CHAPTER 4

Excreta disposal

Safe disposal of excreta, so that it does not contaminate the environment, water, food or hands, is essential for ensuring a healthy environment and for protecting personal health. This can be accomplished in many ways, some requiring water, others requiring little or none. Regardless of method, the safe disposal of human faeces is one of the principal ways of breaking the faecal–oral disease transmission cycle. Sanitation is therefore a critical barrier to disease transmission.

Plans for locating sanitation facilities, and for treating and removing waste, must consider cultural issues, particularly as sanitation is usually focused on the household. Excreta disposal may be a difficult subject for a community to discuss: it may be taboo, or people may not like to discuss issues they regard as personal and unclean. In some cases, people may feel that sanitation facilities are not appropriate for children, or that children's faeces are not harmful. In others, separate facilities may be required for men and women, and it may be necessary to locate the facilities so that no one can be seen entering the latrine building. If the disposal facilities smell and are a breeding ground for flies, people may not use them.

Health improvement comes from the proper use of sanitation facilities, not simply their physical presence, and they may be abandoned if the level of service does not meet the social and cultural needs of community members at an affordable cost, as shown in Figure 4.1. Within a community, several different sanitation options may be required, with varying levels of convenience and cost (sometimes called a sanitation ladder). The advantage of this approach is that it allows households to progressively upgrade sanitation facilities over time.

4.1 Technologies for excreta disposal

Technologies for excreta disposal, with illustrations, are briefly discussed below. More detailed information is provided in the references cited in Annex 2.

Figure 4.1 ***Disused latrine***

4.1.1 **Cartage**

Cartage is the most basic form of excreta disposal—faeces are collected in a container and disposed of daily. An example is the bucket latrine, in which household wastes are collected in buckets under a hole in the floor of a specific room. Each day, the bucket is emptied into a larger container and the contents disposed of. Bucket latrines should not be promoted because they pose health risks to both users and collectors and may spread disease. If cartage is considered for your community, a vault latrine (a latrine where wastes are stored in a sealed container) that is mechanically emptied on a regular basis is a better choice.

4.1.2 Pit latrines

In most pit latrine systems, faecal matter is stored in a pit and left to decompose. Unless specifically designed, pit latrines do not require periodic emptying; once a pit is full it is sealed and a new pit dug. If faecal matter is left to decompose in dry conditions for at least two years, the contents can be safely emptied manually and the pit reused. Indeed, some pit latrines are designed to allow faecal matter to compost and be reused in agriculture. Other designs use two alternating pits, reducing the need for new pits. Some pit designs are meant to be completely dry, while some use small quantities of water. Ventilation to remove odours and flies is incorporated into certain designs, while others are very basic and use traditional materials and approaches. As with all sanitation designs, it is important to know what community members want and can pay for before embarking on construction. An example of an improved pit latrine is shown in Figure 4.2.

Sanplat

The sanplat is the cheapest and most basic pit latrine. It is a small concrete platform (usually 60 cm × 60 cm or smaller), laid on top of logs or other supporting material traditionally used to cover the pit. The purpose of the sanplat is to provide a sanitary (san) platform (plat) which can be easily cleaned to limit the presence of helminths such as hookworm. Once the pit is full, the sanplat can easily be moved. However, the sanplat design does not overcome problems with odours or flies and may not be acceptable to some community members. The sanplat is best used when there is very little money for improving sanitation and where odours and flies will be tolerated.

The VIP latrine

The VIP (ventilated improved pit) latrine is designed to overcome some of the problems with traditional latrine designs, but it is more expensive than a sanplat. It has a vent pipe from the pit to above the roof of the building as shown in Figures 4.3 and 4.4. When air flows across the top of the vent pipe, air is drawn up the pipe from the pit and fresh air is drawn into the pit from the building. Offensive odours from the pit thus pass through the vent pipe and do not enter the building. The location of VIP latrines is important: unless a clear flow of air is maintained across the top of the vent, the ventilation system may not be effective. VIP latrines should therefore be located away from trees or high buildings that may limit airflow. A dark vent pipe also helps the air to rise. The top of the pipe is usually covered with mosquito meshing. If the inside of the building is kept partially dark, the flies will be attracted to light at the top of the pipe, where they will be trapped and die.

Figure 4.2 ***Improved pit latrine***

When the VIP latrine is constructed and used properly, it provides great improvements in fly and odour control, but may not eliminate either completely.

