sustainable sanitation alliance

Case study of sustainable sanitation projects

Community–led Water and Ecosan Programme Shaanxi Province, China

Figure 1: Project location

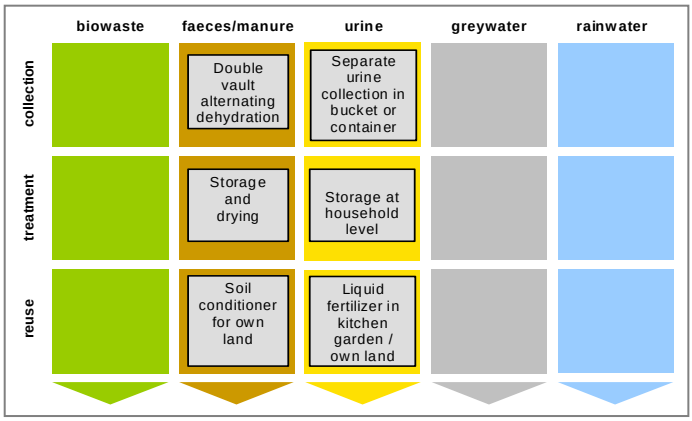


Figure 2: Applied sanitation components in this project

1 General data

Type of project:

Large-scale community-led water and environmental sanitation improvement in rural area.

Project period:

Start of planning: Jan. 2005

Start of construction: July 2005

Start of operation: Jan. 2006

End of Project: June 2009

Project scale:

196,000 beneficiaries up to June 2007 (mid term of the project) based on base line survey for WES program of Plan China.

Total investment: € 1.8 million up to June 2007

Address of project location:

Villages in Pucheng, Chunhua, Xixiang, Chenggu, Jia Xian and Yulin Counties of Shaanxi province, China

Planning institution:

Plan China

Executing institution:

Respective Village Development Committees facilitated by Plan China Program Units

Supporting agency:

Government Township Project Offices

2 Objectives and motivation of the project

- Deliver sustainable health and hygiene benefits to the children and their families through improvement in water supply and environmental sanitation.
- Promote eco-sanitation methods to reduce water consumption and recycle nutrients and organics.
- Improve household income through time savings and income earning opportunities particularly for women.
- Support processes that can nurture self-empowerment of individuals or groups. The ultimate aim is the empowerment of the community, giving it the decision-making power and access to resources.
- Promotion of ecological sanitation option integrated with health and hygiene education.

3 Location and conditions

Despite China's remarkable growth and development, significant pockets of poverty remain in many regions. The development of poor communities is constrained by lack of access to services, unsustainable use of natural resources and unhygienic environmental conditions (e.g. fixed point open defecation, no garbage disposal, unmanaged domestic wastewater disposal, low water quality, mosquitoes breeding, unplanned disposal of animal excreta).

Rural and western China is particularly affected by this inequality. In rural China, only 68% of the population has access to safe drinking water and 29% to adequate sanitation (UNDP data from 2006; although JMP figures are higher). The absence of safe water supply systems and adequate sanitation is one of the most important problems for people in western China.

In the project area, in Shaanxi Province (in the North-West of China), lack of safe water supply and basic sanitation is closely associated with livelihood and other social issues. Poor economic conditions and lack of participation has hampered the initiation of developmental work. Due to a "top

down approach" for community development projects, there is little or no participation from the community.

Annual income per capita is in the range of € 100-150. Farming and fruit orchards are the primary source of income in the programme area. Human excreta are used as fertilizer for crops and vegetables. This is an old practice in China. In many houses toilets are made in such a way that the excreta of all members of the family are collected in buckets, which are taken to the fields periodically and are diluted with water and applied raw on the crops. When one bucket is filled up another one is placed in its place. Furthermore, water is not used for anal cleaning as the habit is wiping. The availability of water resources per capita in Shaanxi province is only half of the country's average. Droughts and low rainfall level, 400 – 600 mm per year, are faced by all rural communities in Shaanxi.

