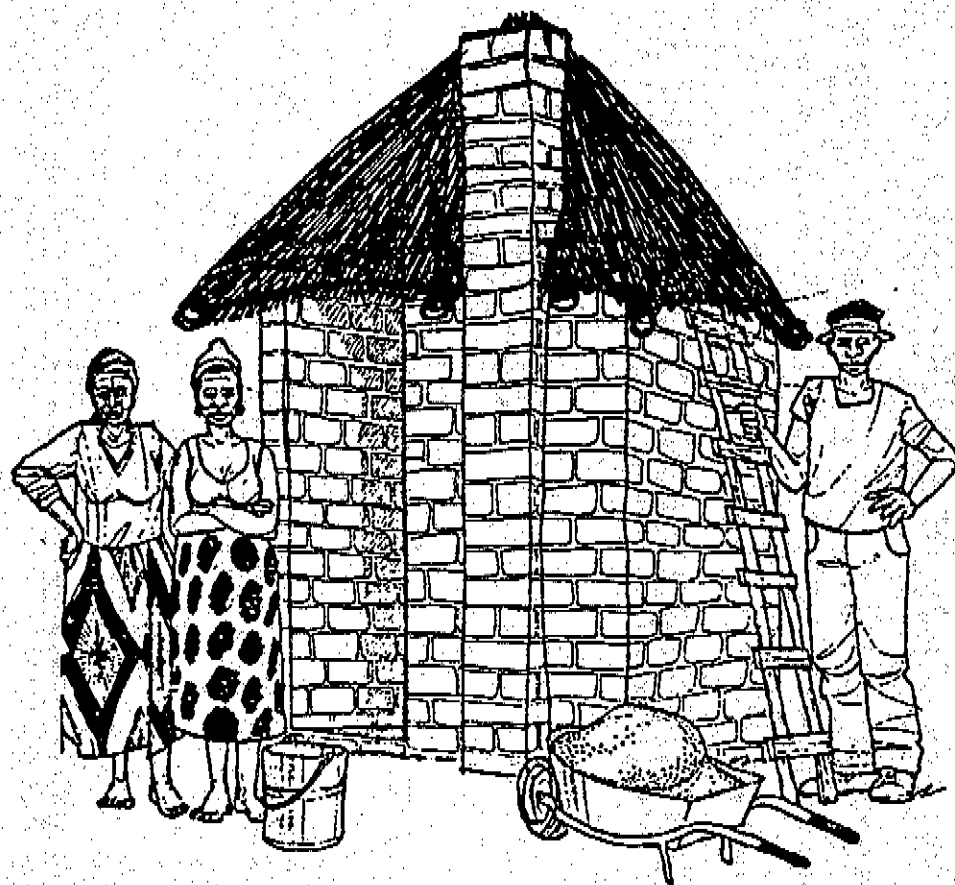
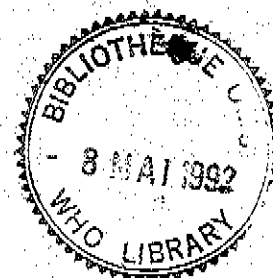


APPROPRIATE SANITATION FOR VERY LOW INCOME COMMUNITIES

VOLUME I: BACKGROUND READER FOR A
WORKSHOP IN HARARE, ZIMBABWE,
NOVEMBER 1991



BLAIR RESEARCH INSTITUTE
WORLD HEALTH ORGANIZATION
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APPROPRIATE SANITATION FOR VERY LOW INCOME COMMUNITIES

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FOREWORD

No nation can move forward unless its peoples are healthy and the provision of safe water supplies and improved sanitation forms the very foundation on which all public health must be built.

Great strides have been made in the provision of rural water supplies in many countries in Africa, although there is still much to learn and still far to go in this area of development. By comparison, the provision of improved sanitation has been rather poor in most African countries, although there are some exceptions to this case. In particular, there seems little movement in the provision of sanitation for very low income communities.

In Zimbabwe the rural sanitation programme has moved well, with over a quarter of a million families being served in the last ten years. This programme has been based on the Blair (VIP) Latrine, a technology which is very popular and eagerly sought by its users.

However, for many countries in the subregion programmes involving the construction of VIP's may be difficult to achieve, and other alternatives may be required, especially for very low income communities.

This workshop is intended to investigate sanitation options which may suit the needs of very low income communities, and it is hoped that progress will be made in formulating guidelines for future consideration by Donors, NGO's and Governments.

This background document written by Peter Morgan of this Institute, provides some of the background to the problem and describes some technical solutions which may be practical in many areas of the subregion. It has been written primarily as a technical document.

I am sure the workshop will be successful. It is certainly timely, for much progress has still to be made in the vital areas of the provision of safe water and improved sanitation to our rural peoples.

Dr Steven Chandiwana

**DIRECTOR
BLAIR INSTITUTE**

**Harare
December 1991**

A GENERAL INTRODUCTION TO THESE TECHNICAL GUIDELINES

These practical guidelines for the construction of low cost latrines were produced to support the workshop on Appropriate Sanitation Technology for Very Low Income Communities held in Harare in November 1991.

The workshop was hosted by the Blair Research Institute and the World Health Organisation and funded by the Swedish International Development Authority (SIDA). A volume of the proceedings of this workshop has also been produced and includes papers delivered from the 9 countries in Southern and Eastern Africa represented at the workshop. These were Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Tanzania, Zambia, and Zimbabwe.

The objectives of the workshop were to take a wide body of opinion from the African Sub-region and discuss current sanitation options, and formulate recommendations for future adoption in the area of Technology, Hygiene Education, Community Mobilisation and Project Planning. A number of recommendations concerned with technical aspects were made at the workshop and endorsed by the group as a whole these technical recommendations were listed as follows:

1. Where conditions are suitable the pit latrine should form the basis of sanitation technology suitable for very low income communities.
2. Some form of subsidy will be required to ensure that minimum standards are maintained.
3. The subsidy should be provided in the form of hardware. This should include a concrete cover slab or the means to make one, and assistance in the construction of the ring beam, or a partially or fully lined pit depending on local conditions. The subsidy should also include the provision of training.
4. The structure of the latrine should be supplied and built by the user and should be made of the most appropriate local building material.
5. The choice of coverplate and/or vent pipe and whether they are included in the subsidy should be left to the appropriate authority responsible for the development.
6. The maintenance of the structure should be left in the hands of the users.
7. Where latrines are placed in high density areas, some effective means of desludging should be used e.g. mini vacuum tanker.
8. The design should take into consideration the end users and also those providing the subsidy. Such designs should provide for ease of maintenance and a reasonable life span.
9. Communities served by improved sanitation should be made aware of environmental issues and be exposed to health education programmes.
10. There is still a requirement for research and development including studies of the greater use of local materials and recycled waste.

Most delegates supported the use of the VIP Latrine. This was assessed by asking delegates to fill in a questionnaire. In analysing the questionnaire two answer sheets were used from each country where possible, since most countries were represented by two participants. In the case of Zimbabwe and Mozambique two answer sheets were selected at random because there were more than two participants from these countries. In the case of Zimbabwe 11 sheets were answered and this would have biased the result towards the VIP. One sheet was analysed for Swaziland because there was only one participant. The sheet completed by the WHO consultant was also analysed. The analysis summarises the views from 9 countries from the sub-region.

1. The highest priority for components of a latrine technology was considered to be the concrete slab and a hygienic floor. The vent pipe and superstructure were considered equally important. Pit lining was considered less important by most of the delegates although those from Zimbabwe considered it more important. The coverplate was considered the least important, possibly because this system did not control fly breeding well and also allowed odours to escape when the latrine was in use. There was some doubt about the hygienic aspects of handling the coverplate with the hands.

2. 83% answered that the VIP should be considered for very low income communities.

3. 100% of the 83% answered that the VIP could be adapted for low income communities.

4a. 76% answered that a low cost VIP should have a concrete slab.

4b. 100% answered that a low cost VIP should have a grass or local materials superstructure.

5. 76% used the VIP as the country choice.

Delegates from Mozambique strongly supported the coverplate concept as they felt the VIP was inappropriate for their country. Malawi and Tanzania were experimenting with a mix of VIP's and non VIP systems. All other countries opted for the VIP.

These technical guidelines therefore cover most of the aspects of latrine construction for VIP and non VIP pit latrines.

THE IMPORTANCE OF IMPROVED SANITATION TO PUBLIC HEALTH

Introduction

The safe disposal of human excreta is of paramount importance for health and welfare and also for the social and environmental impacts that it can engender in the communities served. Its provision has been listed by the WHO as among the first basic steps which should be taken towards ensuring a safe environment in rural areas and small communities. Other steps are the provision of an adequate drinking water supply and the control of insect and animal vectors of disease in places where they are significant. The impact on health is greater if preventative, promotive and curative health measures (including hygiene and general education of the community) are introduced together.

The inadequate and insanitary disposal of infected human waste leads to the contamination of the ground and of sources of drinking water supply. It often provides an ideal opportunity for certain species of flies and mosquitoes either to lay their eggs, or to breed or to feed on the exposed material and to carry infection. It also attracts domestic animals, rodents and other vermin which spread the faeces and with it the potential for disease. In addition it sometimes creates intolerable nuisances of both odour and sight.

There are many problems connected with traditional defecation practices. The most serious are health problems - human faeces can contain harmful organisms including bacteria, which cause disease and these can be spread because people come into contact with faeces. The practice of defecating in the bush, in fields or in open pits may be quite acceptable in sparsely populated areas, but they are dangerous in areas where people live close together in villages or in peri-urban or urban settlements. Faeces and urine have an unpleasant smell, and these attract flies and other insects, which transmit disease and cause a nuisance.

Importance of overcoming disease.

Viral diseases like poliomyelitis, infectious hepatitis and gastro-enteritis can be carried when people touch faeces and then touch food or drink. Similarly bacterial diseases like cholera, typhoid, paratyphoid, bacillary dysentery, and protozoal diseases like ascariasis, trichuriasis, and pin-worm are also passed on when people come into direct contact with faeces and then contaminate food or water.

Today polio is controlled by vaccinating infants and children, but other diseases mentioned must be controlled by the proper disposal of faeces and the protection of food and water. Health education stressing the importance of personal hygiene, including regular handwashing, and the sanitary handling of food and drinking water are also very important if the advantages of improved sanitary facilities are to be felt.

How disease is carried from excreta

Humans themselves are the main reservoir of most diseases that destroy or incapacitate them. Faecal borne diseases, which are primarily intestinal infections and parasitic infestations, cause untold suffering debility and morbidity. Transmission of excreta related disease from one host to another (or the same host) can follow one of a number of routes. One of the most important routes is the faecal-oral route (for ascaris and diarrhoea). Sanitation provides one such block.

Infection by insect vectors

Flies and mosquitoes, which can breed in pits, drains, and other poorly protected septic tanks can carry disease. Bancroftian filariasis, which results in a disease called elephantiasis, is common on the coastal areas of East Africa, and is indirectly related to the poor disposal of human excreta. The disease is carried by a mosquito vector called *Culex quinquefasciatus*. The installation of latrines may in fact result in an increase of mosquitoes, unless the latrines are able to control this vector. In this case it is important to keep the pit as dry as possible, since mosquitoes can only breed in waterlogged pits. Systems like aqua privies, septic tanks and pour flush latrines must be perfectly sealed.

Several diseases can be carried by flies. The Blowflies *Calliphora*, *Lucilia* and *Chrysomya* can carry Intestinal Myiasis and Dysentery (*Clostridium*, *Salmonella*, *Shigella*). The housefly *Musca domestica* can carry Dysentery (*Clostridium*, *Entamoeba*, *Salmonella* etc) and the viruses, hepatitis A, and Poliomyelitis. The Latrine fly *Fannia* spp. can carry Dysentery, and the face flies *Musca sorbens* can carry Yaws, Trachoma, Septicaemia and Infective Dermatitis.

High risk groups

The age group most at risk to these diseases are children under 5 years of age as their immune systems are not fully developed and may be impaired further by malnutrition. The diarrhoeal diseases are by far the major underlying causes of death in this group. They account for almost 30% of all infant deaths in the developing world.

The under fives comprise only about 17% of the population in these countries yet account for up to 80% of the deaths. Worldwide, of the 500 million under fives about 400 million are in the developing countries and account for 97% of all deaths in this age group.

Relationship to health

Although it is universally accepted that improving the sanitation within a community should lead to an improve-

ment in health, it is difficult to ascertain whether the impact is direct or indirect. Often better sanitation is part of a spread of development activities within the community. Improved sanitation only forms part of the Primary Health Care approach, which also includes improved water supply, increased health education, immunisation and child care campaigns etc. Certainly the aim is to improve the hygienic status of the homestead as a whole, and to improve the diet provided to the family as a whole. Certainly the control of vector of disease such as Malaria is also important.

Of the greatest importance is the passing of knowledge about how to improve health, and this would include the importance of improved diet, sanitation and water supplies etc. Great emphasis should always be placed on education, and messages are often passed with impact through schools and other places of learning. The Village Community Worker, or his/her equivalent has a very important role to play in conveying the simple yet fundamental messages relating to health and the environment.

Technical solutions

Many systems of excreta disposal have been designed over the years, but most are expensive to build, especially in urban or peri-urban settlements. However many other low cost solutions are available for use, and can work well provided they are adapted to suit the specific environment in which they are placed. Whilst the technical solution is an important one, it is also essential that environmental and human factors are also taken into consideration. The siting of latrines is important and also the design should be suitable for the people's needs.

Experience has shown that no one technical solution can apply throughout the world or even throughout one continent, or even throughout one country. It is important however that some appropriate system is adopted as a baseline on which to plan national sanitation strategies and produce educational and promotional campaigns.

Obviously technical solutions must be adapted to suit the local environment and local financial resources, and suit traditional skills in construction and the "latrine behaviour" of the users. For example the pour flush system commonly employed in the East, where people use water for anal cleansing is entirely satisfactory. However it will be disastrous when used by people who use sticks and other solid objects for anal cleansing, and will become blocked and unusable. In most of Africa the pit latrine has been found to be most suitable system for use in rural areas, and in many cases peri-urban areas as well. There are several ways of improving the traditional pit latrine and this report concentrates mainly on methods of doing this.

Current problems of coverage and sustainability.