A VIP latrine is designed to work as a dry system, with any liquid in the content infiltrating into the surrounding soil. Although some liquid inevitably will enter the pit, it should be minimized. For example, it would not be appropriate to dispose of household wastewater into the pit as this may prevent decomposition of the contents. VIP latrines are most appropriate where people do not use water for cleaning themselves after defecating, but use solid materials such as paper, corncobs or leaves.

Figure 4.3 ***Twin pit latrine***

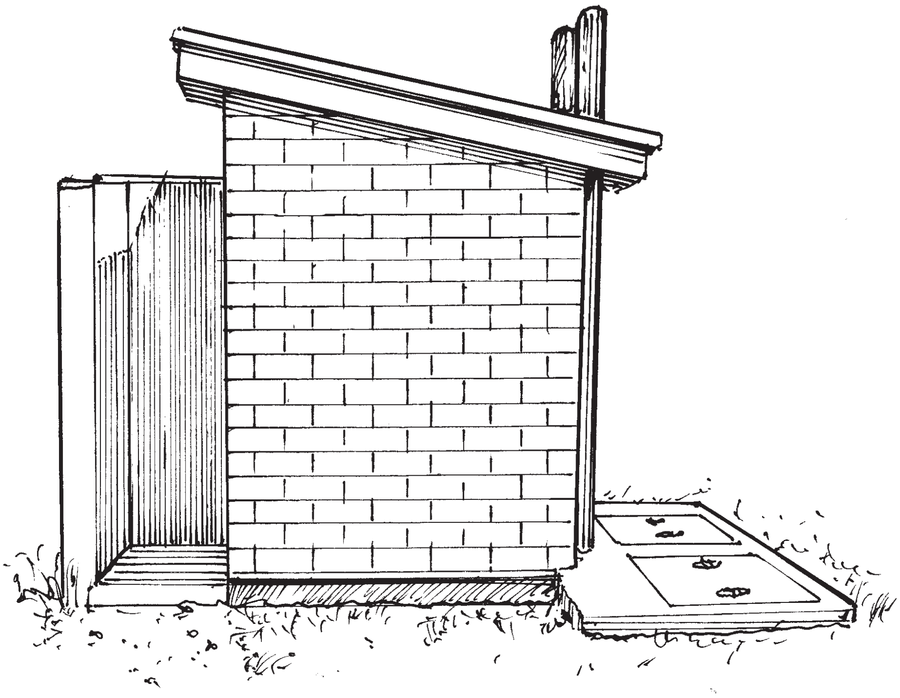
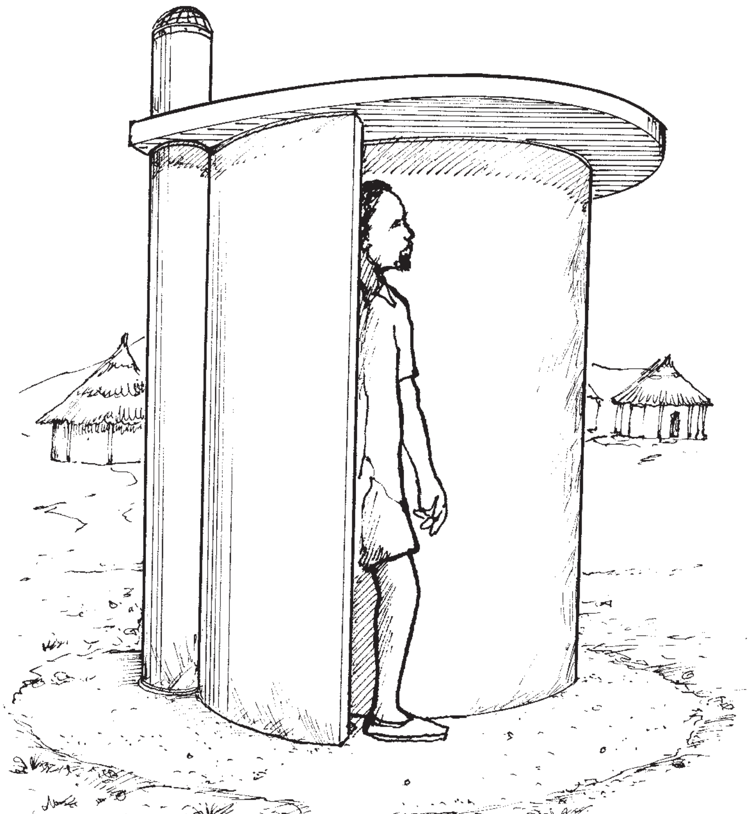


Figure 4.4 ***VIP latrine***



VIP latrines may be designed with single or double pits. Double pits may be used, for example, when cultural taboos prohibit the mixing of male and female faeces. Twin pits may also be used to facilitate emptying and composting. When one pit is full, the other can be emptied and reused. The pit of a VIP latrine is usually located directly beneath the slab to prevent fouling of the chute, which would lead to odour and fly problems, and require regular cleaning.

