VIP and ROEC latrines

Ventilated improved pit (VIP) and Reed's odourless earth closet (ROEC) latrines are improved types of pit latrine which help to remove odours and prevent flies from breeding and escaping. Excreta are collected in a pit which has a vent pipe covered with a fly-proof screen at the top. The difference between the VIP and ROEC is that the pit of the ROEC is offset from the floor of the latrine and connected to it by a chute. The pit of a VIP latrine is directly under the floor slab (see Figure 1).

In these latrines, air circulates down the squat hole or chute, into the pit and up through the vent pipe. This reduces smells in the shelter. It is important that there is a free throughflow of air into the shelter and into the pit, therefore no cover should be placed over the squat hole or seat. In order to ensure an unhindered flow of air, the top of the vent pipe must be at least 0.5 metres above the top of the shelter and the latrine must be well away from high buildings or trees.

The shelter of the latrine is kept semi-dark so that the principal source of light into the pit comes from the vent pipe. Flies in the pit are attracted to the light from the vent pipe, but as the vent pipe has a fly-proof screen at the top they cannot escape and eventually die. Flies outside the pit attracted to the top of the vent pipe by the pit odour cannot enter because of the fly screen.

When the contents of the pit reach 0.5 metres from the top, the pit is filled with earth and a new pit dug. A fruit tree can be planted on the site or the compost can be dug out after two years (when it will be safer to handle) for use as a fertilizer.

These latrines cost more to build and require more maintenance than a simple pit latrine. They are, however, still relatively low-cost and maintenance is straightforward. They are more pleasant to use than simple pit latrines because there is less smell and they are more hygienic. The ROEC has a greater capacity and needs replacing less often than the VIP, but the chute fouls easily with excreta and may allow fly breeding to occur. As with other latrines, if the VIP or ROEC are not used properly there is a risk of disease transmission.

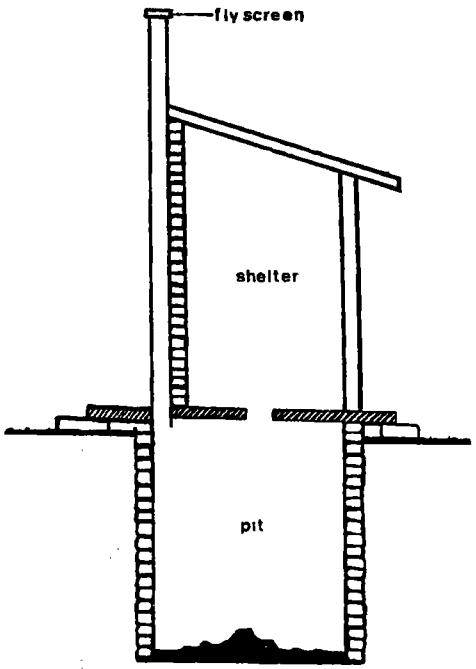

Figure 1. VIP latrine

The VIP latrine is at its most efficient if it is built with the door or opening facing into the prevailing wind to allow air to flow easily into the latrine. Air passing over the top of the pipe causes air to rise up the pipe, which is replaced by new air drawn in through the squat hole. This is called the windshear effect and is shown in Figure 2. The exposure of the pipe to direct sunlight also causes air in the pipe to heat and expand, which draws cooler air up from the pit, thus facilitating the air flow from the latrine to the atmosphere.

The effect of the movement of air from the pit up the vent pipe to the atmosphere is to reduce the odour inside the shelter, as only a small proportion of the pit air will rise into the shelter.

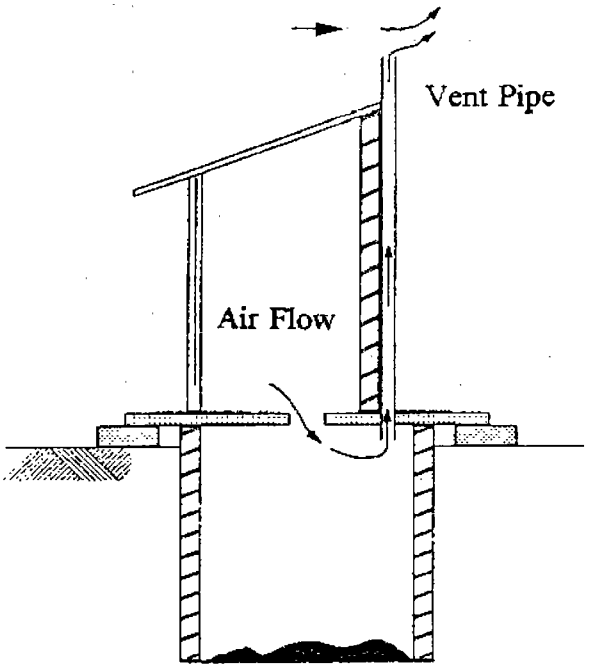

Figure 2. The windshear effect drawing air up the vent pipe

Where to build a VIP latrine

When planning a VIP latrine, the location must be carefully chosen :

