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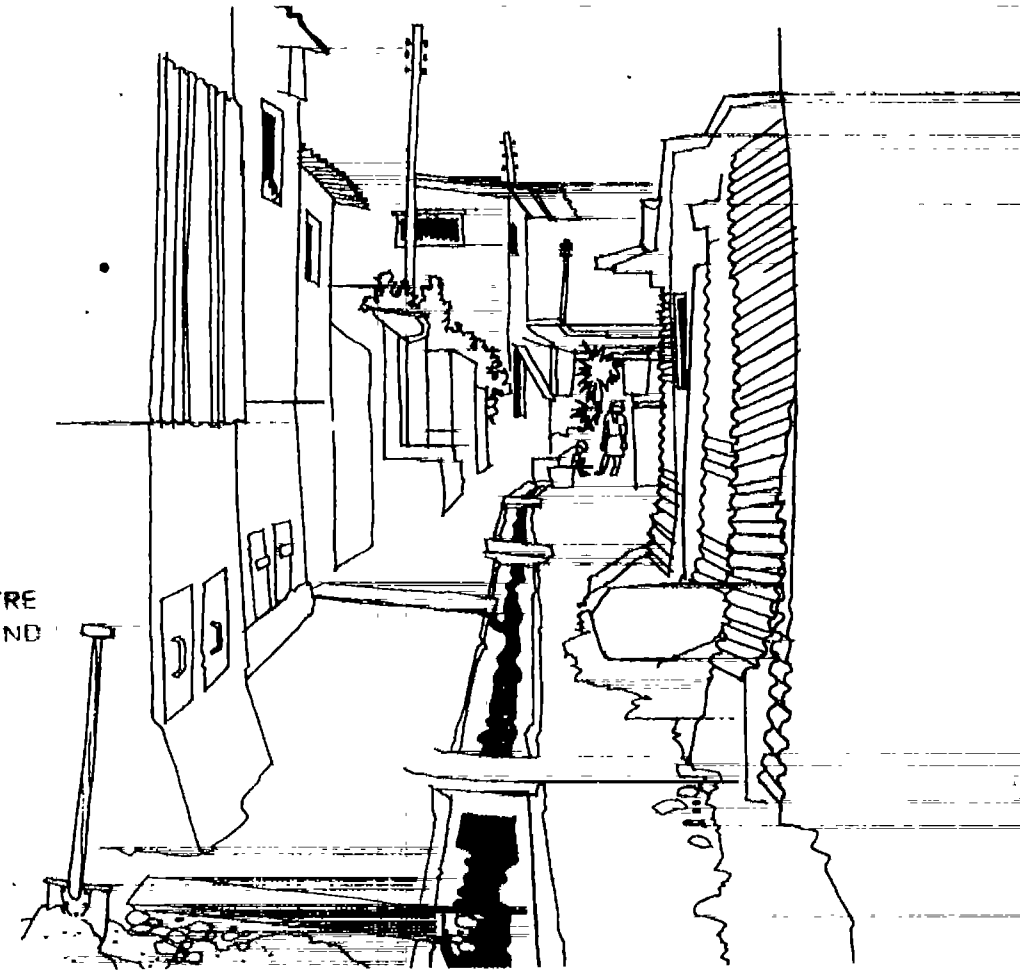
DRY LATRINES FOR URBAN AREAS

The findings of the first Sanres Workshop
San Salvador, 4 - 12 November 1993



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CONTENTS

The workshop was hosted by UNICEF, El Salvador, and financed with funds provided by the Swedish International Development Authority (SIDA) to the Sanres project.

This document was prepared by Uno Winblad, Coordinator of the Sanres project.

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1. Background - the Sanres project 1993-1995

SIDA is currently funding a 3-year action research project on low-cost sanitation. The aims of the project are:

- to develop affordable and replicable sanitation systems for the poorest quarter of urban and rural households in the third world;
- to establish, in selected countries, a local capacity for R&D on sanitation for low-income groups;
- to facilitate South-South cooperation in the field of applied sanitation research.

The anticipated project outputs are:

- a document outlining affordable strategies for the improvement of sanitation for urban low-income groups;
- a manual detailing technical solutions;
- in each participating country a national seminar on project findings and their implications on policy development;
- an informal network of collaborating individuals actively engaged in continuing applied research on low-cost sanitation.

The project is to address the following issues:

- the lack of affordable, replicable sanitation alternatives for a majority of urban and peri-urban households in the third world;
- latrine construction under difficult conditions (high ground water table, difficult soil conditions, limited availability of building materials, extreme poverty);
- on-site sanitation at high population density;
- protection of the environment against pollution, particularly the protection of groundwater and other water sources;
- prevention of vector breeding;
- the use of human excreta as a resource;
- hygiene education focusing on women and school children.

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Approach and organization:

The project is seen as a means of encouraging concerted efforts to solve the hitherto neglected issue of affordable sanitation for low-income urban and peri-urban households. Project activities should primarily be the responsibility of the local partners supported by an international network. A Project Coordinator (presently Mr Uno Winblad) provides a link with the funding agency.

Membership of the network is restricted to individuals and institutions willing and able to play a very active role in the project.

2. Purpose of Workshop

The purpose of this Workshop is to scrutinize all aspects of the dry-box and composting latrine concepts. The Workshop is forward looking rather than just summing up lessons learned. We shall:

- refine the technology and demonstrate ways of lowering unit costs;
- discuss the feasibility of developing high cost luxury models;
- on the basis of good and bad examples from El Salvador and elsewhere in Central America draft guidelines on how to elicit community participation and on how to organize information and follow-up;
- look into the implications for urban ecology and municipal economy of large scale application of dry-box and composting latrines;
- discuss the problem of grey water where there are no sewers.

Another important purpose of the Workshop is to promote the transfer of technology from one Third World country to another, from one continent to another - in this case from Central America to Africa.

The outcome of the Workshop will be a concise report in English and Spanish with a presentation of our findings.

3. Conclusions and recommendations

- The LASF and the SIRDO systems have been used in Central America and in Mexico for over ten years. Experience so far indicates that both systems are viable but also that uncontrolled mass dissemination of the technology will result in unacceptably high failure rates.

- Where there has been community participation, adequate training and community based monitoring and support the success rate has been close to 100%.

- Contrary to common assumptions, dry-box systems like the

LASF and composting systems like the SIRDO are not primarily rural but can very well be used in high density urban areas.

- All LASF units built in Central America so far are more or less identical to the prototype developed by CEMAT some 15 years ago. Although this prototype under favourable conditions works well there is a tremendous scope for product development.

- Product development should be pursued in two main directions: 1/ towards improved performance, better finish and simplified handling; and 2/ towards simplified construction and lower cost.

- A number of technical innovations should be tested in full-scale experiments over the next year:
  * LASF combined with SIRDO's solar heating;
  * SIRDO combined with LASF's urine separation;
  * one-chamber versions of LASF and SIRDO;
  * LASF combined with evapo-transpiration beds.

- The Sanres project should commission a study of community-based follow-up and support systems.

- The project should also make a study of financial strategies for large-scale application of dry sanitation in urban areas.

- A follow-up workshop should be held Mexico towards the end of 1994.