Shaanxi province is among the most under-developed regions in China and a survey conducted by Plan China in 2004 highlights this disparity. 25% of children under three years old suffer regularly from diarrhoea, due to poor access to water supply and sanitation (based on a single survey done by Plan China - a final survey will be conducted after completion of the entire project in 2009 to assess the changes due to project implementation).

A second Plan China baseline survey reveals that only 2% of families have access to potable water and 8% of families dispose excreta in a sanitary manner.

Communities in the programme area are affected by a very high incidence of water borne diseases, particularly diarrhoea and viral hepatitis. After conducting initial health and hygiene awareness raising activities in Shaanxi province and through participatory planning and discussion sessions with the target communities, the inhabitants identified three main needs:

1. The lack of safe drinking water forces families to use contaminated water sources that expose them to a range of water borne pathogens. These water sources are often located far from homes leaving women and children with the duty of collecting water.

2. The lack of access to basic sanitation increases the contamination of local water sources, degrades the local environment and promotes the spread of disease.

3. The lack of knowledge about the relationship between hygiene, water quality and good health increases the vulnerability of families, especially young children, to water-borne diseases.

The project area is most suitable for the promotion of ecological sanitation (in the form of urine-diversion dehydration toilets) based on the following:

- This sanitation practice is not new in China. Chinese people have a long history of using this type of sanitation in which urine is diverted from faeces.
- The same is true for the reuse concept. Since ancient times, Chinese are using human excreta as fertilizer in agriculture, thus the attitude is positive.
- Cleaning habit in China is wiping thus facilitating the dry separation of urine and faeces.
- The shortage of water calls for a solution which does not require water for flushing.

The project has targeted children, their families and the community. The target area covers 247 communities in the counties of Chunhua, Xixiang, Chenggu, Pucheng, Jia Xian and Yulin of Shaanxi province in North-West China.

4 Project history

The WES (Water and Environment Sanitation) programme of Plan China started in 2005 to cover 500 communities and 200 schools in Shaanxi province with a grant from Plan Netherland and supported with a matching amount from child sponsorship which is collected by Plan worldwide. Prior to this, the WES programme was implemented with sponsorship money and the project interventions were limited. The WES programme integrates the water supply, sanitation with hygiene promotion and education with further linkage to health and livelihood.

The first urine diverting toilets of the project were piloted and demonstrated in Sanyong village in Pucheng County during May/June 2005 and later it was piloted in other programme counties. After the successful pilot of urine diverting toilets in all counties, the construction of these systems in larger numbers began in July 2005. The number of toilets constructed in 2006 was impressive, confirming that the community accepted this new technology in large numbers.

The main reasons of the acceptance of this technology by the community are:

- The effective promotion by Plan programme units,
- Low price in comparison to other toilets (eg. biogas, flush latrines and twin pit series latrines),
- Simplicity of usage and maintenance and
- The individual household subsidy provided by Plan China.

The respective government departments (Water Bureau, Health Bureau, Poverty Alleviation and Township Offices) also accepted the fact that this type of toilets can be promoted on a large scale in rural areas since they are hygienic and present a compelling alternative for use by rural households. Subsequently ecosan UDD toilets have been included as the standard type of systems promoted by the Chinese government for on-site treatment, disposal or reuse of human excreta. These standard types are:

- Three compartment latrines
- Twin pit series latrines
- Biogas toilets
- Urine diversion dehydration toilets (UDDTs)
- Elevated dry compost latrine

In this respect the work done by Jiu San Society, a leading social organization, for promoting ecosan in China and also for advocating at national level is laudable. Ecological sanitation is high on the agenda of the Jiu San Society national action plan.

5 Technologies applied

Three types of latrines have been presented to the community to choose from in the programme area:

a) Urine diverting dehydration toilets

b) Biogas toilets

c) Twin pit series latrines (double urn toilets)

The communities were informed about the benefits and cost of all three types of latrines as well as the financial support available from Plan China.

a) Urine diverting dehydration toilets (UDDTs). The major difference between urine diverting toilets and other sanitation systems is that the toilet has two outlets and two collection systems. One is used for urine and one for the faeces, in order to keep these excreta fractions separate (Figure 3). There is a cover for the faeces compartments to protect the latrine from flies and other insects as well as to reduce potential bad odour. The latrine used in the programme area is based on the Vietnamese double vault latrines to enhance the dehydration of faeces and allow the use of urine as fertilizer.

