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Sustainable and Safe School Sanitation

How to provide hygienic and affordable sanitation in areas without a functioning wastewater system



Examples from Eastern Europe,
Caucasus and Central Asia



WECF | Women in Europe for a Common Future

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This brochure is intended for school-directors and teachers, administration-employees, engineers, architects and construction workers from the field and NGOs.

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without a functioning wastewater system**

**Examples from Eastern Europe,
Caucasus and Central Asia**

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More about WECF

Women in Europe for a Common Future is a network of organisations and individuals working for sustainable development, protection of human health and environment and poverty reduction.

Our international network consists of members and partners in Western and Eastern Europe, the Caucasus and Central Asia. WECF supports partners in 13 countries with demonstrations of urine diverting dry toilets for private and public (school) use in:

- Afghanistan
- Armenia
- Azerbaijan
- Belarus
- Bulgaria
- Georgia
- Kazakhstan
- Kyrgyzstan
- Moldova
- Romania
- Tajikistan
- Ukraine
- Uzbekistan

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Proper school sanitation is a question of children's health and dignity. However, in many countries little attention is paid to school sanitation not only because of lacking financial resources, but also due to a lack of awareness of how important school sanitation is.

Pupils support actively the construction of the new UDD toilet facility in Kyrgyzstan. The new toilet facility will be attached to the old school building and can be entered from indoor.

Existing school toilets in rural Tajikistan without any privacy



Schoolboy in Bobryk, Ukraine, is happy about the new UDD toilet. He shows how to use it after defecating



1 Background and Summary

5

School sanitation

School sanitation is an important but often neglected issue for public health. Children are most vulnerable and affected by poor sanitation conditions. Related diseases, particularly diarrhoea and parasite infections hinder the children's physical and intellectual development. In a number of countries, evaluations have shown that pupils are dropping out of school due to bad toilet conditions. This seems to be particularly the case for adolescent girls and leads to lower educational standards and attainment.

The hygienic and sanitary conditions of many rural school toilets in Eastern Europe, Caucasus and Central Asia (EECCA region) range from bad to terrible. In most cases the sanitation facilities consist of simple pit-latrines with little standard of cleansing. Also hand washing facilities are mostly lacking and privacy is missing. In addition to the bad hygienic toilet conditions and lack of privacy, the groundwater of the school community often gets polluted with faecal bacteria and nitrates by infiltration of the toilet pits. This puts the rural population at constant risk of waterborne diseases caused by polluted drinking water, and in some communities it is considered normal to have almost constant diarrhoea. Implementing hygienic, safe and sustainable sanitation in schools contributes to solving the health and environmental problems of these rural areas. Demonstrations accompanied by a training for pupils and teachers about hygienic and sanitation issues lead to higher educational standards and raise the awareness of the whole communities via the children.

In cases where there are not reliably working flush toilets, modern dry toilet technology can be implemented. In the last years, WECF built together with local partners more than 20 Urine Diverting Dry Toilet (UDDT) Buildings for schools, as demonstration projects in different countries of the EECCA region.

A wide variety of innovative school sanitation solutions exist, for example decentralised systems with low flush toilets connected to constructed wetlands, urine diverting dry toilets and simple grey water treatment, low flush toilets connected to biogas systems and many more. These decentralised sanitation solutions are appropriate depending on the different local conditions of available funds and materials, climate functioning water supply systems, local engineering skills etc. This publication will focus on one of the available solutions, that of urine diverting dry school toilet systems.

The UDD toilet as a sustainable sanitation¹ – or often called ecosan toilet – offers high quality and comfort. Because of the separation technology in the toilet device, these toilets do not smell or attract flies. Consequently the UDD toilet or ecosan toilet can be built inside the school like a water flush toilet,

which provides a comfortable solution, especially important in winter. Water resources are saved and protected by safe storage, treatment and reuse of excreta. The installation of UDDTs leads to an immediate improvement of the hygienic sanitary and environmental situation.

Compared to conventional toilets, UDDTs offer the possibility to explain the pupils in combination with the hygiene education the inter-linkages between ecology, agriculture, nutrient- and water-cycles.

Through its pilot demonstrations of school toilets, WECF has shown that the situation can be improved with fewer financial resources compared to the installation of flush-toilets. No infrastructure such as central water supply or sewerage system is needed for the operation of the UDDT.



UDD school toilet in Bobryk, Ukraine

UDD toilet in an Armenian school

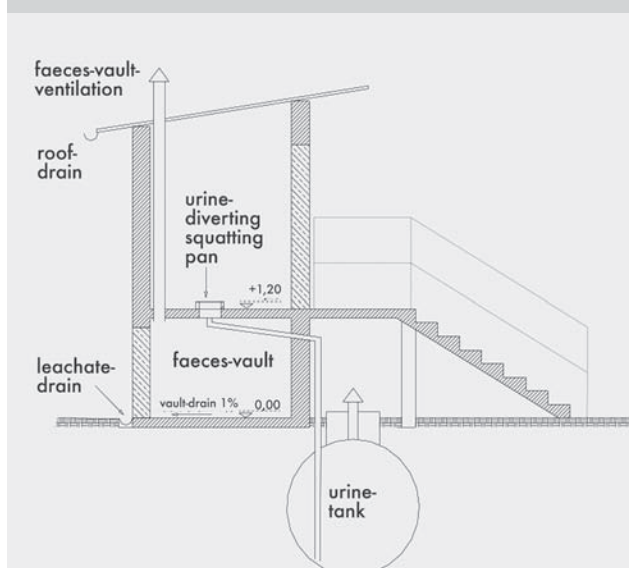
Another important advantage of UDD toilets is the production of organic fertilizer and soil conditioner which represents an important economic benefit for the often poor rural inhabitants who cannot always afford chemical fertilizer.

