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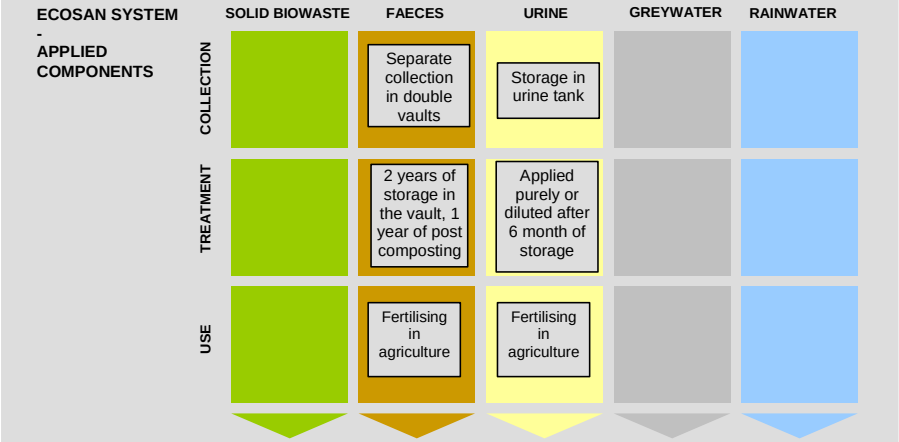
Dry urine diverting school toilets

Gozhuli, Ukraine



1 General Data

Type of Project:
Pilot dry urine diverting school toilets, in the framework of the MATRA project "Co-operation for Sustainable Rural Development", involving citizens and local authorities in rural Ukraine in improvement of drinking water, sanitation and agriculture.

Project Period:
Start of planning: May 2004
Start of construction: July 2004
Start of operation: October 2004

Project Scale:
3 urine diversion toilets and 3 waterless urinals at a rural school with 160 pupils and 15 staff

Address:
Gozhuli, Poltava oblast (province), Ukraine

Planning Institution:
Institute for industrial and municipal wastewater management, University of Technology Hamburg (TUHH)

Executing Institution:
WECF, Women in Europe for a Common Future, Netherlands
MAMA-86, Kiev and Poltava province

Supporting Agency:
MATRA, Netherlands Ministry of Foreign Affairs

2 Objective of the project

- In the scope of the MATRA project "Co-operation for Sustainable Rural Development", WECF and its Ukraine partner, the NGO MAMA-86 and TUHH constructed double vault dry urine diverting toilets in a Ukraine school, in Gozhuli, Poltava province in 2004. The sanitary facility was connected with the school building in such a way that the 6 - 16 years old pupils can stay inside the building for their toilet visits.
- Establishment of an affordable sanitation system to improve sanitary facilities in a rural school.
- Providing the pupils a sanitary facility with direct access from the school.
- Reduce groundwater contamination caused by nitrates and faecal bacteria from pit latrines.
- Raising public awareness with regard to the hygienic and health risks associated with poor sanitation and drinking water supplies.
- Raising public awareness with regard to sustainable resource management.
- Establish a safe and easy to operate and to maintain sanitary system without connection to any central water or sewage system.
- Provision of alternatives to expensive chemical fertilizers.
- Investigation of the feasibility of an ecosan approach in a rural context in Eastern Europe through a small pilot project.
- Provide an affordable and sustainable option to upgrade rural schools sanitation.

3 Location and general conditions

After the collapse of the Soviet Union, Ukraine is one of the Newly Independent States (NIS). Since the independence, rural administration lacks budget for operation and maintenance of existing water and sanitation systems, causing for the population a decrease of access to safe water and sanitation

In the frame of the MATRA project "Cooperation for sustainable rural development", financed by the Netherlands Ministry of Foreign Affairs, the village of Gozhuli (population: app. 3600) in the Poltava province, Eastern Ukraine, was selected besides two other Ukrainian villages by the NGOs WECF and MAMA-86 for the ecosan pilot project. The villagers are partly connected to a central water supply and sewage system. Due to the lack of financial sources the pumps of the sewage system are in a desolate condition and the wastewater treatment facility is collapsed. Water of the central water supply has a much too high fluoride concentration. The not connected families rely on wells, contaminated with nitrate and micro organism. The rather high density of conventional latrines in people's yards was identified as one of the sources of groundwater pollution.

In public meetings the citizens were informed about the disadvantages of latrines and conventional wastewater management and about the advantages of urine diverting toilets and the approach of ecological sanitation.

School staff and citizen's administration were very interested in the alternative approach of managing human waste, in particular because the school sanitation was in an unacceptable state .