There are now clear indications that subsidies from government and donor agencies for VIP Latrines and other improved latrines which need cement, and other materials are unlikely to cope with the present needs or be sustainable. Millions of people in very low income communities cannot afford even the simplest technologies for sanitation. This poses a very demanding, almost impossible technical problem to solve, for even in very low income communities, it is still essential to dispose of waste in a hygienic manner. This at the very least may require digging a pit into which the waste must be placed and protecting this in the most economical manner.

THE CHOICE OF APPROPRIATE LOW COST SANITATION TECHNOLOGY

The technical objective of sanitary excreta disposal is to isolate faeces and urine so that the infectious agents in them cannot reach a new host. Obviously the best latrine designs overcome the breeding and passage of as many of the vectors listed in the first section, as possible. The method chosen for any particular area may depend on culture, the preference of the users or communities, the locally available raw materials and the cost. The types of disease endemic in the area should also be considered when selecting the method of excreta disposal.

The choice of system

Where there are no latrines people resort to open defecation. This may be indiscriminate or in special places such as defecation fields, manure heaps or under trees etc. Open defecation encourages flies, which spread faecal related diseases. In moist ground the larvae of intestinal worms develop, and faeces and larvae may be spread by being carried on people's feet or shoes. Surface water run-off from places where people have defecated results in water pollution.

In this appraisal of appropriate low cost sanitation systems the piped sewerage system will not be discussed as this is neither low cost or appropriate in the context of rural or even peri-urban development in Africa as a whole. On-site systems, might include aqua privies, septic tanks and bucket latrines, but the most appropriate system for low-income communities can only be based on the pit latrine.

SIMPLE LATRINE SYSTEMS

The "Cat Method"

Some areas of Africa are so poor that any method of improving the situation where faeces are scattered indiscriminately around the environment is an improvement. In its simplest form the safest method of disposing of excreta in low density remote rural areas involves digging a shallow hole with a shovel, and covering over the faeces that are placed there. With this technique the faeces are buried in a shallow hole (20cm deep) and covered with tightly packed soil immediately after defecation. Due to intense biological activity in the top layer of the soil, the faeces rapidly decompose. This method is appropriate when people are away from home, working in the fields.

This "Cat Method" is effective but cannot be regarded as an appropriate low cost sanitation technology.

The One Day Latrine.

The "one day latrine" is also a hole in the ground, about 20cm wide and 30cm deep. Every user covers his/her faeces with a layer of soil. A new hole is dug every day. This system can be improved with the use of a piece of sheet

metal as a lid. If the sun is shining on the lid, the temperature of the hole may rise to above 45 degrees. This would kill ascaris eggs as well as eggs and larvae of the hookworm.

This system can be viewed as a type of pit latrine in miniature. Theoretically it would be possible to dig a pit, say 1 metre in diameter and 1 metre deep, and by using half a pocket of cement, make a 1.4m diameter concrete slab (50mm - 75mm thick) and cover the pit with the slab. Very low cost latrines of this type will be discussed in the next section.

The Pit Latrine

The most commonly used latrine is the hand dug pit latrine which is covered with some sort of cover/slab, and surrounded by a structure for privacy. Such latrines are very common throughout the world and have been used since ancient times. Such widespread use for many centuries provides the evidence that they are technically and socio-logically sound. There can be no doubt that the pit latrine must form the basis on which all low cost sanitation options suitable for Africa must be based.

The pit latrine is cheap to build, confines the waste in a specific area, and with adequate siting and protection can cut down on the passage of water borne pathogens like bacteria or the passage of insect vectors. Obviously the exact method of construction, and the principles used to protect the pit and overcome the transmission of pathogens will vary depending on local conditions and the amount of funding available for construction.

Disadvantages

Whilst the pit latrine has so many basic advantages, it also comes with its disadvantages. Sometimes these may develop to such an extent that the pit latrine becomes dangerous to use and even a threat to health. Such disadvantages must be overcome, either in part or completely, if the objectives of improved sanitation are to be gained. Such disadvantages can be listed as follows:

1. Shallow pits

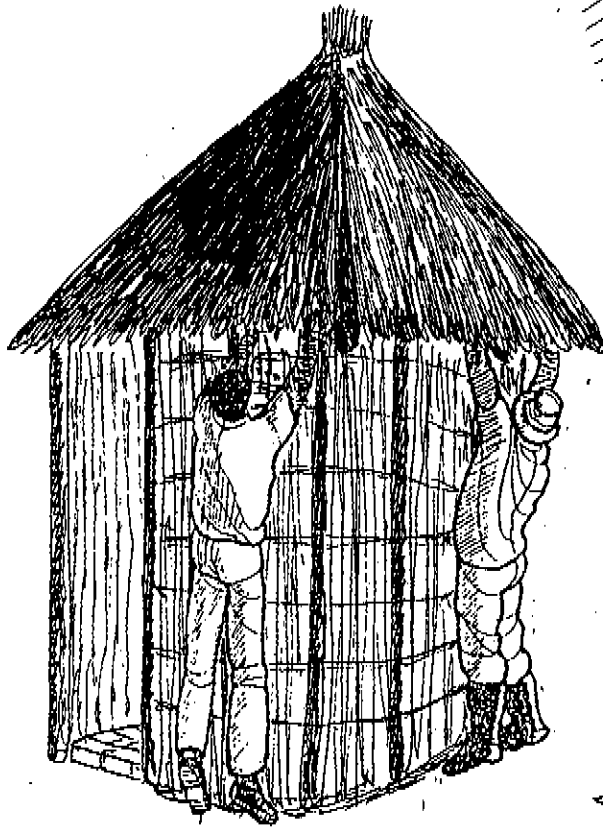
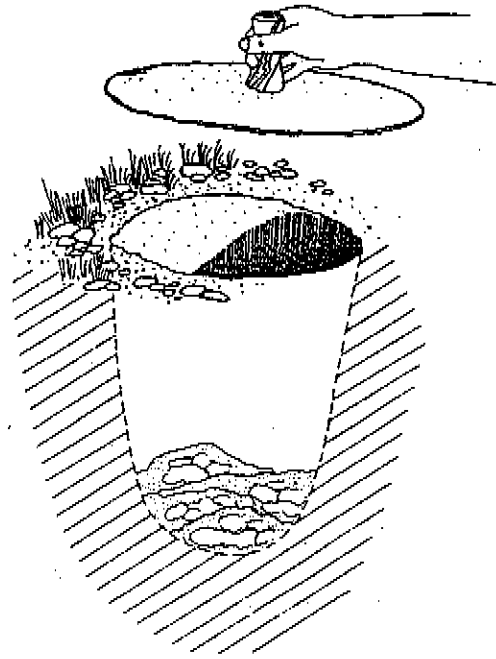
Very often pits are dug shallow, which limits their working life, and exposes waste matter far too close to the surface, where it becomes offensive and a source of fly breeding.

2. Collapse of pit

If a pit is unlined in unstable soil, it is bound to collapse and becomes life threatening. Such systems have little merit and cannot be promoted. A pit lining of some sort becomes essential, unless the soil is very firm. In some cases a partial lining can be regarded as a step forward.

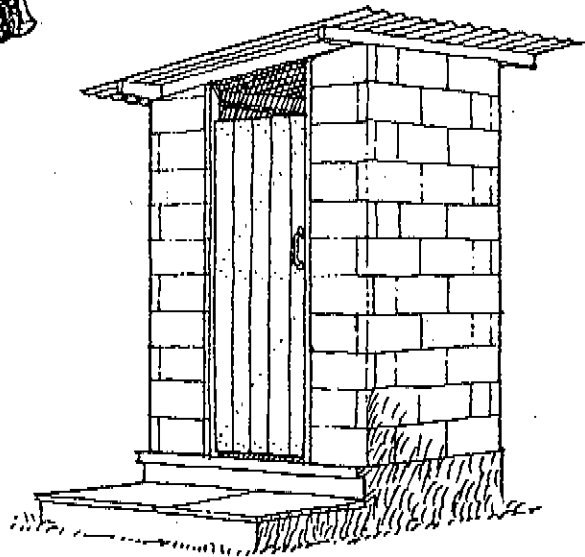
TYPES OF LATRINE

The "One Day" Latrine



Pit Latrine from reeds and grass

Pit Latrine from Bricks and cement



3. Collapse of cover slab or pit cover

Very often the cover to a pit consists of wooden logs or tin sheets which may easily collapse. They are also unsanitary and can not easily be washed down. When pit covers are not easily washed down, they become offensive and a source of disease transmission in their own right. Under such conditions systems such as "The Cat Method" have greater merit. Improved sanitation based on the pit latrine must be provided with a hygienic cover, ideally made of concrete.

4. Collapse of structure

Structures are built usually to provide privacy. If they are temporary and collapse they cannot provide privacy and users may locate alternative sites in which to defecate which may pose a health threat. Obviously superstructures should be reasonably sound in their construction.

5. Production of odour

Bad odours are often associated with pit latrines, and this is one reason why they are not used and maintained properly. Odours may be derived from the pit itself, and this is more obvious the shallower the pit. Odours also emanate from poorly maintained cover slabs which become polluted with faeces and urine.

It is important to try to overcome odours, either by digging the pits deeper, or by providing coverslabs which can easily be washed down. The use of a coverplate covering the squat hole can reduce the amount of odour escaping from the pit, although it cannot do this when the cover is removed and the latrine is in use. The VIP uses a system of ventilation to overcome odour emanating from the pit.

6. Source of flies and mosquitoes

Pit latrines can be a source of many insects, notably flies, and these have the potential to carry disease, and are always a nuisance.

The pit latrine has more worth if it can reduce on fly breeding and this may be overcome to some extent by fitting a cover plate over the squat hole, and keeping it in position unless the latrine is in use. The alternative system of using a vent pipe as a fly trap can be very effective at reducing flies, provided that the latrine is built properly. The use of chemicals has rarely been successful in practice at reducing the fly nuisance.

Only pit latrines which have water exposed in their pits can produce mosquitoes. In almost every case a well used and maintained pit latrine cannot produce mosquitoes.

7. Pollution of groundwater

Pit latrines can act as a very effective polluter of underground water. This is why siting of the latrine is critical. The pit latrine should be sited so that it is convenient for use. It should be sited downhill and at least 30m away from a well

to avoid underground contamination of ground water.

Overcoming these problems

Low cost methods of providing suitable sanitation for Africa as a whole involves overcoming these basic problems of the pit latrine. Obviously the more money that can be spent, the greater the measure of protection that can be provided. Perhaps the most important steps that can be taken in the following order of importance are:

1. Providing a hygienic coverslab on a stable pit collar in an area which will not pollute nearby wells if they are present.

2. Lining the pit to avoid collapse.

3. Providing privacy.

4. Overcoming odour and fly nuisance.

1. Latrine slabs

Most traditionally made latrine covers are made of wood, usually poles which straddle the pit. Often they are covered with soil or tin cover plates to improve safety. However the wood is always prone to attack by termites unless special hardwoods are used. Rotting timbers eventually collapse and make the latrine dangerous. Also the poor seals formed with these traditional covers and the pit rarely offer any fly protection or odour proofing for the latrine.

A cover slab made of concrete is well worth the expense and effort involved in making it. A concrete latrine slab, when properly made will use less than one pocket of cement on a single pit latrine, and it will last almost indefinitely. It should be able to be used on several generations of pit, being moved from one to the other. In Mozambique, the greatest asset perceived by the owners of new latrines fitted with a concrete cover slab was the safety factor afforded by the new cover slab.

A mixture of 4 parts stone, 2 parts river sand and 1 part cement makes a very strong slab. In the absence of stone, river sand and cement can be mixed in the proportion 5 parts sand to 1 of cement. The sand should be sharp and washed. For slabs of 1.5 m in diameter 3mm reinforcing wire is quite adequate, placed in a grid formation with 150mm spaces. Slabs should be cured for at least 5 days.

Flat concrete slabs can be made without reinforcing wire using a mixture of 4 parts river sand and 1 of cement. The curing must be performed correctly and the slab not moved or allowed to dry out for a period of at least 7 days. A properly cured unreinforced concrete slab, made with a 4:1 mixture and cured for 7 days, should be quite adequately strong for any use as a latrine slab.

Slabs are cast with a hole in them for the squatting aperture. When the VIP is made, two holes are cast in the slab, one for the vent pipe and one for the squatting hole.

This will be described in more detail later in this manual. 10 years for a family of 6 persons.

2. Pit lining

Where pits are dug in firm ground, and where the rainfall is low, unlined pits can remain firm for many years without collapse. However this is not normally the case. Very often pits may be dug in sandy soils which will slowly collapse. In addition the effects of erosion either by rainfall or water run-off from some other source can break up the upper sections of the pit. If the pit is dug into high groundwater areas, or relatively large quantities of water are introduced into the pit (from bathing or washing) then the water table in the pit will lie above the base of the pit and erosion of the pit wall will occur. This may have little effect if the soil is of a firm type, but commonly the liquid layer slowly eats its way into the soil and parts of the pit lining fall away, and the upper structures may become undermined. This will eventually lead to pit collapse, especially if the superstructure is heavy.

Clearly a pit lining should be used to avoid collapse. Lined pits which are round collapse less often than square shaped lined pits because the forces on a round structure are evenly distributed. The upper end of the pit lining should be elevated above the ground level, and be formed into a collar or ring beam. This means that when the earth is built up around the collar it will be elevated above the general level of the ground, and this will help to avoid erosion from surface run-off water particularly during the rainy season.

Materials for pit lining.

The best material for lining the pit is fired bricks if these are available. Sun baked bricks can erode in pits if they are waterlogged. If there is no chance of waterlogging then sun baked bricks might be used. Fired bricks are best mortared together with cement mortar with a mixture of 8 parts pit sand and 1 part cement. If the bricks are soaked in water first, the cement mixture can be reduced to 10:1 or even 12:1.

If bricks are not available, then flat stones can be built up, if the shape is round. These can be laid without mortar if the skill of dry-stone walling is available. The pit should be made large enough to provide an adequate open area and allow for the stones to be laid.

Pit Size.

Most traditionally dug pits are very shallow and may have a life of only a few years at most. In improved latrines most pits will have an internal diameter of 1.2 metres and will thus be dug with a larger diameter to accommodate for the lining. If standard bricks are used (225mm X 110mm X 75mm) then the diameter of the pit should be about 1.5m.

The depth should be at least 3 metres, and preferably more. The deeper the pit the longer its working life will be. A pit 3m deep and 1.2m wide should be usable for at least

Pit collar

It is important that a lined pit should also incorporate a ring beam or collar at the head of the pit. As mentioned earlier, this elevates the pit head above the surrounding area, and reduces the chances of erosion and collapse of the slab mounted above it. Also the base slab which covers the pit should be supported properly. If a VIP type pit latrine is to be built, a good airtight seal will be required between the collar and the slab.