- Downhill and an established minimum safe distance from the nearest drinking water source. The minimum safe distance will be site specific and should be determined for each water supply through an assessment of the hydrology and hydrogeology of the area. A distance of 30 metres has been suggested by some workers as standard practice. It is recommended that this figure is taken as a guide to establishing a minimum safe distance in the absence of local information.

- Near to, but downwind of the house.

- Not close to trees which will interfere with the airflow across the top of the vent pipe.

- On slightly raised ground so that rainwater can drain away easily.

Size of the pit

The pit should be as deep as possible but not below the water table, at least 1.5 metres, with vertical sides and 1 to 1.2 metres in diameter. Circular pits have stronger walls than square ones, although they are more difficult to construct. A volume of at least 0.06 cubic metres, per person for every year of anticipated life of the latrine is needed. This should not include the top 0.5 metres which will be filled with earth when a new latrine is built.

A greater volume, for example 0.1 cubic metres per person per year, should be allowed where bulky anal cleansing materials such as corn cobs or stones are used.

Example: A family of six, two adults and four children who build a latrine to last for five years:

Assuming that 0.06 cubic metres is needed per person per year, the volume required will be 5 years ´ 0.06 cubic metres ´ 6 people
= 1.8 cubic metres.

If the pit is 1 metre wide ´ 1 metre long, then a depth of 1.8 metres will be needed to provide this volume.

Adding 0.5 metres to the depth to allow for covering with soil when the pit is full means that the pit will have to be 2.3 metres deep

An example of the method for calculating pit size is shown in the box below.

Provided that the soil is sufficiently permeable, urine and the liquid part of excreta will seep into the ground through the walls and floor of the pit.

The pit should not be dug down into the groundwater and should be at least two metres above the water table, particularly where groundwater sources are used for drinking water, for instance from wells or springs. This is because of the danger of contamination of groundwater by faecal material. If the water table is very high, then the latrine can be built on a mound, as described below.

It may be necessary to provide support to prevent the pit walls from caving in. This is particularly important where latrines are dug in loose sandy soils or clays prone to shrinkage. In stable soil, the top 0.5 metres of the pit should be lined to support the squatting plate or floor.

Mound-built latrines

The presence of solid rock or a high water table near the ground surface generally prevents the construction of pit latrines. In such circumstances, the latrine can be built on a mound, as indicated in Fact Sheet 3.4.

Lining the pit

A wide variety of materials can be used to line the pit, as indicated in Fact Sheet 3.4. Examples include concrete blocks, bricks, cement-stabilized soil blocks, masonry, stone rubble, perforated oil drums and rot-resistant timber. Where blocks, bricks, masonry or stones are used, the lining joints should be fully mortared in the top 0.5 metres of the pit. Below this, the vertical joints should be left unmortared to allow the liquid part of the excreta to infiltrate into the soil.

The base or foundation

The base or foundation serves as a solid, impervious foundation upon which the floor (or squatting plate) can rest and prevent the pit from being flooded by surface water. It also helps to prevent the escape of hookworm larvae (which can climb up the pit walls) and the entrance of burrowing rodents into the pit. The base should be high enough to raise the floor at least 100 to 150 millimetres above the level of the surrounding ground to protect the pit from flooding (see Figure 3).

The following materials may be used to construct the base or collar, depending upon local availability and cost. The base or collar may be circular or square :

- Plain or reinforced pre-cast concrete, using a mix of cement : sand : gravel of 1 :2 :4 or 1 :3 :6.
- Brick - dried mud, burned mud, adobe, etc.
- Rough-cut logs - hardwood and termite resistant.

