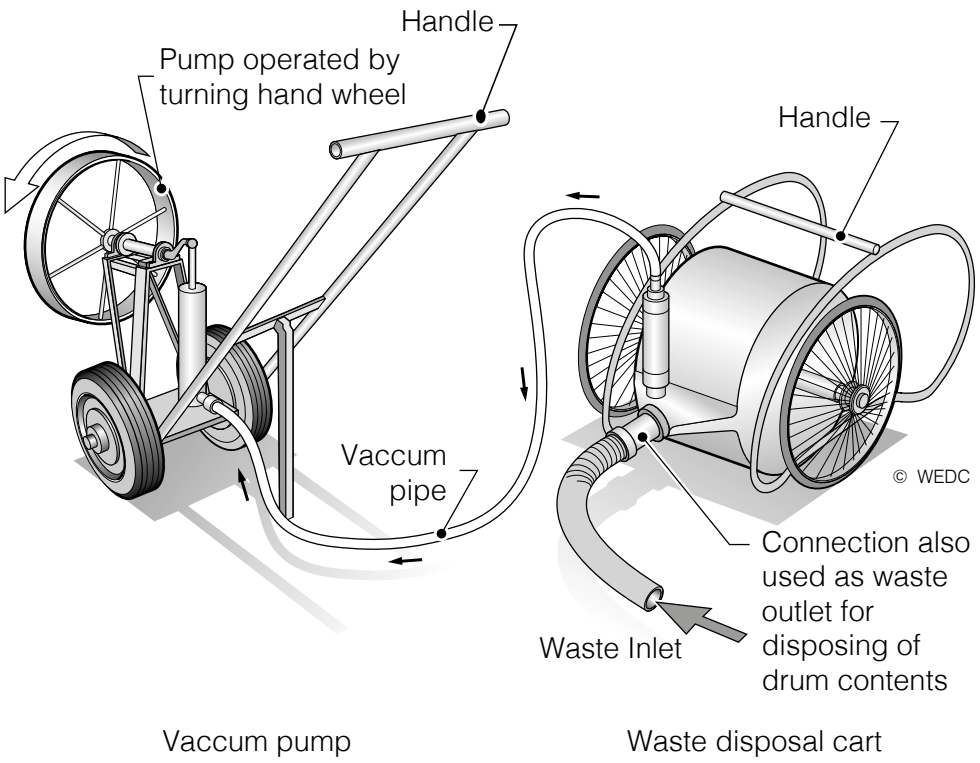


Figure 5. Hand-operated vacuum tankers

Vacutug

The Vacutug is probably the most widely used small vacuum tanker operating in informal settlements. The original

module was designed by Manus Coffey Associates (with support from UN Habitat) for use in Kibera, Kenya in the late 1990s.

The first Vacutug has a 500 litre capacity tank and vacuum pump assembly, driven by a small, motorized operating vehicle.

A suction hose runs from this unit into the pit, either through the squatting hole or a seat in the slab, or through a special opening directly into the pit.

The excreta to be removed may be too solid for the pump to lift, so water may need to be added and the contents mixed to liquefy them first.

Any stones, sticks, plastic bags and other solid items thrown into the pit will block the suction hose. Users need to be educated into what can and can't be put into the pit, if this emptying option is to be used.

Although the vehicle can access properties in densely-populated settlements, its small capacity and a speed limit of 4 km/hour makes for frequent trips and significant travel times to take excreta to a disposal site.

Operators may resort to disposing the faecal sludge into a nearby watercourse or onto waste ground, if there is no provision for discharging into a sewer, or at a nearby treatment plant.

Figure 6. UN-Habitat Vacutug

However, the modified Vacutug (Mark II) subsequently developed operates with two units: a 1,900 litre main collection tank and a 200 litre unit. This 'satellite' unit can be pulled by a small tractor or pick-up, making access to densely-populated areas both easier and faster.

In Dhaka, Bangladesh, demand for pit emptying services using the Vacutug Mark II has been steadily increasing in slums and squatter settlements, as well as for emptying septic tanks in middle-income areas. Finding suitable sites for sludge disposal remains an ongoing challenge (GHK, 2005).

