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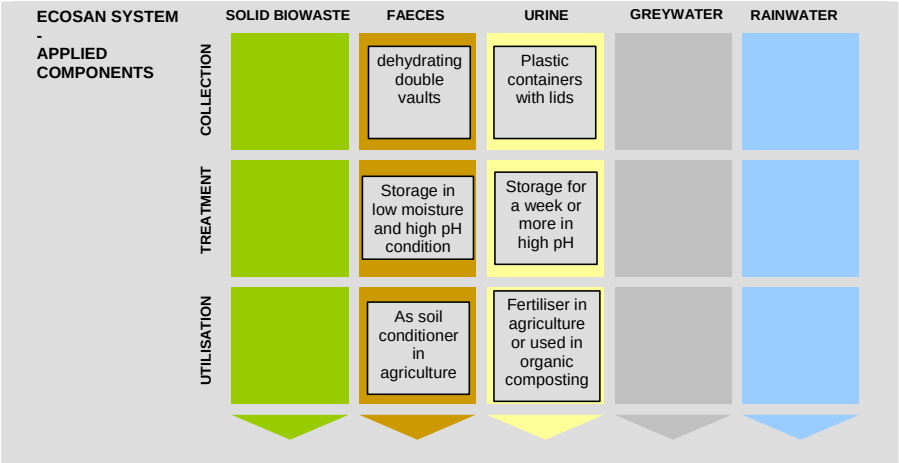
Private urine diversion dehydration toilets in peri-urban areas

Kathmandu Valley, Nepal



1 General Data

Type of Project:
Peri-urban upgrading

Project Period:
Start of planning: 2002
Start of construction: 2003

Project Scale:
Presently 200 toilets in 6 areas operated and under construction

Address:
Peri-urban communities within Kathmandu Valley

Planning Institution:
Environment and Public Health Organisation (ENPHO)

Executing Institution:
Environment and Public Health Organisation (ENPHO)

Supporting Agency:
UN-HABITAT, WaterAid Nepal

2 Objective of the project

- Provide better sanitation facilities
- Provide fertiliser to the farmers

3 Location and general conditions

The peri-urban areas in the Kathmandu Valley are inhabited by poor communities dominated by farmers. Water supply and sanitation coverage in most of these areas is far from adequate. Even though some areas have access to piped drinking water, service delivery is poor and water is usually turbid and microbially contaminated. Water quality of traditional water sources like ponds, dug wells and wells is highly degraded. The majority of the population still practises open defaecation and a small percentage of people having access to sanitation facilities use either pits or septic tanks. Due to improper design and the high groundwater table, pits and septic tanks fill up fast creating unhygienic conditions leading to either unhygienic emptying or abandonment in addition to groundwater pollution.

In the past people were practising use of raw human excreta on their agricultural fields. But after modernisation, the access to this resource was limited and the introduction of chemical fertilizers replaced the local nutrient resources. Farming is usually of subsistence type and people generally do not make much savings from the other small works they are involved in like making mats from straw, labour jobs, etc.

figure 1: Double vault urine diversion toilet (*source: ENPHO*)

Since 2003, 200 ecosan toilets in the communities of Khokana, Lub, Siddhipu, Tigan, Imadol, Siddhika, Dewako have been introduced.

4 Technologies applied

The ecosan toilets are double-vault, urine diverting dehydrating toilets (Figure 1). Urine is diverted through a pipeline to a plastic collection tank of 100l with lid (in the initial phase mortar and brick tanks) outside the toilet and the faeces drop into a vault where they are collected and stored. The latest model has a vault capacity of about 0.3 m3 designed for a family of 5-6 persons. Squat holes each of about 6 inches diameter are covered with lids.

Figure 2: Squat pans and anal cleansing space in the middle *(source: ENPHO)*

After defaecation ash is added and sprinkled over the fresh faeces mainly to cover it up and to increase the pH. Ash is normally available in the household from the kitchen where wood, straw or other dried plants are burnt. Saw dust is also used as additive. Keeping in view the cultural practise, an

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commissioned by Federal Ministry for Economic Cooperation and Development

anal cleansing area is provided between the two pans. Wastewater from the anal cleansing area is sent to a soak pit dug into the ground (in the initial phase mini constructed wetland adjacent to the urine collection tank).

After using one vault for 6 months, it is closed and the second vault is used for the next 6 months. Vent pipes are installed to remove any odour and gases produced and to provide air circulation.

5 Type of reuse

Farmers of the Kathmandu Valley have been practising the use of night soil in the agricultural fields for decades. However, with the introduction of the sewer system in the city areas and of chemical fertilisers, this practise is now limited to small numbers of farmers who rely on the resources produced in their households. However, farmers still realise the importance of human excreta in agriculture. In this regard, ecosan has given them the opportunity to use the nutrients contained in urine. Moreover, addition of faeces after adequate treatment along with home compost is getting popular.