The urine collection pipe is normally a plastic pliable pipe with the diameter of 40 mm. It connects the urine hole in the front of the squatting pan and the urine storage tank. The length of pipe should have sufficient reserve to facilitate the chamber change by turning the squatting slab by 180°. In colder climates, however, the pipe should not be too long to avoid freezing and blockage. The urine storage tank can be bought locally, and comes in various forms, such as barrel, bucket, kettle etc. with lids.

Figure 3: Household urine diverting dehydration toilet in Shaanxi Province (source: Plan China)

The faeces vault is normally built above ground. A faeces vault with a volume of 0.30 m³ can meet the requirement of a family of 5 to achieve a storage time of one year. There are normally two vaults to be used alternatively. The dimensions of the opening for emptying are about 25 cm × 25 cm. It can be sealed with a wooden board, metal board or bricks because the emptying takes place only once per year. The best way to seal the opening is with a black metal board which can effectively absorb solar energy to dry the waste faster (if the toilet is exposed to the sun).

When the first vault is full, the squatting pan is turned 180° and the other vault comes into use. The full vault is sealed for a minimum of 6-8 months for drying and hygienisation. The retention time and the elevated pH level results in die-off of pathogens and allows safe handling for use as fertilizer.

When the second vault is full, the first vault is emptied from the opening provided in the structure, and it then comes into use. The operation and maintenance is explained in Section 10.

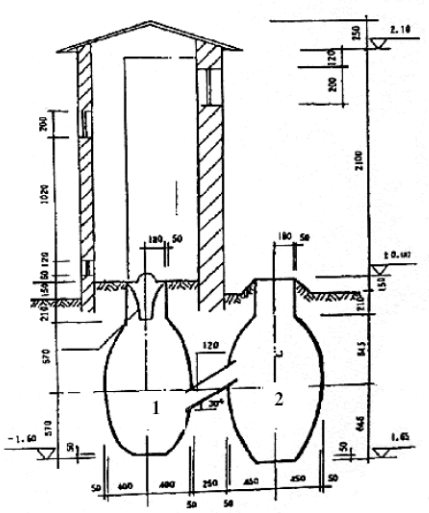
b) Biogas toilet. This kind of toilet consists of a squatting pan, faeces inlet, faeces pipe, biogas reactor (including fermentation chamber and biogas tank) and faeces storage chamber. In order to avoid the escape of biogas, sealing of the innner layer of the fermentation chamber should be done carefully. A squatting pan is normally installed, needing 2.5 to 3 litres for flushing the faeces by pouring water from a bucket.

Under the toilet the faeces pipe is connected. The faeces pipe can be bifurcated to have another inlet which is used for adding animal excreta based on the users' demand and availability of livestock.

c) **Double pit series latrine (double urn toilet).** This toilet has two urns built underground, which are constructed of brick or pottery. There is a concrete squatting slab with an inlet hole for the excreta and with foot rests and a super-structure for privacy and protection from the weather (Figure 4). The squatting pan is fitted on top of the pit without water seal and little water is required for flushing.

The two urn storage tanks are named according to their shape. The front urn is smaller and is normally constructed under the ground. It is mainly used to receive and store faeces. The retention time is generally over 40 days. The excreta can be completely digested to eliminate pathogens such as bacteria and parasite eggs (40 days retention period in first urn and after that carried to second urn through connection pipe to further eliminate the pathogens).

After the digestion in the front urn, effluent of this urn flows into the rear urn via a connection pipe. The rear urn is mainly used for storage of the effluent. A concrete slab is used to cover the outlet of the rear urn which prevents odour from escaping and rainwater from flowing into the urn.



