Chapter 6

Excreta disposal

Excreta disposal is undoubtedly one of the key elements of any emergency sanitation programme. Containment and safe disposal of human excreta is the primary barrier to transmission of excreta-related disease. Implementing agencies often focus solely on the quantity of toilets in emergency situations, however, and pay scant attention to their quality and usage.

6.1 Associated risks

6.1.1 Sources of disease

Inadequate and unsafe disposal of human faeces can lead to the contamination of ground and water sources, and can provide breeding sites for flies and mosquitoes which may carry infection. In addition, faeces may attract domestic animals and vermin which can both increase the potential for disease. It can also create an unpleasant environment in terms of odour and sight.

The introduction of safe excreta disposal can reduce the incidence of intestinal infections and helminth infestations. Excreta-related communicable diseases include cholera, typhoid, dysentery (including shigellosis), diarrhoea, hookworm, schistosomiasis and filariasis (Franceys et al., 1992). The likelihood of all these diseases, and especially epidemics such as cholera, increases significantly when a population is displaced.

6.1.2 Transmission of disease

Transmission of excreta-related diseases is largely faecal–oral or through skin penetration. Figure 6.1 illustrates the potential transmission routes for pathogens found in excreta.

Poor hygiene practice, particularly involving food and hands, may be a major cause of disease transmission, even where appropriate excreta disposal facilities are in place. For this reason it is difficult to obtain a direct correlation between the incidence of excreta-related disease and the provision of appropriate facilities.

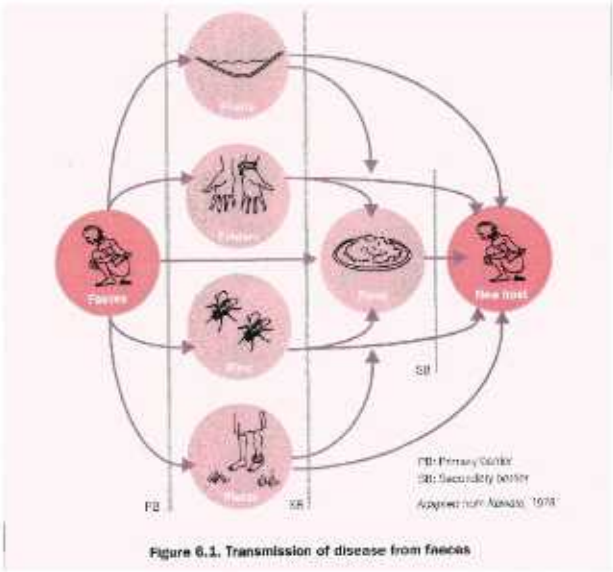


Figure 6.1. Transmission of disease from faeces

6.1.3 High-risk groups

Children under five years of age are most at risk from communicable diseases since their immune systems have not developed. Increased malnutrition, as is common in emergencies, increases this risk further. Since young children are unaware of the health risks associated with contact with faeces it is essential that faeces are safely contained.

Severely malnourished children and adults are at increased risk from diarrhoeal disease, as are elderly people especially if exhausted after travelling considerable distances.

6.2 Selection criteria for excreta disposal

In selecting appropriate excreta disposal interventions there are many criteria that must be considered. These include:

- Socio-political factors
- Socio-cultural factors
- Available space

- Ground conditions
- Water availability
- Anal cleansing material
- Menstruation
- User-friendliness (for children, etc.)
- Time constraints
- Design life
- Mandate of agency
- Financial constraints
- Availability of local materials
- Transportation means
- Human resources
- Operation and maintenance

6.2.1 Socio-political factors

The host country or central authorities are often reluctant to allow family units or long-term solutions to be provided for a displaced population. This is often because they do not want the affected population to feel that they are going to stay permanently in the affected area. This is generally unnecessary since people do not want to stay anyway, but where the authorities believe this, temporary communal facilities may have to be provided. If appropriate, permission for family or shared facilities should still be sought.

6.2.2 Socio-cultural aspects

The facilities provided should be as compatible as possible with the previous practices of the affected population and, where people have been displaced, also with those of the indigenous society. People are much more likely to use latrines if they are accustomed to the type of technology used. In addition, in some cultures it is unacceptable for different cultural groups to use the same latrine and this must be considered. Consultation with different groups within the affected community is essential to ascertain these factors.

6.2.3 Space

The availability of space will influence the type, design and density of latrines. For example, where space is limited family latrines may not be an option. Also, there may not be enough space to replace full pit latrines, meaning that some provision for pit emptying is required (see 6.9), or the distribution of latrines within the site may be severely limited.

6.2.4 Ground conditions

Ground conditions have a particular impact on latrines that rely on soil infiltration (such as pit latrines). The main considerations are

- Bearing capacity of the soil (to support superstructure)
- Soil stability (to prevent pit collapse and allow excavation)
- Depth and ease of excavation possible
- Infiltration rate
- Groundwater pollution risk

See Chapter 4 for more detailed information.

6.2.5 Water availability

An important constraint in deciding on wet or dry excreta disposal systems is the availability of water in the area. Often the quantity of water available in emergency situations is severely limited. If this is the case it is likely to be inappropriate to use latrines which rely on heavy water use, such as water closets. This factor must be weighed against whether the population will use dry systems, however. Where the local custom is to use water for anal cleansing this must be also be considered.

6.2.6 Anal cleansing material

The importance of anal cleansing materials should not be underestimated. These can have a big effect on sludge accumulation rates (see 6.8.9) and water use. It is important to consider the materials the community members usually use and the materials currently available. Care should be taken to avoid making assumptions by speaking to community members and inspecting existing defecation sites to determine what materials are being used in the present situation.