The VIP latrine is more expensive than either traditional designs or the sanplat and this should be borne in mind when considering its use. In some areas, traditional latrines or sanplat latrines can be improved by providing ventilation. However, it likely that traditional floor materials will allow light to enter the pit, which will make fly control more difficult. Installing a vent pipe on an existing latrine may damage it. When considering a VIP latrine as an improvement on existing sanitation, it is important to be aware that this may require the construction of a new latrine, not simply the upgrading of an existing one.

Pour–flush latrines

A pour–flush latrine is a type of pit latrine where small volumes of water (commonly 1–3 litres) are used to flush faeces into the pit. They are most appropriate where people use water to clean themselves after defecating (e.g. in Muslim cultures) and where people have access to reliable water supplies close to the home. Solid materials should not be disposed of into pour–flush latrines, as this could block the pipe and even cause it to break.

A pour–flush latrine has a small collection pan set in a slab. Wastes are disposed of through a section of pipe bent into a U shape (a U-bend) to maintain a water seal for reducing fly and odour problems. A vent pipe may also be added to the pit to help with fly and odour problems. The pit of a pour–flush latrine may be located directly beneath the slab or set to one side, but offset pits may require more water to prevent blockages. The pit is usually connected to a soakaway to allow liquids to infiltrate the soil, leaving solid waste to decompose. Pour–flush latrines can also be designed to be connected to small-bore sewers at a later date. As with VIP latrines, twin pits may be used.

4.1.3 **Septic tanks**

A septic tank is a form of on-site sanitation that provides the convenience of a sewerage system. It is usually linked to flush toilets and can receive domestic wastewater (or sullage). Since flush toilets tend to use large amounts of water, septic tanks are usually appropriate only for households with water piped into the home. The tank is offset from the house and linked to the toilet and domestic wastewater by a short drain. It is designed to hold solids and is linked to a soakaway to dispose of liquid waste (effluent).

Septic tanks generally require relatively large amounts of land and periodic emptying by vacuum tankers. This is often expensive and the trucks will need easy access to the tank. Septic tanks thus tend to be high-cost solutions for improving sanitation. They are commonly used only by communities whose members have access to water supply within the home, have land available and who can afford the cost of emptying the tanks. Communal septic tanks may be feasible if a large number of households close to the tank can be connected with very short lengths of sewer pipe. For such a system to work, however, each household needs sufficient water to flush faeces into the septic tank effectively. This approach will probably be effective only when water is supplied to at least one tap on each plot.

4.1.4 **Aquaprivies**

An aquaprivy is similar to a septic tank; it can be connected to flush toilets and take most household wastewater. It consists of a large tank with a water seal formed by a simple down pipe into the tank to prevent odour and fly problems. Its drawback is that water must be added each day to maintain the water seal, and this is often difficult to do unless water is piped into the home. The tank is connected to a soakaway to dispose of effluent. Unlike a septic tank, the aquaprivy tank is located directly below the house, but it, too, requires periodic emptying and must be accessible to a vacuum tanker. Aquaprivies are expensive and do not offer any real advantages over pour–flush latrines.

4.1.5 **Sewerage systems**

Sewerage systems are designed to collect excreta and domestic wastewater and transport them away from homes to a treatment and/or disposal point. All sewerage systems require water for flushing waste away. Conventional sewerage is a high-cost sanitation option; it is usually deep-laid and must be maintained by professional staff. Such a system is thus appropriate only where funds are available for operation and maintenance by trained staff. All sewerage systems should be linked to a treatment plant, as the raw faeces they carry represent a public health risk

Modified sewerage systems are also designed to transport waste away from the home, but work on different principles from conventional sewerage systems. They do not require high-volume flush toilets, but do need significant amounts of water for flushing. At least one tap on each plot or property is therefore essential. Small-bore sewers are designed to carry only effluent, and each home requires an interceptor tank to collect and store solid material, which must be regularly emptied by mechanical means.

Shallow sewers are larger-diameter sewers that carry both solid and liquid wastes. They differ from conventional sewers in that solids deposited in the pipes are resuspended when water builds up behind the blockage. To ensure that enough water is available to move the solids, all household wastewater should be disposed of into the sewer.

