



## From Pit Latrine to Dry Urine Diverting Toilet – Protecting Groundwater and Improving Sanitary Facilities in a Romanian Village

Margriet Samwel\*, Sascha Gabizon  
Women in Europe for a Common Future (WECF)  
Blumenstraße 28, D-80331 Munich, Germany  
E-mail: [margriet.samwel@wecf.org](mailto:margriet.samwel@wecf.org)

\* Corresponding speaker

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### ABSTRACT

In the World Health Organisation (WHO) European Region, 120 million people do not have access to safe drinking water, and even more lack access to hygienic sanitary facilities, resulting in waterborne diseases. Better management of water and sanitation would prevent over 30 million cases of water-related disease per year in the region. Romania is just one of the European countries with an inadequate water and sanitation management. In Romania more than 10 million people lack adequate sanitation.

The Romanian village, Garla Mare has no central drinking water or sewerage system. Its 3500 citizens rely on 500 wells for drinking water and have pit latrine in their yards. Women in Europe for a Common Future (WECF) and its local Romanian partner Medium & Sanitas (M&S) have carried out a multi-stakeholder pilot project Garla Mare to address the occurrence of blue-baby-disease (methaemoglobinaemia), which is caused by too high intake of nitrate-contaminated drinking water. The goal was to develop replicable, low-cost, short-term solutions to health effects from drinking polluted water among children and to increase the sanitary conditions. Identified was, that the ground water in Garla Mare was extremely polluted with nitrate and faecal bacteria, such as *E. coli* and streptococci. Health effects of this pollution are both long term (thyroid and brain dysfunction) and immediate (blue-baby-disease, diarrhoea, parasitic diseases) and can be lethal to adults, but in particular to newborn babies and small children. This pollution is, amongst others things, caused by the use of pit latrines nearby water wells.

Double vault dry urine diverting (u. d.) toilets were constructed in the primary school in order to show how to improve sanitation, the health of the children and to protect ground water against infiltration of human waste in an affordable way.

A year after the implementation WECF carried out an evaluation. The results show that the dry urine diverting toilets are well accepted and operated by even 6-10 years old children. The children have hardly any problems with bad odours and there are no flies.



The results show a gender specific pattern: women prefer ecosan toilets while men prefer water flush toilets. The u. d. toilets improved the sanitary conditions for the children at the school.

More than half of the interviewed citizens are willing to use the u. d. toilet products for agriculture. They all complained about nuisances of odour and flies of their pit latrines.

## INTRODUCTION

Inadequate sanitation causes negative effects on both public health and the environment. Diseases transmitted by the faecal-oral route threaten in particular children of young age. Unsafe drinking water and lack of hygienic sanitation are resulting in several intestinal diseases like diarrhoea or typhoid fever. To improve the sanitary conditions, to prevent infection and the pollution of groundwater, dry urine diverting toilets were built at a primary school in Garla Mare, Romania.

## BACKGROUND

In the World Health Organisation (WHO) European Region, 120 million people do not have access to safe drinking water, and even more lack access to hygienic sanitary facilities, resulting in waterborne diseases such as hepatitis A, diarrhoeal diseases and typhoid fever. Microbial contamination has been recognised as a prime concern throughout the European Region. Better management of water and sanitation would prevent over 30 million cases of water-related disease per year in the region [1].

Romania is just one of the European countries with an inadequate wastewater management system and inadequate means of protecting the groundwater. In Romania more than 10 million people lack adequate sanitation [2]. Poor sanitary conditions, pit latrines, the mismanagement of waste dumps, and agricultural waste cause the groundwater and surface water to be polluted with nitrates, pesticides and faecal bacteria, such as *E. coli* and streptococci. Health effects of this pollution are both long term (thyroid and brain dysfunction) and immediate (blue-baby-disease, diarrhoea, parasitic diseases, hepatitis) and can be lethal to adults, but in particular to newborn babies and small children.

## PROJECT “SAFE DRINKING WATER”

To address the United Nations Development Programme’s Millennium Development Goal (MDG7) – increasing the number of people who have access to clean drinking water and sanitation by 50% by the year 2015, the Romanian NGO Medium & Sanitas (M&S) together with its German and Dutch partners of Women in Europe for a Common Future (WECEF) have carried out a multi-stakeholder pilot project from November 2001 to February 2004 in a village of 3500 inhabitants “Garla Mare”. The



project was funded by MATRA, a programme of the Dutch Ministry of Foreign Affairs. In Garla Mare are 78 public wells and 400 private wells on which the dwellers rely for their drinking water. All the 1200 households have a pit latrine in their yard. After completion of the project WECF continued with supporting the villagers and monitoring the implemented pilot projects.