6.2.7 Menstruation

Women and girls of reproductive age need access to appropriate materials for the absorption and disposal of menstrual blood. Latrines should therefore allow for the disposal of women's sanitary protection, or provide women with the necessary privacy for washing and drying sanitary protection cloths in a hygienic manner. There may also be a need to supply appropriate materials for this use.

6.2.8 Time constraints

Time is especially important in the immediate stage of an emergency, when the aim is to provide facilities rapidly in order to minimise the spread of excreta-related disease in the affected area. Possible time-constrained scenarios include:

- the sudden occurrence of a natural disaster where most infrastructure is destroyed (e.g. flood or earthquake); and
- the mass movement of an affected population to an area where there are no facilities (i.e. movement of refugees or internally displaced people).

In the above scenarios, it is likely to be appropriate to begin with the provision of simple communal facilities which can be constructed quickly. The life span of these facilities will depend on how quickly the affected population can be mobilised to construct improved family units and how long the people are likely to be displaced.

Another time constraint could be the time taken to procure equipment and materials due to the scarcity of local resources. Where this is the case, immediate emergency measures should be taken until appropriate materials can be obtained.

6.2.9 Design life

The design life of the facilities to be constructed must be considered from the onset. If the affected population is staying in a temporary camp and it is known that they will be moving within a fixed period of time, temporary facilities must be designed accordingly. Conversely,

if it known that the population will be staying in the area indefinitely, solutions must be designed for long-term use. Often it is not known how long a situation will last and this is a frequent cause of controversy. Latrine programmes, therefore, should be designed in such a way that they can be adapted to suit changing circumstances.

6.2.10 Mandate of agency

Some implementing agencies have a mandate to deal with the initial stages of an emergency and after that to withdraw from the affected area or hand over activities to another agency. Furthermore, if the mandate of the agency is 'direct emergency response' then a relationship has to be worked out between it and those responsible for longer term solutions, otherwise tension may be created which could adversely affect the population concerned.

It is therefore essential that all agencies should consider a long-term solution in their outline design, allowing flexibility for upgrading even if they do not have any intention of implementing these plans themselves. Such an approach will help to ensure continuity from direct response to long-term solutions.

6.2.11 Financial constraints

The financial resources available to the implementing agency may influence the choice between communal or family facilities, and the type and quality of latrine selected. For this reason it is important that a draft budget is produced in the outline programme design and that materials (including transportation) and labour are properly costed.

6.2.12 Availability of local materials and tools

If facilities can be constructed from local materials this may reduce the implementation time and cost considerably. For these reasons it is important to ascertain what resources are available and whether they can be used without adverse effect on the local environment and economy. Detailed designs that rely on high-quality imported materials may be totally inappropriate when the logistics of procuring and transporting these items is considered.

6.2.13 Human resources

The skills and experience of the available personnel may be important constraints or opportunities for selecting appropriate interventions. Complex technical designs may be inappropriate if construction personnel are unable to implement them. If staff have solid experience of particular construction techniques, however, it may be appropriate to use these, although the high turnover of staff in some situations should be considered.

6.2.14 Operation and maintenance

The operation and maintenance (O&M) of latrines should be given equal emphasis to their construction. If responsibility for O&M has to be taken by the implementing agency (i.e. the end-users will not, or cannot, clean and maintain facilities) then only communal facilities should be provided. If community members are willing to take on the responsibility for O&M, however, family latrines may be a more appropriate option.

The availability of cleaning materials, the ease of cleaning of latrine slabs or basins, and facilities for emptying pits must also be considered in latrine selection and design.

6.3 Communal or family latrines?

It is widely accepted that family excreta disposal facilities are preferable to communal facilities. Many of the factors outlined in Section 6.2 may influence this decision, however.

6.3.1 Operation and maintenance

Perhaps the most important factor concerning the choice between communal and family latrines is operation and maintenance. Field experience tends to indicate that there is a direct relationship between the ratio of facilities to the affected population and the involvement of

Table 6.1. Advantages and disadvantages of communal and family latrines (adapted from Adams, 1999)

Factor	*Communal*	*Family*
Speed of construction	Can be constructed fast by well-trained and well-equipped team, although rate of construction limited by number of staff and equipment.	May take considerable time to train families in the initial stages, but large numbers of latrines may be built quickly.
Technical quality	Quality of design and construction easier to control but innovative ideas from users may be missed.	Potential for innovative ideas of users, but more difficult to ensure good siting and construction.
Construction costs	Use of materials can be easily controlled but labour must be paid for.	Construction labour and some materials may be free of charge, but families may not have the time or the right skills.
Maintenance costs	Maintenance, repair and replacement costs are easier to predict and plan, but staff are required to clean and maintain facilities in long-term.	Users take responsibility for cleaning and maintenance but recurrent costs are less predictable.
Technical possibilities	Heavy equipment and specialised techniques may be used where necessary (e.g. rocky ground).	Families may not be able to dig in hard rock or build raised pit latrines where the water table is high.
Cleaning and hygiene	Users do not have to clean latrines, but these are often dirty, and a greater mix of users increases the risk of disease transmission.	Latrines are often cleaner but many users may prefer not to be responsible for construction, cleaning and maintenance.
Access and security	Latrines may be less accessible and more insecure, particularly for women.	Latrines are often more accessible (closer to dwellings) and safer.
Development issues	People may lose or not acquire the habit of looking after their own latrine.	People keep or develop the habit of managing their own latrine.

that population in O&M activities Responsibility for O&M of communal latrines is often the source of tension or resentment, and as a result facilities may not be adequately maintained leading to increased health hazards.