1. Front Urn; 2. Rear Urn

Figure 4: Side view of a double urn toilet (source: Plan China)

65% of the constructed systems in the project area up to June 2008 are urine diverting dehydration toilets (UDDTs), as can be seen in Table 1. The promotion of UDDTs is quite successful in the Plan China programme area particularly in the central plain and south. There is still an operational problem in the North where harsh winter conditions cause frequent freezing of urine pipes.

Table 1: Number of toilets constructed in Shaanxi Provence under the Plan China WES programme

Period	UDDTs	Biogas	Double urn
July 2005-June 2006	8,457	1,214	1,650
July 2006-June 2007	6,410	1,369	3,072
July 2007-June 2008	3,189	1,020	1,500
Total	18,056	3,603	6,222

6 Design information

The design information in this section is only for the UDDTs since they are the most used option in the programme area. Expected average quantity (from Swedish literature) of faeces and urine per adult is:

- 400 - 500 litres urine per year i.e. 1.10 -1.36 litres per day.
- 50 kg wet faeces per year

Whilst these figures were derived for Swedish diets, they seem to also work for the Chinese UDD toilets built with these design parameters.

In the UDD toilets promoted in the Plan China programme area, the urine is collected in a separate container which is often placed under the stairs for safety and efficient space utilization. The construction of these types of toilets is quite simple and there is no risk of leaking from the vault - hence, water proofing of the vaults is not required. The flood risk in the Plan China program area is minimal. However in flood prone areas, water proofing is must.

The toilet can be constructed entirely above ground. Due to separation of urine and no flush water, the volume of potentially hazardous materials becomes smaller and the toilet requires less space for construction.

- For a household of 5 persons the unit should consist of two processing chambers, each of a volume of 0.25 m^3 (50 kg per person per year x 5 (No. of adults) x 1 year = 250 kg ≈ 0.25 m^3).
- The entire construction is above ground and the vaults are placed on a solid floor. The size of a vault may be 0.9 m x 0.7 m x 0.4 m (depth) = 0.25 m^3. 0.2 m of free space is provided, i.e. total depth = 0.4 + 0.2 = 0.6 m. Thus, final vault size is 0.9 m x 0.7 m x 0.6 m. For a smaller household the size may be reduced.
- Two openings of size 0.25 m x 0.25 m are provided in each vault for the removal of dried faeces.
- One vent pipe (diameter 10 or 15 cm) extents from the vault to above the roof for ventilation and is equipped with lids to stop rain water. Vent pipes should be as straight as possible as bends reduce air flow, and should be minimum 50 cm above the roof. If necessary the vent pipe can be fitted with a small electric fan (price: € 3).

Setting/location of UDDTs:

- Location of a UDDT can be done in several different ways depending on the availability of space, its location inside or outside the house, convenient position/space for openings for the removal of dehydrated material and urine collection (the location is selected in consultation with the households).
- The vent pipe should be provided in the middle. Where it is not possible to provide a pipe in the middle then two vent pipes, one in each vault, should be provided at the edges especially in warmer/humid areas. Generally in the toilets constructed inside the house, it is not possible to provide vent pipes in the middle as this would encroache on leg space. If the vent pipe is provided in the middle without bend then due to optimal size of surface area of squatting it will cause inconvenience in squatting and getting up.
- Where the plinth level of the house (in dry areas) is substantially higher than ground level (around 1-1.5 m higher than ground level), and the location selected for the latrine has access to an external wall in which an opening for collecting dehydrated material can be provided, the UDDT can be constructed partially/fully underground (the vault opening would be above ground from the outside and can be emptied easily). In this case the urine container can also be placed outside the house. This arrangement will save space needed for stairs but extra precaution should be made to avoid dampness. Excessive dampness will negatively affect the dehydration of faeces.
- The steps of the stairs can be 200 mm or 150 mm. For children and elderlies the steps should be ideally 150 mm. Number of steps should not be more than 3 in case of 200 mm and 4 in case of 150 mm thus limiting the depth to 0.60 m. Higher depths require more space for stairs and are not safe for children and elderly.
- The stairs can be constructed in the middle or in the sides depending on the availability of space. Stairs should be by the side of toilet if it is constructed together with the bathroom otherwise it will obstruct the bathroom use.
- In extremely cold conditions, insulate the urine pipe so that it will not freeze. Urine pipes should be attached to the container in such a way that all urine passes to the container and that it is free of any residues (stagnant urine) after use (Figure 5). This will help the urine pipe not to freeze in extremely cold conditions.

