Available sanitation technologies
for rural and peri-urban Africa

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For most parts of rural and peri-urban Africa the pit toilet remains the most commonly used sanitation technology.
This is likely to remain so for a very long time.

The pit toilet has several merits:
It is relatively easy to build and use
It is a lower cost option
It is adaptable

Its disadvantages are:
It can smell and breed flies
It can collapse
It can pollute ground water
It eventually fills up

There are several variations and adaptations of the pit toilet. These include:

The cat method
(dig and cover)
The traditional pit toilet.
(many variations)
The pit toilet with concrete slab and cover
(San-plat)
The shallow pit compost toilet
(Arborloo)
The shallow double pit compost toilet
(Fossa alterna)
The ventilated improved pit toilet
(VIP)

Other sanitation technologies which have application are:

The conventional flush toilet
(with septic tank)
The pour flush toilet
(with septic tank)
The urine diverting toilet
(with above the ground vault)

(note the urine diverting toilet can also be adapted to fit over a shallow pit system)

The cat method
(dig and cover)

This is one step above defecation on the ground, but is a big step because the feaces are contained and covered and being surrounded by soil they decompose into compost quickly.

It does however require extra effort to use it (with spade or shovel) and privacy has to be sought.

The traditional pit toilet.

This is by far the most common toilet system in use. A hole dug in the ground, lined or unlined, fitted with cover slab of wood, soil or concrete and with a superstructure of many different materials.

The traditional pit toilet.

Pit toilets are usually very smelly and fly ridden especially during the hotter and wetter months. Many are built with logs across the pit and mud covers. These can collapse as a result of termite attack. Urine absorbed by the mud can smell. If unlined they may collapse, especially of the "house" is made of bricks or the water level rises in the pit.

They can contaminate ground water and it is wise to distance wells from deep pit toilets by 30m.

This may be possible in the rural areas but not in high density settlements.

The pit toilet with concrete slab and cover

(San-plat)

The San-plat is a concrete slab with a fitting concrete lid attached to a wire handle. It can be fitted over logs on a traditional pit toilet or over a brick lined pit. Or over an unlined pit. The can be made in a round or square shape or in a round domed shape. It offers a hygienic surface in the toilet house which can easily be cleaned down.

The pit toilet with concrete slab and cover (San-plat)

The San-plat is used in many countries in Africa. It is also used as part of the Arborloo in some countries like Malawi and Ethiopia.

The shallow pit compost toilet

(Arborloo)

This is a shallow unlined pit (max 1m deep) fitted with a slab (normally concrete) in which regular additions of ash and soil are made. These promote composting and reduce fly breeding and odour if added in sufficient quantities. When the pit is nearly full the slab is removed, the pit filled up with soil and a tree planted. The slab is moved to a new location. Trees (and vegetables like pumpkin) grow well using the nutrients in the compost.

The shallow pit compost toilet

(Arborloo)

The addition of ash to pits is traditional in many African countries. It certainly helps to control odours and flies. Soil adds bacteria which help the composting process. The soil and ash can be mixed together to add to the pit. The potassium in ash also helps better fruiting in fruit trees added later. Adding leaves also produces better compost.

Recycling potential

With portable structures on shallow pits, the addition of soil and ash to the excreta in the pit reduces the fly and odour nuisance and also promotes composting in the pit. It is possible to grow trees on such pits (Arborloo concept).

The shallow pit compost toilet

(Arborloo)

Trees of many different species can be added to Arborloo pits. They can provide fruit, fuel, building materials, shade etc. Fruit trees can also grow in marginal areas like the Rift Valley. In the Rift Valley of Ethiopia, below.

The shallow double pit compost toilet

(Fossa alterna)

In this system two shallow composting pits are used each about 1.5m deep. They can be housed in a permanent structure or separated and fitted with a portable structure. Composting is accelerated by the regular addition of soil, ash and leaves. This system operates on a 12 month cycle with the composting time balancing the pit filling time. Each year compost is removed from one pit and the slab is moved from filled pit to empty pit. The filled pit is covered with a thick layer of soil.

The shallow double pit compost toilet

(Fossa alterna)

The removed compost can be dug in to vegetable gardens or used to fill pits dug for trees (tree pits). It can also be bagged ready for adding to maize or vegetable beds.