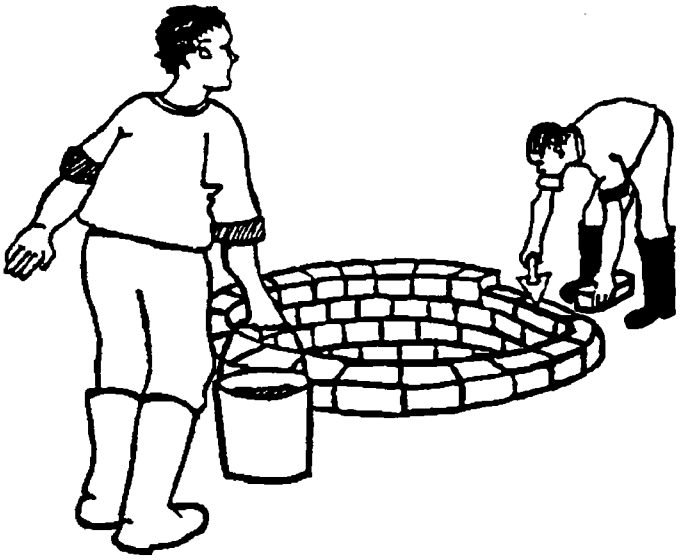

Figure 3. Latrine base or collar

The floor or slab

The floor or slab supports the user and covers the pit. It should fit tightly and be flush with the outer edge of the base. The slab must be larger than the pit and rest firmly on the foundation or base to avoid the danger of collapse.

The floor or slab can be made from reinforced concrete, rot-resistant wood or bamboo covered with a layer of mud and cement mortar. The slab should have a smooth surface and ideally slope towards the squat hole to provide easy drainage for urine and water used for cleaning the floor. A concrete slab is heavy and will need several people to lift it onto the base.

The floor or slab may be of the squatting type or provided with a raised seat. The opening should be no bigger than 250 millimetres, so that it is too small for a young child to fall through. A keyhole shape with foot rests is ideal, as shown in Figure 4.

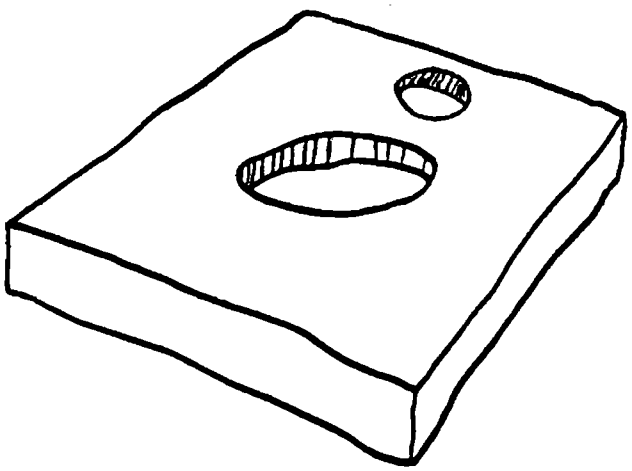

Figure 4. Concrete floor or slab

Instructions for making a simple floor slab are presented below.

To construct a simple reinforced concrete covering slab :

- Dig a square, shallow pit, about 200 millimetres wider and longer than the pit and 50 millimetres deep. Be sure that the bottom of the pit is level and smooth (see Figure 5).

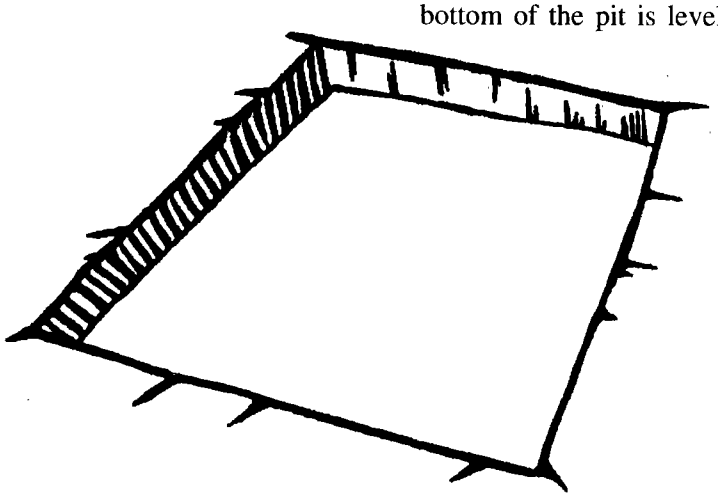

Figure 5. Preparing a pit for cover slab casting.