Figure 5: Open hatch shows access to the urine pipe and urine storage tank of the UDD squatting toilet (source: Plan China)

- For toilets constructed outside the house, again there can be a number of different ways to place the opening for taking out the dehydrated faeces. It can be placed on the rear wall, on any side walls or even in the front. The most optimal setting of an outside toilet is to provide openings in the rear wall and stairs in the front (middle of the vault). The other option is to provide openings in the sides and stairs in front of one vault.
- The thickness of the vault partition wall should not be more than 60 mm. Since it is a non-load bearing wall and the squatting slab rests on the peripheral wall (120 mm thick) the thickness can be reduced further by using other materials like thick dark hard glass, stone slate slab and wood with aluminium wrap. If the thickness of the partition wall exceeds 100 mm there is a chance that faeces will stick to it.
- For lighting and ventilation adequate openings in the walls of an outside toilet should be provided.

7 Type of reuse

Since ancient times human excreta has been used in China for crop fertilization. However, the safety aspects have often been overlooked and mostly fresh excreta have been taken to the fields while neglecting the health risks.

By promotion of ecosan systems the hygienic concerns are being addressed, and excreta can be safely utilised for crop fertilization. Note that if households open the faeces vault prematurely (less than one year) and use the dried faeces for fertiliser too early, this is not a safe practice.

The dried faeces are removed from the vault once or twice a year depending upon the filling rate. They are applied to the field before plantation or sometimes in between two planting periods. However the amount produced from one household is relatively small compared to the fertilizer need of the household, as they produce crop not only for their own consumption but also for sale. The average fertilizer need for these households of five members is 150 kg per year and the use of composted faeces and urine from UDDT fulfills around 15% of total need of the family.

Urine is applied by the households once or twice a week mostly to nearby fields. Often it is applied with a dilution of 1:2 with water but sometimes also raw followed by watering.

The toilet users are generally small farmers owning on average an area of 0.2 - 0.33 ha. Most of the farmers have some land near their household used mostly for vegetable farming and some fruit orchards (apples, dates, pears, plum, apricot etc.). The land further away from the house is generally used for grain farming such as rice, wheat and maize.

8 Further project components

This programme aims for comprehensive development in the field of water and sanitation in the respective communities. The sanitation programme is integrated with hygiene promotion and education activities in the communities to raise the residents' awareness about the linkage between health, sanitation and livelihood. The project focuses on behaviour change through communication. The approach of this program is "software precedes hardware", "demand based, child centred development and gender awareness", and "sanitation precedes water supply and other infrastructure".

"Sanitation precedes water supply" was the main approach with full participation from community. The sanitation intervention starts from the planning phase itself and continues in post implementation as well. The water supply component was taken up only after the overall improvement in sanitation and acts as an incentive to the community. The other project components include water supply, solid waste management, greywater management, rainwater harvesting and water source protection.

Mid-term evaluation of the programme was carried out in September 2007. The evaluation showed the improved usage of toilets (data on health improvements is planned to be collected in 2009). However it has been recommended to extend post implementation support for minimum one year to ensure the sustainability of system. The project is regularly monitored at three levels - community, programme units and country office(s). The country offices are planning to conduct research on community participation, use of urine and faeces in agriculture and the programme's impacts on community and children health in coming years.

Similar programmes are being implemented outside of Shaanxi province and also in other counties in Shaanxi in association with government departments on the initiative of Plan China.

Urine separating systems have also been introduced at schools in Plan China program area of Shaanxi province (Chunhua, Puchenmg and Xixiang county) and the initial results are encouraging (the demo toilets are being used by children and teachers). In the future more schools will be covered under this programme for constructing urine diverting toilets - in consultation with school authorities and the education bureau of the province.