Recycling potential

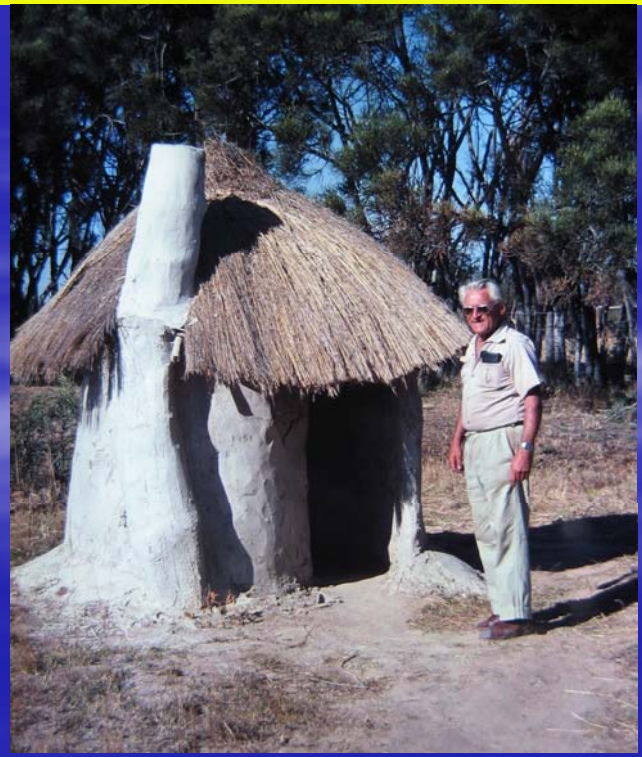
If two alternating pits are used (Fossa alterna) the pit compost can be excavated and used on the garden after a year of composting.

If two ring beams are used, the unused ring beam can be turned into a "ring beam garden" for growing vegetables whilst the other ring beam is used for the toilet. Small "ring beam gardens" can be very productive.

This method is being tried at Hopley Farm through a UNICEF supported programme.

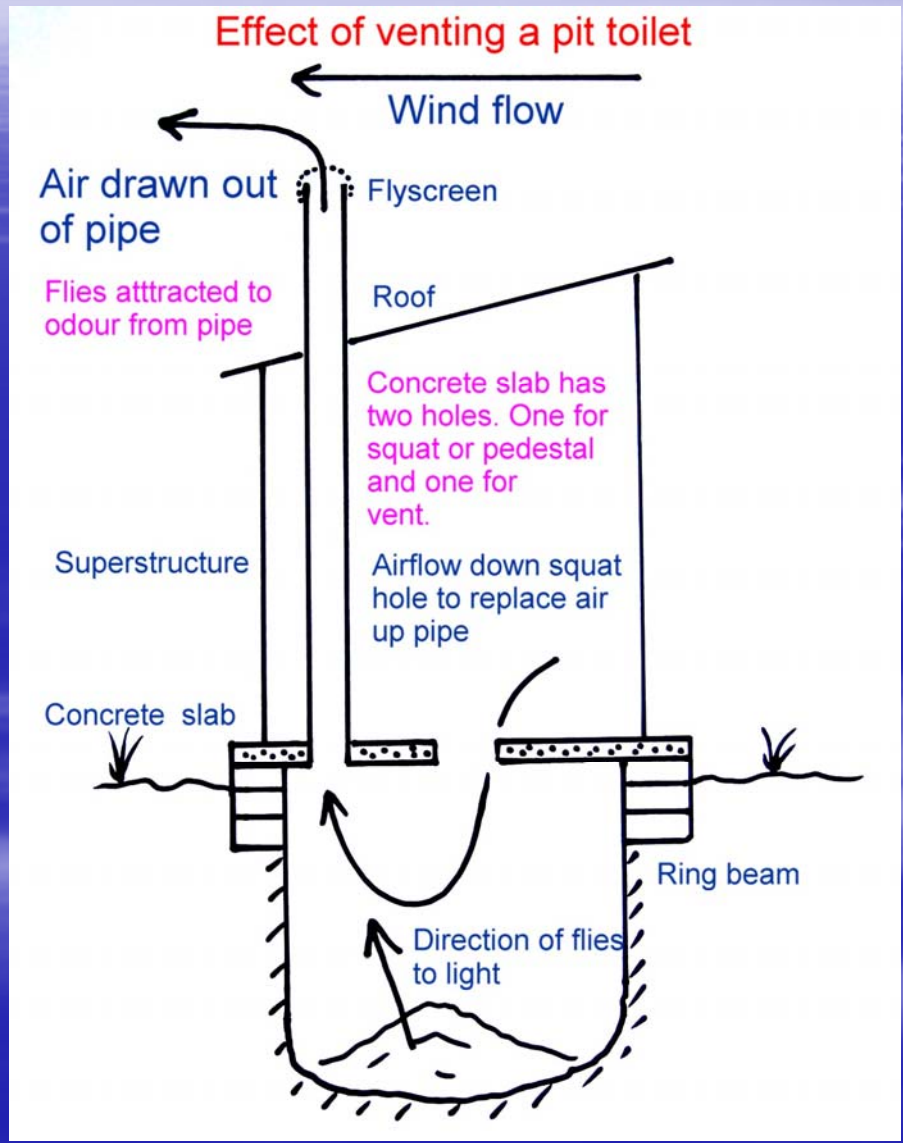
The ventilated improved pit toilet (VIP)