- Make or cut a wire mesh or grid to lie inside the pit. The wires can be 6 to 9 millimetres thick and about 200 millimetres apart (see Figure 6). Cut a hole about 250 millimetres in diameter in the middle of the grid.

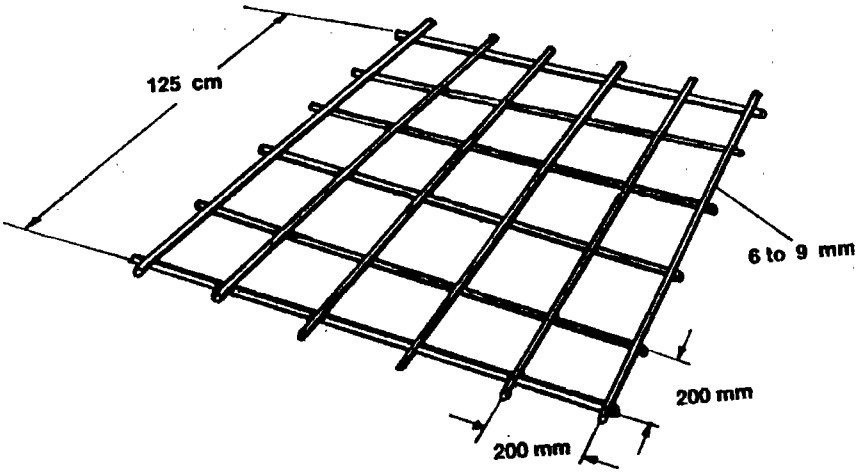

Figure 6. Re-inforcement grid

- Put the grid in the pit. Bend the ends of the wires, or put a small stone at each corner, so that the grid stands about 2-3 millimetres off the bottom of the pit (see Figure 7).

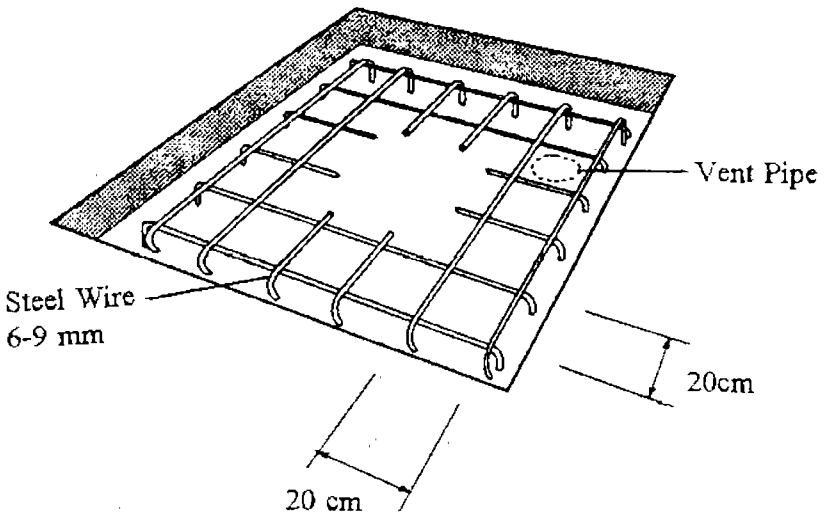

Figure 7. Laying the grid in the pit

- Put an old bucket with a bottom about 200 millimetres across or a template in the shape of a keyhole in the grid (see Figure 8).

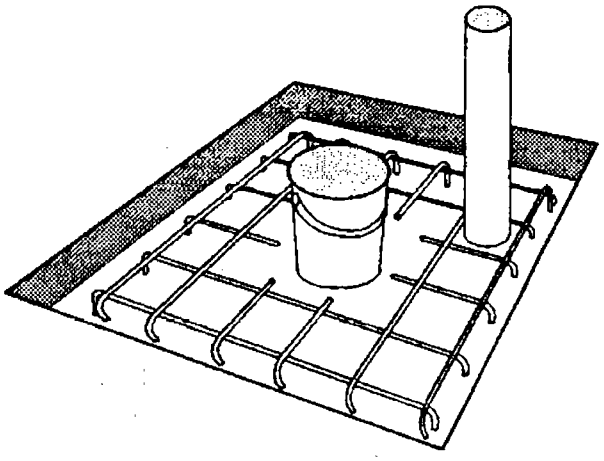

Figure 8. Making the squat hole

- Mix cement with sand, gravel and water (with each shovel of cement, mix 2 shovels of sand and 4 shovels of gravel). Mix well and pour it into the pit until it is about 50 millimetres thick (see Figure 9).