4. Dry sanitation - an overview

by Uno Winblad

INTRODUCTION

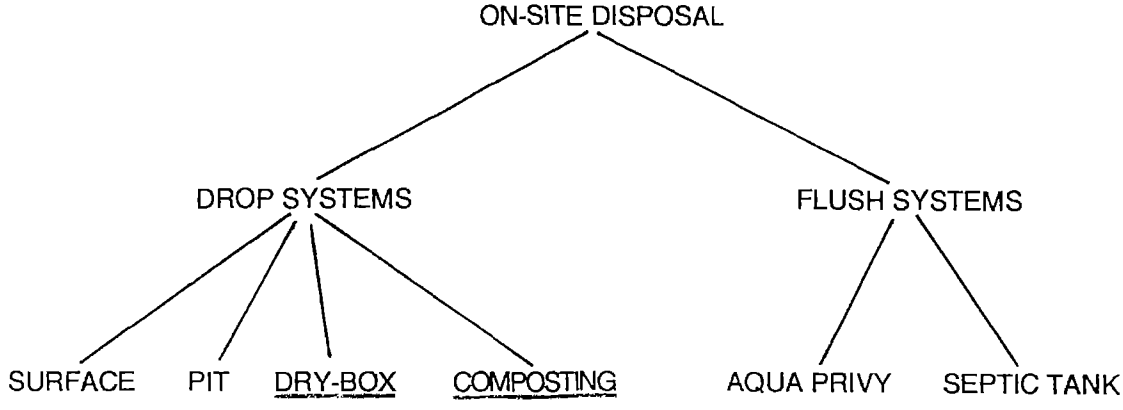
One of the most difficult problems of modern civilization is how to dispose of human excreta. In spite of considerable efforts by governments and donor agencies the number of households without adequate sanitary facilities is growing. Today nearly 2,000 million people are without latrines. By the turn of the century there will be 3,000 million (WHO 1992). The problem is particularly acute in Third World cities where between 30% and 60% of the population live in so called peri-urban areas usually without access to basic urban services (UNCHS 1987). Over the next few decades most Third World urban growth will take place in such settlements.

My hypothesis is that the problems of human excreta disposal in Third World cities cannot be solved by the application of con-

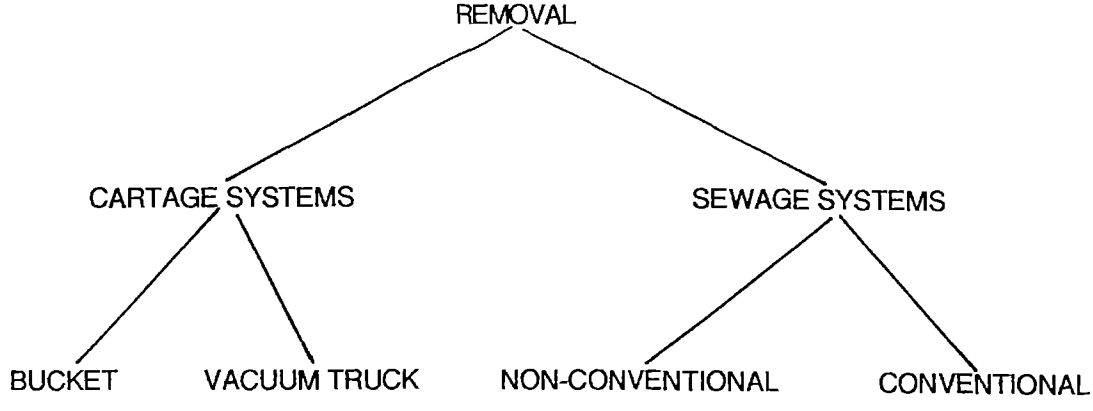
ventional sanitation technology based on sewerage. Such systems are prohibitively expensive for low-income communities, they use large amounts of clean water to flush away a small amount of excreta, pollute streams, lakes and groundwater, and can only be effectively applied where there is planned urban development.

There are basically two ways of getting rid of human excreta: they can be disposed of at the point of defecation, *on-site disposal,* or they can be removed from the point of defecation and disposed of somewhere else, *off-site disposal.*

Disposal on-site can be on the surface of the ground, in a pit (temporary or permanent), in a dry-box or in a composting vault. These systems can be grouped under the sub-heading *drop systems:* the faeces fall straight down, to the ground, or into a pit or a vault. There is no water-seal and no need for flushing. On-site disposal also includes *flush systems* with septic tanks or cesspools.



Removal from the site can either be through a *cartage* systems (manual or by vacuum truck) or through a *sewage* systems.



The term 'dry' is often used for any non-flush sanitation system.

I suggest we use the term 'dry-box' for completely dry systems like the Vietnamese double-vault latrine, the Yemeni long-drop latrine, the Ladhaki latrine and the Central American 'LASF' (Winblad & Kilama 1985).

Such latrines are often referred to as 'composting' latrines. I suggest we reserve that term for proper composting systems like the Swedish 'Clivus multrum' and the Mexican 'Sirdo seco' (*ibid.*).

The most common sanitation technologies, in the form of pit latrines and sewerage, are based on the notion of *human excreta as an unpleasant and dangerous waste product to be disposed of.* The dry-box latrine and the composting latrine on the other hand are based on the notion of *human excreta as a resource.*

The basic principle of the resource approach is simple enough: Human excreta left on their own will gradually decompose and turn into a rich organic soil. In this process the volume is reduced and pathogenic organisms destroyed. This is a perfectly natural process and requires no additives of any kind. The decomposition is carried out by a variety of organisms including bacteria and fungi. Bigger organisms like ants, sowbugs, maggots, earthworms, and cock-roaches feed on the micro-organisms and on each other. They also play a role in mixing, aerating and breaking up the faeces. The end result is a rich organic soil.

The effectiveness of the decomposition depends on the right combination of a complex of four factors: adequate aeration, ideal carbon/nitrogen (C:N) ratio, optimal water content, and degree of surface area exposure of the wastes (Dindal 1979).

A latrine is a device for containing and controlling the decomposition of human excreta. In a pit or a vault decomposition is hampered because urine and faeces are mixed together. The mixture turns watery, liquid accumulates, the pit or vault rapidly fills up, lack of oxygen slows down decomposition and results in foul smells, and there is likely to be intensive fly breeding.

These conditions, common in pit latrines, must not occur in dry-box or composting latrines. Urine and faeces must be separated and no water added to the pit or vault. Dry-box and composting latrines are therefore more sensitive to misuse than an ordinary pit latrine. Their introduction requires a substantial amount of promotion, instruction and follow-up.

During this Workshop we shall look at a variety of dry-box and composting latrines. For our purpose the two most important ones are the LASF and the solar heated composting latrine exemplified by the SECO.

THE LASF LATRINE

The most common dry-box latrine in Central America, the 'Letrina Abonera Seca Familiar' (LASF), is an adaptation of the Vietnamese double-vault latrine.

The LASF is built above ground. The receptacle consists of two compartments ('vaults'), each with a volume of about 0.6 m^3. On top of the receptacle there is movable seat with a urine collector, or alternatively there is a fixed seat above each vault. From the collector the urine flows via a pipe into a jar (for use as a fertilizer diluted with 4-5 parts of water) or a soakpit. Compost is removed via low level openings, normally covered by wooden hatches.