The Vacutug Mark II also has its limitations. The pit must be within 30m of the satellite unit for the suction pipe to reach into the pit, which can really only lift excreta from a maximum of 2m below ground.

Fully emptying deep pits it not possible.

The use of vacuum tankers requires good management and a market for the service, if reliable pit emptying services are to respond to user demand, willingness and ability to pay for the service. To find out more about how local independent providers are offering pit-emptying services using the Vacutug in Bangladesh and Mozambique, refer to GHK (2005) and Sugden (2005) respectively.

Manual emptying

Emptying excreta from a pit is an unpleasant task and can be extremely hazardous, both from a public health point of view and a safety perspective. Ideally the pit should be emptied by people standing at ground level and using shovels, buckets and ropes to remove the excreta, without having to enter into the pit. In reality, this is rarely the case, as the excreta can be quite dense and difficult to shift and many pits are too deep to remove the excreta without entering them.

Think safety!
No one should enter a pit without wearing a harness and safety rope. The rope should be held by at least 2 people standing on the surface, who can lift the person out of the pit if overcome by fumes, or the pit starts to collapse. Pit walls, especially in unlined pits, can collapse if the pit is emptied after years of being filled. The structural stability of the pit walls must be continually monitored as emptying takes place.

At least part of the pit cover slab will need to be removed to provide access and improve air circulation. The pit should be left to 'vent' for some time before anyone enters it and fans can be used to improve the circulation of air in the pit.

Buckets will be needed to lift the contents to the surface. Gloves, boots and other personal protective equipment are essential, as are washing facilities close to the pit.

Manual emptying can take several days, depending on the size of the pit and the consistency of the contents.

Disposing of faecal sludge

Once faecal sludge has been removed from the pit, it needs to be transported and disposed of carefully. There are several options – some of which are mentioned here.

These options, and others, are briefly outlined in Pickford and Shaw (1999) and explained in more detail in Cairncross and Feachem (1993), pages 143-146 or from SANDEC (2006).

Discharge into a sewer

If the sludge is mainly liquid and there is a sewerage system nearby, it can be emptied into a trunk sewer, or at the start of a wastewater treatment works, with the permission of the local sewage authority. Sludge should not be emptied into stormwater drains unless they

are so polluted already it is the best environmental option available.

Co-composting and applying to land

Faecal sludge can be composted, mixing it first with 2-3 times its volume of vegetable waste to enhance an aerobic composting process. As has been practiced in countries including Ghana, Haiti and South Africa, the mixed compost can then be applied to farmland. As the compost is likely to contain plastic bags, stones and faeces that are not fully decomposed, it should be buried with a soil covering at least 0.5 m deep. Burying excreta in a shallow trench with a large surface area, is better than a deep pit, as a trench is easier to dig and provides better protection to any groundwater resources.

Direct burying

Smaller volumes of sludge can be buried directly in a trench. The sludge is placed in layers (e.g. 100 mm thick) that are

then covered with 200 mm of soil before the next layer of sludge is added. The final layer should always be soil. After a couple of years, the contents can be dug out and used as a soil conditioner.

Crops grown in the area should not come into direct contact with the soil where faecal sludge is applied (so growing trees on the land is best, and growing beans or corn is better than salad crops).

The disposal site should be away from any water source and areas that are liable to flooding. As a possible route for faecal contamination is through rainfall runoff, surface water must be directed away from any disposal site, using ditches or low soil embankments.

Drying beds and ponds

Large quantities of faecal sludge may require more formal treatment, for example by drying it in a sludge drying bed. This shallow basin must be sited

away from houses and designed to ensure the contents cannot be washed away by rainfall (Figure 7).