At the start of the project the existing

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

school sanitation had the following conditions:

- Two pits for 160 pupils, male and female in the age of 8–16 years old.
- The pits were overloaded with excrements and bad smelling. Parents and staff of the school were planning to dig a new pit for the next school year.
- Distance from school approx. 80 meters. Due to the very cold Ukraine winters (at least minus 20^0C) this outdoor pit latrines are to be considered as a health risk for the pupils.
- Hand wash facilities were far from the pit latrines.
- For staff, children of the kindergarten and school children 6-7 years old was a flush toilet, connected with the sewerage available.

Figure 1: Former school latrine in Gozhuli *(source: WECF)*

To address the previous mentioned problems and goals, in co-operation with the local partners and staff, and the TUHH an ecological sanitation pilot project was developed for the school.

4 Technologies applied

A toilet facility with 3 double vault dry urine diversion toilets, 3 waterless urinals was designed and constructed in conjunction with the school.

The urine was collected in stored in reservoirs, buried in soil.

The faeces was collected, covered with wood chips, and stored in faeces chambers.

For hand washing a washbasin was rehabilitated and equipped with towels and soap.

Figure 2 : urine diverting toilet demonstration model *(source: WECF)*

Figure 3: location for conjunction the new ecosan toilet facility with the school *(source: WECF)*

5 Type of reuse

Faeces: Because of the large volume of the compost chambers it will take app. 2 years or more until one chamber is filled. Local farmers with fruit trees or crops will use the treated faeces.

Urine: According the WHO guideline on storage time of urine of a large-scale facility, the urine is to be stored for at least 6 months. In autumn 2006 a local farmer carried out the first application of urine for production of cereals.

Analysis of the urine collected from in-use tank showed high amounts of macronutrients. All analyses were performed according to German standard methods in a German laboratory. The results are shown in the table below:

Date of sample: 12.07.06

pH	[-l]	8,94
El. conductivity	[mS/cm]	37,9
total N	[mg/l]	5350
total P	[mg/l]	176
total K	[mg/l]	2290
TOC	[mg/l]	1420
TC	[mg/l]	4030

Grey water: The grey water of the washbasins will not be treated and reused, because the authorities preferred to add the grey water to the already existing sewage system.

6 Project History

The local stakeholders expressed the wish, that the project should address the existing inadequate school sanitation.

Amongst other goals, like ground water protection against infiltration of human excrements, the pilot should provide an affordable option to upgrade school sanitation.
The pilot 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 ground water protection and gain of excellent fertilizer.

Stefan Deegener of the University of Technology Hamburg, who also supervised the construction, did the design of the dry double vault urine diverting toilets. Pictures and posters of different toilet systems and a demonstration model of a double vault dry urine diverting toilet were presented during a public meeting and the preference for squatting slabs instead of seats was figured out.

Figure 4: School toilet facility backside

Figure 5: Interior of toilet facility; slab and cover are not yet installed

Figure 6: Finished interior of the toilet

Figure 7: Urinals for the boys

Authorization for the construction was obtained from the mayor and school director/board. During the summer holidays 2004 a local constructor, authorized to carry out school constructions, started the construction of the toilet facilities.

October 2004 the first dry urine diverting toilet in a Ukraine school was inaugurated.

After some months in use difficulties appeared with the plastic urine tanks. The two in soil buried tanks did not have the quality promised by the vendor and did not effort the soil pressure. The material of PE was not suitable for burying in soil. In January 2005 both tanks showed severe deformation and had to be renewed. Nevertheless local authorities supported the project in finding appropriate solutions for the storage facility of the urine. They decided to construct and finance a sub-surfaced chamber, where the urine tanks could be placed. New tanks were bought, same quality and same size as the previous tanks.

Another problem occurred during wintertime; in the urinal rooms of the boys appeared a bad smell, a problem, which was difficult to solve. In order to decrease the exchange of ammonia air from pipes or urine tank, all but one holes of the conventional urinals were darned. As alternative odour blocker, stripped condoms were insert in the pipe of the urinals. Finally all pipes were controlled on leakages and adequate slopes. In March the odour problem seemed to be solved, but started again in winter 2006.

7 Costs

In first instance the total costs of the toilet were about 11000 Euro. The material costs were rather high because of the high prices of e.g. bricks or concrete. Also due to the Ukraine regulation on school constructions, the costs were higher than expected. For example the thickness of walls should be minimal 50 cm; the depth of foundation minimal 120 cm. Renewing the damaged urine reservoirs, rehabilitation of the territory and solving the odour problems costed more than 4000 Euros.