Figure 3: Urine application *(source: ENPHO)*

Figure 4: Faeces for use in agriculture *(source: ENPHO)*

Urine from the plastic tank is taken in smaller jerry cans or other containers to the fields as and when required. It is also used in the kitchen garden next to the house. Excessive urine is also applied in the organic compost, thus retaining most of the nutrients of urine in the compost.

Year	Locations							Total
	Khokan	Lub	Siddhipu	Tigan	Imadol	Siddhika	Duwako	
2003	10							10
2003/2004	30	6			12			48
2004/2005			24	6	1	4		35
2005/2006	25		185				10	220
Total	**65**	**6**	**209**	**6**	**13**	**4**	**10**	**313**

Table: number of ecosan toilets in different areas *(source: ENPHO)*

Faeces are allowed to remain in the vault for a period of 6-7 months after which they are taken to the fields. Some households have also started co-composting stored faeces with organic compost.

6 Further project components

Training is a major component of the implementation programme. Users are provided with training in three different phases in order to understand the concept of ecosan, so they get familiar with the toilet before it is ready-for-use and know about urine and faeces application methods.

Research is another important project component. Intensive research on the effect of urine on crop production was initiated in 2004 and is ongoing. So far experiments have been done on paddy, wheat, potatoes, radishes and onions. Two crop cycles for potatoes, paddy and wheat with urine application have been completed with promising results. Results for potatoes show that even though the yield with urine application is less than with chemical fertiliser, it is however higher than the national average yield thus showing the potential of using urine as the source of nutrients for crop plants.

Furthermore, research is going on with urine application in organic composting. Preliminary results have shown so far, that with use of urine, compost is ready previously and the nitrogen content of the compost is high.

Research has also been carried out concerning microbial reduction in the faeces at field storage conditions. Depending on the findings and recommendations of the study various improvements are being made in the later constructions. Some of the improvements include replacement of the mortar- and brick urine collection tanks by plastic tanks as the former tanks were leaking into the faeces collection chamber, improvements in the pan and slab of the toilet to minimise the amount of water going into the vault while cleaning the toilet slab, increase in the amount of additive to increase the pH. Currently research is undertaken concerning the use of different additives and microbial reduction.

Also a detailed study will be carried out to asses the technical, social and financial aspects of all ecosan toilets that have been implemented so far to make further improvements.

7 Project History

The concept of ecosan was introduced to Nepal when a water and sanitation professional from ENPHO attended the training course provided by the Swedish International Development Agency (SIDA) in Sweden in 2001. After his return, ENPHO organized the first talk programme in January 2002 to sensitize stakeholders working in water and sanitation sector regarding the concept of ecological sanitation.

After the programme, many organizations were motivated to initiate programmes in the peri-urban communities of the Kathmandu Valley.

With this concept, a pilot demonstration project with construction of 10 toilets was initiated in 2003 in a peri-urban area (Khokana) under financial assistance of WaterAid Nepal (WAN). The project was implemented in the community in association with partner organisations.

WAN has since then been funding ecosan constructions in other peri-urban areas as well. In the second phase, 30 toilets were constructed in Khokana and 18 in two other communities. WAN and UN-HABITAT are now extensively implementing ecosan in Siddhipur which is another peri-urban area. There, 80 toilets are already under operation and about 44 are under construction.

The most favouring aspect for up-scaling of the initial programmes has been the social acceptance of this system in the farming communities. The other aspect is the situation of sanitation in the peri-urban areas. In a situation where the pits and septic tanks fail and where there are no sewer systems, ecosan has become the best sanitation option.

8 Costs

Unit costs during the pilot phase were US$ 270. It has however not been possible to bring down the cost substantially as the present unit cost is still US$ 230. Due to the high cost, people from this and other poor communities cannot construct these toilets without outside funding. Currently, each household bears 30% of the total cost which includes provision of unskilled labour and construction of superstructure, the rest being borne by UN-HABITAT and WaterAid. Various options are however being looked into for further reduction of the costs.

So far O&M costs have not been analysed and have been assumed to be negligible. The products are used by the households themselves and the treatment is also done in-house therefore there is no cost incurred in treatment and reuse.

9 Operation and Maintenance

Households themselves are responsible for the operation and maintenance of the toilets. Experience shows that if the users are motivated and also trained well, then the operation of the toilets is simple. However, there are still some constraints in the proper operation mainly due to the reason that the toilet users were either used to open defaecation or to the pour flush toilets making it difficult to get habituated to the procedure of the ecosan toilet.