A VIP toilet was designed to control odours and flies in a pit toilet. It uses a vent pipe to draw air out of the pit. The vent pipe also acts as a fly trap, when the superstructure is semi – dark. There are many ways of building VIP toilets, including low cost options.



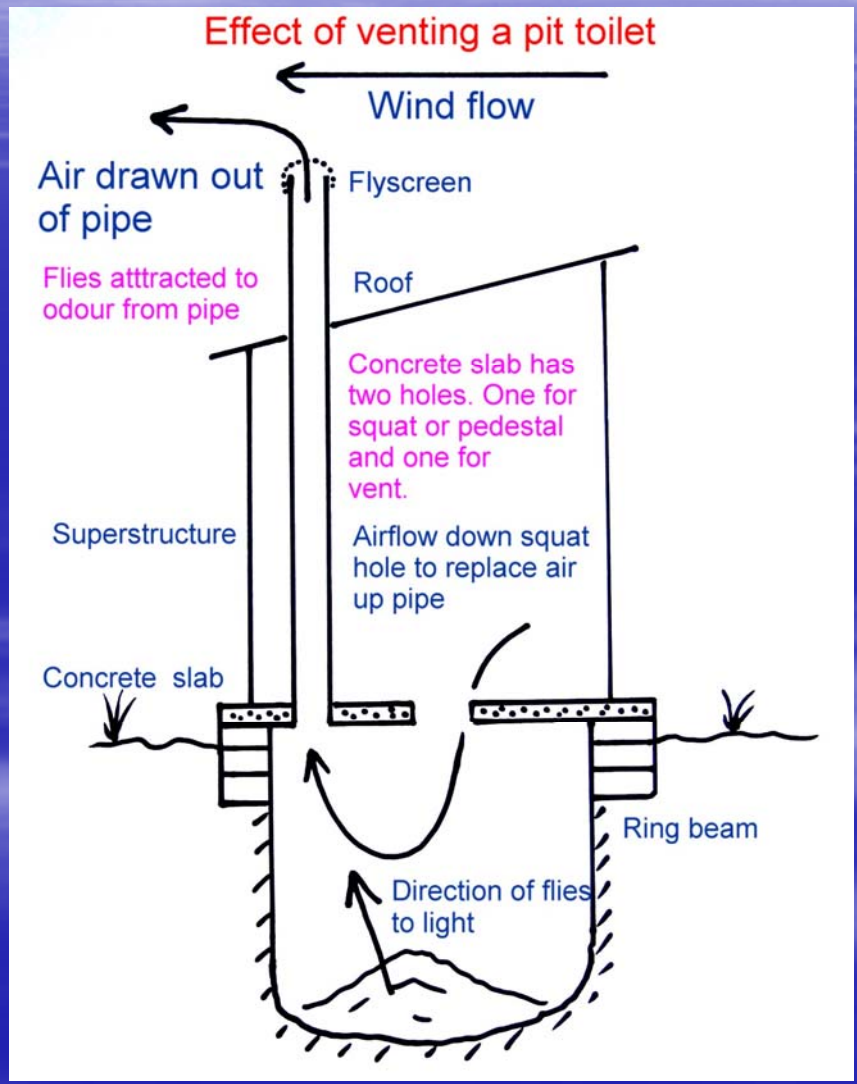
The VIP Latrine
How it works
1. Air flow