It is also important to consider that it is possible to implement one type of facility parallel to another in such a way that they complement each other For example, communal latrines may be provided for new arrivals at a refugee camp but after a short period of time these are replaced with family latrines.

6.3.2 Advantages and disadvantages

There are many advantages and disadvantages of both communal and family latrines. The final decision will depend on a variety of factors as outlined in Table 6.1.

6.3.3 Communal latrine scenarios

It is likely that in the following scenarios communal latrines will be the most appropriate or only option:

- Hard shelters (schools, public buildings, factory buildings, emergency centres)
- Enclosed centres (prisons, hospitals, orphanages, feeding centres, etc.)
- Difficult physical conditions (e.g. rocky ground, high water table level)
- Over-crowded peri-urban areas
- Crowded camps with little available space (population density >300 per hectare)
- Transit camps where facilities are temporary
- Where the local authorities do not permit family units

6.4 Immediate measures

Immediate measures are designed for use in the initial stage of an emergency only.

6.4.1 Clearing of scattered excreta

Where indiscriminate open defecation is practiced the first step in excreta disposal is to provide designated defecation sites and clear existing scattered faeces. This is an unpleasant task and in some cultures it may be especially difficult to find willing and suitable personnel, but it is essential to minimise the spread of faecal-oral disease. Faeces can be covered with lime and should be removed to a safe disposal site such as a pit Workers must be provided with appropriate tools and protective clothing.

6.4.2 Controlled open field defecation

In the initial stages of an emergency, areas where people **can** defecate, rather than where they cannot, should be provided immediately. These should be located where excreta cannot contaminate the food chain or water sources. Open areas or fields surrounded by screening may be set up (Figure 6.2), with segregated sites for each sex. People should be encouraged to use one strip of land at a time and used areas must be clearly marked. It is also possible to use internal partitions to provide more privacy and encourage greater use.

It is essential that defecation areas are:

- far from water storage and treatment facilities;
- at least 50m from water sources;
- downhill of settlements and water sources;
- far from public buildings or roads;
- not in field crops grown for human consumption; and
- far from food storage or preparation areas.

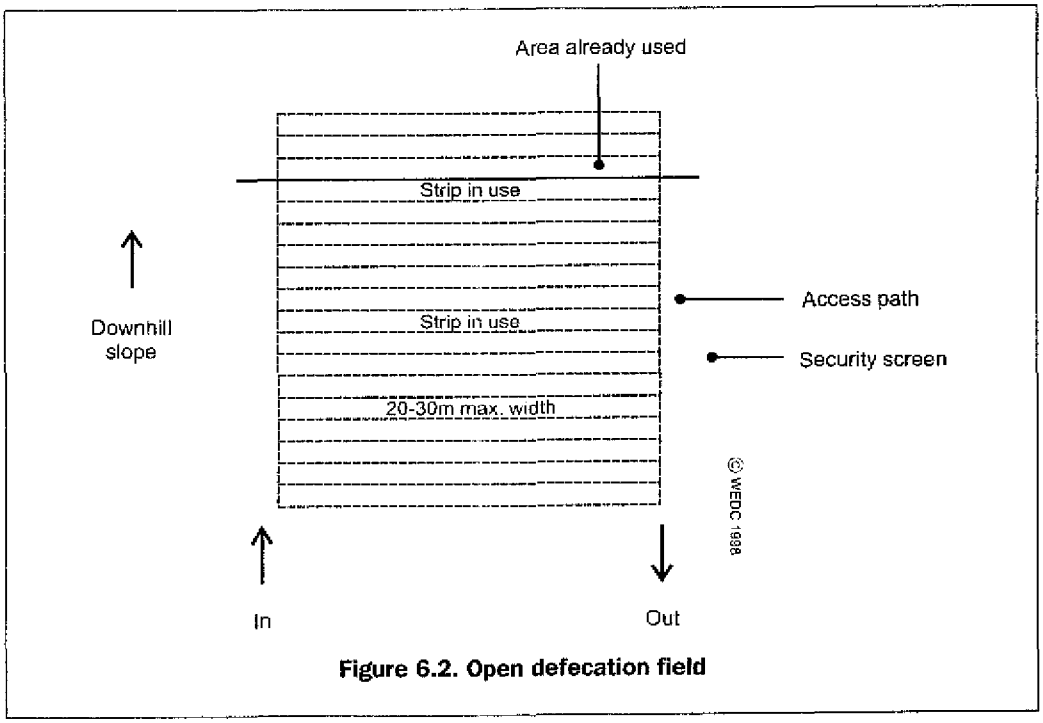


Figure 6.2. Open defecation field

Advantages: It is rapid to implement; minimal resources are required; and it minimises indiscriminate open defecation.

Constraints: There is a lack of privacy for users; considerable space is required; it is difficult to manage; ther is potential for cross-contamination of users; and it is better suited to hot dry climates.

6.4.3 Shallow trench latrines

A simple improvement on open defecation fields is to provide shallow trenches in which people can defecate (Figure 6.3). This allows users to cover faeces and improves the overall hygiene and convenience of an open defecation system. Trenches need only be 20-30cm wide and 15cm deep, and shovels may be provided to allow each user to cover their excreta with soil.