Plan China is lending support to other organizations such as local NGOs, Water Bureau, Poverty Alleviation Office and Health Bureau for promotion of UDD toilets in their respective

areas (reuse is the old Chinese tradition so this type of toilet promotes safe use)

Specific activities for childern should be planned in the preparation phase. Women should be encouraged to participate in regular meetings of VDC (Village Development Committees) as well as in community-wide meetings. Some activities should be planned for more active women involvement to improve overall health and hygiene of a family. Consult women for site selection of household latrine and water tap connection: For long-term and consistent use of sanitation facilities by the entire household, female members of the houses should actively participate from planning to implementation and operation and maintenance.

Post implementation support is required for permanent behaviour change, consistent use of toilets and safe use of faeces as fertilizer.

9 Costs and economics

The standard urine diverting toilet (complete in all respects) in the project in 2007 costs 750 RMB (€ 80). However, due to the use of local materials for superstructure, such as the use of thick plastics or asbestos sheet for roofing, the cost has come down to 500 RMB (€ 54). In cases where it has been constructed inside the house, the cost of the superstructure was saved and normally it costs 300 RMB (€ 32). Table 2 shows the cost breakdown of a standard UDDT.

The rates of materials in Table 2 are for bulk procurement by the community inclusive of transportation. The rates would be higher if procurement of material would be done individually due to higher transportation and retail cost.

Plan China has a policy of individual household subsidy for the UDDTs (50% subsidy per toilet in 2006, down to 44% in 2008). However gradually this subsidy is being reduced and will be phased out in the next 2-3 years. In the future the focus will shift more towards intensive software with complete discontinuation of hardware subsidy.

Table 2: Cost breakdown of a standard UDDT (outside, with superstructure including labour) in Plan China project area in 2007 (1 RMB = 0.107 € in Aug. 2008). For comparison: Double urn toilet costs 1000 RMB and the cost of biogas toilet was 2500 RMB.

Item	Quantity	Costs in RMB	Costs in EUR
Urine diverting squatting plastic pan (produced by Jiu San Society)	1 unit	61	6.5
Concrete squatting slab	1 unit	29	3.1
110 mm PVC ventilation pipe	6 m	24	2.6
PVC bend 110 mm plus adhesive	1 unit	3	0.3
Cement	3 bags	33	3.5
Sand	1 m^3	35	3.7
Glazed tiles (20 x 0.3 x 0.3 =1.8 m^2)	1.8 m^2	36	3.9
40 mm plastic urine pipe	1.2 m	3	0.3
Urine container	2 unit	5	0.5
Ash Container	1 unit	4	0.4
Toilet paper basket	1 unit	2	0.2
Spade for ash	1 unit	5	0.5
Mason (1 for 3 days)	3	120	12.8
Labour (2 x 3 days)	6	168	18.0
Bricks	700 pieces	112	12.0
Galvanized corrugated iron (GCI) sheet for roof	3 pieces	24	2.6
Wooden beam to support roof	1 unit	6	0.6
Door	1 unit	60	6.4
Ventilation	1 unit	20	2.1
Total		**750**	**80**

10 Operation and maintenance

The operation and maintenance of urine diverting dehydration toilets (UDDTs) is very simple. The most important do's for UDDTs are:

- Before the first use, cover the vault floor with a 3 cm thick layer of dry powdered earth to absorb moisture from the faeces and to prevent faeces from sticking to the floor.
- Always keep two containers on the latrine platform, one full with ash and a shovel or a small bowl, and the other for storing used toilet paper after anal cleaning with a small stick to compress it in the container (toilet paper may retard the drying process of the faeces by covering them).
- After each use (for defecation), sprinkle two bowls or shovels of ash over the faeces and return the cover attached to the pan. The ash absorbs moisture, controls bad smell, prevents fly breeding and makes faeces less unsightly to the next user.
- Paper used for anal cleaning stored in a container should be burnt regularly outside the house.
- Keep a brush or small piece of cloth for cleaning the pan at regular intervals.
- Wash hands with soap after defecation, handling urine container and cleaning the squatting pan. Always wear gloves during emptying the faeces vault and wash hands with soap afterwards.
- Always keep two small urine containers and two big urine containers. The big urine containers with tight lids should be placed in the courtyard in a shed for storing the urine from the small container. Two small containers (with a small inlet for inserting urine pipe) should be used alternatively to collect urine by placing it next to the latrine. Urine containers should be closed at all the time to prevent odour and losses of ammonia into the air. - For households who have their field away from their houses, it is not practical to take urine frequently, but for those households who have their kitchen garden and nearby fields, they can use small urine containers alternatively.