Thus the collar surrounding the head of the pit is important for three reasons:

1. Elevates the pit lining above ground level
2. Acts as a sound foundation for the slab
3. Provides a surface on which to form an airtight seal between pit and slab (as in the VIP latrine).

Pit collars are usually made of bricks cement mortared together. They can also be made of stone, which should ideally also be cement mortared together and levelled off to form a flat upper surface for slab attachment.

3. Providing Privacy

Superstructures

Traditionally the superstructure has one role, that of providing privacy. Simple pole and grass structures surrounding the simple pit latrine are well established all over the continent. Pole and grass structures are subject to termite attack and require frequent maintenance.

In more recent times the brick built structure has become more favoured since it requires less maintenance and can also be built with local materials.

Sun dried bricks can be used in climates with less rain, and even in rainy environments. Sun dried bricks can be used provided a well thatched roof is fitted with an adequate overhang. Where bricks are used, ideally these should be made of fired bricks. Also, ideally, they should be built up using cement mortar with a mixture of 8 parts pit sand to 1 part of cement.

However, there is much traditional knowledge on the use of traditional earth mortars, usually taken from old ant mounds. These mortars are partly resistant to erosion by rain and can make an excellent material for building latrines and houses. They are best placed beneath roofs with a good overhang.

Structures can either be made with or without doors depending on the degree of privacy required. Spiral structures, either rounded or squared, require the least maintenance since there are no moving parts. A door adds more privacy, however, and can be fitted to an existing spiral structure. Being a moving part it requires some maintenance and repair.

Roofs

The simplest roof is made from poles and grass. This type provides coolness within the structure and if well built can also protect against the rain. However a roof is not essential in the standard, unventilated pit latrine, and in fact can be undesirable, since the open nature of the crude pit latrine allows for the odours and flies to escape easily. However in the more advanced pit latrines described a little later, semi darkness is considered an asset, even on unventilated structures.

More advanced roofs can be made of asbestos, tin, or Ferrocement. Such roofs can be made with a bag of cement, using 3 parts river sand and 1 of cement and chicken wire for reinforcing - they are built up to a thickness of 25mm - 35mm, and cured for 7 days. Such roofs are permanent.

4. Overcoming odour and fly breeding

The chemical method is not described here since this is generally expensive and not particularly effective.

Basic methods

The following basic steps can be taken to reduce odours in a simple pit latrine:

- a) Dig pit as deep as possible, and at least 3 - 4 metres.
- b) Keep coverslab well washed down at all times and the surrounding area as well kept as possible.
- c) Use a simple cover over the squat hole when the latrine is not in use.

The following steps can be undertaken to reduce the fly nuisance in a simple pit latrine:

- a) Dig pit as deep as possible, and at least 3 - 4 metres.
- b) Keep coverslab well washed down at all times and the surrounding area as well kept as possible.
- c) Use a simple cover over the squat hole when the latrine is not in use.
- d) Build a cool shady superstructure over the pit.

Which Pit Latrine?

Bearing in mind that the focus of this report is on very low cost options, it is important to start the discussion at the very simplest level. Three basic concepts will be discussed, based on material requirements. It is assumed here that the sanitation technology, must be a technology and not a behaviour pattern (like the cat method), and must therefore require some material input. It is also assumed that the technology must be some type of pit latrine, and that a concrete slab, at the very least must be provided, as this provides a hygienic surface for the latrine.

1. The Simplest Pit Latrine

This is a simple unlined shallow pit, perhaps 1 metre deep

and 1 metre in diameter which is covered with a simple concrete slab and surrounded by the simplest structure to ensure privacy. A slab can be built in concrete (5 parts river sand and 1 part cement) with a diameter of 1.4 metres with half a pocket of cement. With care at curing, no reinforcing wire is required. The slab is laid on the ground over the pit, and the excavated soil brought back to the level of the slab. A structure may be built with any convenient material drawn from the environment (grass, leaves etc.).

2. The Hygienic Pit Latrine with Coverplate

This is advocated in some circles as overcoming all the problems of the pit latrines, but this is debatable. A closely fitting coverplate fitted into the squat hole of a pit cover slab will stop the passage of flies and odours when it is in place, and this must reduce the nuisance. However odours will be released when the latrine is in use, when the cover is removed, but these will be less if the pit is deep.

If the cover is used meticulously the fly problem will be reduced, since the number of occasions when flies have access to and from the pit is reduced. However if the cover is left off for a period of time, which is quite common in actual use, fly breeding will be maintained.

Perhaps the most serious defect of this system is the potential of the handle as an active site of disease transmission. If the handle is touched by a contaminated hand, which it is likely to be after defecation, the handle will become soiled, and this will be passed on to the next person. For this reason coverplate handles should be foot operated, so the hands do not touch the mechanism.

A system known as a Sanplat (a Sanitary Platform) is now used in Malawi and Mozambique and elsewhere as the preferred method of sanitary disposal system in the rural areas. It consists of a concrete cover slab, placed over a pit (which may be lined or unlined). It is fitted with a concrete lid which fits closely into the squat hole. The lid is fitted with a wire handle which is lifted by hand.

3. The VIP Latrine

The Ventilated Improved Pit Latrine employs a ventilation pipe system to overcome the problems of odour and fly breeding in the pit latrine. It has been used quite widely in Africa, but is thought by some authorities to be too costly and complex to fit into many rural sanitation schemes in many countries. At least 2 or 3 bags of cement are required to make the latrine, in its simpler form, and builders should be quite experienced to gain the best out of the design. Many so called VIP latrines do not work properly because they are poorly built.

The system is the best available method of protecting a pit latrine and there is nothing to equal it when properly built. The real question that has to be faced is - is it too complex for most rural African rural sanitation programmes? The answer is probably yes, with the possible exception of its use in schools and other centres.

THE SIMPLEST PIT LATRINE

Using half a pocket of cement

This system will use up to a maximum of 25kg of cement (half pocket) and this is made for the slab. Since no attempt is made at pit lining, or even a collar with cement mortar, the pit diameter is not too great and the pit is shallow. The system is regarded as temporary, but may last a few years with a small family. When the pit is nearly full the slab is moved over to a new pit site and the old hole filled up with soil.

The pit should not be more than 2m deep and 0.9m in diameter. The slab should be made to suit the quantity of cement available for this technology. A 1.3m diameter slab, 75mm in thickness at the rim and 50mm in thickness at the squat hole can be made using a mixture of 5 parts river sand and 1 part cement with half a pocket of cement. If this is mixed and cured well, no reinforcing is required, but a few strands of wire within the slab will assist if there is any doubt about the quality of manufacture.

The slab is moved so that it lays over the pit and soil removed from the pit is then heaped up around the slab to the same level. This is rammed down hard. The area should be elevated above the surroundings so that rain water tends to drain away from the site.

A simple structure must be built around the slab for privacy. Grass may be a suitable material, but any material

from the surroundings is suitable if it provides privacy.

General fly and odour nuisance can be reduced by keeping the slab clean and tidy and also by adding a loose fitting cover plate over the squat hole.

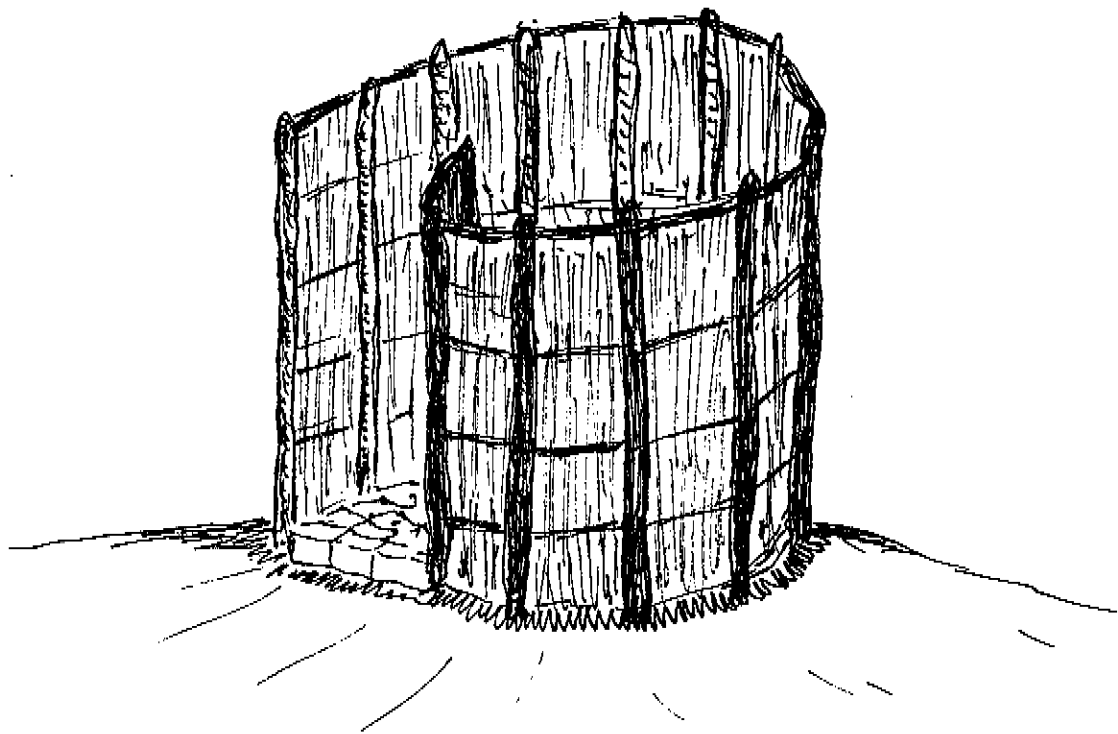
A part pit lining with anthill bricks and mortar

Where the top soil is unstable, but no more cement is available, the upper end of the pit can be stabilised with the use of anthill soil bricks bonded together with anthill soil mortar. The bricks and mortar are used to make a partial lining of the pit and a ring beam around the head of the pit. In this case the pit may be deepened to 2m or even 3m in stable soil.

Bricks (or stones if available) are gathered, and the brick wall is built up within the pit. The pit diameter is increased slightly from about one metre down, and the brickwork or stone work built up on the ledge of the cutting. This is built up to slightly above ground level and the slab is bedded down with anthill mortar on the upper ring of bricks or stones.

Soil is built back as before so that the general level of the latrine lies above the ground level in the immediate surroundings of the latrine. A simple superstructure is made as before.

THE SIMPLE PIT LATRINE

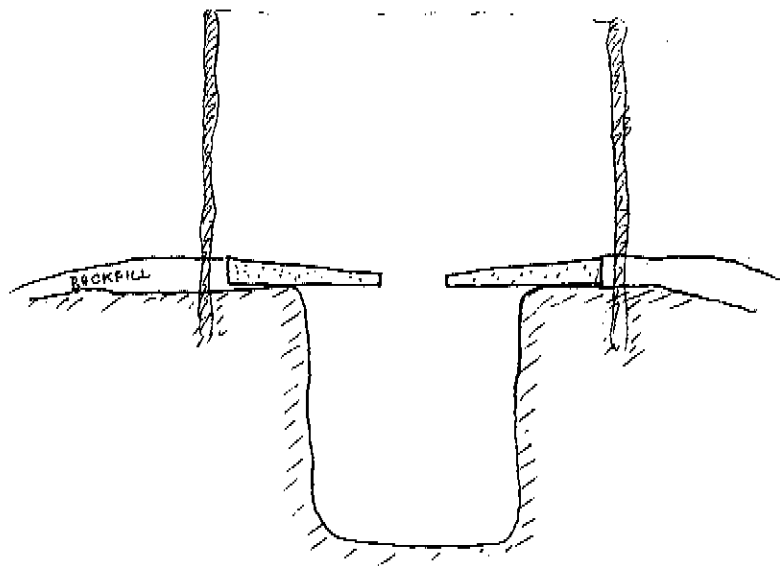


THE SIMPLEST PIT LATRINE

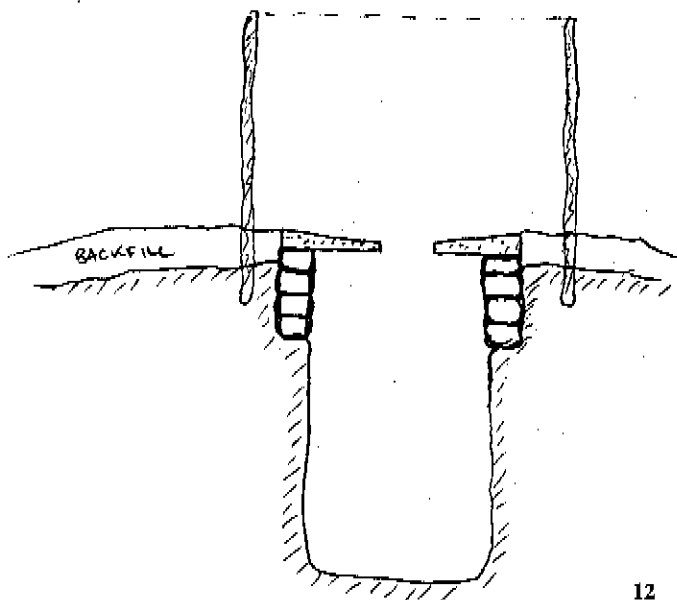
This uses a half bag of cement for the coverslab, which is made with 5 parts river sand and 1 part cement. The slab diameter is 1.3m, being 75mm thick at the rim and 50mm at the squat hole.

If the soil is firm at the surface of the ground, a round pit is dug 0.9m in diameter and 1 to 2 m deep. Once cured the slab is laid centrally over this. Soil excavated from the pit is back filled around the slab and up to the same level of the slab and then sloped away from the latrine site. This ensures adequate drainage away from the latrine during the rains.

If the top soil is not firm, a few layers of bricks made with anhill soil can be bonded with antill mortar on a recess made within the upper half metre of the pit and built up to ground level. The concrete slab is laid over this and the soil taken from the pit is backfilled around the slab as described above.