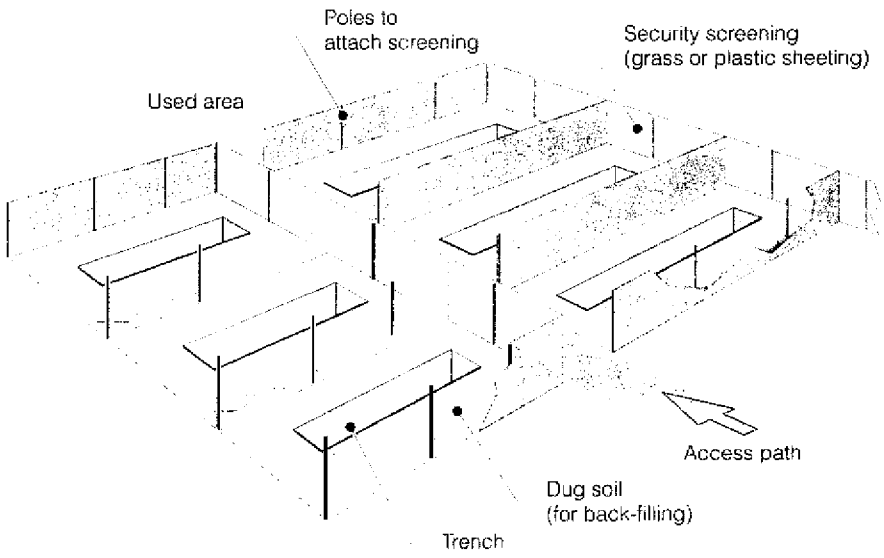


Figure 6.3. Trench defecation field

Advantages: It is rapid to implement (one worker can dig 50m of trench per day); and faeces can be covered easily with soil.

Constraints: There is limited privacy; a short life-span; and considerable space is required.

6.4.4 Deep trench latrines

Deep trench latrines are often constructed in the immediate stage of an emergency and will be appropriate if there are sufficient tools, materials and human resources available (see 6.5.3).

6.4.5 Shallow family latrines

In some situations it may be more appropriate to provide shallow family (rather than trench) latrines. This is particularly suitable where people are keen to build their own latrines or have experience of latrine construction. A shallow pit of approximately 0.3m x 0.5m and 1m deep may be excavated. Wooden foot rests or a latrine slab (approximately 0.8m x 0.6m) can be placed over this, overlapping by at least 15cm on each side. This latrine should be an immediate measure only and back-filling should occur when the pit is full to within 0.2m of the slab. A simple superstructure for privacy can be made from local materials (Figure 6.4).

Advantages: There is increased privacy; it is rapid to implement; reduced labour input is required from agency; and it allows people to actively participate in finding an appropriate solution.

Constraints: The community must be willing and able to construct family latrines; it can be difficult to manage siting and back-filling of pits; and large tools and materials required.

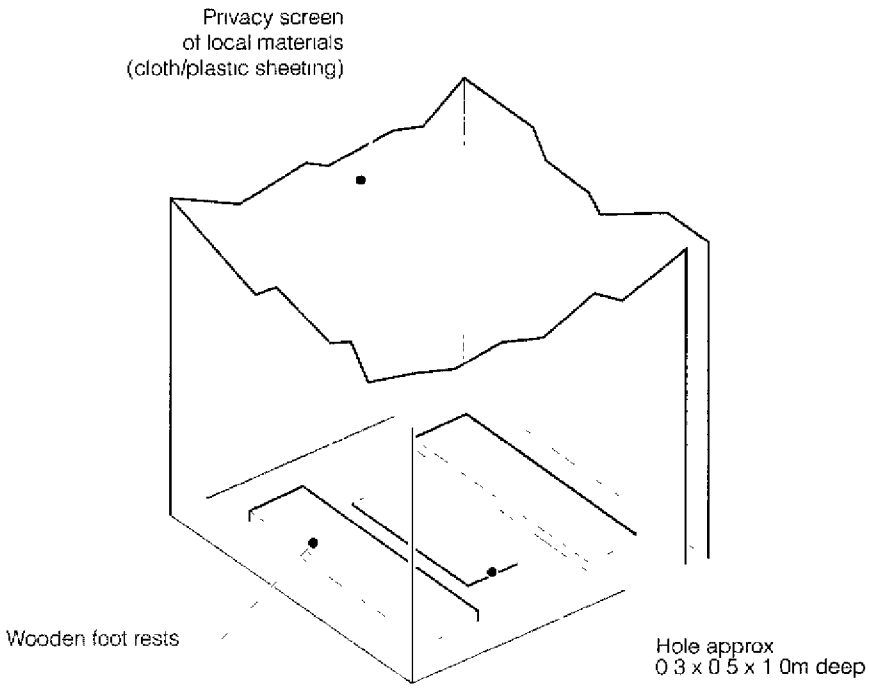


Figure 6.4. Shallow family latrine

6.4.6 Bucket/container latrines

In situations where there is limited space it may be appropriate to provide buckets or containers in which people can defecate. These should have tight-fitting lids and should be emptied at least daily. Disinfectant may be added to reduce contamination risks and odour. Containers can be emptied into a sewerage system, a landfill site or waste-stabilisation ponds. This measure will only be appropriate where there are no other immediate action options and users find the method acceptable, so it is not used in most situations.

Advantages: Defecation containers can be procured easily and transported; once the containers are provided only the final disposal system need be constructed; and they can be used in flooded areas.

Constraints: Many people find the method unacceptable; large quantities of containers and disinfectant are required; extensive education regarding final disposal is required; and containers may be used for alternative purposes.

6.4.7 Storage tank latrines

In some emergency situations, such as in flooded areas or where ground excavation is difficult, large storage tanks can be situated above ground with wooden platforms and a simple superstructure fitted above. Here the user must climb steps to the latrine and the

effluent is collected in the tank. This is suitable as an immediate or short-term measure only and the tank is likely to require regular emptying. A suitable emptying mechanism and final disposal site are therefore needed from the onset.

Advantages: Large storage tanks are often available in relief shipments; they are rapid to construct; and they can be used on rocky ground or in flooded areas.