- The VIP Latrine is a pit latrine which uses a screened vent pipe to control odours and flies.
- A concrete slab covering the pit has two holes caste in it - one for the squat hole and one for the vent pipe
- A “superstructure” is built over the squat hole for privacy
- The pipe draws out odours from the pit mainly from the effect of wind passing over the pipe head.
- Pipes which get warm in the sun also draw air.
- Air passing up the pipe is replaced in the pit by air drawn down the squat hole. Thus odours from the pit do not pass into the structure



The VIP Latrine – How it works
2. Fly control

- Flies are attracted to odours when they enter a pit
- Flies are attracted to light when they leave a pit.
- If the latrine structure is roofed and the door is closed the interior becomes semi dark.
- With the vent pipe in place, bad air from the pit will escape only from the pipe head. Thus flies from outside will be attracted to the pipe head.
- If the pipe is fitted with a fly screen, flies will not be able to enter the pit.
- Any flies in the pit will be attracted to the light coming down the pipe if the latrine is semi dark inside. They too will be trapped by the screen.
- Thus the pipe acts as both a pit ventilator and a fly trap at the same time. It is simple and uses the forces found in Nature .



The ventilated improved pit toilet (VIP)

A VIP toilet has the following characteristics

1. A screened vent pipe
2. A structure which is semi dark
(ie roof and door-less spiral or self closing door)
3. A good seal between slab and pit
4. A free air flow down the squat hole or pedestal and up the pipe

Note that it is not essential that the structure be made of bricks and the type of pit lining is not specified in the design.

A range of low cost VIPs have been designed for construction with varying levels of cost.

VIP Toilets

There are many ways of building VIP toilets. Brick is the most commonly used material. Pits are normally lined with bricks. The structure must have a roof.

Aborloo's fitted with vents and using semi-dark structures can become variants of the VIP.

Life of the VIP pit

Blair VIP latrines built in Zimbabwe during the 1970's had large pits, 1.5m in diameter and 3m deep. The pit had a long life. Later Blair VIP toilets had smaller pits to save on cost, but did not last as long. The photo below shows a Blair VIP Latrine built. in 1976. The same unit was still in use in 2006, 30 years later.

Making and fitting a low cost vent pipe

There are several ways of making home made vent pipes which are much cheaper than the commercial units. The most durable method is to use strong cement slurry made of a mix of PC15 cement, river sand and pit sand and water. The ratio is 1 part cement, 1 part river sand and 1 part pit sand. This is applied as slurry to material like old clothing or cement bags over a mould which may be made of PVC, grass or even plastic bottles with their tops and bottoms cut off and taped together. Making homemade pipes will be described in more detail in another power point.

Technology of the pit structure

The pit structure is an important part of any pit toilet. In firm soils it may not require lining, but if a heavy brick structure is built it is always best to line the pit.

With lighter structures and soil which is moderately firm a ring beam method may be used to line the pit. This reduces cost and hastens the construction.

For lighter structures start with 2 basic building components:

1. The concrete slab

2. The ring beam

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Lighter structures

1. *Using ring beams on unlined pits for lightweight structures. The ring beam (in this case concrete) is caste and sets. The pit is dug inside the ring beam.*

The slab is caste and allowed to cure. It is then placed on top of the ring beam.

2. Digging and lining pits with bricks using a method called corbelling where a smaller slab can be fitted.

Lining pits with bricks

Corbelling

The brickwork is stepped in – about 20 -25cm for every course. This method makes it possible to fit a small slab over a large pit.

Economy pit lining

With care and careful measurement of cement and sand it is possible to line a pit with bricks down to two metres and even make a concrete slab to fit on top with a single bag of cement. In the photos shown below at Hopley Farm a single bag of masonry cement was used to make a 1.2m slab and mortar to brick line a 2m deep pit.

Superstructures

A huge range of superstructures can be built on brick lined pits. On unlined pits fitted with a ring beam, the structures should be light weight and portable. On lined pits the superstructures can be made of bricks.