### **Objective and Target audience**

The pilot project aimed at directly improving the health of the children in the primary schools in Garla Mare as well as the health of all newborns in the village by reducing occurrence of gastroenteritis and blue baby disease through education, better sanitation and by providing access to clean water. M&S selected the village of Garla Mare because health statistics showed that many cases of methaemoglobinaemia (blue baby disease) had occurred there. Blue baby disease is linked to diarrhoeal, intestinal or stomach infections in combination with high nitrate levels in water used for baby drinks or food/formula.

### **Investigation and planning**

M&S and WECF started with an investigation of the water quality of the 78 public wells in Garla Mare. Water samples were tested for nitrate and partly for microbiological pollution. None of the public wells tested had safe water: nitrate levels averaged 120 mg/l with peaks over 500 mg/l, high amounts of Escherichia Coli and Faecal Streptococci up to 5420/100ml. The high faecal bacteria levels indicated that the primary cause of bacterial pollution were the conventional pit latrines in people's gardens. These latrines were mostly neither sealed nor emptied, and the faecal bacteria and nitrates were washed into the groundwater. The two schools and one kindergarten in the village did not have functioning wells and provided no means for children to wash their hands after using the toilets. The school had pit-latrines in the schoolyard. In spite that the latrines cabins were regularly cleaned, they smelled very bad. Flies caused a nuisance in particular during summertime. At the back of the latrines it was visible, that many children preferred open defecation instead of using the latrines.

An in-depth gender-balanced socio-economic analysis was carried out using focus interviews with a representative group of 20 inhabitants. This analysis showed that the income level of most families was so low that they could hardly provide sufficient food and pay for the electricity bill [3]. Additional money to pay for a household connection to a centralised drinking water system was not available.

An improvement of the sanitary systems by providing water flush toilets would mean constructing a (drinking) water system and a sewerage system. In small rural villages like Garla Mare there is not enough money for construction, connection, operation and maintenance of such a system. During public meetings information on the water quality of the wells and possible improvements were provided and discussed. Alternatives to improve sanitary conditions and to protect groundwater for infiltration of human excrements by implementing dry urine diverting (u. d.) toilets were discussed. Because

children suffer the most from waterborne diseases a safe drinking water facility and u. d. toilets were installed at the primary school in Garla Mare.

## IMPLEMENTATION OF PILOTS

### Dry double vault urine diverting toilets for a primary school in Garla Mare

Approximately 200 pupils between the ages of 6-11, attend the school five days a week from 9:00 a.m. until 1:00 p.m. With the technical support of the Hamburg University of Technology (TUHH) 4 double vault dry urine diverting toilets and 3 waterless urinals were installed in a new toilet building in the schoolyard (Figure 1) [4]. Because of hygienic reasons, urine diverting squatting slabs was chosen (Figure 2).



**Figure 1.** U. d. toilet building in Garla Mare (Design TUHH)



**Figure 2.** Interior of the u. d. toilet (Design TUHH)

## METHODS

The urine and faeces are diverted, stored, and treated separately to eliminate pathogens. For each toilet there are two easily accessible faeces chambers (vaults) with a sealed floor. One chamber will be used for approximately 1 year and then allowed to rest for one year while the other chamber is being used. For the proper function of the dry urine diverting toilets, the user has to add a cup of dry mixture consisting of soil and ashes, lime or wood dust after defecation. Ventilation pipes with fly nets were installed from

the faeces chambers reaching to above the roof. These two measures prevent bad odours, and the attraction of flies. The sanitised faeces will be used as soil conditioner after storage/composting time of at least 2 years. The urine from the separation toilets and the waterless urinals is collected in a reservoir, which is buried under the soil. This urine tank is divided into two chambers of 3m<sup>3</sup> each. The two compartments are, similar to the composting chambers, necessary for the 6 month resting time before it is used as a fertiliser. During this time many pathogens are killed or at least reduced [5].

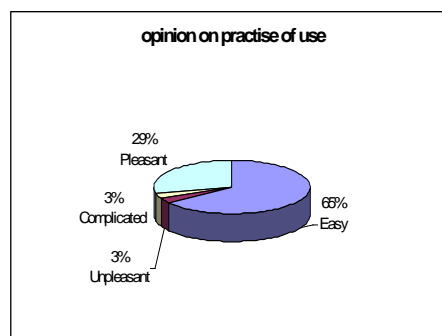
To incorporate proper hygiene and hygiene education into this sanitation project, water taps were installed in the school, linked to a well and pump. A multi-barrier filter to take out the nitrate and bacteria was provided for the schoolchildren and was made accessible for mothers with babies. For teachers, parents and children, workshops about the proper use and maintenance of the dry u. d. toilets were organised. WECF and the TUHH have continued monitoring the toilets after they were installed. Urine and faeces samples were collected to analyse the concentration of the nutrients and micro organisms, and the farmers were instructed and assisted on how to apply the urine to their fields. After one year of experience with the ecosan toilets, WECF carried out a gender and age balanced survey on the toilets among the school children, teachers (the users) of the primary school and villagers [6].

