

Fig. 1: Project location

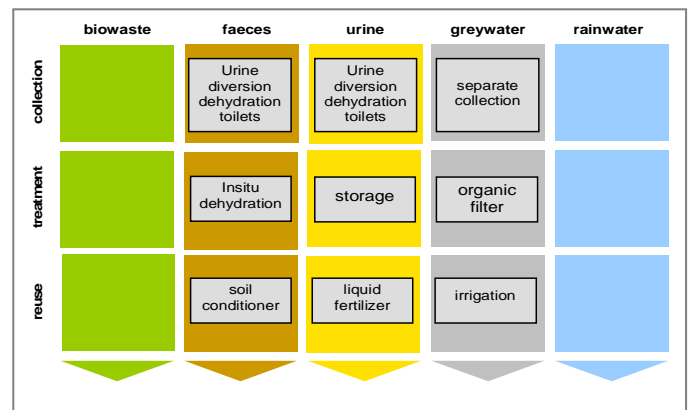


Fig. 2: Applied sanitation components in this project

## 1 General data

### Type of project:

School sanitation, rural upgrading and pilot project

### Project period:

Start of planning: July 2004

Start of construction: Feb. 2005

Project end: 2006

### Project scale:

The project covers 3 primary schools with up to 210 pupils each. The construction cost for the urine-diversion dehydration toilets in all three schools was approximately € 5,500.

### Address of project location:

The schools 'Navsarjan vidhyalaya', are located at 3 different villages in the state of Gujarat:

- Rayka village, Dhandhuka taluka, Ahmedabad district
- Katariya village, Limdi taluka, Surendranagar district
- Sami village, Sami taluka, Patan district

### Planning institution:

Seecon International gmbh, Switzerland

Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), GmbH, ecosan program, Germany

### Executing institution:

Navsarjan Trust, India

### Supporting agency:

Swiss Agency for Development and Cooperation (SDC) Berne, Switzerland

German Federal Ministry for Economic Collaboration and Development (BMZ) via GTZ

## 2 Objective and motivation of the project

The overall objectives of the Navsarjan boarding school sanitation projects were to:

- Provide sanitation facilities to the newly constructed schools
- Demonstrate viable sanitation options in water scarce areas
- Develop, implement and evaluate sustainable and hygienically safe sanitation; treatment including reuse concepts for human excreta and greywater
- Empower socially, culturally and ecologically sustainable sanitary practices for Dalit children in respect of human dignity

## 3 Location and conditions

The three Navsarjan boarding schools (Fig. 3) are located in three different villages in the state of Gujarat:

- Rayka village in Dhandhuka taluka in Ahmedabad district
- Katariya village in Limdi taluka in Surendranagar district
- Sami village in Sami taluka in Patan district



Fig. 3: View of Navsarjan Primary School at Rayka village. (source: seecon gmbh, December 2006)

The three villages are situated in remote, water scarce areas without any connection to public water supply. Drinking water has to be hauled by trucks from the nearest villages. Today, each school uses ecological sanitation systems for its toilet needs.

Navsarjan Trust seeks to develop confidence and self-respect for Dalit children who are mistreated and marginalized in local government schools. Their parents are migrant workers and often involved in seasonal agriculture and manual scavenging. In the final implementation stage, each boarding school will support around 210 students. The schools are

running 10 months out of the year and the state curriculum is applied in order to be recognized by the state government. The main units of each school are the classrooms (Fig. 4). Conceptualized as boarding schools, these classrooms are used as dormitories in the evening.



**Fig. 4:** Students of Rayka school during music lessons (source: seecon gmbh, February 2006)

#### 4 Project history

Navsarjan Trust, an Ahmedabad based NGO, was established in 1989 to eliminate discrimination based on caste, race, gender and ethnicity. The NGO aims to improve the social status of Dalit communities by enforcing the law against ethnic discrimination. Dalits are faced with social injustice associated with the Indian caste system that marginalizes these communities.

Navsarjan Trust traditionally works with Dalits but also with tribals and other poor population groups all over Gujarat. Central components of the Navsarjan agenda are legal assistance, social mobilization (campaigns), women and community empowerment. Navsarjan strongly believes in education coupled with the establishment of a suitable training system to empower the Dalits economically.

Based on the successful construction of the vocational training institute entitled "Dalit Shakti Kendra" in 1999, Navsarjan Trust launched this primary boarding schools project in 2005.