Simple pit latrine with unlined pit in stable soil. A simple structure of grass/reeds and the earth backfill are shown



Simple pit latrine in less stable soil lined with anhill bricks and mortar. A simple structure of grass/reeds and the earth backfill are shown

THE HYGIENIC PIT LATRINE WITH COVERPLATE

If between one and two bags of cement may become available for the construction of a pit latrine, it is possible to build a unit with a part or fully lined pit and a concrete cover slab, the basic essentials for an improved facility. This type of unit should be chosen where latrine programmes do not permit the use of ventilation pipes as a result of a lack of supply or for other reasons. These do not control flies or odours as well as VIP's, but they can be designed so that they are an improvement on poorly built pit latrines. If the latrine is also used as a washroom, it will be natural that some sort of coverplate will be placed over the squat hole to avoid the loss of soap.

Construction.

Notes on the siting, pit, pit lining and collar can be found earlier in this report. Ideally the pit should be deep and lined with some permanent material. If the soil is firm, a partial pit lining may suffice. In any event a strong collar or ring beam should be built around the rim of the pit. The concrete slab will be mounted on this. Particular attention should be placed on the slab. The pit diameter should be 1.1m

The Concrete slab.

This should be made with concrete and several plans have been made for use in Africa. The dome shaped model once used in Mozambique is being phased out in favour of flat or preferably inward sloping dished slabs. Dome shaped slabs accumulate waste deposits on the rim which are not easily disposed of, and may actually erode the side walls of the pit beneath the slab. Flat slabs accumulate urine, which cannot drain away and this causes an odour which is offensive. The slabs are best dished towards the squathole and finished off with a steel float so that urine and water drains away easily down the squat hole.

In some countries footplates cast as part of the concrete slab are popular because they indicate where people should place their feet, and this is thought to reduce fouling of the slab. However these are by no means essential and add to the complexity of making the slab, and may actually make cleaning of the slab, with water, more difficult.

Where a sitting pedestal is used, rather than a squat hole, special provisions must be made for this in the slab itself.

Concrete mixture

Ideally the concrete mixture should be 4 parts stone, 2 parts river sand and 1 part cement, but good slabs can also be made with 5 parts river sand and 1 part cement. Slabs vary in size and thickness, but are generally about 1.3 m in diameter. The best slabs are dished so that the thickness at the squat hole is 50mm and the thickness at the rim is 75mm. The squat hole should be about 300mm long and

125mm wide, but there is much variation with some preferring longer and narrower squat holes. A special mould can be made to form and shape the squat hole.

Reinforcing

It is desirable to add reinforcing wire to the concrete. 3mm thick wire is quite adequate for this purpose. About 15m of wire is sufficient for a 1.3m diameter slab. This is cut and placed at 150mm spaces in a grid formation within the mould used to make the slab.

NOTE: if no reinforcing wire is available it is possible to make a slab without wire. In this case, the mixture is 4 parts river sand and 1 part cement. The mixture is well compacted - smoothed down - covered and left to cure for at least 7 days in a wet state. It should ideally be covered with soil and kept wet throughout the 7 - 10 day period.

Actual method of construction

To make the slab, a circle is marked on a levelled area of ground near the latrine site. This should be 1.3m in diameter. A ring of bricks is then laid around the circle. This will make the depth of the brick mould 75mm at the rim. The thickness at the squat hole will be about 50mm, if this type of lid is used also as mould to make the squat hole.

Lay some sort of plastic or paper (paper from the cement bag) on the ground within the brick mould. Place the form for the squat hole within the mould, with its wider back end about 500mm from the edge of the slab.

The mixture is now made with sand and cement (if these are the ingredients available). About 1/2 bag of cement will be required for this job. The mould is filled to 1/3rd depth and the wire reinforcing is added. The remainder of the concrete is now added, shaped with a wooden float and finally smoothed off with a steel float. It should be dish shaped with all surfaces sloping down towards the squat hole. The concrete lid/template should be loosened slightly after about 2 hours and replaced in position. This will make its removal easier the next day.

Curing.

Once finished, the slab is left for a few hours and then covered with sand or sacks or paper. In the morning it should be soaked and should be left in a wet state to cure for at least 5 days.

Lifting and mounting slab

The slab should be lifted carefully, by twisting first, to

release it from the ground and then lifting first from one side. It should now be placed on the collar, being mounted in a bed of cement mortar.

The lid/coverplate

There are several methods of making a lid to fit over the squat hole of the coverslab.

Simple plate

The simplest form of coverplate is in the form of a flat piece of tin sheet, usually round in shape - often cut from the bottom of a 20 litre tin can. It is larger in diameter than the length of the squat hole, and therefore cannot fall into the pit. The plate is moved about by foot, and there is no possibility of it contaminating the hands of the users. It is placed over the squat hole after use, a behaviour pattern which may require an educational component. When the latrine does not smell offensive it will be used as a wash room, and in this case the plate will be placed over the squat hole to avoid the loss of the soap used in bathing.

This type of plate is simple, and prevents most of the light from above entering the pit when in place. It is not fitted tight however and flies can move too and from the pit. It will reduce excessive odour from the pit.

Shaped tin cover-plates

It is possible for local tinsmiths to manufacture shaped tin cover plates, which are also used as a mould in the formation of the squat hole in the concrete cover slab. These are quite tightly fitting, and when in place will prevent the movement of flies and odours too and from the pit. They should be fitted with a handle that can be moved by the foot to avoid cross contamination of users. When not fitted, they have no effect, and a user educational programme is essential. They can be lost down the pit and it is desirable for them to be attached by string to the superstructure.

Shaped concrete lids

It is possible to shape a lid in concrete using a special mould, and use this also as a form for making the squat hole. The handle can be made of stout wire, and is best shaped so that it can be lifted with the foot, although this is more difficult with the concrete lids since they are heavier than tin plates. Concrete lids may also be too heavy for children to lift.

A concrete lid can be made first, 300mm long and 125mm wide and 50mm deep so that the side walls are tapered. A special mould can be made for this purpose. A good strong mix of concrete (River sand and cement 3:1) can be used to make this "lid" which also can act as a "form" to make the squat hole. The lid can be fitted with a handle of 12mm rod, shaped for convenience. The Lid/form is made first and left to cure for a couple of days before it is used to assist in the construction of the slab.

The "Sanplat" has been promoted in Mozambique, Malawi and Angola and elsewhere as the answer to all sanitation problems. It is a coverslab fitted with a coverplate and not a latrine system. It uses a concrete cover plate fitted with a wire handle. This is also used to shape the keyhole shaped coverslab squat hole. The slabs are made in centres from where they are distributed. The slabs are dome shaped or flat, but never dished towards the hole. In Malawi the slabs are placed over existing traditional slabs often made of wood, which are mounted over pits which may or may not be lined. Promotional literature supporting the Sanplat condemns the VIP as being too complex and expensive.

Superstructure.

Many materials can be used for the structure, and these include grass, reeds, poles, sun dried and fired bricks. If sun-dried bricks are used in areas which have a moderate rainfall, they should be protected with a roof. Obviously the structure must be made to suit local conditions and the materials that are easily available.

The structure can be made with a door or without a door. Doorless structures shaped in a spiral are easier to maintain.

Pole and grass structures.

These can be made by selecting poles and arranging in a round or spiral shape outside slab. The poles are placed in the soil around the slab. Saplings are then attached to the poles with binding string and then grass or reeds can be added to form the walls. A roof is not essential as the structure is intended to provide privacy only. A door can be added if necessary - car tyre rubber hinges can be used if necessary for self closing purposes.

Brick structures.

Where brick structures are built, some sort of solid brick foundation will be required. This can be built, like the grass structure around the outside of the concrete slab, with the slab placed centrally. Foundations are normally made 225mm wide and built up to one course above ground level. The brick structure is made 110mm wide - a standard single brick width - the height is about 1.8m. Suggested measurements are provided in the illustrations.

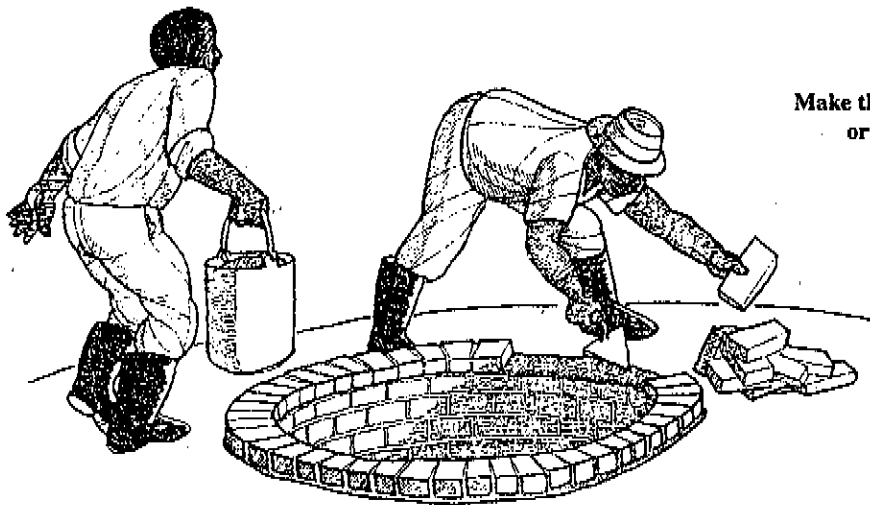
Backfill

In these lower cost structures, the area surrounding the slab is built up with the soil, taken from the pit to the level of the slab. This built up soil is extended beyond the structure, so that the latrine as a whole is raised above the general level of the ground.

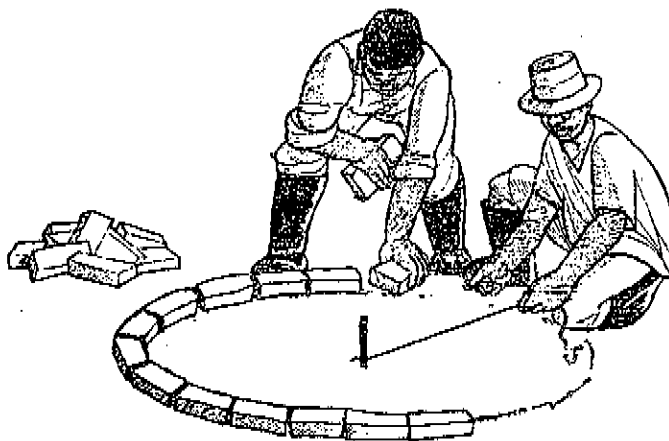
The slab itself will form the floor of the latrine - which is why it should be dished and smoothed down with a steel float. Finally the lid is fitted in place and it is best to attach it to a cord or wire so that it will not accidentally fall into the pit.

MAKING AN HYGIENIC PIT LATRINE WITH COVERPLATE

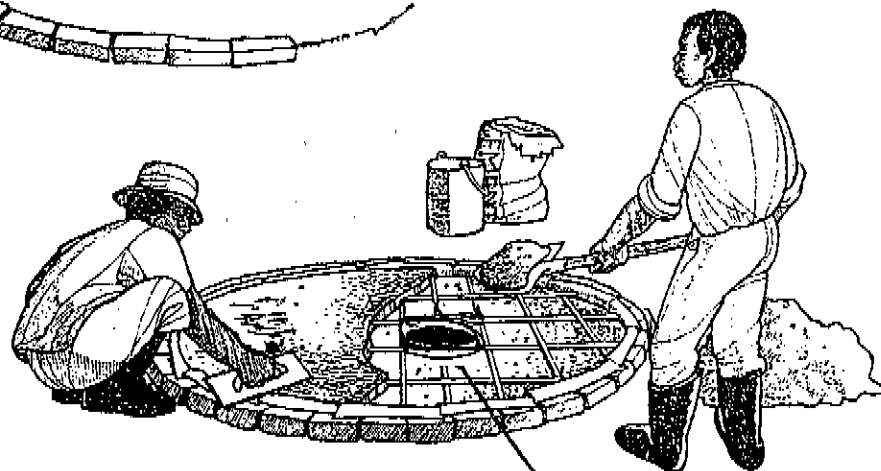
This technique can be used where between 1 - 2 bags of cement are available. The pit should ideally be fully lined using cement mortared brickwork. The pit should be 1.1 metres in diameter (final diameter with brickwork) and the slab 1.3m in diameter. The coverplate should ideally be made of tin with a handle that can be removed by the foot. The superstructure should be made of low cost local materials such as grass or reeds. If bricks are used, a protective roof will be required.



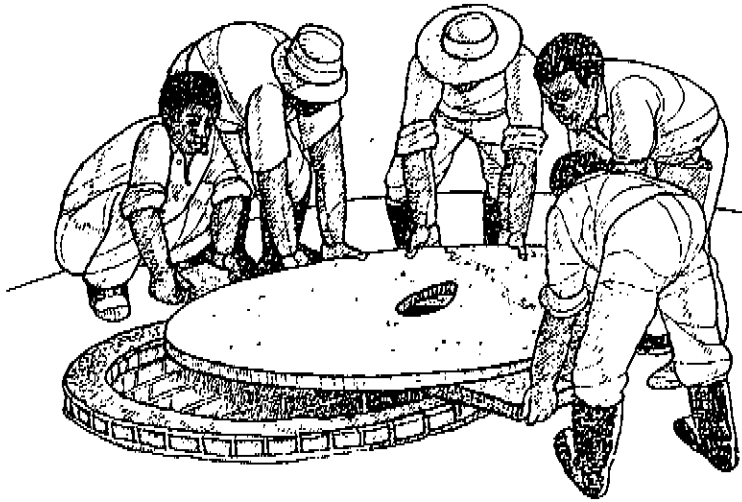
Make the collar over a lined or partly lined pit.



