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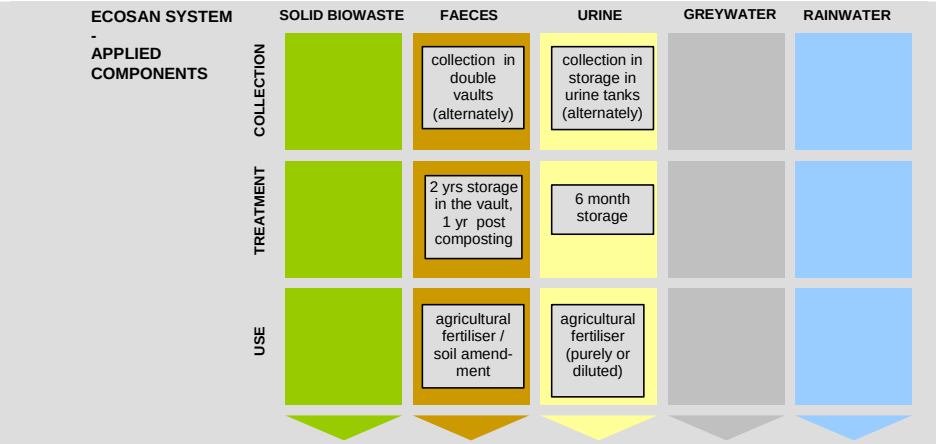
Dry urine diverting school toilets

Hayanist, Armenia



1 General Data

Type of Project:
Ecological school sanitation pilot project, in the framework of the TMF (Netherlands Ministry of Foreign Affairs) project “Tapping Resources”.

Project Period:
Start of planning: Autumn 2005
Start of construction: June 2006
Start of operation: November 2006

Project Scale:
7 urine diverting toilets and 3 waterless urinals at a rural school with 350 pupils and 26 staff

Address:
Hayanist, Ararat marz (province), Armenia

Planning Institution:
QUELQUE-CHOSE Architects, Yerevan, Aleksandr Danielyan

Hamburg University of Technology, Institute of wastewater management and water protection (TUHH)

Executing Institution:
WECF, Women in Europe for a Common Future, Netherlands
AWHHE, Armenian Women for Health and Healthy Environment, Armenia

Supporting Agency:
TMF, Netherlands Ministry of Foreign Affairs

2 Objectives of the project

- Establishment of a sustainable, affordable and safe school sanitation system in the framework of the project “Tapping resources”, funded by the Netherlands Ministry of Foreign affairs.
- Providing a sustainable and hygienic solution where outdoor pit latrines are the norm.
- The 6 - 17 year old pupils do not have to go outside for their toilet visits. The toilet building is conjunct with the school building.
- Introduction of approaches towards ecological sanitation in Armenia.
- Reducing contamination of drainage water and groundwater with pathogens and nitrates from pit latrines.
- Raising public awareness with regard to the hygienic and health risks associated with poor sanitation and drinking water supplies.
- Raising awareness with regard to the ecological sanitation approach of a sustainable and affordable wastewater management.
- Providing alternatives to expensive chemical fertilizers.
- Investigation of the feasibility of an ecosan approach in a rural context in Armenia and Caucasus region through a pilot project.

3 Location and general conditions

Armenia is a small Trans-Caucasian country that suffered severely after the collapse of the Soviet Union in the early 1990s and through the war. The economical situation deteriorated dramatically. The unemployment rate in Armenia is very high, approx. half of the population have a consumption level below the poverty line.

To address the common problem of inadequate school sanitation in rural areas and the absence of an adequate sewage system, the village Hayanist with approx. 2500 inhabitants, has been chosen to be the location of an ecosan pilot project

The school used to have one simple pit latrine for about 200 boys/male teachers and 200 girls/female teachers each. In order not to be forced using the latrines many pupils and teachers avoided drinking during school time .