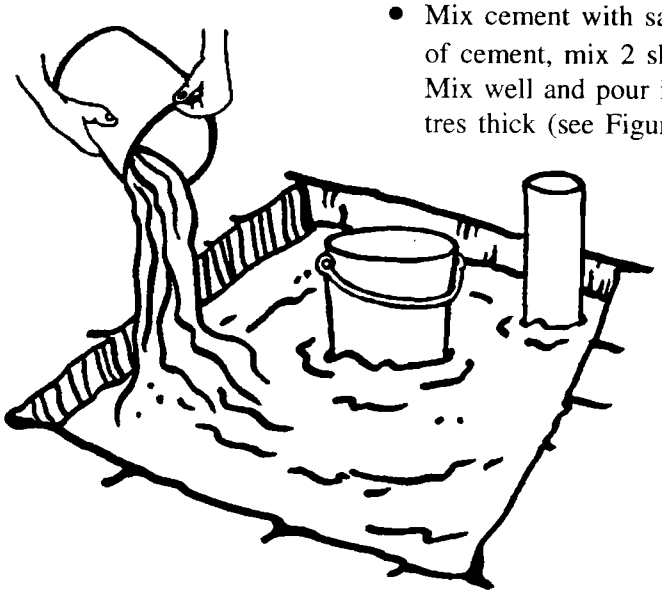

Figure 9. Laying the slab

- Remove the bucket when the concrete is beginning to harden (after about three hours). Then cover the cement with damp cloths, concrete bags, sand, hay or a sheet of plastic and keep it damp. It is important that the concrete is kept damp for five days to reach its full strength. Remove the slab after five days.

The vent pipe

Thin-walled, dark coloured vent pipes, with a minimum internal diameter of 100 millimetres, are the best type of vent pipe. Suitable examples include black painted PVC or fibre-cement. Brick chimneys constructed as part of the shelter will also work adequately, provided the internal walls are made smooth and internal measurements are not less than 225 millimetres by 225 millimetres. A pipe made from cement-plastered hessian sacking, with a chicken wire frame, with a 200 to 250 millimetre internal diameter or cement-plastered split bamboo or reeds may also be used as vent pipes.

The vent pipe should have a fly screen on the top opening to prevent access to insects. Most metal screens are destroyed quickly because the gases coming up the pipe from the pit are very corrosive, although aluminium, copper or stainless steel screens do work well. PVC-coated glass fibre mesh can be used, but will not last more than five years. The openings in the screen should not be smaller than 1.2 millimetres by 1.5 millimetres so that the air flow is not blocked.

The shelter

To give the best fly control, the inside of the shelter should be as dark as possible. The shelter must also provide a free throughflow of air, which is required for odour removal. One way of achieving this is to construct a spiral shelter with no door, so that just sufficient light comes in from the entrance for users to see by, whilst allowing a free throughflow of air into the shelter and pit. Figure 10 shows an example of a spiral VIP latrine and Figure 11 shows an example of another type of shelter.