The overall project aim was to find technical solutions for manual scavenging practices. Scavenging is a caste based occupation and is perceived as a source of ethnic discrimination. Gender issues are crucial in this regard as scavenging is often done by women. Consequently, ecosan technologies are not only supporting hygienically safe sanitation but also socially and culturally acceptable sanitation practices. These practices include treatment and reuse of human excreta (urin and faeces) and greywater.

Concepts and technologies implemented at the primary schools shall provide Navsarjan Trust with first-hand experiences and knowledge on ecologically sound sanitation systems to further disseminate ecosan in Gujarat.

The urine-diversion dehydration toilet centre at the primary school in Rayka village was introduced on February 25<sup>th</sup>, 2006. Sanitary facilities at the boarding school in Katariya village were put in operation in end of July 2006 and those in Sami taluka followed soon afterwards.



**Fig. 5:** Sanitation facility at primary school in Rayka village. (source: seecon gmbh, April 2004)

#### 5 Technologies applied

##### Urine-Diversion Dehydration Toilets

Elevated urine-diversion dehydration toilets (2 chambers with showering facilities) (Fig. 5 & 6) commonly referred to as "composting toilets" in India. These toilets have been constructed for the separate collection of urine and the hygienically safe treatment of faeces.

In order to facilitate the harvest of the finished "compost" (desiccated faeces and cover material), the toilets are designed to operate in batches and cubicles which act as showers during the "resting period". If a processing chamber is full, the cubicle above is converted into a "bathroom". By providing a specially designed cover, the urine-diversion squatting pan is closed and it prevents shower water from entering in either the processing chamber or the urine collection system. Greywater collected from bathrooms, washbasins and the laundry area is drained to a vertical flow filter filled with organics (rice husk, saw dust, etc.) to retain the solids on top of the organic layer (Fig. 7). Water for anal cleansing is used but has to be carried in buckets from water taps outside the toilets.



**Fig. 6:** Rear view of UDDT at Rayka village. (source: seecon gmbh, April 2006)

##### Greywater treatment

An additional collection system has been provided for the discharge of greywater. The water trickles through the filter and is collected before being reused for irrigation purposes.



**Fig. 7:** Vertical flow filter for greywater treatment (at Rayka school) (source: seecon gmbh, April 2006).

## 6 Design information

### Urine-Diversion Dehydration Toilet

The toilets at the schools in Katariya and Sami village are provided with prefabricated urine-diversion squatting pans made of reinforced fibre plastic (Fig. 8). The Rayka village school was built some months in advance and prefabricated urine-diversion squatting pans were not available on the market at that time. That is the reason why a “3-hole squatting pan system” had to be cast on-site to facilitate the separate collection of urine, faeces and anal cleansing water.

As schools had to start with 1 class only, numbers of students were expected to be low in the beginning (but would steadily increase up to 210 in future). Therefore, it was decided to establish only one sanitation block, comprising 8 cubicles in the beginning at each school, (4 toilets, 4 bathrooms). With an increase in number of pupils, additional sanitation blocks are required to be built.



**Fig. 8:** Toilet cubicles (left); and top view of prefabricated urine-diversion squatting pan with washwater bowl (right) (source: seecon gmbh, August 2006)

### Design of UDDT:

- Max. number of users per seat: 30
- Working days per year: 270
- Specific storage capacity: 0.25 litres per person per day

Considering a storage time of approx. 1 year (270 working days per year), the inner volume of each processing compartment must exceed 2,000 litres (2 m<sup>3</sup>). This calculation does not consider volume reduction of faecal matter during the dehydration process.

### Greywater treatment

#### Design assumptions:

- Number of users: 220 (210 students, 10 staff members)
- Specific water consumption: approx. 40 litres per person per day (showering, washing hair, washing hands, etc.)

Based upon these assumptions daily greywater production was calculated to be approx. 9 m<sup>3</sup> (at full capacity).

### Urine storage tanks

#### Design assumptions:

- Number of users: 220 (210 students, 10 staff members)
- Specific urine production: 1.0 to 1.2 litres per person per day
- Storage time: 4 weeks



**Fig. 9:** Urine is lifted through a solar-operated non-corrosive pump tank (bottom left corner) to storage/hygienisation tanks (black tank “urine”). Urine is diluted with water (blue tank “urine + water”) before application (source: seecon gmbh, December 2008)

## 7 Type and level of reuse

The “compost” (i.e. desiccated faeces and cover material) and urine are applied as soil conditioner and nitrogen-rich liquid fertilizer to flower beds, kitchen gardens, etc. (Fig. 10).