Figure 1: the school of Hayanist *(source WECF)*

Figure 2: Former school latrine *(source: WECF)*

Hayanist is situated in a basin-shaped and swampy area with a high ground-

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

water table. The village and surrounding fields are covered with a net of drainage canals, including small and shallow drainage canals along each street. A large majority of households have pit-latrines, in general unsealed. Due to the high groundwater level, the depth of the pits is just one meter. The wastewater of households with flush toilets is conducted without any treatment to a drainage canal. This water is used for irrigation. The majority of the households have a homestead land or a field for some vegetable or crop production. The costs of fertilizer are one of the limiting factors for food production. Due to poverty and the lack of gasification e.g. cow dung is used as a fuel for heating and cooking.

Ten percent of the households in Hayanist are connected to the central water supply system of Yerevan. The other households receive their drinking water from local artesian wells. The chemical and bacteriological parameters meet in general the limits fixed for drinking water, but the water contaminants indicate influences of anthropogenic pollution as it occurs from pit latrines.

Armenia has only a very limited budget for the operation and maintenance of public facilities, including schools. Therefore school buildings and their sanitary facilities are in an extremely bad shape like in Hayanist. During Soviet times the school had flush toilets for teachers and pupils, and piped water supply system. This system is out of order, forcing pupils and teachers to use very bad smelling, dirty latrines outside the school, close to the drainage canal.

The village would not be able to pay for the operation and maintenance of a centralised sewage. The use of decentralised solutions was therefore seen as being the most appropriate approach in the village.

4 Technologies applied

- A toilet facility with male and female restrooms, with a total of 7 double vault urine diverting toilets, and 3 urinals was constructed. The toilets were equipped with urine diverting squatting slabs.
- Both faeces chambers of one toilet-unit are equipped with urine diverting squatting slabs.
- The urinals have a conventional design
- For hand washing 6 washbasins were constructed, provided with water supply and equipped with towels and soap. The resulting grey water flows in the already existing sewage system
- The local architect QUELQUECHOSE in cooperation with the Hamburg University of Technology did the design of the double vault dry urine diversion facility. To safe expensive construction materials, the facility was designed with the aim providing sufficient toilets, meanwhile using minimal space and walls.
- The toilet facility was constructed as an extension of the existing school building.
- The cellar/basement of the toilet building is used as deposit of the urine tanks.
- For the collection and storage of the urine and faeces the double vault system was chosen
- The urine of boys and girls is separated collected and stored
- Adequate ventilation was provided by an active wind driven ventilator
- The applied technology was chosen through public meetings, where pictures and posters of different toilet systems and a mini model of a urine diversion toilet were presented.

5 Type of reuse

Local farmers will use the urine as fertilizer for fruit trees. A demonstration school garden with application of the sanitized urine is planned. In accordance with the WHO guideline on use of urine in agriculture, the urine is stored for at least 6 months

Because of the large volume of the compost chambers it will take approx. 2 years until one chamber is filled. Approx. 4 years after construction of the facility local farmers will use the first compost for decorative trees in the schoolyard.

Storage and treatment of the toilet products will be supervised and monitored during the first 3 years of toilet-use by AWHHE, WECF and TUHH. Urine will be analysed on nutrients and bacteria, treated faeces on bacteria and parasites and eggs.

6 Project History

The need of an improvement of the actually inadequate sanitation for the school children in Hayanist had a very high priority for teachers and partners.

In public meetings the citizens and authorities were informed about the disadvantages of conventional wastewater management and the approach of ecological sanitation, about the disadvantages of latrines and the advantages of urine diverting toilets, about the health risks of untreated waste and sewage water.

Long discussions about the construction of ecosan toilets for the school took place with parents, school staff and local authorities. It was decided, that double vault dry urine diversion toilets with access from the school will be built. The winter in Armenia are very cold (minimums of minus 20^{o}C) and visiting outdoor latrines pose a health risk for the pupils. On the other hand it took efforts to convince the staff that, without water for flushing, dry urine diverting toilets can function properly and odour-poor.

The project should - amongst other goals - provide an affordable option to upgrade school sanitation. It should serve as an example of how sanitary conditions in rural areas without any connection to sewage or central water supply system can be improved. In addition the population should become aware of the advantages of urine diverting toilets regarding water protection and gain of excellent fertilizer.

For the construction of the toilet facility, permits from different institutions were needed, e.g. from education department, hygienic inspection and local government.

Several designs and discussions about the number of toilet units were needed, to decrease the expected costs and to agree on a design acceptable for all stakeholders.