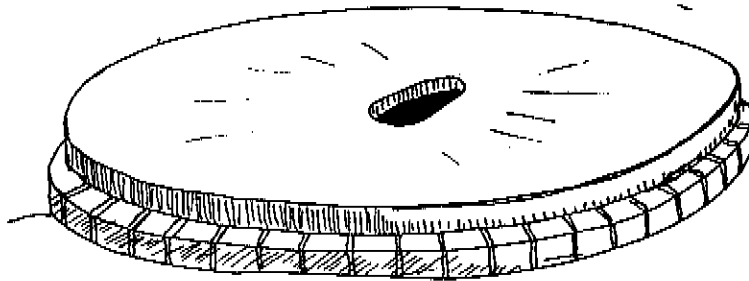
Make the slab 1.3 m in diameter with river sand and cement (5:1)



Reinforcing wire



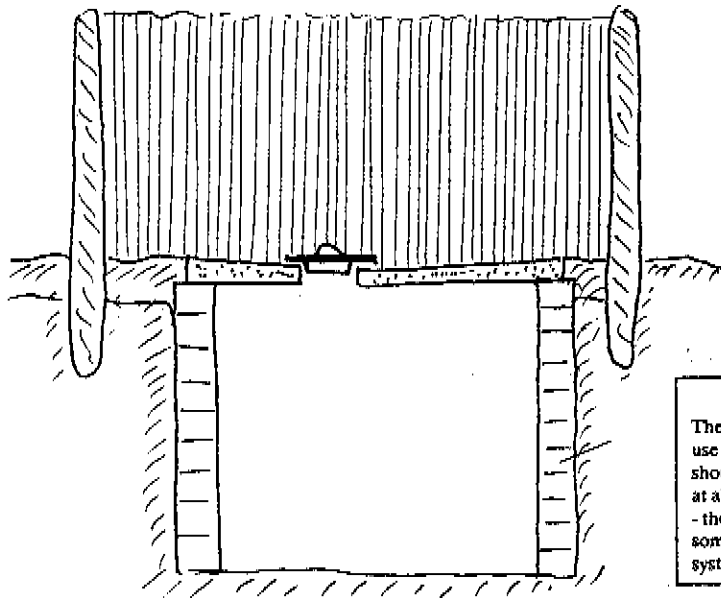
Fit the slab in a bed of cement mortar



The final slab mortared over the lined pit



Select a durable coverplate.
(A tin coverplate can be used as a mould to form the squat hole)



Build the superstructure from locally available materials and backfill soil to raise latrine surroundings above ground level.

Education.

The family concerned should be educated in the correct use and maintenance of the latrine. The squat hole lid should be replaced at all times and the floor kept clean at all times. If these simple instructions are carried out - the latrine should provide quite acceptable service for some years. User education is very important in this system.

FITTING THE HYGIENIC PIT LATRINE WITH A VENT PIPE

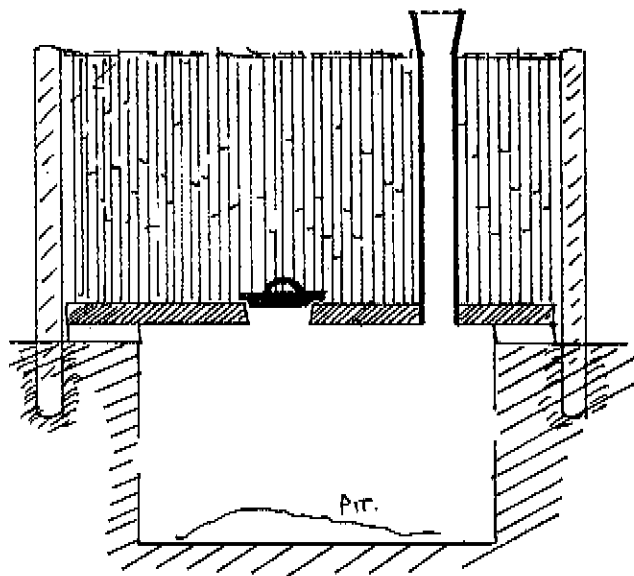
The hygienic Pit latrines just described are not fitted with vent pipes. Normally most pit latrines fitted with vent pipes are called VIP latrines (Ventilated Improved Pit Latrine) and these will be discussed in great detail later. In order to guarantee fly control, as well as odour control, the final structure of the VIP is always fitted with a roof. This helps to cut down the light entering the structure of the latrine. The most effective VIP's are made with a spiral structure, which guarantees semi-darkness, which is essential for effective fly control.

However there is a technology that lies between the hygienic pit latrine and the VIP. This structure is fitted with a vent pipe, but no roof. It is fitted with a lid for the squat hole to make the pit dark, and thus make the vent pipe more effective at controlling flies. The vent pipe controls odours as it does in a VIP, but the degree of fly control is entirely dependent on the squat hole lid being put in place for all the time, apart from when the latrine is in use. This means that the latrine must be used with great care, and the children

taught that it is essential to replace the lid after each time they use the toilet.

Structures made in this way are relatively cheap and simple to build, provided that some sort of pipe can be procured. A bag of cement will be sufficient in the lowest cost structures, with traditional building material being used for the structure. Structures are made to provide privacy only, and therefore can be light, since they do not have to support a roof. Two holes are made in the concrete pit cover slab, one for the squat hole and one for the vent pipe. A branch, fastened to the structure and to the upper part of the pipe supports the free standing pipe within the structure.

The system is illustrated below. It must be remembered that health education campaigns are very important, as this system will only control flies if the lid is constantly fitted in position.



HYGIENIC PIT LATRINE - VENTILATED

THE VENTILATED IMPROVED PIT LATRINE (VIP)

Whilst not the cheapest of sanitation systems, simple and effective VIP latrines can be built at modest cost with two or three pockets of cement, and when built correctly offer many advantages over the systems described previously. The interior should be free of odour and flies, which makes the system more attractive as a washroom. The VIP is not an ultra low cost answer to sanitation, and was never intended to be so.

Most of the problems of the ordinary pit latrine are overcome by the construction of the VIP. VIP latrines are best built as single units or double units for the family or as multicompartiment units for schools or institutions. They do not require water to operate, although water is required for cleaning.

The VIP latrine was specifically developed to overcome the problems of odour and flybreeding commonly found in pit latrines. Some pit latrines are almost odourless and flyless even without a pipe, but these are rare. They occur when the pit is very deep, say over 5 metres, when the latrine structure is dark and cool, and when the latrine is used only by a small number of people and kept very clean. Such conditions rarely occur in practice in the rural areas of Africa, and most unprotected latrines smell rather badly and are infested with flies and other insects.

When a latrine is odourless and free of insects it is used more often and appreciated more. Because it is a private place it can also be used as a bathroom. The VIP latrine is popular and hundreds of thousands have been built on the African continent. This popularity suggests, very strongly, that the basic principles used in the design are sound and actually work in practice.

The VIP latrine works well because it employs the forces found in the natural world to make it operate. Such forces are dependable and can be guaranteed to operate over a wide range of conditions.

Basic principles of the VIP

VIP latrines differ from standard pit latrines in that the concrete slab which covers the pit is made with two holes in it. One hole is fitted with a screened ventilation pipe, the second hole is used for squatting. All VIP latrines are fitted with a roof. Two basic forces are operating, one concerned with the movement of air in pipes, the other with the instinctive behaviour of flies.

1. Pit ventilation.

Where the pipe is fitted over the latrine slab, any air movement across the top of the pipe will cause an up-draught in the pipe. Air is literally sucked out of the pipe by the air passing across the top. The air forced to rise up the pipe is replaced by new air which is sucked in through the

squatting hole in the slab. The squatting hole acts like an air inlet with the vent pipe acting as an exhaust, just as in a motor car engine. In the VIP the air is passing through the squat hole and the vent pipe continuously, often rising in the pipe at a rate of over 1 metre per second, when a good breeze is blowing. When this air movement is taking place, it is impossible for the foul gases in the pit to escape up through the squat hole into the latrine house, at least, not to any extent. All the odours pass up the pipe and are diluted in the atmosphere. The interior of the latrine therefore remains odourless.

Although wind is normally the main force which draws air through the vent pipe, this is not the only mechanism operating. On hot still days, the pipe ventilates without wind. In this case the sun heats the wall of the pipe and this in turn heats up the air inside the pipe. Since hot air rises, the air will pass up the pipe and cooler air will be drawn in from the pit. This mechanism works particularly well in thin walled pipes, which heat up quickly. It is less effective in thick walled brick pipes. Thin walled pipes made of asbestos, steel, and PVC are usually coloured black or grey to help this effect. However on most occasions even unpainted white asbestos pipes works very well.

Smoke test.

The effect of the pipe can be demonstrated in a "smoke test" when a smokey fire is lit inside the pit, usually with a mixture of paper sticks and grass. Once the flames have settled down, the smoke is drawn up the pipe, with almost none coming out of the squatting hole. This test is very valuable when checking on the construction of a VIP latrine. If there has been an error in the construction, and the pipe does not ventilate well, smoke will come out of the squat hole. It is important to check for possible mistakes in construction.

Efficiency of ventilation

The efficiency of ventilation varies depending on the type of pipe chosen and the direction of the structure in relation to the wind. If the latrine structure opening is facing into the wind, more air will pass through the latrine, compared to a latrine with an opening facing away from the wind. When the latrine opening faces the wind, air blows into the structure, and is forced up the pipe. This movement of air is assisted by the suction caused by the wind blowing over the pipe. If the latrine opening faces away from the wind, the wind will try to draw air out of the structure, whilst the pipe is trying to draw air into the structure. When the pipe is efficient, it will always draw more air than the superstructure opening, no matter what direction the structure faces. However if the pipe is less efficient, it is possible that in unfavourable conditions, air may actually be drawn down the pipe to replace air passing out of the structure opening. This will lead to odours building up in the latrine, and is

most common when brick vent pipes are built too small, and the wind is blowing away from the structure opening.

The most efficient pipes are thin walled pipes made of steel, PVC and asbestos. Asbestos is the most permanent. Steel pipes tend to corrode in time, and PVC becomes brittle over the years. Brick pipes are less efficient, but work well enough if they are made to the required specifications. They should have an internal measurement of 225mm X 225mm and the internal wall should be smooth. The head of the pipe should be at least half a metre above the roof level, and preferably more. If a brick pipe is not tall enough, or is made with four bricks per column and not the recommended six bricks it will not work well. Also if the internal wall of a brick pipe is roughly finished off and the internal area is small it will not work well. Very often a builder leaves a lot of mortar on the inside surface, caring more about the external appearance of the pipe. In this case the internal appearance is the most important and should be smooth.

It can be seen therefore that an efficient vent pipe is essential in the VIP latrine. At one time 150mm diameter pipes were commonly chosen, but their high cost led to the adoption of smaller pipes. A 2.8m long X 110mm pipe works well and is used a great deal in VIP latrine programmes. Asbestos is probably the best material from which to make pipes since their quality does not deteriorate much with time. Some rural programmes in Africa use brick pipes almost exclusively - in these cases it is important that builders are trained to make the pipes correctly.

Maintenance of the vent Pipe

Another important aspect of the vent is that over the years cobwebs do grow inside the pipe, and these can greatly reduce the efficiency of air movement. It is important to ensure that pipes are washed down with a bucket of water from time to time to keep the pipe clear.

Latrine location.

Ventilation pipes do produce an odour, which is quickly dissipated into the air. Obviously the higher the pipe, the less the smell will be noticed outside. It is wise to ensure that the air passing over the head of the pipe does not drift into a nearby house. In a typical homestead, the latrine is best placed downwind of the living area, so that the wind will carry odours away from the homestead, and that fresh wind will blow into the superstructure opening.

Latrine orientation.

Although solar radiation is less important than other factors in deciding the orientation of the structure, it is wise to ensure that morning and evening sun do not shine too brightly on the internal walls of the latrine, as this may influence the emergence of flies from the pit. The latrine opening should face north or south if possible. The priorities as far as latrine orientation are concerned should be as follows:

1. PRIVACY
2. WIND DIRECTION
3. NORTH/SOUTH

The more efficient the pipe is, the less critical the wind direction and other factors become.

2. Control of flies

VIP latrines are very effective at controlling flies. Indeed they were originally designed for this purpose. The theory of fly control is quite simple. Flies are attracted to a latrine by an odour and away from it by light. Once inside the pit, flies breed and when they emerge, they fly towards the strongest light source, which in most pit latrines is the squat hole. Thus in most pit latrines, odours come out of the squat hole, and flies pass freely to and fro through the same hole. There is no control of either odours or flies.

In VIP latrines most of the odours are sucked up the pipe and escape into the atmosphere. Likewise most of the light falling into the pit passes down the pipe if the structure is fitted with a roof. Flies approaching the latrine from outside are therefore attracted strongly to the head of the pipe, and flies from within the pit are attracted up the pipe. These two groups of flies are never allowed to meet however because the head of the pipe is fitted with a corrosion resistant flyscreen through which they cannot pass. This makes it impossible for flies to enter the pit through the pipe, although some will find their way into the pit through the structure and squat hole. The number of flies attracted through this route will be few if the interior of the latrine is kept clean. However if the interior is poorly maintained and smelly, flies will be attracted inside, and will find their way into the pit and breed there. This is one good reason why latrines should be kept clean. However in the VIP latrine, flies that escape from the pit will pass up the pipe and will not be able to pass through the screen. Such flies may pass up and down the pipe, but they are permanently trapped and die, falling back into the pit. They are the victims of their own instinctive behaviour.

If the screen is broken, all fly control is lost because flies will have direct access both into the pit (via the pipe) and away from the pit (via the pipe). It is clearly essential that the screen material is strong and corrosion resistant and is kept in tact.

Screen Material

Most metal screens are destroyed rapidly at the head of the pipe because the gases passing up the pipe are very corrosive. Normal metal screens will last much less than a year and are of little value. PVC coated fibreglass screens last up to 5 years and then become weak and must be replaced. Aluminium screens are known to last over ten years and can be used with success. Stainless steel screens are the screen of choice although they are more expensive than other screens. Another screen material with potential is made of copper wire.

A mesh size of 1.2mm - 1.5mm is recommended. The open area should be about 60%. If the apertures are larger some flies and mosquitoes will pass through. If they are smaller there is too much frictional resistance to the updraught of air.