Constraints: Regular emptying is required; a large number of tanks may be needed which could be used for other purposes; and appropriate materials must be available to build steps and simple superstructures.

6.4.8 Packet latrines

In some emergency situations relief agencies have provided disposable packet latrines. These are plastic packets (similar in appearance to a plastic bag) in which the user can defecate. The packets contain a blend of enzymes which assists the breakdown of the excreta and must be disposed of in a safe place.

Advantages: Packets are lightweight and easy to transport; and may be used where space is severely limited or in flooded areas.

Constraints: The method may not be acceptable to affected population; and final disposal site must be clearly marked, accessible and used.

6.4.9 Chemical toilets

Chemical toilets are commonly used on a temporary basis in developed countries. These are normally single prefabricated plastic units incorporating a sit-down toilet, lockable door and effluent tank containing chemicals to aid digestion and reduce odour. They have been used in emergency situations such as the Kosova refugee crisis in 1999. In general, however, they are an expensive and unsustainable solution.

Advantages: They are hygienic; and odour is minimised.

Constraints: They are high cost; difficult to transport; and require regular emptying.

6.4.10 Repair or upgrading of existing facilities

In some emergency situations the affected community may remain or be displaced in sites where there are existing sanitation facilities. These facilities may have been damaged, however, or may be inappropriate for the changed circumstances. In such cases the repair or upgrading of these facilities is likely to be the most appropriate intervention measure, but it will depend on how quickly this can be implemented as to whether this may be an appropriate immediate measure.

Advantages: The basic infrastructure is in place to build on; and indigenous technology and materials are used.

Constraints: There are limited expansion possibilities; and repair and upgrading may take time.

6.5 Technology choice: Longer term intervention

Once it has been decided whether communal or family facilities should be provided, and what the design life of these should be, the choice of technology must be made. The selection criteria outlined in Section 6.2 should be used to make this decision.

6.5.1 Open defecation

In some emergency situations it may be perfectly acceptable for the affected population to practice open defecation. Indeed, in some cultures defecating inside a latrine superstructure is unacceptable. Where people are accustomed to open defecation it may be appropriate to continue this, providing there is adequate space and vegetation to allow people to find an appropriate defecation space so that the risk of disease transmission is minimised. Such situations can be assessed in terms of excreta disposal space rather than facilities.

Advantages: There is no cost; and no construction activities are required.
Constraints: Practice is unsuitable where people are living in overcrowded conditions; large space is needed; and this is only acceptable if the population is already accustomed to such practice.

6.5.2 Simple pit latrines

Pit latrines are by far the most common technology choice adopted in emergency scenarios. This is because they are simple, quick to construct and generally inexpensive. Figure 6.5 shows a typical simple pit latrine.

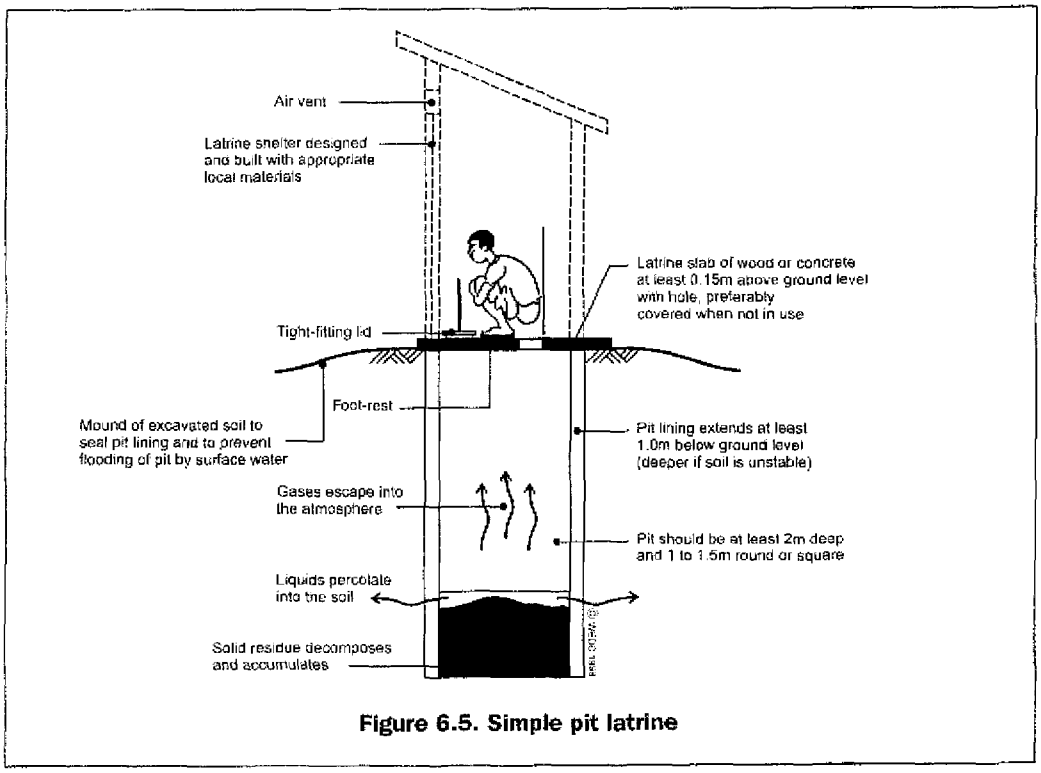


Figure 6.5. Simple pit latrine

The pit should be 2m or more in depth and covered by a latrine slab. The slab should be firmly supported on all sides and raised above the surrounding ground level to prevent surface water entering the pit. If the soil is unstable, the pit should be lined to prevent collapse (see 6.8.7). A squat or drophole is provided in the slab which allows excreta to fall directly into the pit. This can be covered with a removable lid to minimise flies and odour.