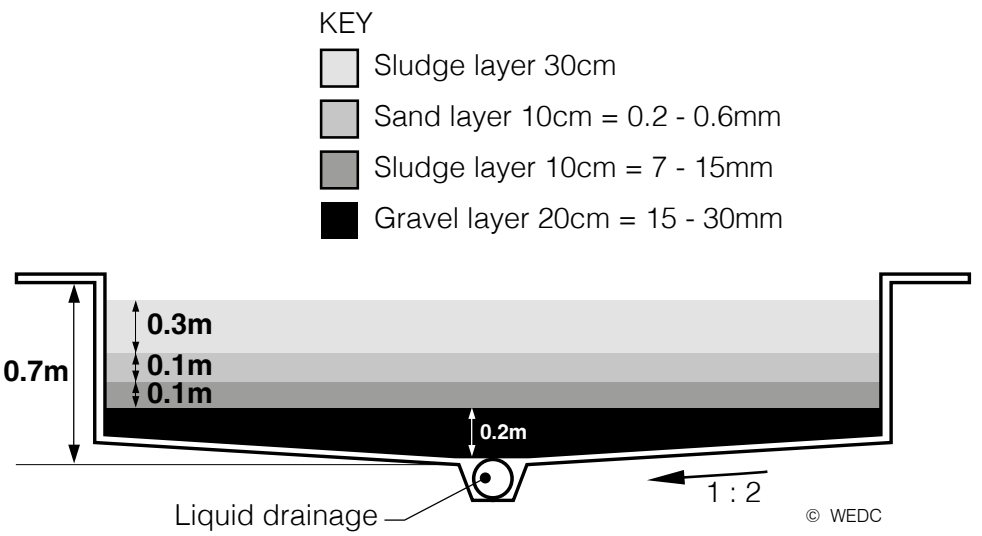


Figure 7. Cross-section through a sludge drying bed

A further method of sludge treatment is using waste stabilization ponds. This can be done in combination with municipal wastewater, or separately.

References

CAIRNCROSS, S. and FEACHAM, R., 1993. *Environmental Health Engineering in the Tropics: An Introductory Text*. (2nd edn) Chichester, UK: John Wiley and Sons Ltd.

EALES, K., 2005. *Bringing pit emptiers out of the darkness: a comparison of approaches in Durban, South Africa, and Kibeira, Kenya*. Sanitation Partnerships Series, Building Partnerships for Development in Water and Sanitation. London: BPD Water and Sanitation.

GHK, 2005. *Decentralised domestic wastewater and faecal sludge management in Bangladesh*. London: GHK.

PICKFORD, J.A. and Shaw, R. J., 1999. 'Technical Brief No. 54: Emptying pit latrines'. In SHAW, R.J. (ed.). *Running Water*. London: IT Publications (now Rugby, UK: Practical Action Publishing).

[Online] [Viewed 09/02/17] Available from: http://www.lboro.ac.uk/well/resources/technical-briefs/54-emptying-latrine-pits.pdf

SANDEC, 2006. *Faecal sludge management (FSM)*. [Online] [Viewed 09/02/17] Available from: http://www.sandec.ch/FaecalSludge/index.htm

SUGDEN, S., 2005. *An assessment of mechanical pit emptying services in Maputo*, London: London School of Hygiene & Tropical Medicine.

WELL, 2006a. *Briefing Note 27: Should ecological sanitation carry a health warning? Assessing the health risks of ecological sanitation*. Loughborough, UK: WEDC, Loughborough University. (See Note 55 in this series)

WELL, (2006b), *Briefing Note 32: SSIPs: a role in sustaining sanitation services to the urban poor*. Loughborough, UK: WEDC, Loughborough University.

About this note

Authors: Rebecca Scott/Brian Reed
Editor: Rod Shaw
Illustrators: Rod Shaw / Ken Chatterton
QA: Andrew Cotton

Designed and produced by WEDC

Water, Engineering
and Development Centre (WEDC)
School of Civil and Building Engineering
Loughborough University
Leicestershire LE11 3TU UK

Phone: + 44 (0) 1509 222885
Email: wedc@lboro.ac.uk
Website: wedc.lboro.ac.uk
Twitter: wedcuk
YouTube: wedclboro

BACK TO TOP

Note: Click on the home icon wherever it appears to return to the list of subjects.