Figure 3: the new ecosan toilet facility for 350 pupils *(source AWHHE)*

7 Costs

The costs of the toilet were about 26,560 Euro, one fourth for the labour and design, and three fourth for the materials. The material costs were rather high because of the high prices of e.g. bricks or concrete. Construction materials are very expensive in Armenia, because most of them have to be imported

while borders with two countries are closed.

Costs for the different categories are shown in the following table:

Category	costs (€)
Earthwork	500
Basement	6990
Brickwork	2540
Electric installations	250
Completion interior	6890
Doors, windows	4700
Sanitary installations	1910
Urine reservoirs	3050
Completion exterior	1270
Ventilation	640
Total costs	**28700**

These costs include labour and transportation:
Labour, design authorisation 8509 €
Transportation 1270 €

8 Operation and Maintenance

- To raise awareness about environmental issues and put the urine diverting toilet in a wider context, performances and eco games were carried out with the children.

Figure 4: Eco games for children *(source AWHHE)*

- For teachers and pupils workshops on the use and maintenance of double vault urine diverting toilets were organised.

Figure 5: workshop with children; trying the slabs *(source: AWHHE)*

- A caretaker for O&M of the double vault urine diverting toilets was contracted and intensively instructed.
- Education materials, leaflets and posters for the use and maintenance of the toilets were written and designed.
- The caretaker inspects and cleans the toilets daily. Tiles, and if needed the toilets are cleaned with soda or vinegar.
- The heaps in the faecal chambers are weekly levelled and if needed covered with soil/ashes.
- The composting-chambers and the urine-tank are monitored by the caretaker. When one tank / vault is full (compost-vault up to app. 80%), the urine / faeces will be directed to the other compartment.
- Pupils are instructed to cover the faeces with dry earth, ashes, sawdust or a mixture of these after defecation to minimise the water content and thus odour and flies. The caretaker adds these materials if necessary.

Figure 6: Educational material for boys and girls *(source AWHHE)*

9 Design information and technical specifications

For each toilet there are two easily accessible faeces chambers (vaults) with a sealed floor made from concrete. The vaults are used alternating in a 1 year rhythm (minimum). The volume of each chamber is 1 m^2 .The floor of the compost vaults has a slope of 1 % to drain any leachate.

For boys three urinals on different height were installed. For the collection and storage of the urine from the urine diverting toilets and the urinals four Polyethylene urine tanks of each 2 m^3 were installed in the basement, located under the toilet facility. The urine of the girls and the boys is separately collected from faeces and stored. If one tank is filled, the urine is conducted to the second tank. While the second tank is in use, the urine of the first tank will be in rest during 6 month and after this storage time ready for use as a fertilizer. During the 6 months or longer resting time, most of the pathogens will be killed or at least reduced. For monitoring and emptying the tanks an easy access from outside is constructed.

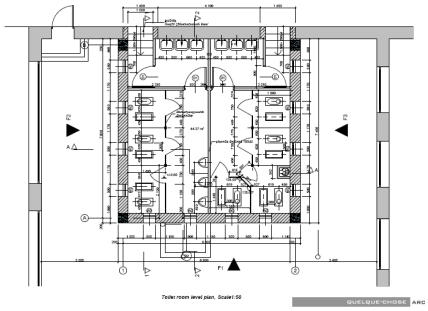


Figure 7: Toilet room level plan; Design Quelque Chose *(source AWHHE)*

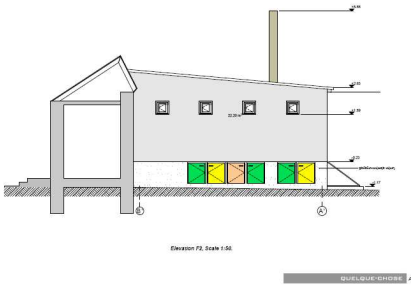


Figure 8: Elevation of the toilet facility, Design Quelque Chose *(source AWHHE)*

Figure 9: urinals in different height for the boys *(source AWHHE)*

Tanks with higher volumes were hardly available and expensive, and would hardly fit through the entrance

The urine-pipe, from the slabs and urinals is guided to the bottom of the tank to avoid ammonia stripping and thus bad odour and nitrogen-losses when fresh urine is deposited into the tank. In

this way the liquid does not come in turbulence and extra input of oxygen is avoided.