Semi dark conditions

The vent pipe can only act as a fly trap if the interior of the structure is kept semi dark, thus allowing light to enter the pit predominately from the pipe. Flies move away from the pit to the strongest light stimulus, and this must be the pipe at all times. Where doors are fitted to non-spiral VIP latrine structures, semi dark conditions cannot be guaranteed, and fly control can be lost altogether. Many VIP programmes in Africa, have chosen not to use the spiral model of the VIP, with disastrous consequences. Only with the spiral superstructure can semi darkness be guaranteed and the VIP work as it was first designed to work. It is quite possible to fit a spiral structure with a door, if total privacy is required. When this technique is used, fly

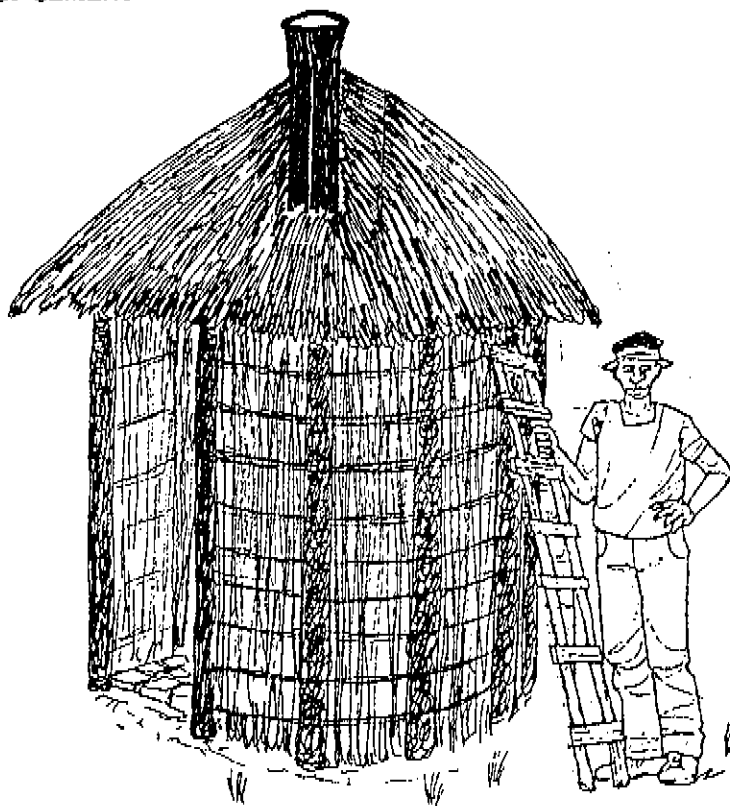
control is not lost, if the door remains in the open position.

Use of the VIP Latrine in Country Programmes

The VIP latrine has been advocated as a latrine system to aim for in many country programmes. In Zimbabwe, the birthplace of the VIP latrine, some 250 000 units have been built since 1980, and it is regarded as the standard latrine model for country programmes. Originally the standard model VIP (Blair Latrine) consumed between 5 and 6 pockets of cement for a single family unit, but now a more modest 3 bag (pocket) model, which uses some traditional materials has been accepted by Government as a more appropriate option for the future.

The VIP latrine is perhaps too sophisticated for use in many family based country programmes in Africa, where the simpler models described in this report may be more appropriate. However, the lowest cost VIP's should always be considered. VIP latrines will always be suitable in school settings in these countries, and efforts should be made to retain this standard.

BLAIR LATRINE USING 1 BAG OF CEMENT



IN THIS MODEL A TUBULAR VENTILATION PIPE MUST BE FITTED WITH A MINIMUM DIAMETER OF 100mm. THE HEAD OF THE PIPE SHOULD BE FITTED WITH A CORROSION RESISTANT FLY SCREEN

LOW COST BLAIR (VIP) LATRINES

Standard Blair (VIP) Latrines are built using high standards of construction to give permanence to the latrine structure. However with skill and the use of some locally available materials, it is possible to make durable Blair (VIP) latrines with less cement. The simple hygienic pit latrine fitted with a coverplate and a vent pipe is a type of ventilated pit latrine but normally a roof is fitted to VIP's to ensure semi darkness within the structure. If the soil is firm and a full pit lining is thought to be unnecessary, lower cost Blair VIP's can be built using a single bag of cement together with a PVC or asbestos cement ventilation pipe and traditional materials to built the superstructure and roof. Lower cost Blair VIP's using a brick vent pipe require a full pit lining to support the weight of the pipe and normally require at least 2 bags of cement. Field manuals describing the techniques are available from the Blair Research laboratory.



Blair VIP using
2 bags of cement

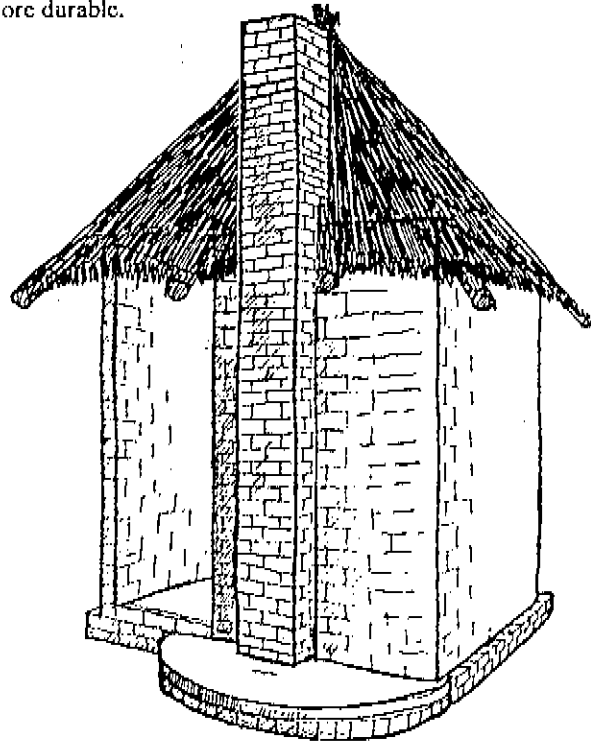


Blair VIP using 3 bags of cement
(with iron or asbestos roof)

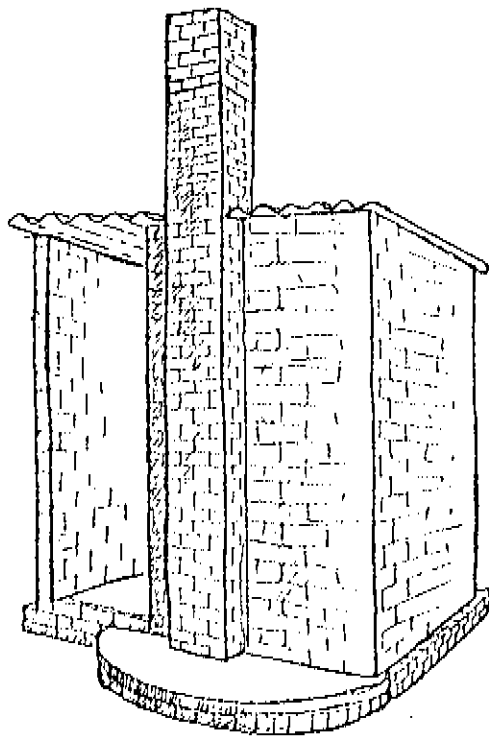
Blair VIP using 3 bags of cement
(with grass roof)

UPGRADING THE 3 BAG MODEL OF THE BLAIR (VIP) LATRINE

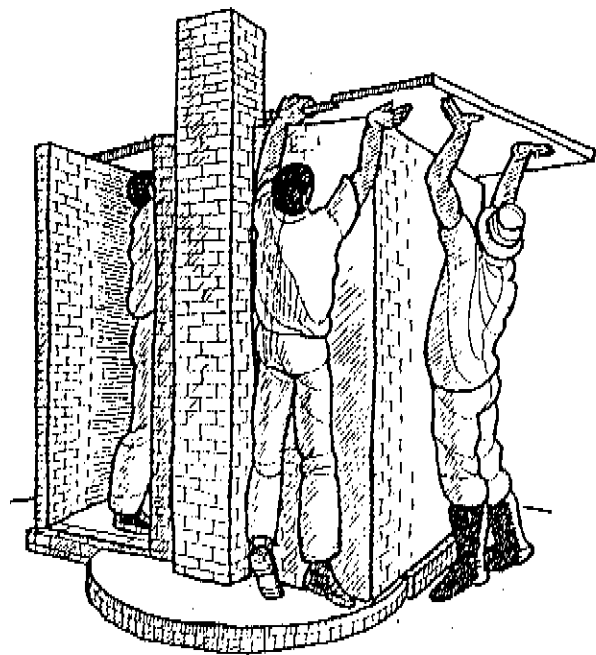
3 bag model of the Blair (VIP) latrine can be made more permanent by adding a more durable roof. This can be provided by the owner of the latrine in the form of a tin or asbestos roof without any additional cement being required. A ferrocement roof can be made using chicken wire and an additional bag of cement. Cement mortaring the external wall will also make the structure more durable.



Blair (VIP) Latrine
using 3 bags
of cement and
thatched roof



Blair (VIP) Latrine using 3 bags of cement
with a tin or asbestos roof



Blair (VIP) Latrine using 4 bags of cement
with ferrocement roof

UPGRADING NORMAL PIT LATRINES TO VIP'S

The common pit latrine normally consists of a hole dug in the ground, a covering slab made of wood, concrete or cement overlaying wood, and some sort of structure built for privacy. Very often a door is used to ensure privacy. This simple structure is a very common sight in the rural areas of many African countries and can work well if the hole is deep, the inside of the structure is dark and the slab is kept well washed down with water, and a cover plate is used to restrict access of flies to the pit. In most cases however, the pit is shallow, the structure allows a lot of light in, and may not be kept clean and no cover plate is fitted. Even when a cover plate is provided, it is not always replaced immediately after use and flies still have access to the pit, and may abandon the pit in large numbers once the plate is removed. Most pit latrines smell very badly and act as breeding places for flies. As many as 150,000 flies a year can breed and emerge from a single pit latrine. Such flies can carry disease and are a great nuisance in the homestead.

Fly breeding and odours can be overcome by the addition of an efficient screened ventilation pipe to the pit latrine. The development of improved pit latrines fitted with screened ventilation pipes and superstructures which guaranteed semi darkness took place in Zimbabwe in the 1970's and these evolved into the VIP Latrine.

A great number of existing, unventilated pit latrines exist and can be upgraded to make them odour and fly free by the simple addition of a vent pipe and a means of keeping the interior semi dark. The structures are often well built with brick walls and are fitted with doors and a roof. Air holes are often built into the walls to aerate the interior. The pit itself is usually oblong and may or may not be lined with bricks. The great weight of a brick built latrine on an unlined pit can be disastrous unless the pit is dug in rocky soil. Collapse is inevitable.

However in many cases bricks have been used to line the pit and a concrete cover slab has been fitted. If the structure is sound, such a pit latrine can be upgraded so that it works as well as a VIP Latrine.

The upgrading process

Pit latrines that can be upgraded should have pits which are brick lined and only partly full. The cover slab should be made of robust concrete. The structure should be substantial and fitted with a door and a roof. The structure should be checked to see if the following steps are possible:

1. Fit a ventilation pipe with a flyscreen.
2. Ensure that the door can be adjusted so that it is self closing.
3. Replaster the floor so that it slopes towards the squat hole and is more hygienic.

4. Reduce the internal light within the structure by reducing the size of existing air holes in the wall.

The Ventilation pipe

In the normal pit latrine air (and odours) from the pit must pass upwards and escape through the squatting hole. Flies are attracted to these odours and find their way directly into the pit and breed there. If a second hole is made in the latrine slab and a vent pipe is fitted through this so that the top of the pipe is well above the roof level, air from the pit will pass up the pipe and fresh air will be drawn down the squatting hole to replace it. The exact position of the pipe is not critical and it can be fitted inside the structure as well as outside. What is essential is that the pipe is fitted directly over the pit and that the pipe draws air efficiently.

In normal pit latrines which have not been designed for a pipe, this means that a hole for the pipe will have to be knocked through the concrete base slab within the structure. This can be made either behind the squat hole or to one side of it. When pipes are fitted in this way, a matching hole should also be made in the roof through which the pipe can be fitted. The minimum size for an efficient vent pipe is 110mm, the most convenient being PVC or asbestos. The screen can be made of aluminium or PVC coated fibreglass, but stainless steel is the best. PVC and asbestos pipes are available commercially. The hole through the concrete slab should be cut out to the required size with a hammer and cold chisel. It is wise to ensure that the slab is strong enough to accept this treatment. The hole should pass right through the slab. The vent pipe is fitted so that it fits neatly and tightly into the hole in the concrete slab. Some cement mortar can be trowelled around the pipe where it fits into the slab and also where it passes through the roof.

The Door

Many normal latrine doors can be left open. If this is so, flies emerging from the pit will not choose to pass up the pipe but will pass through the squat hole. Under these conditions there is no control of flies. It is important, therefore, to design the door so that it is self closing. When the interior is darkened, when the door is closed, flies will be attracted to the light passing down the vent pipe and will be trapped there. One technique which works well is to cut some rubber tyre and attach it to the frame of the door in such a way that it bends backwards when the door is opened. The rubber can be nailed or screwed into the door frame. It is necessary to experiment with this technique to ensure that the door will self close. In fact there are several techniques using rubber that might be useful. Spring hinges can also be used, but are not easy to obtain and require regular maintenance.

The Latrine Floor

Many latrines smell because the floor itself is soiled or the cement is filled with urine. All latrines should be built with an dished shaped floor with all surfaces steel floated and sloping towards the squat hole. The mortar for the floor should be made with cement and clean river sand with a mixture of 1:3. Foot rests can be fitted but are not essential. Ideally the dried cement floor should be painted with a thick layer of waterproof paint like bitumastic, but this is not always available. The most important aspect of the floor is that it is frequently washed down with water. This helps to keep the interior of the latrine fresh and the pit contents moist.

Semi-darkness

In order to make fly control effective, the interior should be semi dark. This does not mean that the interior should be as dark as night however. Flies will be attracted from the pit to the greatest light source, which will normally be the vent pipe where the superstructure is semi dark within. When upgrading existing latrines it may be necessary to paint the inside of the roof black. When seen from the depths of the

pit, a fly is normally attracted to light coming from the inside of the roof. Air vent holes made in the walls may require reducing in size, but can remain in use. Fly control depends on a combination of factors. A good vent pipe, a clean interior and semi dark conditions are essential.

Routine Maintenance

In upgraded latrines it is important to ensure that the self closing door continues to work and that the floor is washed down frequently and the vent pipe is fitted with a complete fly screen. Fly control is lost if the screen becomes broken, as the flies will pass through the broken screen down the pipe into the pit and up the pipe away from the pit. Over the years it is possible that cobwebs are spun inside the pipe. If webs become too thick they can seriously reduce the rate of air flow in the pipe, and this will lead to odour and fly problems. It is therefore wise to flush a bucket of water through the pipe from time to time, to clear the webs.

If the latrine is used as a washroom, the floor will slowly erode away over the years, and may require replastering. If these simple maintenance procedures are followed, the latrine will provide good service for many years.

SOCIAL MOBILISATION AND THE PROMOTION OF LOW COST SANITATION OPTIONS

It is now well established that the provision of improved water supplies and sanitation forms the very foundation of all work carried out in the Public Health sector, and that unless these basic services are improved, the total result of improved "Health for All" cannot be achieved. One of the problems facing current programmes of sanitation implementation is the coverage in marginal or low income areas. Even so called low cost options, may be unaffordable by the lowest income communities, and thus improved sanitation still remains unavailable. If the aims of "Health for All by the Year 2000" are to be achieved, this shortcoming must be addressed in the future. The question that must be asked is: how this wide coverage can be achieved?