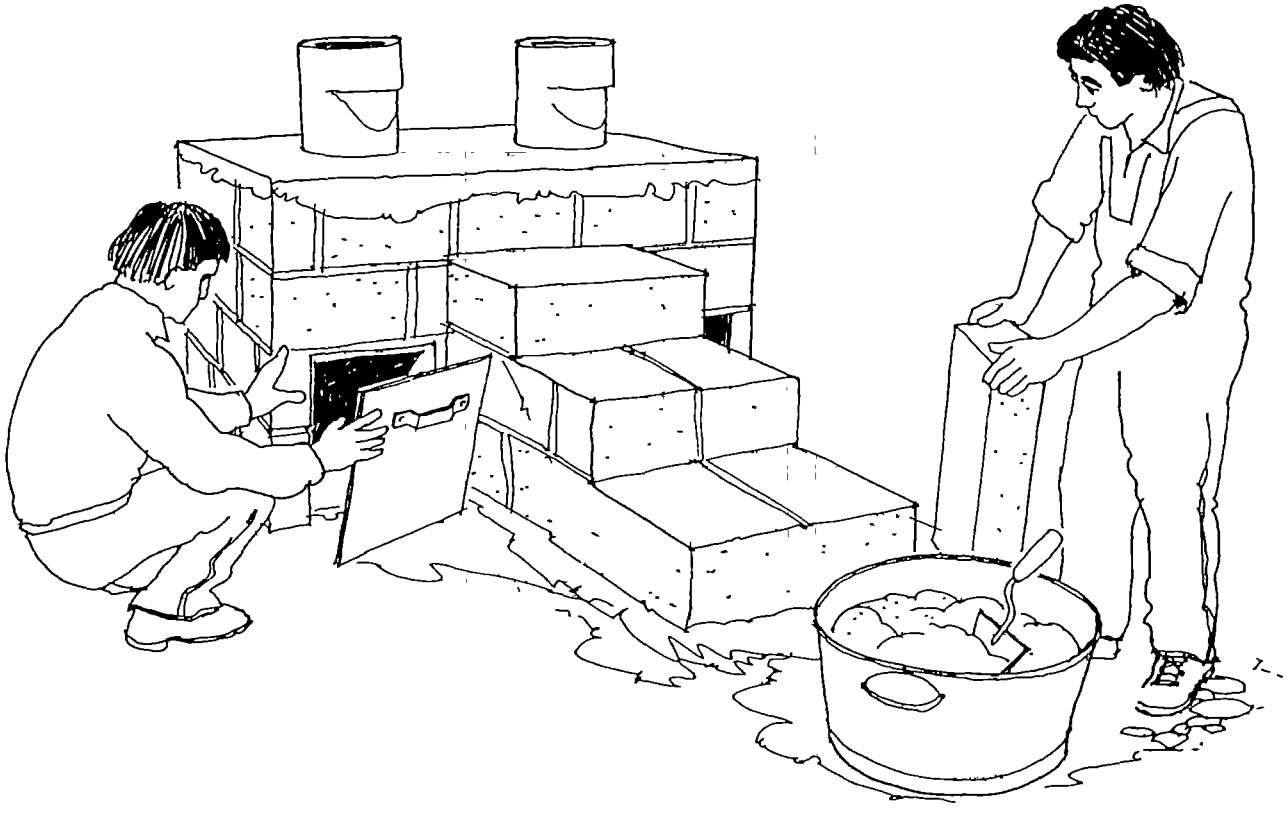


Fig 1: LASF latrine under construction, Sta Cecilia, El Salvador

After using the latrine, the user sprinkles ashes, soil or a soil/lime mixture over the faeces. The vault thus receives only faeces, ashes or soil/lime plus paper or leaves used for anal cleaning. (Compostable kitchen and garden refuse is not put in the vault as it contains too much water.) Every week the contents of the vault should be

stirred with a stick and more ashes added.

When the first vault is nearly full it should be topped-up with earth and the opening in the platform is closed. The second vault should now be used. A year later, or when the second vault is nearly full, the first vault is opened and emptied. It will by now contain about 250 kg compost which can be used in the garden, to reclaim wasteland in the neighbourhood or sold to a farm or a market garden.

The cost of this type of latrine (excluding the superstructure) is in this part of the world around USD 60-80 for material and transport, plus the cost of self-help labour, training and follow-up.

The LASF has been used in Central America for nearly 15 years. Thousands of units have been built, in urban as well as in rural areas. This experience has validated the concept. There are unfortunately also many examples of LASF-units not functioning so well. But this is not due to any flaw inherent in the basic LASF concept. It is rather due to a poor implementation with insufficient promotion, training and follow-up.

THE SOLAR HEATED COMPOSTING LATRINE

The solar heated composting latrine as developed in Tanzania and Mexico is an adaptation of the Indian 'Sopa Sandas' latrine and the Swedish 'Clivus Multrum' (Winblad & Kilama 1985).

Like the LASF it has a receptacle divided into two vaults and it can be built above ground. Each vault is about 1.2 m^3 and is covered with a black-painted aluminium lid. The lid facing the sun acts as a solar heat collector. This increases the evaporation of liquids from the vaults. The latrine may also have a ventpipe to take away odours.

There is normally no separation of urine. The composting latrine receives faeces, urine and paper plus organic kitchen and household residues like vegetable and meat scraps, peelings, eggshells, floor sweepings and grass clippings. The process of decomposition will reduce the contents to less than 10% of its original volume. The latrine is emptied once a year.

The cost of the solar heated composting latrine is slightly higher than that of the LASF because of its larger volume and the solar heat collector. A Mexican group, Grupo Tecnologia Alternativa SA, has developed a prefabricated unit in plastic. For Third World conditions this is a luxury version, but with cost effective design and mass production it should be possible to reduce the cost. Besides, we need luxury versions of these technologies to show that dry disposal is not an inferior technology fit only for those unable to afford a WC.

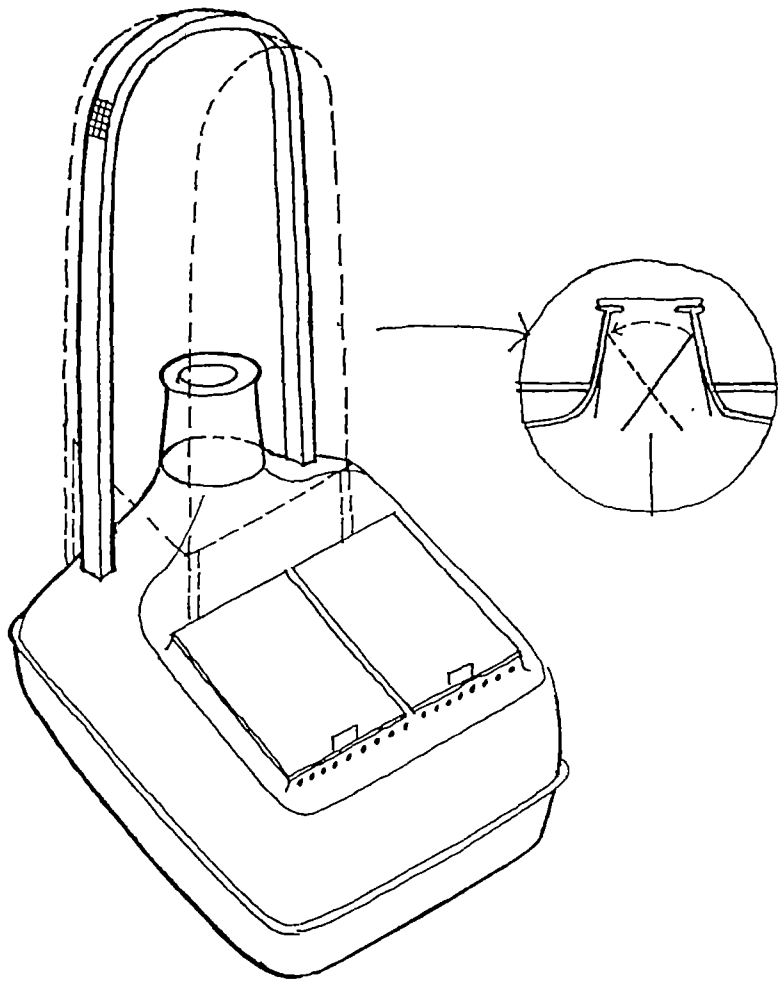


Fig 2. The "Sirdo Seco" solar heated composting latrine, Mexico City

BARRIERS AND POSSIBILITIES

There are today no technological barriers to wide spread application of dry systems for human excreta disposal. There are some constraints though: dry systems are less feasible where people use water for anal cleaning; in some cultures there is a reluctance to handle compost derived from human excreta; and, as mentioned before, the users of dry systems require more guidance and initial support than users of conventional pit latrines and WCs.

The main barrier is mental: a widespread feeling that dry systems are inferior. That is why it is important to develop not only low-cost models but also luxury versions of the dry systems.