- When the first big urine container is full then seal it properly for use as a liquid fertilizer (undiluted) after 30 days and use the second container.
- In kitchen gardens, urine may be applied directly but the time gap between urine applications and harvesting should be at least one month. Urine contains salt so plain watering would be beneficial after urine application for better plant growth.
- Apply undiluted urine to open soil. For growing plants urine can be used diluted or undiluted. If urine is diluted then use one part urine with three parts of water. It may be applied in one large dose or several small doses. Apply urine in smaller doses for crops with smaller roots. For fertilizing 1 mu (0.067 ha) land, approximately 850 litres of urine would be required i.e. approx. the total urine discharge of two adults in a year.
- The first vault can be used for about 6-7 months by a household of 5 persons. Additives are also added after defecation and soil is placed on the bottom and also on top for sealing when the vault is full. Therefore the effective depth would be 0.6 m - 0.03 m (soil on floor) - 0.05 m (top soil for sealing) - 0.20 m (free space) = 0.32 m. When the vault is full up to 35 cm, level the content by a stick and then fill the vault to the brim with dried powdered earth and seal it for processing for six months. The second vault now comes into use. When the second vault is nearly full, empty the first vault.
- The timing for using compost should be planned in advance (400 - 500 kg humus per family per year can be formed).
- Wash the urine pipe at regular intervals by passing small quantities of water through it from the squatting pan, where it is attached.

11 Practical experiences and lessons learnt

A community, if properly mobilized and trained, is capable of identifying sanitary problems and their solutions, and is also ready to plan, design and execute the system which is useful for them. Children and women have eagerness to learn, analyze and solve their problems and manage their time in a most useful manner. One should design hygiene promotion messages with women and children in mind. Hygiene activities should suit to the women in the family and their domestic responsibility. The focus in this case study is on ecosan but this project is part of the comprehensive WES program of Plan China.

Demonstration and cross visits are important tools for community capacity building. Urine diverting toilets proved to be a community-friendly technology in rural China. Promotion of new technologies should always be supported by demonstration and cross visits. The community is able to accept the new technology for betterment of their lives and changing their unhygienic behaviours by health and hygiene information conveyed by the ecosan promotion programme. Simple, low cost technology allows independent local level construction.

More community mobilization activities should be planned. Community mobilization and gender awareness is a continuous process and cannot be achieved by a single training period.

12 Sustainability assessment and long-term impacts

A basic assessment (Table 3) was carried out to indicate in which of the five sustainability criteria for sanitation (according to the SuSanA Vision Document 1) this project has its strengths and which aspects were not emphasised (weaknesses).

Table 3: Qualitative indication of sustainability of system components. A cross in the respective column shows assessment of the relative sustainability of project. (+ means: strong point of project; o means: average strength for this aspect and – means: no emphasis on this aspect for this project)

	Collection and transport			Treatment			Transport and reuse		
Sustainability criteria (aspects)	+	o	-	+	o	-	+	o	-
• Health and hygiene	X			Not appropriate as there is no external treatment (other than the storage of urine)			Not appropriate as reuse is by the toilet users themselves		
• Environmental and natural resources	X								
• Technology and operation	X								
• Finance and economics		X							
• Sociocultural and institutional		X							

With regards to long-term impacts of the project, the main expected impact of the project is improved public health (e.g. reduced rate of diarrhoea incidences in children). It is planned to assess this at the end of the project in late 2009.

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Case study of SuSanA projects

Community-led Water and Ecosan Programme, Shaanxi Province, China

SuSanA 2008

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