Urine diverting toilets

They use special pedestals or squat plates which separate the faeces from the urine. The appearance of the toilet can vary enormously. Examples from Mexico and Malawi

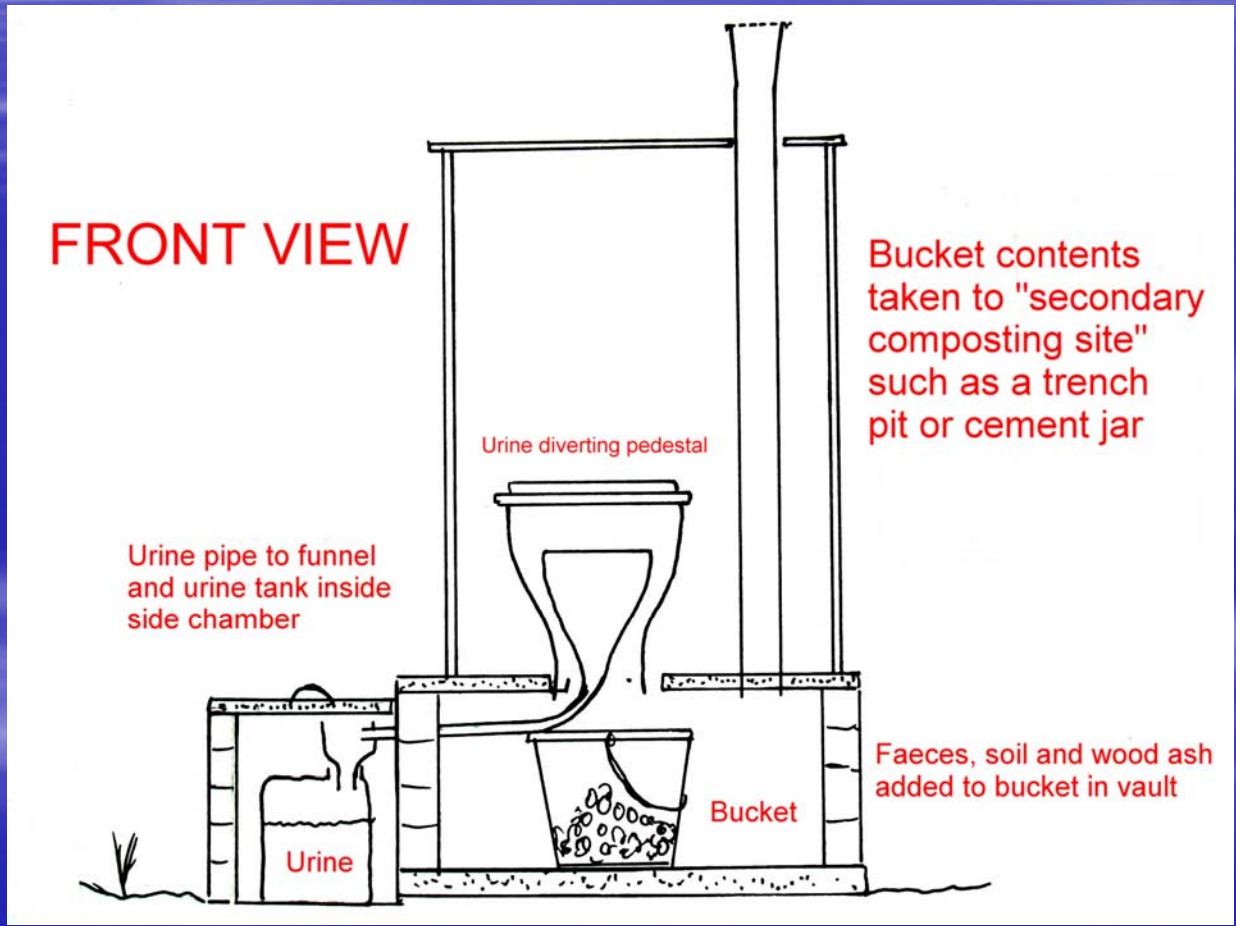
When urine is separated from faeces, the faeces are easier to handle, and the urine can be used to fertilise vegetables and maize

The urine is diverted with special pedestals or squat plates

Examples from South Africa and Kenya

Most urine diverting toilets use two alternating vaults to retain the faeces but it is possible to use a single vault

Parts of the single vault urine diverting toilet



Hand washing

Every toilet should be fitted with a hand washing device. They can be made at low cost.

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Conclusions

A large range of sanitary hardware is available for use in a wide range of environments. Both high cost and low cost methods can be used depending on local conditions. New concepts are being explored that link sanitation with other vital areas of development like agriculture and forestation. The book on sanitation technology development is not yet fully written!