Awareness Background

Many successful current programmes have not emerged overnight. In Zimbabwe, for instance, the relative success of the programme in the current decade was built upon a strong foundation laid in earlier decades by the Public Health Services. The concept of improved sanitation and its advantages had been the subject of educational campaigns for decades before, albeit not as high powered or well funded as in more recent years. Where the importance of improved sanitation has not been emphasised in earlier times, it becomes more difficult to promote improved latrine programmes. Under such conditions, earnest attempts must be made to strengthen awareness amongst communities.

Thus all successful sanitation programmes must depend on a fundamental awareness by the target group, of the importance of basic improvements in hygiene and proper waste disposal. Such an awareness develops over a prolonged period.

Using the technology to "sell" sanitation

This awareness of the public, acts as an important starting place from which more elaborate programmes can begin. Public health officials find it easier to promote improved sanitation programmes under these conditions compared to situations where the earlier awareness programmes have been lacking. In addition the promoters of new sanitation find it more easy to "sell" technologies that have specific and easily observable benefits. The VIP, for instance, with its potential for fly and odour control and its relatively long life is easier to promote than more temporary and less effective technology. It also brings status to the household, an important consideration in such programmes.

Even with simpler types of improved sanitation, the basic improvements can be emphasised in promotional campaigns. Even with the so called "half bag model" described in this report, the simple parts may represent significant steps forward in terms of sanitary hardware, especially in

under privileged areas. The permanent sloped hygienic concrete cover slab is, in itself, a huge step forward compared to crude covers made of wood or earth. It can be washed down and kept clean, and the washing water can drain into the pit and thus aid the decomposition of excreta. In such simple latrines, where the pit is unlined, the considerable overlap of the slab over the pit (of reduced diameter) and the backfill of pit cuttings around the slab, can be emphasised as distinct improvements over earlier more traditional designs. Such latrines are less prone to collapse, and this is an important consideration in any improved latrine. The advantages of protecting pits from collapse and particularly of lining them should always be emphasised. These simple and basic improvements in themselves make possible an improved sanitary environment around the latrine itself, and this must be seen as an important step forward. The privacy offered by a well drained latrine, also provides an excellent washing facility, and one that might also have a direct impact on personal bodily hygiene.

Technology Level

The technical level of sanitation being promoted must be acceptable to the users and to the relevant Government Department. The simpler types of sanitation are only appropriate where nothing existed before, or at least the barest minimum facility existed before. Where improved types of sanitation had existed before, the new step must be forward and not backwards. It is for this reason that VIP sanitation has a found a ripe ground in much of Zimbabwe, where some form of brick built sanitation had existed before. What remains important is that the sanitation is affordable and represents a step forward in the proper disposal of human waste.

Subsidy

There can be no doubt also that the offer of a subsidy, greatly assists in the promotion of sanitation programmes, and may even act as a trigger mechanism. The subsidy is important, some think even essential, provided that it does not remove the important element of family involvement and commitment, both in labour and financially. It is essential that the family (and most successful programmes of sanitation are aimed at providing family sanitation) should be involved with financing with a heavy emphasis on self help. The subsidy, where provided, should be thought of as an incentive. Cement is often a key ingredient, and this can be considered as a successful subsidised ingredient, because it is often unavailable in the more remote and low income areas. Bulk purchase of cement is also cheaper. Cement can be combined with a careful and skillful use of local materials to make the finished product. The importance of the use of traditional materials and techniques cannot be over emphasised.

Government Support

Successful sanitation programmes do depend on sound technology, but they also depend very much on the support of central Government. There is some variation in the subregion, when it comes to the responsible Government Department. In some it will be the Ministry of Health, others the Ministry of Housing or Construction. Where the Ministry of Health are involved, the Government Health Inspectors and the Health Assistants (Environmental Health Officers and Environmental Health Technicians) will play a vital role in the promotion of improved sanitation. Such people, together with their counterparts in other Ministries (such as the Community Development Workers in Zimbabwe), provide a vital service to the nation in their role as health educators. They are really in the front line. They must bring an awareness of sanitation in the first place.

Demonstrations

In starting new programmes, it is essential that demonstration models are built and used in key situations, where the public can view and form their own opinions. It is also essential that the most suitable department, whichever this may be, is able to sense acceptance or rejection by the potential users. If acceptance is sensed, then an early programme of training (usually of officials and builders - in that order) must be initiated as soon as possible. Such programmes can never succeed unless there is complete support by the community and by individual families. There must also be a guarantee of the external inputs, such as cement, being delivered. To make people aware of a programme and its targets, and to prepare them, and then to let the people down, is counter-productive. The importance of good sanitation must be "preached," and then proven by example.

SUPPORTING RURAL SANITATION PROGRAMMES

The progress made in the provision of sanitation is likely to take place at a more rapid pace, if some sort of support is made from donors or Government. This can either be in the form of promotion and education but may also be in the form of a supporting subsidy.

Subsidy or no subsidy?

In some countries, donor agencies, through the appropriate Government Department, offer each family or institution, like a school, a subsidy to assist in the construction of an improved latrine. This system has mixed blessings. On the one hand, where subsidies are given, far more families are prepared to come forward and put their own efforts into improved latrine construction, even if this means providing materials and money for paying builders. On the other hand, very few African Governments can afford to carry the cost of the subsidy themselves and must rely on imported donor funding. This dependency on foreign aid, is not sustainable forever, and may be counter productive in the long term.

Possibly a compromise may be reached where some sort of part-subsidy, rather than a full-subsidy, is given, as an incentive for families to actively participate in latrine construction projects. A subsidy in the form of a bag of cement, or possibly two bags may be sufficient to "trigger" the initiative for latrine construction.

For the VIP latrine, a bag and a pipe may be sufficient in stable soils, or two bags and a pipe in less stable soils. All other components might be found locally, and provided by the user. The challenge, once again, is for Government to find a pipe cheap enough and readily available in relatively large numbers to provide at very low cost.

Looking for suitable designs for future use.

Several models of upgraded pit latrines might form the basis of further work to be carried out in the countries concerned. It is important, whilst testing these ideas to look for already existing traditional techniques in excreta disposal, that already work well in practice. To build on existing indigenous techniques is perhaps the soundest approach of all, to sustained development. The most important aim, is to make improved methods of excreta disposal acceptable and widely used. Such campaigns require innovative educational literature and the effective use of the media.

Which system to use?

The hygienic Pit Latrine

This is perhaps the most suitable latrine system to build in the household situation in most of rural Africa. The simplest models should offer a good well sloped coverslab

mounted over a ring beam at the head of the pit. A simple tin cover can be supplied with the subsidy or by the user himself. The superstructure should be built with simple local materials for privacy and a roof is not essential.

This model requires cement (half a bag) and river sand for the slab and another half bag of cement, pit sand and bricks or rocks for the ring beam. It can therefore be made very cheaply, with a minimum of imported materials (1 bag of cement) if the soils are firm, and perhaps 2 bags if the pit needs lining with bricks or rocks.

It is unwise to mount the slab over an existing temporary pit without a lining, as the advantages of the slab may be offset by subsequent collapse.

More sophisticated models of the simple pit would be fitted with specially made, close fitting lids, preferably of shaped tin which can be lifted by foot, thus avoiding cross contamination of hands by the handle. Concrete lids might also be used, such as in the "sanplat system" as these may be familiar in many areas, bearing in mind the reservations expressed above.

The VIP Latrine

Many African countries and several international agencies operating in Africa have already made a technology choice in favour of using the VIP latrine. This is a wise choice provided that the system can be sustained. VIP latrines require cement and vent pipes in their construction, two commodities which may not be widely available. They may find a better place in schools and other centres under these circumstances.

If the sanitation programme is to expand using VIP technology, it is essential that low cost models are chosen which take advantage of traditional materials and skills in their construction. It is also essential that models of the VIP are developed which have local flavour and can be easily identified. Such developments make the impact of educational and propoganda campaigns much greater and more nationally orientated.

Clearly specific constructional techniques, which reduce the amount of cement, should be identified, field tested and then chosen in national schemes. These include techniques for both pit lining, superstructure and roof construction and slab making. Also efforts should be made through various channels to identify a means of making ventilation pipes far more easily available than they are at the present time. The discovery of low cost, simple to make, effective and robust ventilation pipes for VIP latrines has yet to be made. In the meanwhile, imported materials like PVC will be required for the pipe material, unless bricks are used in vent pipe construction.

Evaluation

In evaluating different latrine models for rural programmes, it is important that some national institution places on trial the various options to assess the merits and disadvantages of each. The aim is to bring down the overall cost of the unit, whilst maintaining performance and durability. It is possible that some of the lower cost latrines described here should form the basis of further work to be carried out in the country itself.

Training Programmes.

The advantages of improved latrines, of all types, only become apparent when they are built correctly and demonstrated to potential users. Most latrines can be built well, so they work properly, or they can be built badly, with the same amount of materials, so they will not work effectively. It is important therefore that the skills of proper latrine construction are taught correctly in the locations where latrine programmes are taking place. Builders of latrines perform their best work when they understand how the system works. This means having adequate training themselves and having suitable educational material, on construction, freely available to them.

Training of supervisors

Two types of training appear to be required. The first is the training of supervisors who will themselves be required to train others in field conditions. These people will be involved in the construction of demonstration models in the field. Usually such training programmes take place at a central place in a District and are backed by theoretical training. Good builders' manuals, and background theoretical training material are required for these programmes.

Several points are stressed at these training sessions. The operating principles of the latrine are described and demonstrated in detail. These include siting and orientation of the structure, and methods of construction of the pit, pit lining, collar, foundations, slab, vent pipe (where used), superstructure, floor and roof. Concrete slabs are constructed with particular emphasis on reinforcing (or the lack of it) hole size and position. The importance of a good vent pipe fitted with a corrosion resistant screen is also emphasised if the system is a VIP. The importance of a sloped hygienic floor and daily household maintenance is stressed. Life expectancy of the pits are also discussed. Site visits are also made.

Training of Builders.

The second type of training is designed for local builders, who are already skilled in building techniques, using bricks and mortar, for instance, or in the skill of using traditional materials in the construction of structures. Such builders may have little knowledge about building the latrines, but are trained in latrine construction in the villages where they will continue to operate and use their skills. These are the

most active programmes, and participation of community leaders and government officials is very active, as well as the builders and householders themselves.

Initially a plan of action is drawn up. Approximate dates are agreed when a demonstration team will move into an area. Specific sites are chosen, usually at specific homesteads, where pits are dug and the local materials, like bricks and sand are gathered in preparation for the demonstration. Several families may participate within a specific area, with several builders being trained simultaneously at different sites. Alternatively, several builders may jointly participate in the construction of the first unit, and then move to build one themselves.

The method of lining the pit and casting the slab may be shown, for instance, at one homestead, whilst methods of fitting the slab, making the foundations and structure and roof, may take place at other sites. Thus a series of demonstration latrines are made in one area, often in the homesteads of families who came forward early, with a fully dug pit, a supply of bricks and other materials. Finished latrines are inspected and discussed in detail by the group.

Builders require specific knowledge on measurements of the pit and slab, vent pipe, and structure. Advice on where specific care is required in the construction and how errors can be made is essential. Although some theoretical instruction is given, most of the emphasis is placed on practical "hands on" construction.

Educational Material.

The importance of well illustrated educational material on constructional techniques cannot be over-emphasised. It is important that such manuals can be fully understood by builders who may not be able to read, but can use a tape-measure and take measurements from the manuals. This requires a skilled artist, who can combine technical accuracy with good figure work. Health education campaigns backed by educational literature also plays an important part in ensuring that the latrine will be maintained properly by the family owner.

A knowledge of the chosen latrine and latrine programmes should be well known to the public. Latrine construction should be taught at schools and might also appear in the school curriculum. Successful programmes might be reported in the newspaper and descriptions of them be relayed over the radio or television. Films or videos of constructional techniques or successful latrine building programmes can also be made to emphasise the importance of the programmes.

Latrine building programmes are important as they form a cornerstone to primary health care programmes where self help is important and the promotion of improved hygiene in the homestead is encouraged. A well built latrine in the homestead demonstrates very clearly the families commitment to promoting the cause of improved health and hygiene.

APPENDIX

**Summary Findings of the Harare Workshop
19-22 November 1991**

HARARE WORKSHOP

GROUP RECOMMENDATIONS

TECHNOLOGY CHOICE

1. Where conditions are suitable the PIT LATRINE should form the basis of sanitation technology suitable for very low income communities
2. Some form of subsidy will be required to ensure that minimum standards are maintained.
3. The subsidy should be provided in the form of hardware. This should include a concrete cover slab or the means to make one, and assistance in the construction of a ring beam, or a partially or fully lined pit depending on local conditions. The subsidy should also include the provision of training.
4. The structure of the latrine should be supplied and built by the user and should be made of the most appropriate local building materials.
5. The choice of coverplate and/or vent pipe and whether they are included in the subsidy should be left to the appropriate authority responsible for the development.
6. The maintenance of the structure should be left in the hands of the users.
7. Where latrines are placed in high density areas, some effective means of desludging should be used e.g. mini vacuum tanker.
8. The design should take into consideration the end users and also those providing the subsidy. Such designs should provide for ease of maintenance and a reasonable life span.
9. Communities served by improved sanitation should be made aware of environmental issues and be exposed to health education programmes
10. There is still a requirement for research and development including studies of the greater use of local materials and recycled waste.

HYGIENE EDUCATION

1. Evaluation on sanitation programmes needs to be thorough and continuous - there is a need to follow up more often.
2. There is a need for the promotion and provision of hand-washing facilities.
3. There is a need to intensify health education and this means spending more time and money.

4. Hygiene educators should lead by example and "practice what they preach."

5. There is need for emphasis on sound personal hygiene practices. These are the goals for motivating people through educational programmes.

6. Team work is essential between all personnel involved in facilitating the implementation of health and other programmes. There is a need for continuation within the system of health workers, integrated services are essential.

7. There is a need for authorities responsible for hygiene and prevention of diseases to take the lead in the campaign for better sanitation and then involve and integrate other services.

8. Sanitation programmes need to be budgeted for as a priority especially education on hygiene.

9. Promotion of preventative health methods and training of health workers in these methods should help reduce future curative health treatments.