The superstructure can be made from materials available locally, such as wood, mud and grass, or can be a more permanent structure of bricks and mortar. The rate at which pits fill will depend on the sludge accumulation rate and the infiltration rate of the soil. Design and construction details can be found in Section 6.8.

Advantages: They are cheap; quick to construct; operate without water; and easily understood

Constraints: They are unsuitable where the water table is high, soil is too unstable to dig or ground is very rocky; and often have odour problems.

6.5.3 Deep trench latrines

If communal latrines are to be constructed, a common option is the construction of deep trench latrines (Figure 6.6). These operate on exactly the same principle as the simple pit latrine but involve the siting of several cubicles above a single trench. Care should be taken to not put too many latrines side by side. The recommended maximum length of trench is 6m, providing six cubicles.

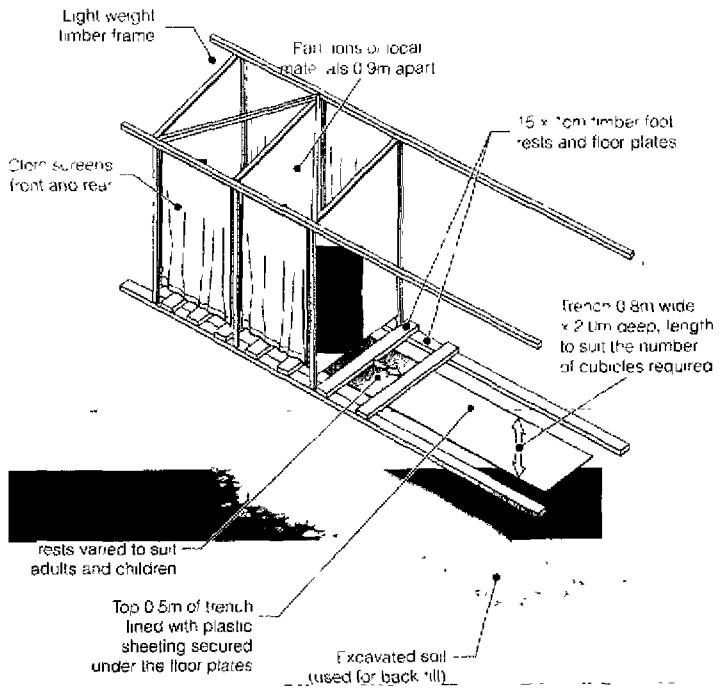
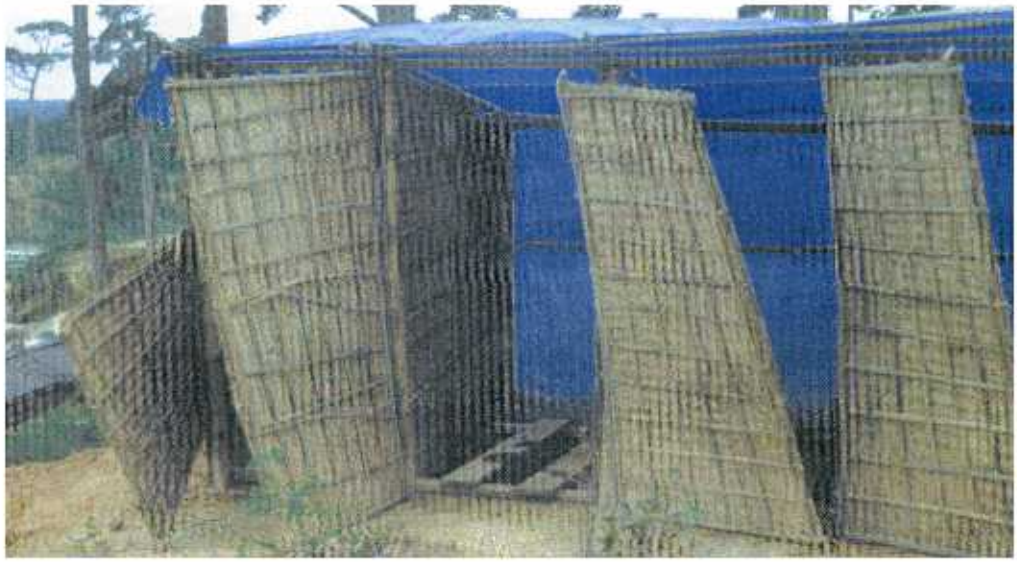


Figure 6.6. Deep trench latrines

Trenches should be about 0.8m wide and at least the top 0.5m of the pit should be lined. Wooden platforms can be used above the trench and covered with plastic sheeting and soil. Simple wooden footrests may be used beside each drophole in the immediate stage, to be replaced with plastic or concrete latrine slabs later.

Advantages: The same advantages as simple pit latrine

Constraints: The same constraints as simple pit latrine; and cleaning and maintenance of communal trench latrines are often poorly carried out by users.



Simple trench latrines, Bangladesh

6.5.4 VIP latrines

The Ventilated Improved Pit (VIP) latrine (Figure 6.7) is an improved pit latrine designed to minimise odour and flies. A vent pipe is incorporated into the design to remove odourous gases from the pit. This should ideally be situated outside the latrine interior, should extend at least 50cm above the latrine superstructure, and should be painted black to increase solar heating of the air in the vent pipe, causing it to rise (see 6.8.7 for more details). Air should be able to flow freely through the squat hole and vent pipe, therefore no drophole cover is required.

The open end of the pipe is covered with a gauze mesh or fly-proof netting which is designed to prevent flies entering the pit and to trap any flies trying to leave.