There is also a knowledge barrier, reinforced by the tendency in professional circles to hunt with the hounds. According to conventional wisdom there is no alternative to waterborne systems in high density urban areas. This is incorrect. Dry systems can be used at very high densities and can even be adapted to multi-story

dwellings. Grey water from households, not catered for by dry latrines, is easier and less costly to dispose of or re-use than sewage.

Greed and corruption is another barrier. Large-scale multi-million dollar projects are more attractive to politicians and civil servants than small-scale systems based on self-help.

CONCLUSIONS

Dry-box and composting systems have a great potential, particularly for urban sanitation. However, the technology should be refined and that is one of our tasks. Another important task for us is to work out suitable methodologies for instruction and follow-up support.

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5. Some notes on the construction and use of the LASF in El Salvador

by Enrique Jonathan Siliézar, Miguel Angel Santamaria, Elton Manfredo Membreno and Herberth Gregorio Aparicio, Ministry of Public Health and Social Assistance, El Salvador[1]

The LASF, see figure 3, has proved to be a viable and sanitary alternative for the disposal of human excreta. This paper presents the experience of a group of Environmental Sanitation Inspectors directly involved in the promotion of the LASF in El Salvador.

CONSTRUCTION

Foundation

Excavate for the foundation as shown in figure 4. Place and level the foundation frame, figure 5. Build a hardcore up to but not exceeding the level of the foundation frame. Pour the concrete flour using a cement/sand mixture of 1/4. The foundation frame can normally be removed after 20 minutes.

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[1] Translated by UJG, edited by UW.

Seat-risers and urinal

Use the prefabricated metal moulds supplied by the Ministry of Health, see figure 6. Make sure that the moulds have been cleaned. Apply oil to the surfaces coming in contact with the concrete. Place the moulds on a sheet of paper or a thin layer of sand on a flat and level surface. Use a cement/sand mixture of 1/2. While the concrete is being poured the inner form should be held in position by one person. Remove the inner mould after 30 minutes. Make a hole for the 1" tube for urine as shown in figure 3. Remove the external mould the following day. Make the surfaces that will come into contact with the human body as smooth as possible.

Slabs

Make the slabs on a horizontal surface. Place the slab moulds (supplied by the Ministry of Health) on a sheet of paper or a thin layer of sifted sand. Place the mould for the hole under the seat as shown in fig 7. Fix the position of the moulds with some mortar. make a cement/sand mixture of 1/3. Pour the concrete. Make a hole for the urine-tube as shown in fig 7. Remove the moulds after about 15 minutes. Keep the slab shaded and damp for three days after which they can me moved.

Chambers and steps

Build the chambers from 10 cm concrete blocks as shown in figure 8 and add the steps. If the concrete blocks are made on site, use a cement/sand mixture of 1/5. For the mortar, use a mixture of 1/4.

OPERATION AND MAINTENANCE

Place a 5 cm layer of dry, absorbent material inside the chamber. Use a mixture of ashes or lime and soil. Place a bucketful of the same mixture next to the seat-riser.

Every household member, including school aged children, must take responsibility for the correct use of the latrine. Place yourself on the seat in such a way that urine flows into the urine collector and the faeces drop straight down into the chamber. (Males should use the separate urinal.) Put the paper used for anal cleaning inside the chamber. Cover faeces with a small amount of the dry mixture (ash/lime and soil). Keep the seat covered when not in use.

Wash your hands with soap and water after using the latrine.

When the first chamber is filled to within 20 cm of the slab, cover with a 10 cm layer of the dry mix. Cover the seat with a sheet of plastic and start using the other chamber. (First cover the floor of the empty chamber with 5 cm of the dry mix.)

Collect the urine in a jar, see figure 9. Add 4-5 times as much

water and use this liquid as a fertilizer for your plants.

Sweep the latrine every day. Wash the urinal every third day with a chlorine solution (two tablespoons of chlorine to one litre of water).

When the second chamber is full, empty the first chamber from the outside through the hatch. Bury the compost or use it as a fertilizer in the garden.

If the material in the chamber turns wet, add more dry, absorbent material. If there are fly maggots, add a large amount of hot ashes daily until the problem disappears.

If the humidity/maggot problem persists, cover the contents of the chamber with 20 cm dry material, close the seat with a sheet of plastic and use the other chamber instead.