## RESULTS OF SURVEY

### School children's opinions about the dry u. d. school toilets

#### *Use and design*

After their experience with the new u. d. toilet at the school, the majority, 87 %, of the 31 interviewed children would prefer this type of toilet over the pit latrine they have at home. When asked about the toilets, the children tended to mention the beauty and the cleanliness of the ecosan toilets. The girls put the emphasis on the absence of bad odours; the boys emphasised the ease in using them.



**Figure 3.** School children opinion on the practice of use

All of the children surveyed use the school toilets daily or weekly: 73 % use the school toilet daily for urine and 65 % daily for defecation. Almost all of the children (94 %)



find the ecosan toilets easy and pleasant to use. Only 6 % of the children said the toilets are complicated or unpleasant (Figure 3).

#### *Complaints on odour and flies*

While flies are a problem in and around the conventional pit latrines, the dry u. d. toilets do not have this problem. Only 3 % of the children complained about a weekly appearance of flies, 94 % of the children never see flies in or around the u. d. toilets. Before the survey was conducted, nobody complained about bad odours. Although the majority of students (66 %) never had complaints, 3 % were bothered monthly by bad smells, 13 % weekly and 16 % daily. The results of the survey did reveal that odour was a problem in the boys' toilet room. The conventional designed urinal bowls, located in the boy's bathroom turned out to be the cause of the relatively frequent occurrence of bad odours. These urinals had many flow-off holes, which allowed an ammoniac smell to escape from the urine reservoirs into the restrooms. These holes are now sealed; just one hole is left for the flow-off of the urine. The odour problem is now solved.

#### *Number of toilets*

All of the girls interviewed were satisfied with the three u. d. toilets that were available for them, and 71 % of the interviewed boys were content with the three urinals and one slab for defecation that was made available for them. The boys who were less content suggested that two or three slabs would be better. Considering the fact that approximately 65 % of the children defecate daily during the school day, one slab for the boys indeed doesn't seem enough.

#### *Preference of type toilet and location*

The pupils were asked which toilet they would prefer to have at school and at home. No one reported that they would prefer a pit-latrine. Instead, half of the children would prefer a urine diverting toilet, and the other half would prefer a water flush toilet at both locations. However, girls tended to prefer a urine diverting toilet at home over a water flush toilet. The students gave the following arguments for preferring the water flush toilet: they are better than a urine diverting toilet, more beautiful or it is so nice when the water flushes. It is the children's experience that their home latrines always have a bad odour. Therefore it is not surprising that, despite the cold winters, 74 % of the respondents would prefer the toilet to be located outside in the yard instead of in their houses or inside the school building.

#### **Teachers' opinions about the dry u. d. school toilets**

One separate ecosan toilet was built for the teachers at the primary school. This meant that the teachers could base their answers, unlike the citizens, on their own experience. All four interviewed teachers found the toilet easy to use and had received enough information on usage and maintenance. Two teachers thought there were enough urinals and toilets for their students; the other two teachers thought that two slabs for the boys might have been better. According to them, it seems that the toilets smell more when the

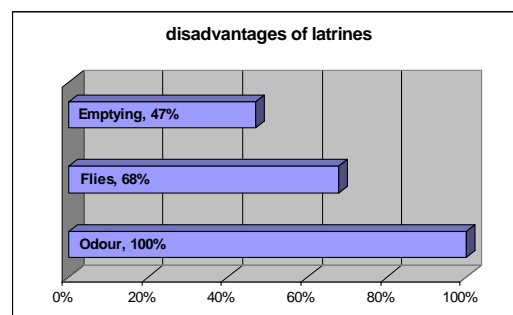


temperature rises. However, they never hear complaints about un-cleanliness or flies and all seem to like the design. The four respondents agree that the improved sanitary situation will be better for the health of the pupils. Two teachers think u. d. toilets should be used for every school; the others think they are only suitable for rural areas. Three out of the four teachers would ideally prefer a water flush toilet for their school because it would be more practical, stating that the children would not have to use soil or ashes to cover their faeces

## Garla Mare Citizens' opinions about sanitation

### *Sanitation at home*

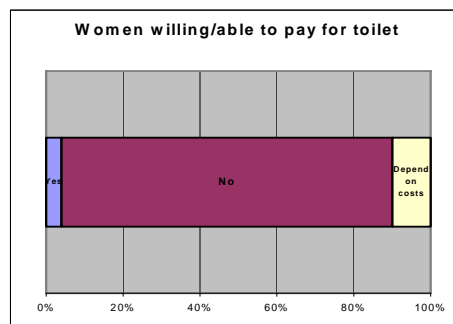
All 40 interviewed citizens had a conventional pit latrine in their yard. The owners of the pit latrines all agree that the bad odour is the greatest disadvantage of a latrine (Figure 4). Other problems that are generally mentioned are the nuisance of the flies and the emptying of the pit latrine. Taking into account these results, it is not surprising that 80 % of the respondents prefer their toilet to be outside and not inside their homes. Given the chance, 98 % of the citizens would prefer another type of toilet than a pit latrine.