**Fig. 10:** Kitchen garden at Rayka school where “compost” and urine are applied (source: seecon gmbh, March 2009).

Pre-treated greywater from bathrooms (showers and washbasins) is reused for gardening purposes (Fig. 11).



**Fig. 11:** Lawn at Rayka school where greywater is applied (source: seecon gmbh, December 2008)

Water can be spilt by people when filling water into buckets at the storage tank. This water is hauled to the garden plants through a ditch (Fig. 12).



Fig. 12: Garden for local infiltration of greywater spilled at water tank (source: seecon gmbh, December 2008).

### 8 Further project components

Other important project components were hygiene education and awareness raising campaigns aimed at promoting hygienically safe sanitation concepts as part of the curriculum (Fig. 13).



Fig. 13: Through proper training, the students have become ecosan experts, having constructed a model of their toilet and even won the first prize in the Ahmedabad School Science Fair (source: seecon gmbh, 2008)

### 9 Costs and economics

Construction and labour costs for establishing a single sanitation centre add up to approximately Euro 5,500.

### 10 Operation and maintenance

Pupils and teachers jointly do day-to-day operation and maintenance. Support is provided by Navsarjan staff members from the Vocational Training Institute "Dalit Shakti Kendra" in Nani Devti village near Sanand, about 30 km southwest of Ahmedabad City.

### 11 Practical experience and lessons learnt

The ecosan concept implemented at the Navsarjan Primary Schools is well accepted by both, the pupils and the teachers. However, it is necessary to continue informing the users about the application of UDDTs (especially the new pupils).

Due to the increase of pupils attending Navsarjan's primary schools (about 150 pupils in each school), number of UDDTs are insufficient.

Lessons drawn from the existing sanitation centres shall help in improving the design of the planned centres:

- 30 persons per toilet seat is not adequately for boarding schools (due to queuing-up in the early morning, pupils may decide to go for open defecation rather than using the toilets).
- The sloping steel-covers that seal the processing compartments are prone to corrosion and require a lot of maintenance due to faults in construction. The steel-covers are leaking and have to be covered up with plastic tarps in the rainy season.
- Heavy rainfalls (even if occasionally short) lead to temporary flooding (frequency of occurrence: once in 2 years time; flood level: approx. 90 cm above ground level; duration: a few days) of the entire surroundings (especially at Sami village, (Fig. 14).



Fig. 14: Teacher indicating highest flood level after a heavy downpour at Sami village at the beginning of monsoon season 2009 (source: seecon gmbh, October 2009)

### 12 Sustainability assessment and long-term impacts

The project gives an example to promote sustainable sanitation in schools. The project raised the awareness amongst the pupils of the importance of sanitation, health and hygiene.

Table 1: Qualitative indication of sustainability of system. A cross in the respective column shows where the system component is considered to have a strong (+), average (o) or weak (-) sustainability.

Sustainability criteria	collection and transport			treatment			transport and reuse		
	+	o	-	+	o	-	+	o	-
• health and hygiene	X			X			X		
• environmental and natural resources		X			X			X	
• technology and operation	X				X			X	
• finance and economics		X			X			X	
• socio-cultural and institutional	X			X			X		

**Sustainability criteria for sanitation:**

**Health and hygiene** include the risk of exposure to pathogens and hazardous substances and improvement of livelihood achieved by the application of a certain sanitation system.

**Environment and natural resources** involve the resources needed in the project as well as the degree of recycling and reuse practiced and the effects of these.

**Technology and operation** relate to the functionality and ease of constructing, operating and monitoring the entire system as well as its robustness and adaptability to existing systems.

**Financial and economic issues** include the capacity of households and communities to cover the costs for sanitation as well as the benefit, e.g. from fertilizer and the external impact on the economy.

**Socio-cultural and institutional aspects** refer to the socio-cultural acceptance and appropriateness of the system, perceptions, gender issues and compliance with legal and institutional frameworks.

For details on these criteria, please see the SuSanA Vision document "Towards more sustainable solutions" ([www.susana.org](http://www.susana.org)).

The main long-term impacts of the project are:

1. improved sanitation coupled with safe reuse of urine, faeces and treated water
2. empowerment of Dalit children
3. increased awareness towards hygienically safe sanitation

**13 Available documents and references**

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Interview with Mr Dayanand Panse, founder of the Ecosan Service Foundation (ESF), see 'Eco-logical Act' (2009) article on by ExpressIndia, available at, <http://www.expressindia.com/latest-news/ecological-act/426845/> (viewed 28/09/2009).

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**Case study of SuSanA projects**

Sanitation improvements at Navsarjan Boarding Schools

Gujarat, India - draft

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