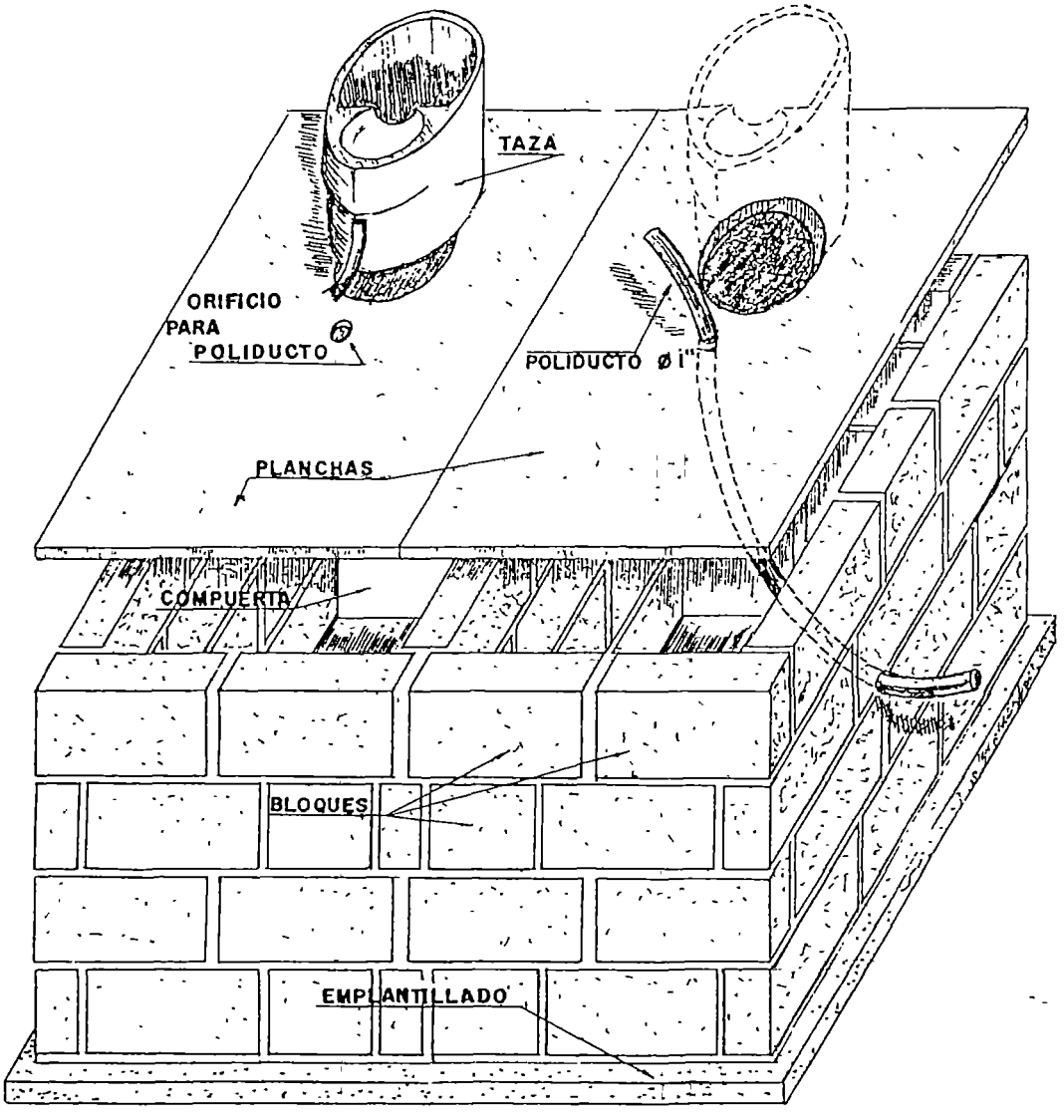

Fig 3: Isometric drawing of a LASF

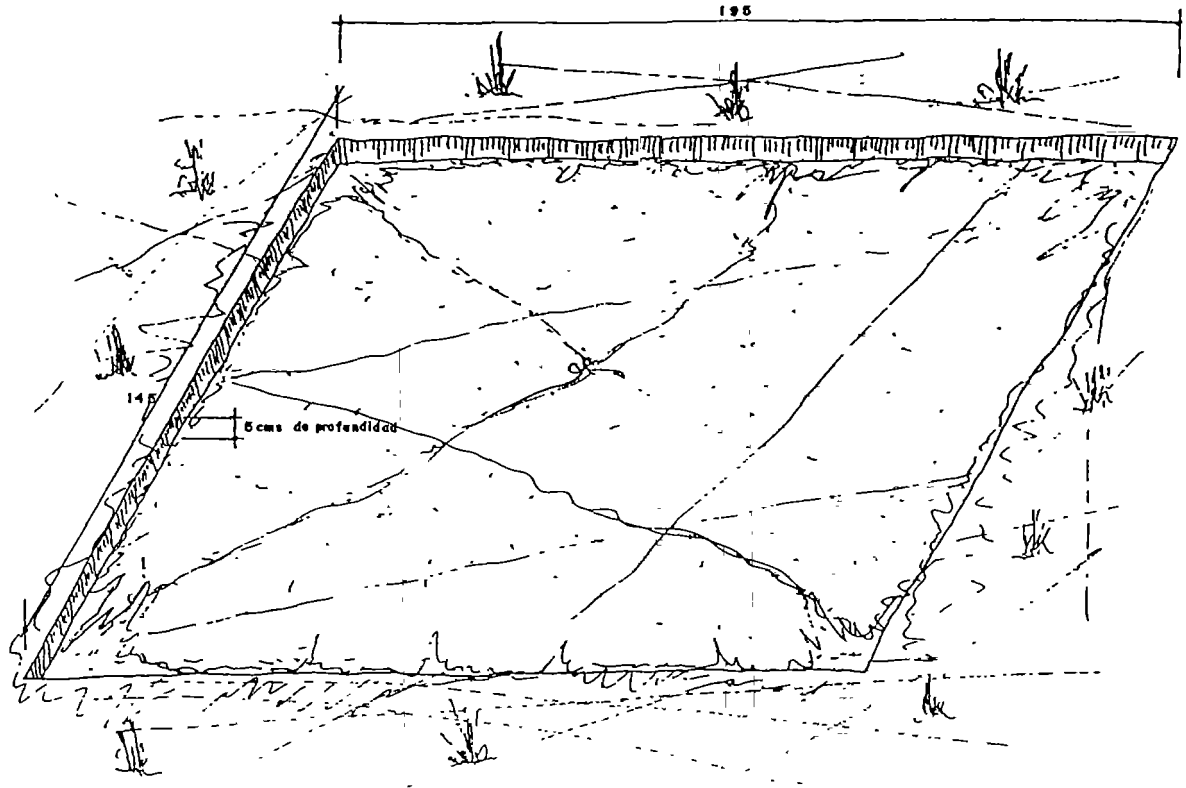

Fig 4: Excavation for foundation

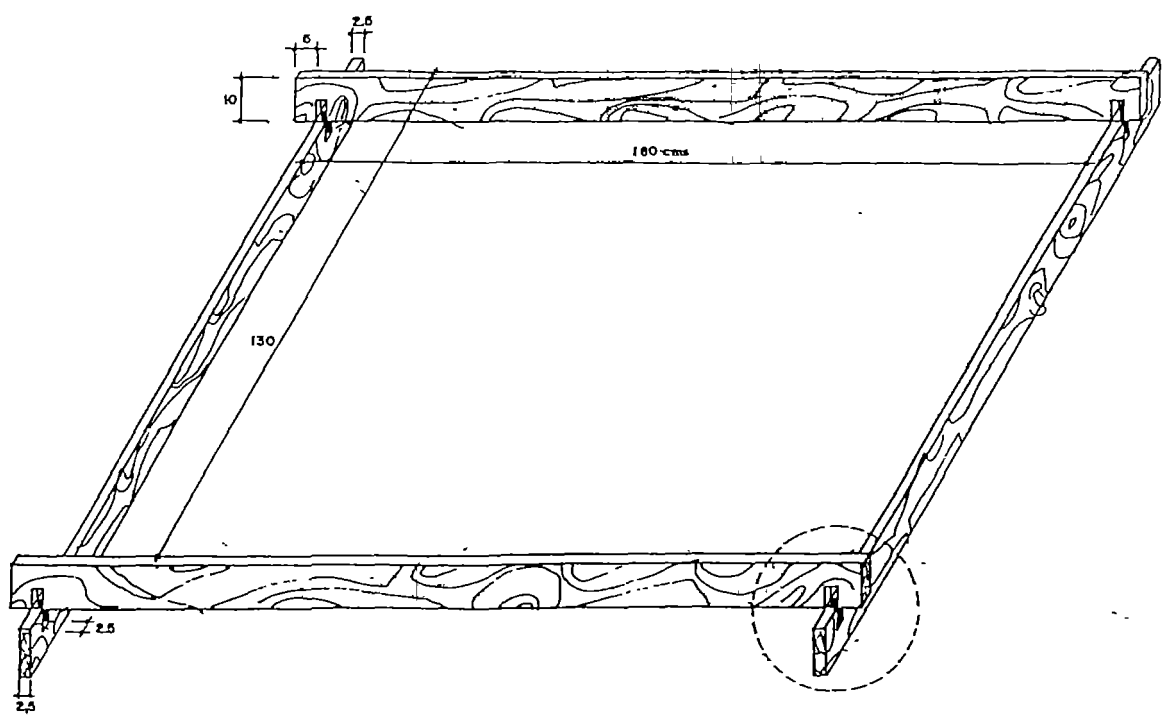

Fig 5: Frame for foundation slab

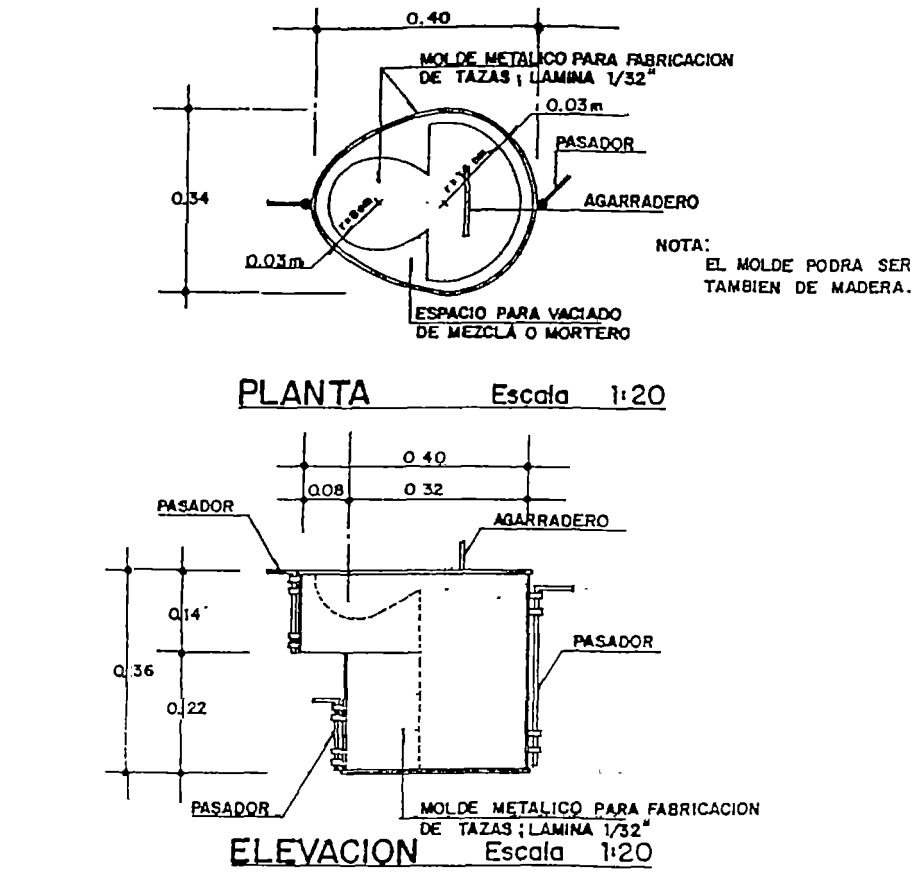

Fig 6: Moulds for seat-riser

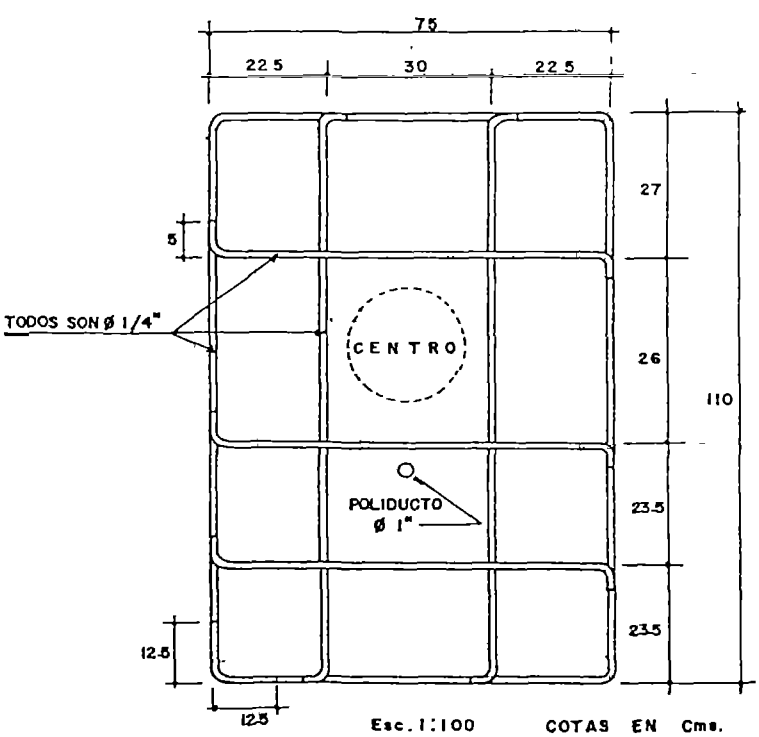

Fig 7: Reinforcement and holes in slab

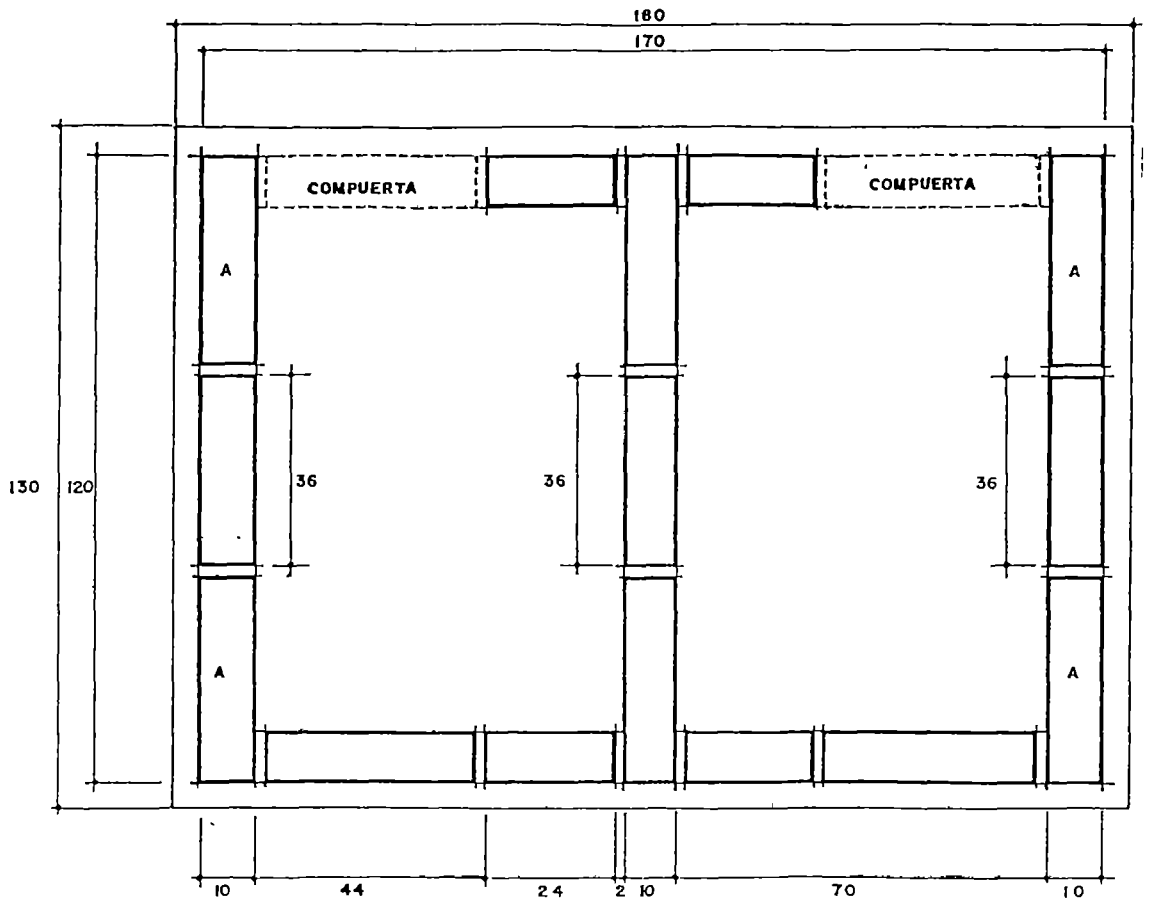

Fig 8: Plan of chambers with 10 cm concrete blocks

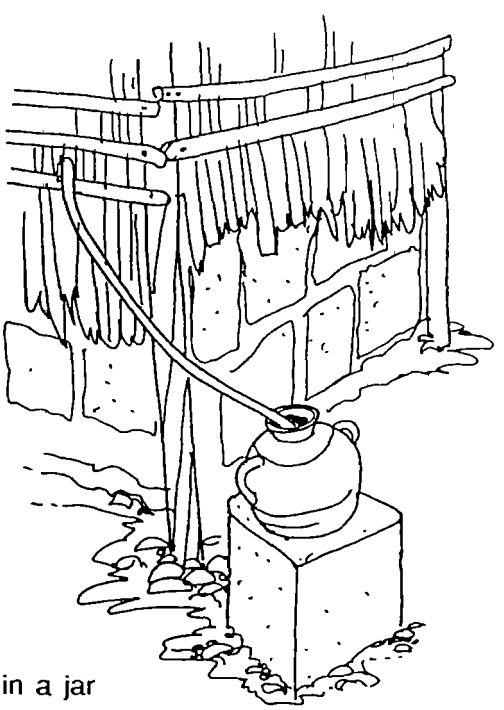

Fig 9: Urine collected in a jar

6 Financial and managerial consequences of large scale application of dry systems in urban areas

By Jorge Vargas Cullell

SCOPE OF THE PAPER

This paper is a preliminary reflection upon the financial and managerial consequences of adopting the dry latrines as a large scale urban policy in developing countries. Whereas the technological advantages of the dry latrines have been object of discussion (Winblad 1985), and experiences of low-cost human waste disposal technologies have been reviewed quite extensively (Kalbermatten 1982; UNICEF 1988; World Bank 1984), the same cannot be said about the management of those systems on a large scale. Most of the papers deal with experiences of low-cost sewerage systems as *projects,* particularly for poor rural communities. I have not yet come across any in-depth discussion of the new institutional requirements if dry systems were to be adopted as a *major urban policy*.