**Figure 4.** Disadvantages of pit latrines

### *Preferences on toilets at home and affordability*

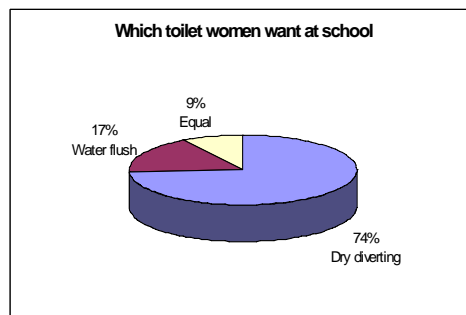
The citizens' pit latrines are placed outside in their gardens. The majority (80 %) of citizens wish to keep it there. Bad odours and flies were mentioned as an argument to place the toilet outside their home. The major complaints about pit latrines could be prevented with a urine diverting toilet. Among the citizens of Garla Mare the water flush and the u.d. toilets appear to be the most popular toilets, leaving the pit latrine far behind. But the income level of most families is so low that they can hardly provide enough food for themselves. So is it understandable that only 3 % of women are willing to invest in another toilet. It is surprising though considering the financial situation that 22 % of the men are willing to invest in another type of toilet. Only 10 % of the women would consider building a new toilet, if the costs would fit into their budget (Figure 5).



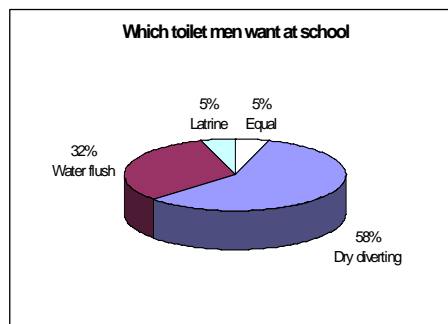
**Figure 5.** Women willing or ably to pay for a new toilet

### *Preferences on school toilets*

Most citizens chose the dry u. d. toilet as the best choice for toilets at the school (66 %), followed by the water flush toilets (26 %), and finally pit latrines (2 %). The others had no preference (8 %). There is an interesting difference between men and women: 74 % of the women and 58 % of the men want dry u. d. toilets for the school; 32 % of the men and 17 % of the women would prefer a water flush toilet (Figure 6, 7). The arguments mentioned for preferring a dry u. d. toilet are that they are good for children's health, there are fewer odours, and children are happy with them.



**Figure 6.** Women's preferences on school toilets



**Figure 7.** Men's preferences on school toilets

### *The use of sanitised urine and faeces in agriculture*

For the future construction of more urine diverting toilets in the village, it is important to have some insight into the willingness of the citizens to use the sanitised u. d. toilet products as a fertiliser and compost in agriculture. The attitude towards using urine collected from the school toilets, as fertiliser is fairly positive since 60 % of the respondents wouldn't mind using it on their fields. However, they were more reluctant about using faeces on the fields: 43 % would want to do this and 40 % answered with an absolute 'no', others were undecided. Data showed, however, that the attitude becomes slightly more positive when it concerns using sanitised faeces from their own families.

## **DISCUSSION AND CONCLUSIONS**



After building and using dry urine diverting toilets at the primary school in Garla Mare, the children are satisfied with the new toilets. These toilets improved the sanitary conditions for the school and the ground water has been protected against the infiltration of excreta. Most citizens in Garla Mare are unhappy with their pit latrine at home. The latrines cause problems with bad odours, flies and groundwater pollution. Under current circumstances, dry u. d. toilets provide a hygienic and environmentally safe sanitary solution. Citizens of Garla Mare also show a rather high acceptance to use urine in the agriculture.

More than ten million people in Romania have inadequate sanitary facilities. However ecological sanitation (ecosan) is in European countries so new that few countries, cities or towns today have any regulations that refer to dry u. d. toilets. The regulations are often written based on systems using water for transporting human excreta. Therefore regulations on ecosan systems, on sanitizing and recycling of human excreta are needed. The World Health Organisation intends to publish new guidelines on the use of human excreta in agriculture in 2006. Governments should adopt these regulations and promote dry u. d. toilets as a safe, sustainable and affordable system, in particular for rural areas. Finally, more national and international attention should be paid to the poverty of the Romanian rural areas and the environmental situation. Affordable long-term solutions, like ecological sanitation should be recognised and implemented.

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