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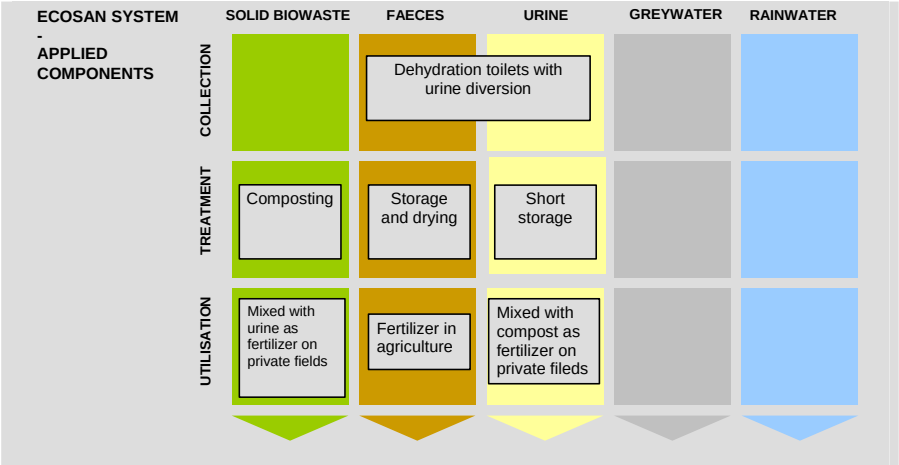
Urine diverting dry toilets project

Kunming, China



1 General Data

Type of Project:
Rural upgrading

Project Period:
01.2003 -02.2005

Project Scale:
142 households

Address:
Zhonghe Village, Chenggong, Kunming, China

Planning Institution:
Eawag/Sandec

Executing Institution:
Kunming Institute of Environmental Science (KIES)
Yunnan Academy of Social Science (YASS)

Supporting Agency:
Swiss National Science Foundation (SNF) and the Swiss Agency for Development and Cooperation (SDC) in the framework of the Swiss National Centre of Competence (NCCR) North South Programme

2 Objectives of the project

To investigate the feasibility and stakeholders' readiness to introduce source control measures in the field of sanitation. The study is composed of two parts:

1. Implementation of the urine diverting dry toilets project in a peri-urban village of Kunming.
2. Investigating the potential and limitations of introducing sanitation alternatives allowing for the safe reuse of urban human excreta as fertilizer.

3 Location and general conditions

The Province of Yunnan is located in south-west China and is one of the country's poorest provinces. Approximately 85% of the population live in rural areas, typically in a mountainous environment. The capital, Kunming City, has about 2.4 million inhabitants and is located north of Lake Dianchi. There are 15 villages and towns which occupy 220 km^2 and take up 7.5% of the total area of the ecological band sourrounding Lake Dianchi.

Increasing population and accelerated industry development in Dianchi watershed imposed great pressure on Lake Dianchi in the last twenty years. The severe deterioration and eutrophication of the water body make Dianchi Lake one of the three most seriously polluted lakes in China. Although the pollution from industry has been decreasing in the last few years and the central and local governments have made huge investements and efforts in an attempt to reverse the current situation by constructing domestic wastewater collection systems and 6 treatment plants and implementing other integrated pollution control measures, the water quality has not improved. One of the reasons is the uncontrolled non-source pollution in the peri-urban area caused by the household wastewater, human excreta and the intensive application of chemical fertilisers.

At the same time, there is a big demand of organic fertiliser in this ecological band where huge quantities of vegetables and flowers are grown and supply both the local and international market.

Zhonghe village, the model project location, is situated in Chenggong Township 30 km outside Kunming city. The village consists of 142 households and some mobile population. The farmers' income mainly derives from vegetables and flowers cultivation.

4 Technologies applied

For the rural upgrading, the urine-diverting dehydration toilet as implemented in other southern Chinese provinces has been chosen. This model already proved to be acceptable and affordable for the village households (for further details see project data sheet "Guanxi dry separation toilet dissemination programme, China").

Figure 1: squatting pan (*source: SIDA*)

gtz ecosan program recycling oriented wastewater management and sanitation systems
commissioned by Federal Ministry for Economic Cooperation and Development

Figure 2: urine-diverting dry toilets (*source: Medilanski*)

Figure 3: public toilet (*source: Medilanski*)

Figure 4: Agricultural land next to the houses (*source: Medilanski*)

Figure 5: Participatory discussion on sanitation requirements of the villagers (source: Medilanski)

5 Type of reuse

Urine and faeces are reused by the village households themselves. Dried faeces were first reused as soil conditioner by the households on their own fields at the end of 2004. Urine is usually mixed with composted organic waste. The quantity of anthropogenic fertiliser available replaces chemical fertiliser to a small extent only, however.

Currently compost and urine are not perceived as a significant fertilizer resource by the households due to the limited quantities.

6 Further project components

Social surveys performed an assessment of sanitation requirements from the households´ point of view. The surveys were carried out by YASS. The evaluation was split into three surveys, each covering 50 households in Zhonghe village. To compare the results, the questionnaires were also used in Taishi village, where the toilets had been implemented unsuccessfully in 2002, and to a village without any knowledge about the urine diverting toilet system.

The social survey showed that the number of households using their dry toilets increased from 40% to 64% in the three months after completion of their construction. During this time the households "satisfied" or "very satisfied" with their dry toilets rose from 38% to 56%, indicating a level of satisfaction of about 90% among housholds that actually use the toilets. 80% of these users were weekly collecting 10 litres of urine or more. On the other hand, little has changed regarding the use of fertilizer due to the small amounts of urine and faeces. There is little correlation between gender, educational level, household income and the use of dry toilets. Most of the households prefer to build the toilet outside the yard. The second choice is outside the house and an in-house toilet is the next choice.