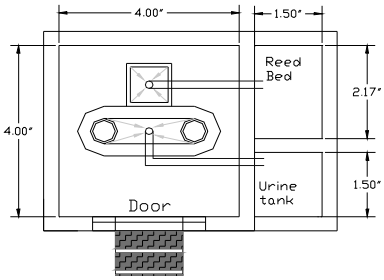
Maintenance requirements are negligible where the structure itself is strongly built. Some small flaws in the initial structures are maintained either by the user alone or jointly by the project and the user depending upon the type of maintenance required. Apart from the design aspect, other regular maintenance like cleaning the toilet or the timely emptying of the vaults is done by the users.

10 Design information and technical specifications

The double vault dehydrating toilets have been built for individual households with an assumption that each household would consist of a family of 5-6 members. Based on this, each vault has a capacity of 0.35-0.4 m3 typically to be used for a period of 6 months before the users shift to the next vault.

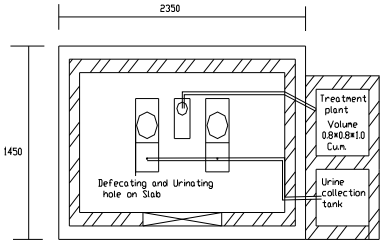
The opening on the outside of each vault is 1 x 1 feet to facilitate the emptying of the vault with a shovel, and covered by a fibre glass cover. But the fibreglass will now be replaced by a thin concrete slab to reduce costs. The hole in the pan for defeacation is 6 inches wide to facilitate easy and safe use both for adults and children. The urine bucket is placed outside the toilet for easy access. The toilets have been designed keeping in view the cultural practises like use of water after defaecation. They are a modified version of the Vietnamese and the Kerala model. The project opted for dry toilets as the mixed toilets might not be appropriate for the climatic conditions as the faeces do not attain high temperatures as shown by past studies.

Model 1 - Pilot Phase in year 2003



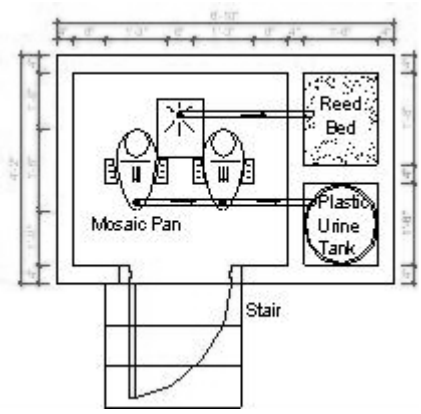
Size: 7.5' * 4.75"
Pan model: Two defecating holes each having separate hole for urinating. Squat is combined with covering slab
Construction cost: NRs: 19236.0 (appr. 320 €)
Urine tank made of Brick masonry
Faeces access doors made of iron frame

Model 2 - year 2004 with slight modification



Size is reduced to 4.75' * 4' for cost optimisation
Pan model: Two defecating holes with common urinating hole for cost minimization. Squat is Combined with covering slab.
Construction cost: NRs: 15585.0 (appr. 265 €)
Urine tank made of brick masonry
Faeces access doors made of iron frame. In four units the faeces access part is constructed as El-Salvador model.

Model 3- Current model after further modification



Size of model 2 is slightly small according to the user. So increased to 5' *4.25"
Construction cost: NRs: 16447.0 (appr. 280 €)
Urine tank leaking problem in previous model; replaced by plastic drum.
Rusting of iron frame in previous design, replaced by concrete groove.

The toilet building walls are made of brick and mortar, roofs and doors are made of galvanised iron sheets. A water resistant surface coating is applied to the toilet floor and about 4 inches up the wall. Substructure is plastered both inside and outside and the inside wall is painted. Superstructure is not plastered.

11 Practical experience and lessons learned, comments

ecosan is well accepted in the farmers' communities for its reuse values. However, it has been realised that the community and the potential users have to be well trained and provided with adequate knowledge on the concepts of ecosan for the proper use and maintenance of the toilets. The users have been found to be very enthusiastic on reuse of products and are happy with the yields. They feel that crop yields are better compared to the chemical fertilisers.

During the course of implementing different programmes, as mentioned, some problems especially with collection and storage were encountered. These had direct consequences on the microbial quality of the stored faeces. By virtue of experience with old toilets, design changes were made in the new toilets and the storage situations have improved. Moreover, R&D is a continuous process and the findings and re-

commendations from these studies are incorporated in new toilets.

However there is still risk of handling of excreta before complete destruction of pathogens due to ignorance and lack of knowledge on health risk factors. Similarly, proper use and storage of urine in a large scale still needs to be practiced.

12 Available documents and references

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data sheets for ecosan projects

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