While both of these modified sewerage systems have problems, they have been successfully managed by communities and have far lower water requirements than conventional sewers. The modified technologies may be appropriate in larger villages that have water supplies close to, or within, the homes.

4.2 Sewage treatment and reuse

All wastes in sewerage or septic tank systems require treatment before disposal, so that surface water and groundwater sources are not contaminated and communities are not exposed to health risks from untreated sewage. This can be accomplished either through high-cost conventional treatment systems, or through a series of waste stabilization ponds (or lagoons).

4.2.1 Stabilization ponds

Waste stabilization ponds require more land, but are cheaper and easier to operate and maintain, and need fewer trained staff than other treatment systems. The final water from waste stabilization ponds can be very good if the ponds are properly maintained. Without proper maintenance, however, the quality of the final effluent may be poor and pose a risk to health if it is used for irrigation.

In usual configurations, sewage flows through a series of ponds where the solid and liquid wastes undergo natural breakdown processes, including microbial activity. Usually, at least two ponds are used, and more commonly three. If the sludge (the solid part of the waste) from septic tanks is to be treated in a waste stabilization pond, it should go into a special pond at the start of the series because it is potentially highly toxic. Subsequent ponds treat effluent (the liquid part of the waste). Wastewater in stabilization ponds tends to have a high organic content and can serve as breeding sites for *Culex* mosquitoes that transmit lymphatic filariasis and other infections. The ponds should therefore be sited well away from human habitation, at least beyond the flying distance of the mosquitoes (over a kilometre with wind assistance).

4.2.2 Wastewater and sludge reuse

As society uses more water, the demand on natural water resources becomes ever greater. Some of the demands for water, particularly for agriculture and fish breeding, can be met by reusing properly treated effluent, since the water quality requirements for these purposes are not as high as for drinking-water. Treated wastewater can also be used to recharge groundwater resources, although this will be usually be undertaken as part of a national groundwater management strategy.

Benefits of reusing treated sewage effluent and sludge

- It reduces the costs of abstracting irrigation water.
- It reduces demand on valuable water resources.
- It reduces the costs to farmers of expensive inorganic fertilizers.
- It stabilizes soils, maintains good organic content, and improves the long-term productivity of the soil.
- It promotes better use of water resources.
- It decreases pollution by reducing the waste load discharged into water bodies.

The use of untreated wastewater in agriculture or aquaculture poses high health risks to farmers and consumers alike, and only the reuse of *treated* wastewater should be promoted. The treated wastes should not contain pathogens (bacteria, viruses, helminths or protozoa), because these could contaminate products and infect consumers, or be accidentally ingested by farmers during handling. Properly operated sewage-treatment plants should produce treated effluent of good enough quality for use in irrigation or fish-breeding ponds. If treated wastewater is to be reused, the community should ask the operator of the sewage-treatment plant or the local health body to carry out regular monitoring to ensure that the effluent is safe.

Solid waste from pit latrines and sewage-treatment plants can also be a valuable resource for farmers as an organic fertilizer and soil conditioner, provided that it has been allowed to properly decompose and contains no pathogens. It is particularly important to ensure that roundworm (*Ascaris*) eggs are no longer infective. Normally, it takes two years for the waste in a pit latrine to decompose, but longer if the pit is wet. Some composting pit latrines (e.g. the Viet Nam latrine) accelerate the decomposition of sludge and inactivation of roundworm eggs by increasing the temperature in the sludge pile. Before your community reuses sludge, however, health officials should be consulted about the minimum time for sludge decomposition. If possible, the quality of the sludge should occasionally be tested. However, testing for microorganisms such as protozoa and helminths is expensive, and it may be more effective to use retention time to judge whether the sludge will be safe to use.

While the microbial quality of treated effluent and sludge is the major health concern, chemical contamination is also a consideration. In particular, wastewater reuse may increase the nitrate and chloride content of the soil. Nitrate has been linked to the "blue-baby" syndrome that can be fatal in infants. Although chloride is not a health concern, it can increase water salinity and affect soil fertility. If community members suspect that a water source is contaminated with chemicals, they should seek the advice of local health and environment officials and request that periodic monitoring of wastewater quality be carried out.

When wastewater is reused, care should be taken to separate domestic effluent from industrial effluent, since the industrial effluent may contain chemicals harmful to health or the environment, such as heavy metals. If industrial sewage is mixed with domestic sewage, it is therefore not advisable to reuse the wastewater. Food products fertilized with such wastewater may pose a health risk to consumers, and the repeated application of solid or liquid wastes may cause chemical build-up in soils, leading to long-term problems for water resources.