Understanding the legal and governmental frameworks, as well as the decision process is important for promoting and introducing alternative sanitation systems. Therefore an institutional analysis and stakeholder analysis has been carried out.

Expert interviews investigating the potential of introducing urban sanitation alternatives in China were carried out and 21 governmental officials, 10 researchers and 8 technical specialists working on ecological sanitation issues were interviewed. The purpose of the interviews was to assess the acceptance of the ecosan concept, to assess the acceptance and feasibility of implementing sanitation alternatives and to characterize the stakeholders. The interviews show that half of the experts believe that source control in a city will be much implemented in 20 years, and when ranking the priorities of implementation measures at the source, they gave the first priority to industry wastewater, second priority to urine and faeces and then greywater.

7 Project History

A first attempt to implement urine diverting dry toilets in Taishi village in 2002 was a failure both because of technical mistakes and the lack of acceptance by the villagers. In order to enhance the chance of success of a second pilot project, Eawag encouraged the knowledge exchange with specialists from neighbouring Guanxi Province, where several hundred thousand urine diverting dehydration toilets are in use. Furthermore, local social scientists from YASS did follow the villagers' acceptance of the new sanitation system throughout the project. Both partnerships with KIES and YASS were financially supported by the Swiss NCCR North South Programme.

A study tour to Guanxi province and a training course in Kunming and in Zhonghe village were organised in 2003. In January 2004, the first 5 model units were finished. YASS evaluated and monitored their utilisation and social acceptance before the majority of toilets was built from spring to summer 2004. Until the end of the year, a total of 112 toilets plus 2 public units with 14 toilet cabins each were successfully constructed.

After the successful implementation in 2005, the government of Kunming declared Zhonghe village as a model village for urine separation dry toilet systems around Lake Dianchi. The "Kunming Urine Diverting Toilet Extension Office" was founded under the Kunming Environmental Protection Bureau and 100.000 units were planned to be implemented in villages around the lake until the end of 2007.

By end of 2006 the construction of around 50.000 individual units and 180 public units has been reported by the UD Toilet Extension Office. However, only a part of the toilets is currently being used. Officials expect the rate of toilet usage will rise within the next years.

8 Costs

The total construction cost of one urine separating toilet is about 85 euro per unit.

9 Operation and Maintenance

Operation and maintenance is the responsibility of the households themselves.

KIES monthly observes the toilet condition and analyses the human excrements after several months of storage.

10 Design information and technical specifications

The farmers preferred the toilets to be built by a building group instead of by farmers themselves.

Almost all toilets follow a standard construction plan:

2 chambers with a volume of at least 0.4 m³ each, corresponding to a filling time of 6 months for one household of 4-5 persons. The compact design locates the pedestal on top of the chambers, accessed by small stairs. The chamber is generally built from local materials. Access to the urine bucket and the chambers is usually from outside the toilet / house. In the bathroom, normally tiles are used. In a minority of houses, the toilet room can also be constructed with local material such as wood, bamboo and a PVC foil.

If the toilet is built on the 1st floor, the faeces drop through a PVC pipe (150-200 mm diameter) to the chamber at ground level.

Prefabricated plastic (fibreglass) squatting pans are used, which are both cheap and break-resistant. They are produced in a local plastic factory. The front is improved by a higher board to prevent urine sprinkles on the floor.

Ventilation pipes are standard 100 mm PVC pipes, rising at least 30 cm above the roof. Lighting of the toilet is another important component, which increases user friendliness and acceptance.

11 Practical experience and lessons learned, comments

The project was implemented quite successfully. The survey conducted shows that 90% of the households using urine diverting toilets are satisfied with their toilets. Nevertheless, after three months several households still did not use their toilets for various reasons: some users were not involved in the selection of the toilet location, technical problems with urine pipe, and worries about increased complexity of the operation and maintenance, or simple lack of interest to change habits.

Some experiences gained through the project are:

- Users must be involved in the design of the toilet, for example the location of the toilet
- Behavioural change, awareness raising and health education must take place prior or in parallel to the construction process;
- It is important to get assistance from the farmers' representatives and the village leaders. In addition, support from the highest level of government can tremendously increase the credibility of the project and will facilitate future work. On the other hand this leads to concerns that people might now primarily accept the system because of this prestige and not out of conviction of the ecological sanitation concept. This might improve when villagers start to use and appreciate this new sanitation system.

Latest reports from the project area suggest that the local authorities have been very convinced by the advantages of the urine diverting dehydration toilets and strongly promote and support their construction in large numbers since completion of the Eawag project. However many of the toilets are currently not being used. The main reason is probably that several of the recommendations drawn from the Eawag project have not been respected in the large scale dissemination of the toilets:

- A supply driven approach has been adopted that did not sufficiently involve the users
- Accompanying information and training campaigns were so far not sufficient

12 Available documents and references

Eawag Novaquatis programme:
http://www.novaquatis.eawag.ch

The final project report will be available from march 2007 on.

Poster:
Edi Medilanski: Investigation of sanitation alternatives for the City of Kunming, 2004, download: http://www.nccr-north-south.unibe.ch/othermedia/othermedia.asp?ID=2372&refTitle=the%20NCCR%20North-South&Context=NCCR

KIES: (2003) Environmental sanitation feasibility study (Chinese only)

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data sheets for ecosan projects

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