The superstructure interior should be kept reasonably dark to deter flies, but there should be a gap, usually above the door, to allow air to enter. This gap should be at least three times the cross-sectional area of the vent pipe (Franceys et al., 1992). Air flow can be increased by facing the door of the superstructure towards the prevailing wind. Each drophole should have its own compartment and there should always be **one vent pipe per compartment.**

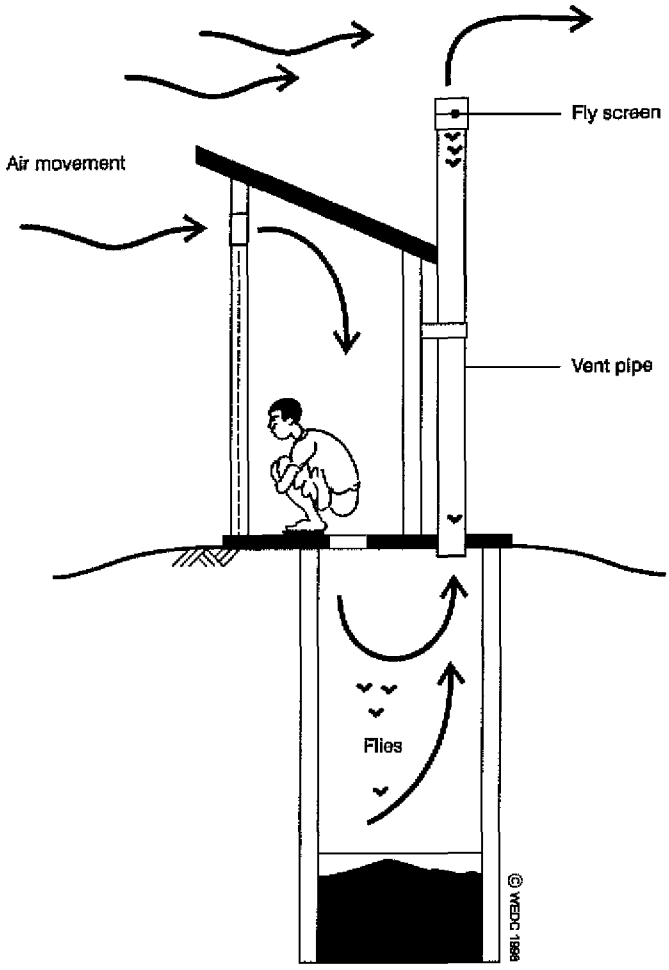


Figure 6.7. Ventilated improved pit latrine

Advantages: Odour and flies are reduced; and a good quality long-term solution.

Constraints: VIPs are difficult and expensive to construct properly; design and operation are often not fully understood; construction may take time; dark interior may deter young children from using the latrine; design does not deter mosquitoes; and there is an increased odour outside.

6.5.5 Pour-flush latrines

Pour-flush latrines rely on water to act as a hygienic seal and to help remove excreta to a wet or dry disposal system. The most simple pour-flush latrines use a latrine pan incorporating a shallow U-bend which retains the water (Figure 6.8). After defecation, a few litres of water must be poured, or thrown, into the bowl in order to flush the excreta into the pit or sewerage system below.