Figure 10: four urine tanks are deposit in the basement of the school *(source AWHHE)*

Plastic urine diverting squatting-slabs from China were selected instead of seat risers for hygienic reasons and since the children were used to squatting. For practical reasons, both chambers were equipped with a urine diverting slab. The idle chamber/slab is covered with a lid, which is temporary fixed. Therefore it is not needed to change the slabs if one chamber is filled. When one chamber is filled, only the lid is to be moved to the other slab and the second chamber can be taken in usage.

Figure 11: ecosan toilet interior *(source AWHEE)*

Figure 12: faeces collection chamber *(source: WECF)*

Ventilation pipes were installed in the composting-chambers. These ventilation pipes and the chamber with the urine tanks were finally connected with a wind driven ventilator (diameter of 30 cm). By the special design of the faeces-chamber-dividing-walls only one ventilation pipe was installed for both chambers (compared to former designs where every chamber had one pipe)

The facility was built by the company "Masin shin" from Masis region.. As far as possible local labour and construction materials were used.

10 Practical experience and lessons learned, comments

- The establishment of ecological sanitation is especially reasonable in regions with no central water supply, with no adequate sewage systems and no sanitation except pit latrines.
- A very crucial factor is the real understanding of the facility and its effects by the stakeholders. This was addressed in the workshops, which were held before and after the installation of the toilets, and by the easy to understand posters and eco games for the children.
- The good cooperation between the school staff and the local project coordinator AWHHE, encouraged among the school staff the feeling of ownership for the toilet facility, and their responsibility for maintenance and operation.
- Through the implementation of the facility trust and confidence was gained among the citizens
- In this pilot project the women of AWHHE were intensively and creatively involved in ecological education of the school children.
- With proper education even 6 year old children understand the principle of urine diverting toilets as a part of ecological sanitation.
- It was shown that the installation of dry double vault urine diverting toilets is a very fast and easy to realise method to upgrade unsafe sanitary facilities and thus health conditions.
- It is important to keep urine and faeces separate as most of the pathogens are contained in the faeces, while the urine (from healthy persons) is mainly aseptic. The possibility of cross contamination can however not be eliminated completely.
- To avoid bad odour in large scale ecosan facilities it is important to install a well functioning active ventilation system.
- The new toilet system was accepted very well by the teachers and pupils. The interest of the parents and citizens in ecological sanitation became very high and in a follow-up projects more ecosan toilets will be installed for households and other schools.
- This pilot-project can serve as an example not only for other Armenian villages, but for many Eastern European, Caucasus and Central Asia (EECCA) countries, which are facing similar sanitary, environmental and health-problems.
- Construction materials are extremely expensive in relation to the local salaries.
- Due to the economical situation in Armenia, an improvement of the actual existing inadequate school sanitation is not affordable without international financial support. In this moment more active and financial support is needed to realize ecosan toilets for schools and households
- In the frame of other WECF projects in several ECCAA countries constructions of the same type of toilets for schools and for private households are planned.

11 Available documents and references

Urine Diversion in Climates with Cold Winters, a WECF publication (English), 2007

Dry urine diverting toilets, Principles, Operation, and Construction, a WECF publication 2006 (English, Armenian, Romanian, Bulgarian, Ukraine)

Education materials on the use and maintenance of dry double vault urine diverting toilets (English, Armenian, Romanian, Bulgarian, Russian, Ukraine)

Information on the use of urine and compost in agriculture (English, Armenian, Romanian, Bulgarian, Russian, Ukraine)

Ecosan poster- closing the loop in wastewater management and sanitation from GTZ, translated by WECF and partner in Ukraine, Romanian, Russian, Armenian, Bulgarian

Ecological Sanitation and Hygienic Considerations for Women (English, Armenian, Romanian, Ukraine)

Socio- Economical Gender Survey of Hayanist, WECF, Solomiya Babyak/Kitty Bensvelden, 2005 (English)

Ecological Sanitation and Associated Hygienic Risks, a WECF publication

2004 (English, Romanian, Bulgarian, Russian, Ukraine)

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data sheets for ecosan projects

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