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

category	costs (€)
Building:	
Incl. labour and materials	59190 UAH
1. Set of urine reservoirs (incl. transport)	5698 UAH
Sub Total costs	**64888 UAH**
	or **10815 Euro**
2. Set of urine reservoirs	6210 UAH
Construction sub-surfaced chamber	12000 UAH
Upgrading ventilation	2500 UAH
Rehabilitation territory, + extra corridor door	1466 UAH
Final total costs	**87065 UAH**
	or **14510 EUR**

8 Operation and Maintenance

- Workshops on the use, operation and maintenance (O&M) of double vault urine diverting toilets were organised for teachers and pupils
- A caretaker for O&M of the double vault urine diverting toilets was contracted and intensively instructed. He will be paid during 2 years by the MATRA project.
- 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. Tiling, and if necessary toilets, are cleaned with soda water. The heaps in the compost chambers are levelled and if needed covered with wood ships.
- The composting-chambers and the urine-tank have to be monitored by the caretaker. When one tank / vault is full (compost-vault up to app. 80%), the urine / faeces should be directed to the other compartment. Actually experience is that one 2-m^3 urine reservoir can be used for 6 months, a 1m^3 compost chamber for at least 3 years.
- Because in the project village ashes are hardly available, it was recommended to cover the faeces with dry sawdust after defecation to minimise the water content and thus odour and flies.

9 Design information and technical specifications

For each toilet there are two easily accessible composting-chambers (vaults) with a sealed floor made from concrete.

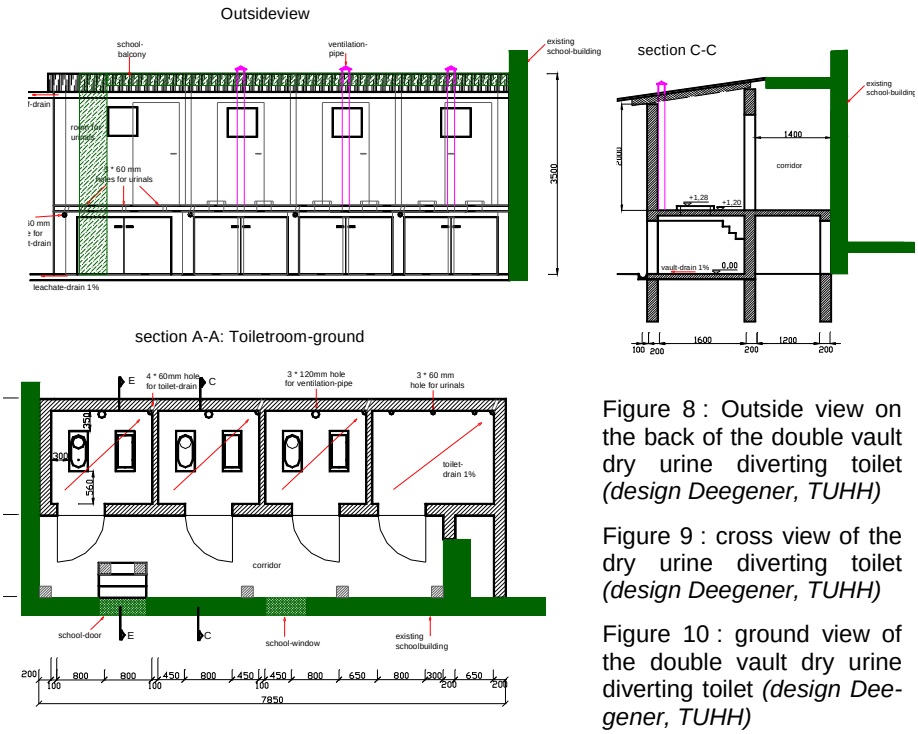


Figure 8 : Outside view on the back of the double vault dry urine diverting toilet *(design Deegener, TUHH)*

Figure 9 : cross view of the dry urine diverting toilet *(design Deegener, TUHH)*

Figure 10 : ground view of the double vault dry urine diverting toilet *(design Deegener, TUHH)*

The vaults are used alternating in a 1-year rhythm. The volume of each chamber is 1,2 m^3 with a useful volume of 1 m^3. The floor of the compost vaults has a slope of 1 % to drain any leachate.

To avoid odour and flies ventilation pipes equipped with fly nets are conducted from the compost-chambers atop the roof. Due to the special design of the compost-chamber-dividing-walls only one ventilation pipe was necessary for both chambers (compared to former designs where every chamber had one pipe).