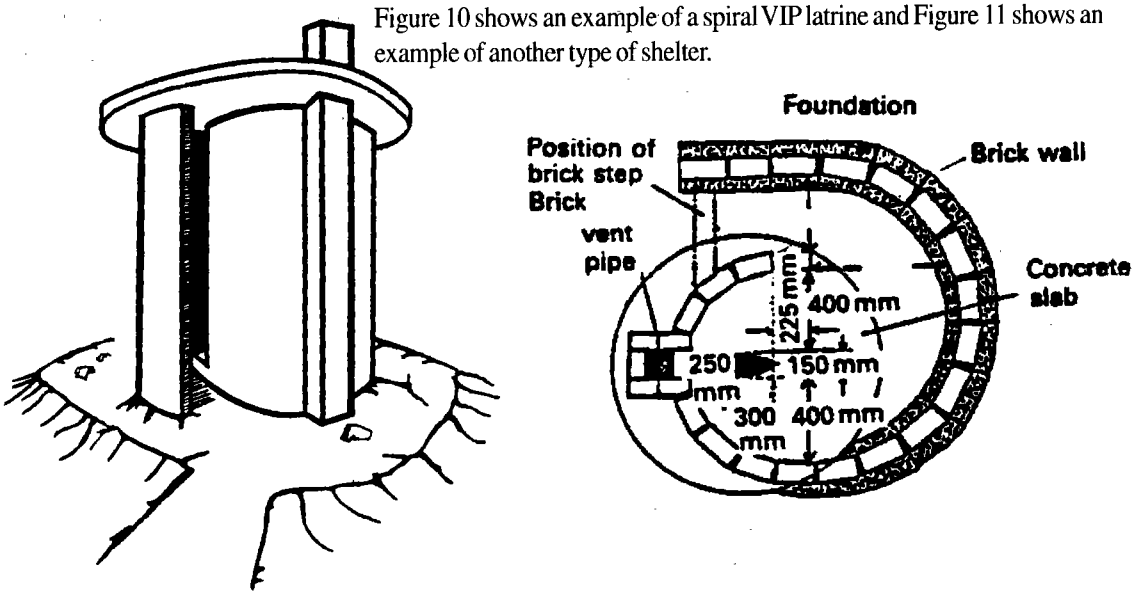

Figure 10. Spiral VIP latrine shelter

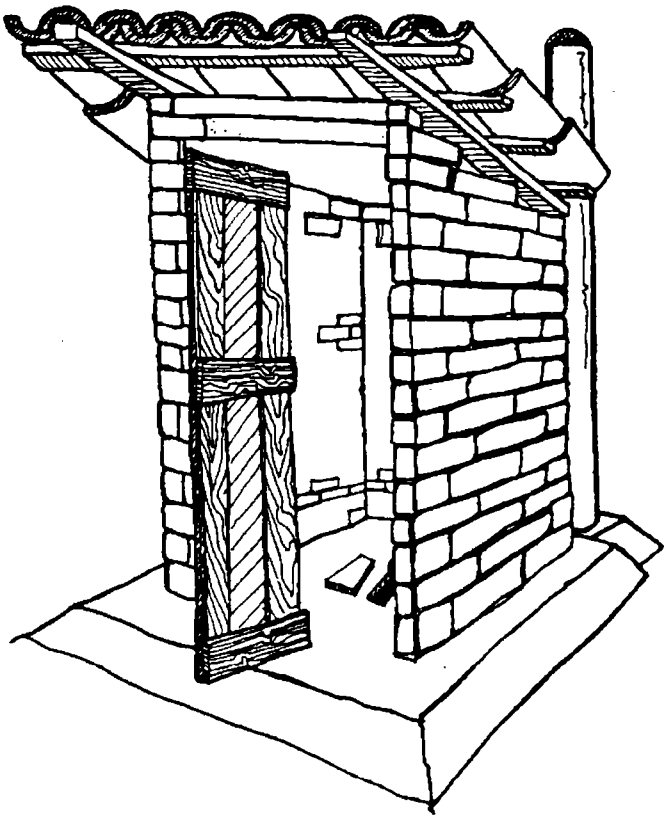

Figure 11. Latrine shelter

If a door is used on the shelter, it must be kept closed to ensure that the interior of the shelter is kept as dark as possible.

Use and care of the VIP latrine

VIP latrines require a minimum level of day-to-day operation and maintenance :

- The most important aspect is cleanliness. A latrine which is dirty and soiled with excreta will soon be abandoned. The cover slab and squat-hole must be cleaned daily using water or ashes.
- Grass or plants growing around the latrine should be kept well cut.
- Cracks in the cover slab or foundation and holes in the mound which lead directly into the pit should be filled.
- The squat-hole or raised seat must be kept open, as covers prevent the circulation of air which is essential for fly and odour control.
- The fly screen must be regularly checked for damage and replaced if necessary. It should also be cleaned every month by pouring a small amount of water down through the vent pipe to clear away cobwebs and dead flies which may block the air flow and the entry of sunlight.

- Do not deposit tins, glass or plastic inside the pit.
- To stop mosquitoes breeding in pits, the pits should be kept as dry as possible. If too much water has got in, ashes or dry horse or cow dung thrown into the pit every week helps to absorb water and odours.
- No disinfectant should be added to the pit.
- When the pit is full, that is when the contents reach a level of 0.5 metres from the squatting plate, the pit must be filled in with soil. In areas where excreta are used as a fertilizer, the pit should be left for two years before the contents are safe to handle.
- During an epidemic, the floor of the latrine should be cleaned with a disinfectant such as bleach (sodium hy-