What should be the role of public and private institutions in the delivery of a human waste disposal service based on dry-box latrines? How to mobilize the entire population into accepting, operating and maintaining dry latrines? What new problems are likely to arise in the follow up, monitoring and evaluation of this service? The complexity of these issues by far exceed the scope of a short paper. Here I am going to address the major issues that, in my opinion, should be worked out to pave the way for an effective and efficient management of dry systems as a major urban policy[2].

FINANCIAL AND MANAGERIAL PROBLEMS

For over a hundred years water-borne sewerage has been seen as the ideal system for human waste disposal in urban areas. Non-flush systems have been and are regarded as sub-standard and temporary solutions for the urban poor. The assumption is that increased standard of living and better institutional capabilities will make it possible, someday in the future, to provide adequate services (meaning sewerage) for everyone. The basic question posed by policymakers when managing sewerage systems as well as other urban services is:

"... how better to finance public services in large, growing cities and in particular how to capture the benefits of urbanization in order to increase the supply of services" (Bahl and Linn 1992, p 1).

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[2] We do not discuss the technical feasibility of implementing the dry latrine in urban squatter areas but assuming it as a matter of fact. This issue is being faced by other papers in the Workshop. The experience of UNICEF in El Salvador is quite supportive of this assumption.

Within this vision, various degrees of centralization are allowed in the management of human waste. For "sub-standard" solutions de-centralization is actively or passively pursued. Projects based on such solutions are normally funded by international organizations and few, if any, national public resources are allocated. Without such funding local communities have to manage human waste disposal at their own expense or with the help of private organizations.

For water-borne sewerage a centralized system is recommended and enforced. Sewerage provision - as well as piped water - has normally been considered as a "natural monopoly" (Richards 1984, p 27):

"... insofar as it would be impractical to allow a number of different pipe systems to exist and compete commercially with one another. The externality argument also applies, in terms of the effect on urban cleanliness and the effect of the spread of disease."

Bahl and Linn (1992) state that centralized urban water systems "improve health, save money and give more personal comfort" (p 286). The main issue is therefore how to provide a more rapid extension and improvement of urban water services given the limited financial resources available in developing countries, and much of the attention is given to pricing policies (pp 286-345).

Winblad (1978, p 1) enumerates the disadvantages of flush systems:

"The flush toilet cannot solve the problems of excreta disposal in the poor countries. Nor has it indeed solved those problems in the rich part of the world. It is expensive to install, uses large amounts of clean water to flush away excreta, and pollutes the receiving stream, lake or aquifer. For the large majority of the world's population that still has no access to piped water, a flush toilet is not even an alternative to consider."

Pickford (1984, pp 164-165) states that sewerage can be appropriate only for "prosperous" urban centres. Among the reasons for their inappropriateness he lists: (a) it is not affordable for the urban poor; (b) insufficient water supply for flushing; (c) likely abuse of water-flushed sewerage systems; (d) construction and maintenance by public bodies short of financial resources and expertise; and (e) environmental pollution. We could add one more disadvantage: the financial resources required to build and maintain systems covering the majority of the urban population in Third World cities is out of the reach of most of the countries' economies. Shuval stated the same problem (Shuval 1993, pp 247-248) at a recent conference.

From a financial perspective, it could reasonably be argued that no matter how efficient the pricing policies applied to sewerage systems, the revenues generated by such policies will not be able to fund the required extension of the sewerage to cover the entire

urban population. Bahl and Linn (*ibid,* p 338) arrive at the same conclusion, but they don't deal with the consequences of it for public finances and urban policies.

THE PRACTICAL PROBLEM

Lets consider the problem from a practical point of view. Consider "Balabia", an imagined Third World city of 2 million inhabitants. It has a rapid population growth, specially among the poor, who represent around 50%. As usual, most of the poor lack access to municipal services. Despite efforts by the public institution responsible for managing the water supply and sewerage system to implement an efficient pricing system[3], political considerations have established a cap to tariffs, as a percentage of household income. As a consequence the water supply and sewerage services are in many cases subsidized.

Table 1: The city of "Balabia"

population	2,000,000	inhabitants
percentage poor	50%	
annual growth city	4%	
growth poor	65%	
sewerage poor	25%	
sewerage non poor	85%	
annual income poor	USD 500	
coverage new poor	25%	
coverage new non poor	85%	

Is sewerage for all a realistic policy? Two gross scenarios can be depicted for the purpose of this workshop. We assume that costs and incomes remain constant in USD and that no major repairs are required on the existing sewerage network. Annual cost of sewerage per household has been taken from Bahl and Linn: USD 400. Other authors give a higher range of annual capital investment for households (Shuval 1993; UNCHS 1991), but the ratio between high-cost and low-cost technologies is similar.

Scenario 1. No new coverage goals are set for the sewerage system. It expands at its historical rate which only partially caters for the demands of the growing population. Our calculations show that in Year 10, 39% more resources would be required to maintain a coverage level of around 55%.

Table 2: "Balabia" scenario 1- Comparison between year 1 and 10 according to the assumptions of table 1.

	Year 1	Year 10
population	2.000.000	2.835.000
percentage poor	50%	54.3%
total coverage sewage	55%	53.9%
annual investment	USD 88.1	USD 122.8

[3] According to Bahl and Linn (p 341), an efficient pricing structure has to reflect the marginal costs of providing a service, adjusted by considerations of externalities and shadow prices. This structure should include all service charges: development, connection and user fees.

annual revenues	USD 54.7	USD 74.6
annual subsidy	USD 33.3	USD 48.2

Scenario 2. A new administration sets a bold policy goal for the sewerage service: an increase of 20% in the overall coverage of the city's households. The public bodies would be obliged to cover 100% of the new needs of the non poor and to substantially enhance coverage among the poor. In Year 10, 70% more resources are required and the level of subsidies would be expected to increase.

Table 3: "Balabia" scenario 2 - Comparison between year 1 and 10 according to the assumptions of table 1.

	Year 1	Year 10
population	2.000.000	2.835.000
percentage poor	50%	54.3%
total coverage sewage	55%	66.0%
annual investment	USD 88.1	USD 150.4
annual revenues	USD 54.7	USD 86.5
annual subsidy	USD 33.3	USD 63.9

TAILORING NEW INSTITUTIONAL AND FINANCIAL FRAMEWORKS

Financial and technological issues should not be a major obstacle to the use of dry latrines as a major urban policy. In terms of the resources needed it can easily be shown that dry latrines are far cheaper than conventional sewerage systems. Additionally, as it is a low cost, simple technology, dry latrines do not pose great difficulties in construction and maintenance. This does not mean that technology is unimportant. We are aware that no policy is feasible unless its technology is sound, efficient, cost-effective and attractive. For the purpose of this draft, we assume that dry-box latrines can be made to meet such standards.

The main problems arise elsewhere. Even if the political will[4] to adopt such a policy existed, a massive construction of dry-box latrines cannot be undertaken until strategies to cope with new organizational, institutional and financial problems have been implemented.

Meeting the organizational requirements

Local organizations are required for the adequate operation and maintenance of dry latrines at the community level. However, the strength of local organizations varies significantly from place to place. If dry-box latrines were to be a major urban policy they must be built and used by all communities, regardless of the strength of the local organization. The strength of such organizations varies significantly from time to time whereas the operation and maintenance of dry-box latrines is a permanent task.

[4] This political will encompassing both institutional authorities as well as communities.