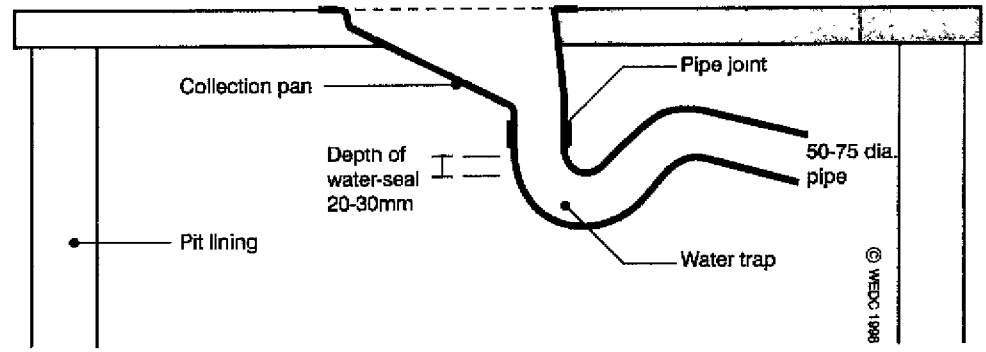


Figure 6.8. Cross-section of typical water-seal pan

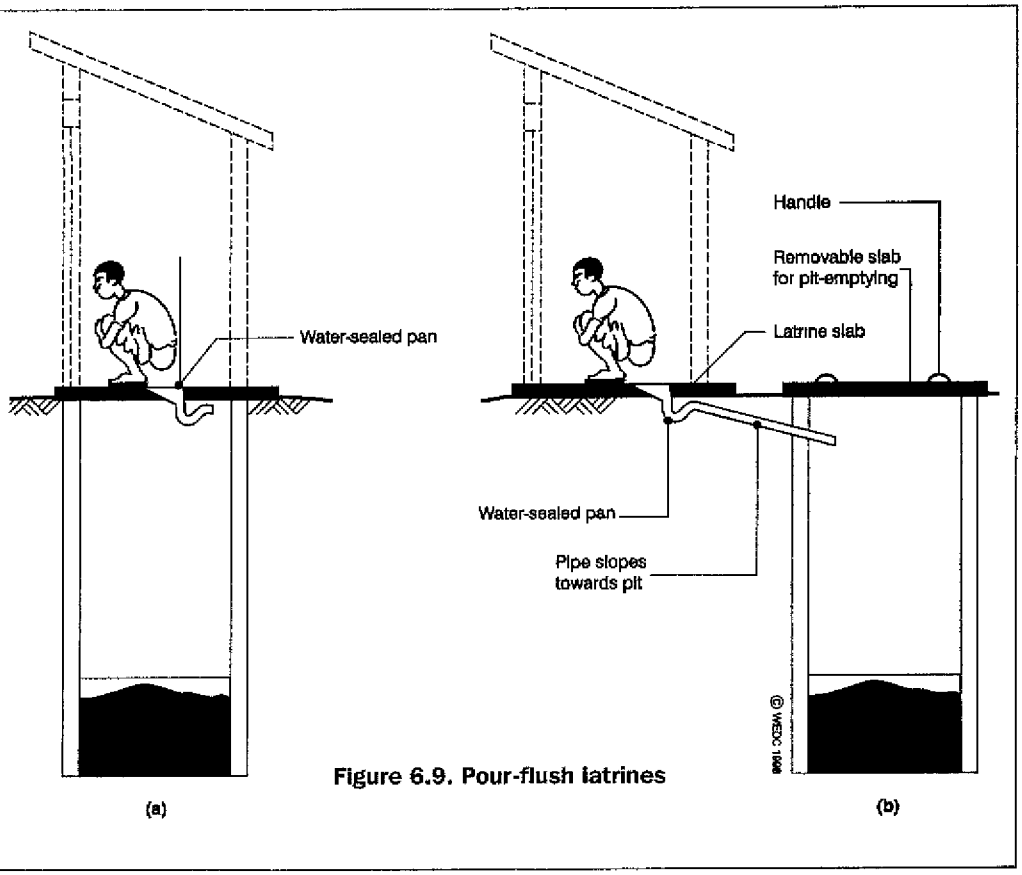


Figure 6.9. Pour-flush latrines

Pour-flush latrines may be constructed directly above a pit or may be offset, whereby the waste travels through a discharge pipe to a pit or septic tank (Figure 6.9).

Advantages: There is a lack of odour, ideal where water is used for anal cleansing; and they are easy to clean.

Constraints: An increased quantity of water required; solid anal cleansing materials may cause blockages; and they are more expensive than simple pit latrines.

6.5.6 Over-hung latrines

An over-hung latrine consists of a superstructure and floor built over water (Figure 6.10). A squat hole in the floor allows excreta to fall directly, or via a chute, into the water below. Over-hung latrines are rarely appropriate and should only be considered if other options are not possible, such as in areas prone to continued flooding. The receiving water must be sufficiently deep throughout the year, preferably should be saline to prevent human consumption, and should be flowing away from settlements.

Advantages: May be the only option in flooded areas.

Constraints: Can only be used where the contamination of the watercourse will have no adverse effect downstream, cannot be used over still water or where water is used for recreation, washing etc.; and superstructure must be solidly constructed and safe for users.

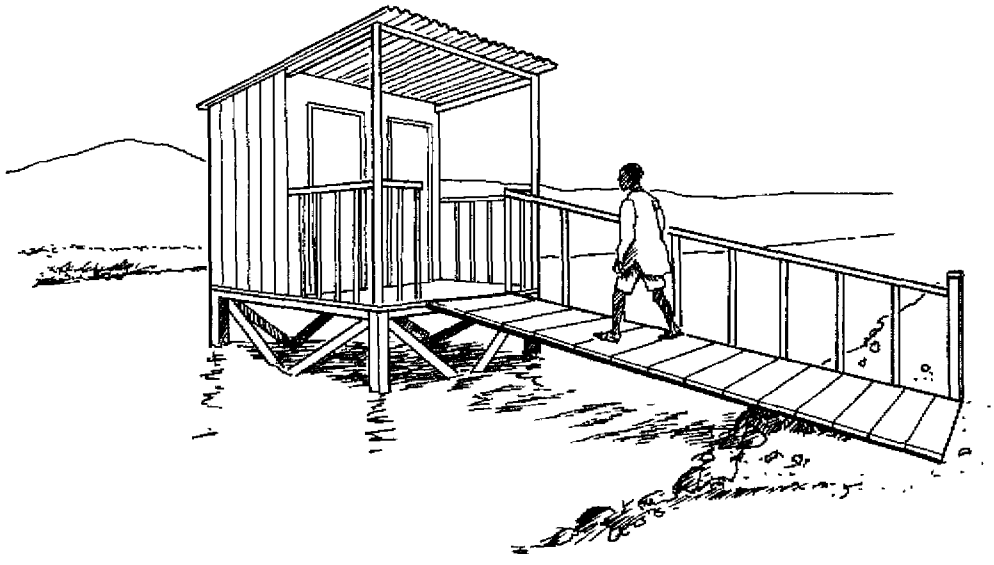


Figure 6.10. Over-hung latrine

Overhung latrine, Bangladesh

6.5.7 Borehole latrines

A borehole drilled by machine or hand-powered auger can be used as a latrine (Figure 6.11). This has a typical diameter of 400mm and a depth of 4-8m. At least the top 0.5 m should be lined although it is rarely necessary or appropriate to line the entire depth.

Borehole latrines are most appropriate in situations where boring/drilling equipment is readily available, where a large number of latrines must be constructed rapidly, and where pits are difficult to excavate, either due to ground conditions or lack of a suitable labour force.

Advantages: The borehole can be excavated quickly if boring equipment is available; suitable in hard ground conditions (where there are no large stones or rocks); and appropriate where only a small workforce is available.

Constraints: Drilling equipment is required; there is a greater risk of groundwater pollution; life span is short; sides are liable to be fouled, attracting flies; and there is a high likelihood of blockages.