MOBILISATION FOR SUSTAINABILITY

1. For any sanitation project to be sustainable it is imperative that the involvement of women, school children, and senior citizens should be emphasised.

2. Having realized and accepted the fact that local communities of whatever economic status, have a capacity of solving most of their problems, communities must be given an opportunity to assess and analyse their problems and then take action.

3. For any sustainable project, there is need to carry out an initial survey (KAP study), the results of which should be discussed thoroughly with the community who should look for solutions to their problems.

4. Health education should be an integral part throughout the process.

5. Sustainability is assured if local resources, materials, technology and manpower are fully utilized.

6. Emphasis should be put on the local human manpower resource development.

7. For the very low income groups, the issue of subsidies cannot be ruled out. The subsidies should be a felt need by the communities.

8. Continuous participatory monitoring and evaluation of the project should be an integral part throughout the implementation process.

PLANNING AND IMPLEMENTATION

1. A National Sanitation Policy should be formulated by each country defining the objectives, strategies and action plans for sanitation programmes.

2. Defined organisational structures with the Ministry responsible for sanitation from central to community level must be established and allocated sufficient resources to execute nation sanitation programmes.

3. Linkage and co-ordination mechanisms should be well

worked out at all level with sectoral and external supported donors.

4. The planning should be based on problem identification and needs assessment and to include six phases of planning (preparatory, pilot, implementation, monitoring and evaluation, replanning and follow up and operational research).

5. More specific guidelines for monitoring and evaluation process should be developed based on measurable and quantifiable indicators and baseline data.

6. Guidelines on planning and implementation discussed in the workshop should be incorporated into the final guidelines.

HARARE WORKSHOP

GROUP REPORTS

GROUP 1 - TECHNOLOGY CHOICE -

The group first went through the various technology options that were available, but most of these were not appropriate for low income communities.

The one day latrine and the cat method of disposal were unanimously considered inappropriate for promotion in any community including low income communities.

The following latrine systems were briefly discussed:

1. Bucket type
2. Borehole latrine
3. Pit latrine
4. VIP latrine
5. Septic tank system
6. Compost type

The bucket, borehole, septic tank and compost latrines were considered unsuitable for use in low income areas for various reasons and the most appropriate models were considered to be the pit latrine and the VIP latrine.

There was then some debate about the importance of various components of the pit and VIP latrines. These included the lining of the pit, the cover slab, the latrine floor, the superstructure, the cover plate and the vent pipe. The importance of a strong slab and hygienic floor were emphasised, with an adequate pit lining being essential in unstable soil conditions. In comparing the coverplate and the vent pipe, the plate was considered cheaper, but the vent pipe conferred several benefits to the ordinary pit latrine. The general consensus was that finance should not be a limiting factor, especially if the health benefit was to be sacrificed. However there was no complete agreement on the vent/coverplate issue. Structures could be designed to suit local conditions.

On the issue of the subsidy or no subsidy, it was accepted that low income communities would definitely need some form of assistance, in the form of a subsidy of some type, if acceptable standards of low cost sanitation technology recommended at the workshop were to be promoted. This might be in the form of training or education or in the form of hardware.

In high density areas, where pit latrines were used, an effective pit or tank emptying service was considered essential.

A detailed questionnaire was circulated to the participants on the topic of technology choice. The results of this are reported later in this document.

GROUP 2 - HYGIENE EDUCATION

Four main areas were discussed;

1. Determining what hygiene education is required and in what language.

-Hygiene education is very vital to low income communities. It needs to be established who we are addressing as regards their socio-cultural and economic backgrounds.

-Referring to the document "Appropriate Sanitation for Very Low Income Communities," the section on "Educational Material" concentrates on the education during the construction process, whereas the working group felt that emphasis should be placed on the need to change or redirect the community behavioural patterns.

-There is a need to achieve maximum community participation and co-operation (no dictation) e.g. special care to be taken with unique groups like some church sectors when determining education.

-Hygiene education must be developed from within the community, bearing in mind the level of literacy in the community.

2. Determination of who delivers which message when.

WHO?

-The best person to deliver the education messages should be a knowledgeable, experienced and mature community person or participant, e.g. a community worker, selected by the people. Anyone else from outside the community should only contribute by assisting and advising.

-Identified community people need to be basically trained to educate their community.

WHICH MESSAGE?

-Depends on who the message is intended for.

-In case of education on sanitary hygiene, it is recommended that women be educated by another women and men by another man. Sanitary topics could be very sensitive and even embarrassing).

-A colleague from Botswana gave an account of the pit latrine school programmes where schools are supplied with wash basins and soap for washing hands.

-School health clubs had also been established to enforce hygiene education in schools. These clubs ensured that school children clean the toilets and pick up litter. They

also educate other children via poems, drama etc.
-School curricula should include hygiene education.

WHEN?

-Hygiene education to be a continuous process carried out by accepted community workers after being trained.

-Sanitary hygiene can be discussed during workshops for community leaders or any other seminars like political rallies, work parties, womens clubs, church etc. i.e. at appropriate meetings.

-The time of the day is essential, hence education should be carried out during the day in rural areas or on rest days depending on prevailing circumstances.

3. Development of Support Material

-Again depends on the community being served i.e. its literacy level and the socio-economic status > KAP which includes need assessment, incidence of disease and data analysis.

-Training materials should be as basic as possible e.g. a basic chalk board at school.

-Simple audio-visual materials should have relevance to the community i.e. something they can easily recognise and that they can compare with.

-Songs, rhythm, poems, and radios can be used to support the education system.

-Care should be taken not to use offensive insulting materials.

4. Training required.

-Depends on who is being trained for what.

-KAP(knowledge, attitudes and practices) to be borne in mind.

-Training methods to be basic and simple.

-Training can be targeted towards Village Health Workers, Traditional Midwives, Traditional Healers, Health Personnel and School Teachers.

-Refresher courses are essential for the trainers and also on the job training.

-Training should be as practical and community based as possible with full participation from the community.

-Trainers require extra skills for adult education.

-Training required also depends on the problems in the particular community e.g. in Zaka (Zimbabwe), Blair Toilets had been constructed but diarrhoea persisted

because people had not been trained to wash hands after using the toilet.

-The responsibility for supervision and monitoring should be a bottom-up approach, starting right from the family unit to the authorities in charge.

GROUP 3. SOCIAL MOBILISATION AND THE PROMOTION OF LOW COST SANITATION OPTIONS

The target group to include vulnerable people like women, school children and oldmen and women. These are important resource persons for most programmes.

In the African culture, the women are the ones who bear most of the burdens in the home:-

- Collecting water for domestic use from long distances,
- Taking care of the sick persons in the family, etc.

Therefore, anything that can bring about some relief to their living is likely to have their full support morally and materially.

School children are in the learning age. They are eager to try and practice what they learn. They can offer a cheap workforce and they are also good change agents in the communities.

The old men and women have a characteristic of having a high command of respects and are therefore influential in their respective areas.

Having realised and accepted the fact that local communities of whatever economic status have a capacity of solving most of their problems, the principle that is going to be applied here is that of triple A circle. That is communities must be given an opportunity to assess and analyse their problems and then take action.

Approach

1. Identify the community leadership both the formal and informal ones. This should be the entry point to the community which is the main actor in water and sanitation activities.

2. In collaboration with the community and using the existing administrative structure carry out surveys to identify the water and sanitation related problems.

3. Again with the community carry out knowledge, attitude and practice (KAP) studies.

4. In group discussion, sit down with the community to analyse the information obtained during the survey and the KAP study. Learn from what the community knows and build up from there. Plan with the community on how to solve their problems, always giving the community a chance to look for solutions to the problems. In this process health education is cautiously instilled to

relate the findings of the survey and the study with health.

5. To solve these problems the mobilisation of local resources should be encouraged such as materials, technology, manpower and whenever possible funds. Where indicated, local personnel can be trained/retrained to take advantage of any new technology.

In this way the whole process of planning, implementation and evaluation comes in the hands of the community itself.

External assistance could only come as a last resort otherwise the community should learn how to be responsible for their health. Only when this situation is achieved can the programmes be sustainable.

GROUP 4. PROJECT PLANNING AND IMPLEMENTATION.

The Guideline prepared in advance by the Chairman was distributed to the members of the group and formed the basis for discussion. A brief presentation of the Guidelines was made by the Chairman (Mr Zawide) followed by discussion.

This resulted in the following comments for effective implementation of the Guidelines.

1. The Guidelines serves only if there is a national sanitation policy and strategies. Therefore each country should formulate a sanitation policy with defined objectives, strategies and an action plan..

2. There must be an institution (Government Ministry of Organisation) responsible for planning, implementation, co-ordination, monitoring and evaluation of national sanitation programmes. The institution should have an organisational structure from central to peripheral levels with the necessary staff and budget.

3. The priorities of the communities to be benefitted from sanitation projects should be based on problem identification and assessment of needs.

4. The planning process should include the following phases:

- Preparatory phase
- Pilot phase
- Implementation phase
- Monitoring and evaluation phase and
- Replanning phase.

5. More effective co-ordination mechanisms should be set up to ensure the proper planning and implementation of sanitation projects at all levels by involving the sectoral ministries and external support agencies including NGO's and the local communities.

6. Practical and specific monitoring and evaluation methodologies should be developed for sanitation projects by establishing base line data and measurable indicators.

The group adopted the Guidelines for project planning and implementation with the above comments and recommended for its incorporation in the final document (Guidelines for Appropriate Sanitation for Very Low Income Communities).

GUIDELINES FOR PLANNING AND IMPLEMENTATION OF RURAL SANITATION PROJECTS

STAGE	STEPS	LOCATION	ACTIVITIES	PARTICIPANTS	OUTPUT
I. PREPARATORY PHASE	1. Community diagnosis and organisation (Sanitation problem identification and needs assessment)	Community level (Households in Villages)	<ul style="list-style-type: none"> -Allocating budget -organizing meetings of village health committee local leaders, household owners - Briefing and discussions on project objectives and acceptance by the community -Base line data collection and analysis to identify needs and priorities -Formation of village sanitation committee -Formulation strategy for village sanitation improvement programme 	<ul style="list-style-type: none"> -village health and community development workers -local leaders and community members including women, teachers, traditional healers etc. -Representatives of district administration, (District Council), health and development committees -NGO's active in the village 	<ul style="list-style-type: none"> -village base line data and affordability -Sanitation project or programme strategy -Village sanitation committee
	2. Health Education and social mobilisation	Village Households	<ul style="list-style-type: none"> -Allocating budget for health education and social mobilisation -Developing and field testing appropriate health education materials and methods with community participation -Identifying human resources within the community for health education and social mobilisation (health and community workers, teachers, volunteers etc) 	<ul style="list-style-type: none"> -Village health and community workers -volunteer educators -District health educator -Village health committee -Community members 	<ul style="list-style-type: none"> -Pragmatic health education package (methods & materials) -Popular demand for latrine by householders (programme acceptance) -Participation of the community in the execution of the project -Improvement of personal and environmental hygiene
II PILOT PHASE	3. Set up Criteria for selecting pilot villages 4. Implementation of pilot project to identify appropriate sanitation technology (latrine options) 5. Monitoring and evaluation of pilot project	Pilot villages in selected district or districts	<ul style="list-style-type: none"> - Select pilot villages -Setting up project steering committee -identifying project sites for construction of latrines - Training of local builders - Organising the community to construct demonstration latrines -Selecting and collecting appropriate local materials and providing non-locally available materials - Constructing different types of demonstration latrines on sites where geological conditions are different - Preparing cost analysis of the different sanitation technology (latrine) options. -Monitoring the use and acceptability of the technological options being field tested with community participation -Concurrent evaluation of the project for planning the expansion phase 	<ul style="list-style-type: none"> - Village health and community workers - Village health and development committee -Local leaders and community members - Local builders - District sanitation co-ordinator - District health and development committee 	<ul style="list-style-type: none"> - Appropriate sanitation technology options for rural communities under different site and geological conditions

GUIDELINES FOR PLANNING AND IMPLEMENTATION OF RURAL SANITATION PROJECTS

STAGE	STEPS	LOCATION	ACTIVITIES	PARTICIPANTS	OUTPUT
<p>III. IMPLEMENTATION PHASE</p>	<p>6. Preparing national rural and sanitation programme 7. Selecting priority districts based on needs assessment or base line data 8. Preparing programme of implementation in phases</p>	<ul style="list-style-type: none"> - Central level - Provinces - Districts - Wards - Villages 	<ul style="list-style-type: none"> - Setting up mechanisms for project co-ordination at central and operational levels - Establishing a project planning and implementation unit within the project execution Ministry - Prepare rural sanitation projects for priority districts based on needs assessment (health needs) with budget estimates and manpower requirements - Carry out training programme, seminars and workshops for project personnel at all levels - Mobilizing local and external resources (materials manpower and finance) - Integrating the project into national development plan - Intensifying the latrine construction project at all levels 	<ul style="list-style-type: none"> - Central government Ministries of Finance, Economic Planning and Development, Health, Community Development and other relevant ministries - Provincial and District Health and Development Committees - District and Rural Councils - Local Leaders - Village health and development committees - Community members - External support agencies including NGO's - Private sector 	<ul style="list-style-type: none"> - National rural sanitation project - Increased coverage of latrines - Improvement in quality of life and health status of the beneficiary communities - Improvement in environmental sanitation
<p>IV. MONITORING AND EVALUATION (according to the duration of the National Development Plan).</p>	<p>9. Developing monitoring and evaluation formats (methodologies) and questionnaires etc.</p>	<p>Projects Districts and Villages</p>	<ul style="list-style-type: none"> - Compiling data and analysis - Reviewing technology choice, affordability and acceptability - Reviewing project progress and constraints - Assessing the impact of the project on decline in the incidence of faeco-oral disease - Preparing evaluation reports as a feed back to improve project planning and implementation 	<ul style="list-style-type: none"> - District and Rural Councils - Community members - District and Village health and development committees - Sectoral Ministries at central level - External support agencies - District sanitation co-ordinator 	<ul style="list-style-type: none"> - Improvement on selected technologies - Proper maintenance and use of Latrines - Improvement in project planning, co-ordination and implementation
<p>V. REPLANNING</p>	<p>10. Identification of constraints</p>	<p>Project District Headquarters</p>	<ul style="list-style-type: none"> - Preparing new plans by taking into consideration the short falls in the previous plan. 	<ul style="list-style-type: none"> - Sectoral Ministries - District and Provincial project co-ordinators and managers 	<ul style="list-style-type: none"> - Improved plan