Training, hygiene education and follow-up support to households and to local organizations is indispensable. But it may also be necessary to introduce a system of incentives and sanctions for the population to use and maintain the latrines and for the local organizations to provide long-lasting support.

Incentives could be access to further community upgrading projects, priority in land regularization programmes, employment of members from successful communities as trainers for dry-box latrine projects in new communities etc. Sanctions could be the withholding of incentives but also fines etc. The structure of incentives and sanctions should be specifically designed to provide concrete stimulus capable of reinforcing training and health education actions and to minimize organizational risks.

Institutional and functional arrangements

As said, construction, operation and maintenance of the environmental sanitation systems should be *delegated* to the communities.

Monitoring, follow-up and evaluation of the urban policy should be *decentralized.* Private organizations, specially non-profit, legally authorised and capable of executing those functions as consultants would be in charge of such functions. Contracts should be signed and copies submitted to the public bodies. Obligations would be to provide regular information about the operation and maintenance of the environmental sanitation systems to public bodies, to help communities to correct operational problems and to provide continuous sanitary education and training. Contracts should be geographically delimited and renewed on the basis of: (a) the performance of the dry latrine systems in the area contracted; (b) the quality of the information provided; (c) an appraisal (performance evaluation) of their work by the communities.

Financial and corrective functions at the policy level should be *centralized* in the public institutions. Dry-box latrine systems at the urban policy level cannot imply the demise of the duty of the state to provide adequate sanitary services to the population. Additionally, the public bodies in charge of environmental health should reinforce their surveillance in the communities.

Financial arrangements

Three major components of a financial strategy should be considered:

The first is *resource mobilization and allocation.* In a given city, dry-box latrines would normally coexist with already installed sewerage systems but better coverage would not mean costly

investments. The institutional and functional arrangements for the dry-box latrines as an urban policy imply a significant re-estimation of the financial resource allocation required to meet the sanitation needs of densely populated urban areas. The investment cost for dry systems is only a fraction of that of sewerage technology. Moreover, as dry systems are independent of water supply, they considerably reduce pressure on increasingly scarce water resources. In the Balabia example above the same goal of 20% increase in sewerage services pursued through the use of dry-box latrines would significantly reduce the required volume of investment.

A second major component is the *pricing policy.* As suggested by Bahl and Linn (1992), prices should reflect the cost structure. In this case the structure is completely different, not only quantitatively but also qualitatively. With dry systems construction is not a major financial hurdle as is the case with sewerage systems. The same thing can be said about operation and maintenance as it is performed by the users. The key element in the cost structure is the training and education required, as well as the technical control, support and monitoring functions to be performed mainly by local, non-government organizations, as recommended above.

Thus, monthly fees to be paid by households should cover: (a) operation and maintenance; and (b) follow-up. In the initial phase the fee should also include: (c) a charge for construction of the latrines. Finally, if rebuilding of latrines is recommended, the fee should include again, for few months: (d) a charge for the new construction.

A third major component is the *administration of the fees.* Policies in this regard will vary depending on the local conditions and no single "adequate" universal policy can be outlined. However, two general recommendations can be made: on the one hand, the criterion that most of the money should be administered by communal organizations - at least the control and training component mentioned above. To avoid the risks of corruption or mismanagement by local leaders, a series of controls should be implemented: (a) payments must be collected by a financial institution (local bank, cooperative); (b) authorisations for automatic withdrawals should be surrendered to the financial institutions by the communities in order to pay the private organizations contracted to do the monitoring and training functions; (c) annual reports should be submitted to the public bodies in charge of the sewerage.

On the other hand, if some money should be returned to public bodies to reimburse for construction or rebuilding, mechanisms ought be designed to prevent such payments from entering the

institution's operational budget. An alternative could be to establish a trust fund in a financial institution, oriented to the financing of new sanitation projects.

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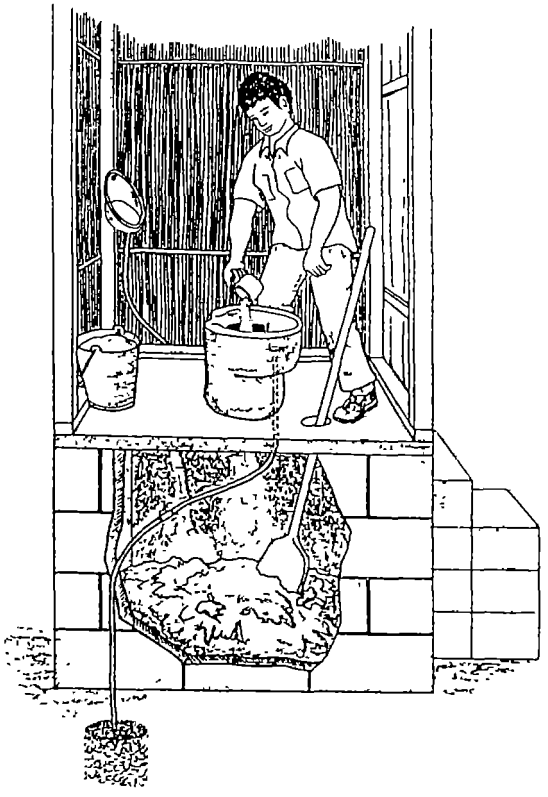

Annex 1

Workshop programme and papers presented

Thursday 4 November

0900-1000	Registration
1000-1030	Opening address
1030-1130	Coffee break, exercise "getting acquainted"
1130-1400	Lunch
1400-1700	Dry sanitation - an overview (Uno Winblad)
	Strategy to incorporate women in the programme of Integrated Basic Services (Marina Morales)

Friday 5 November

0800-1200	Study visit: Hermosa Provincia peri-urban area
1200-1400	Lunch
1400-1700	Discussion: Hermosa Provincia project
	The SIRDO composting latrine system (Josefina Mena)

Saturday 6 November

0800-1700	Groupwork: experimental construction
1900-2100	SIDA-dinner at the Bella Vista Restaurant

Sunday 7 November

0800-1700	Field visit: MoH LASF latrine project in County Flora Maria, Ciudad Arce
	Beach excursion

Monday 8 November

0800-1030	Results of the national survey on LASF's installed in Guatemala (Cecilia Alvarez)
1030-1230	Groupwork: experimental construction
1230-1400	Lunch
1400-1730	Field visit: "La Joyita" women' group in Ciudad Arce
1900-2100	Reception: Ms Miriam de Figueroa, UNICEF Res.Rep.

Tuesday 9 November

0900-1230	A socio-economic profile of the city of Addis Ababa (Amakelew Cherkosie)
	Environmental health conditions of Addis Ababa (Befekadu Girma)

	A strategy for urban sanitation (Jember Teferra)
	The sanitation problem of Harar - the donkey solution (Ahmed Zakaria)
1230-1400	Lunch
1400-1730	Groupwork: experimental construction
1900-2130	Dinner meeting: working groups/issues

Wednesday 10 November

0800-1000	Financial and managerial consequences of large scale application of dry systems in urban areas (Jorge Vargas)
1000-1130	Hygiene education in Nicaragua (Oscar Caceres)
1130-1230	Refuse disposal (Josefina Mena)
1230-1400	Lunch
1400-1700	Groupwork: experimental construction
1900-2100	Groupwork on issues, conclusions and recommendations

Thursday 11 November

0800-1000	Grey water disposal (Thorkil Boisen)
1000-1100	Pathogen destruction in dry latrines (Cecilia Alvarez, Uno Winblad)
1100-1230	Groupwork
1230-1400	Lunch
1400-1700	Groupwork

Friday 12 November

0800-1230	Plenary session on recommendations and lessons learned
1230-1400	Lunch
1400-1530	On-site discussion of experimental construction
1530-1600	Plenary session on follow-up activities
1600-1645	Evaluation of the workshop
1645-1700	Final announcements
	Closing address (Uno Winblad)

Annex 2

List of participants

Name of participant	Location	Organization/Address	Tel/Fax
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