All restrooms also have a window to be opened for ventilation

The urine from the diverting-toilets and the waterless urinals is collected in a urine tank made of Poly Ethylene (PE), 5 mm. Two urine tanks of 2 m^3 each were bought. The two tanks, similar to the composting chambers, are necessary for the 6 months or longer resting time, during which most of the pathogens are killed or at least reduced.

Figure 11: Piping system for changing the urine flow-in from the one to the other urine tank *(source: TUHH)*

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.

Plastic squatting-pans were selected instead of seating pans for hygienic reasons. The pans were elevated 10 cm from the floor for a more comfortable defecation-position and to avoid water from cleaning the toilet room floors from entering the compost-chambers.

The floor has two big holes to the collection chambers; one covered by the squatting pan, the other by a wooden lid. When one chamber is full the pan and the lid has to be switched. The squatting pan is moved to the empty faeces chamber and the lid covers the filled faeces chamber well.

Conventional urinals were selected for the boy's restroom. The urinals and the slabs are connected through a PVC pipe with the main urine pipe (PE diameter 40 mm). Where the PVC pipe meets the urine outlet of the slabs, the pipe is narrowed with a metal band.

A company from the nearby city built the facility. Although in the village hardly any construction material was available, local labour and construction materials were used as far as possible.

10 Practical experience and lessons learned, comments

- A very crucial factor is the real understanding of the facility and its effects by the stakeholders. This was addressed in workshops, which were held before the installation of the toilets, and by the easy to understand posters for the children.
- It is important to keep urine and faeces separated 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.
- It was shown that the installation of double vault urine diverting toilets is very fast and an easy to realise method to protect groundwater and thus improve health conditions.
- With proper education also young children understand the principle of urine diverting toilets as a part of ecological sanitation.
- In the start of using the ecosan toilets, they were less accepted by the young women. A reason could be that in the beginning no cleaning tools and water for the young women was available in the restrooms.
- To have access to the toilet facility without a walk in the cold or rain, was a real improvement for the users. The new toilet system was accepted very well.
- The 5 mm thickness of the PE tank was not enough to support the soil pressure.
- The local authorities were very cooperative and supported the ecosan project. They even initiated the construction of a sub-surfaced chamber, which will serve as a safe disposal for the urine tanks
- Problems with bad urine odour was solved by changing the urinals outlet.
- The ventilation problem of the urinal restrooms seems to be related with the seasonal temperature.
- The design of the ventilation was not optimal and some construction mistakes occurred .
- Decision was taken to improve the situation in the restrooms by installing a ventilation pipe in every rest room.

Figure 12 : Deformed urine tanks *(source: WECF)*

Figure 13: New tanks in a sub-surfaced chamber *(source: WECF)*

The aforementioned smell problems could be improved by:

- Installing urinals with adequate odour blockers, which are in the region not available. The water less urinals with odour blockers from abroad are for the region too expensive.
- Installation of electric or wind-driven ventilation for the restrooms, which is unfortunately in Poltava province not allowed to use for schools

Until now no independent laboratory in Poltava province was found for monitoring the reduction of pathogens in faeces or urine.

- In spite of the temporary smell problems, this pilot-project can serve as an example not only for other Ukraine villages, but for many countries in Eastern European Caucasus

and Central Asia (EECCA) region, which are facing lack on adequate sanitation and similar groundwater and health-problems. The establishment of ecological sanitation is especially reasonable in regions with no central water supply and no sanitation system except pit latrines.

- In other projects in Armenia, Moldova, Georgia, Uzbekistan, Kyrgyzstan and Afghanistan the same type of toilets for schools and private households are planned, built or under construction.
- The project drew the attention of the wastewater department of the Technical University Poltava, Ukraine, and the regional school administration Poltava.
- In Poltava oblast school sanitation became a political issue.

Follow up ecosan projects in Ukraine are carried out in 2006 in Nizhyn, Odesa province and Crimea. Similar toilets facilities were constructed for a school with 36 and 360 children, and for a summer camp

11 Available documents and references

The following documents are to down load from website:
www.wecf.eu/publication and/or
www.mama-86.org.ua

Ecological Sanitation and Associated Hygienic Risk, a WECF publication 2004 (English, Romanian, Bulgarian, Russian, Ukrainian)

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

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 Ukrainian, Romanian, Russian, Armenian, Bulgarian

Ecological Sanitation and Hygienic Considerations for Women (English, Ukrainian)

Socio- Economical Gender Survey of Poltava, Gozhuli, WECF, Kitty Bensvelden, 2004 (English)

MATRA project Report “Cooperation for sustainable rural development” MAMA-86, 2006 (English, Russian, Ukrainian)

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data sheets for ecosan projects

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