The experience showed a very high acceptance of the new sanitation system by pupils and teachers. Also many local residents are interested in the (re-)use of the toilet products (urine and faeces) although the reuse aspect is influenced by the specific local mentality and cultural practices.

Key success factors are the following:

- Good education of pupils, teachers, care takers and cleaning staff
- Regular cleaning and maintenance of the UDDT
- Early involvement of all stakeholders (director, pupils, teachers, cleaning-staff and caretaker, different levels of administration, farmers)

Schematic cross-section of a UDDT (designed by Stefan Deegener, TUHH)



What is a UDD toilet?

A urine diverting dry toilet, also called ecosan toilet, has two outlets and two collection systems, one for urine and one for faeces, in order to keep these excreta fractions separate.

What are the benefits of UDD toilets?

- Offer a high level of comfort and hygiene even when there is no central sewage system
- Do not smell or attract flies
- Do not use water for flushing
- Do not need a connection to water supply and sewerage
- Do not pollute groundwater like latrines do
- Do not pollute rivers, lakes or the sea with micro pollutants and nutrients as do wastewater treatment plants
- Produce excellent fertiliser and soil conditioner
- Preserve nutrients
- Can be built inside (warm in winter, more privacy)
- Do not need electricity for water pumps
- Are less expensive to build and maintain than water flush toilets
- Less costly than conventional sanitation

In rural areas of the EECCA region where there is no reliable water supply and/or no functioning sewerage system, the urine diverting dry toilet is an excellent sustainable sanitation option.



2 Sustainable School Sanitation

The major goal of sustainable school sanitation is to provide a healthy school environment which optimizes children's learning capacity and where children and teachers feel at ease. The needed hardware is a safe, proper and hygienic toilet with hand wash facility. To achieve sustainability, other criteria should be met additionally:

The sanitation system should be environmentally sound, the excreta should be collected, treated and reused safely. And water sources should be protected.

Technology must be robust and operation must be appropriate so that it can be maintained by local personnel.

The software required, such as socio-cultural and institutional aspects, include provision of hygiene education (e.g. PHAEST training²) and training for the use, operation and maintenance of facilities for pupils, teachers and personnel. Additionally an enabling policy environment is needed to overcome administrative hindrances towards innovative sanitation options. Task managers from the health, education, and water and sanitation sectors must work together to ensure that school sanitation programmes will be successful in achieving their objectives. Awareness about the importance of sanitation is needed at all levels.

Last but not least the important factor for long term success is the capacity to pay for school sanitation. The affordability of the chosen sanitation investment, operation and reinvestment is crucial (financial and economic issues). Besides the direct costs, indirect benefits should be taken into account: these include health improvement and reduced needs for medicines as well as benefits from recycled products (soil conditioner, fertiliser and reclaimed water) have to be taken into account.

For the implementation of urine-diverting dry toilets and waterless urinals in schools, local engineers and architects have to be trained on the principles of UDDTs. After training and supervision of the first pilot UDDT by an expert, the following toilets could be planned, constructed and operated by local stakeholders.

2.1 Location of the Facility

The main selection at the beginning of a school sanitation project is the selection of the toilet facility location. We recommend to place the toilet inside the school or attached to the school-building where it is most convenient for the users:

- Convenient temperature, i.e. warmer in winter and colder in summer compared to a toilet in the yard. This is especially important for girls who are more prone to urinary infections (UTIs) exacerbated by cold temperatures.
- Keeping the toilet room cleaner and more hygienic is much easier if the children have not to cross the yard to get to it.

Building a new school-building is the best opportunity to properly plan and design the infrastructure of the UDD toilet inside or attached. In most projects however the school-building already exists and only the toilet-facility is newly constructed. Then it is often possible to use intelligent planning or to retrofit a room that is not needed anymore such as a storage room. In other cases, it is possible to attach a new toilet building to the school house and install a new door so that the children can directly enter into the new toilet. If there is no place available inside and no suitable place to attach the toilet, it should be implemented in the yard, as close to the exit of the school as possible to keep the distance short for the users. Hand wash facilities should optimally be installed best in a separate room in front of the toilet rooms. Otherwise they should be as close to the toilets as possible.

When selecting the location and setting of the new toilets, it is good to involve the school children as their perceptions and views differ from views of adults. Concerning the UDD system, the children understand the principles and mostly accept the new toilets faster than adults.



*School children
are educated how to use
the UDD toilet*



*Restroom with the
squatting slab on the right.
When the right faeces
chamber is full, the slab
has to be switched to
the left side and the right
place will be closed*

2.2 Number of Restrooms

Depending on the size of the school the number of toilets must be determined. Separated rooms for boys and girls are obligatory as well as walls separating the restrooms to secure the pupils' privacy. There are WHO standards and usually national standards which define the number of restrooms per pupil. The problem of lacking financial resources often hinders the implementation of the official recommended number. The experience of WECF showed that toilet-facilities with the below given number of restrooms and urinals do not lead to queues in front of the toilets.

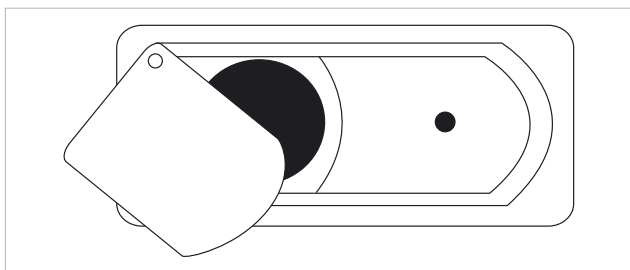
The problem of queues when there are only few toilet rooms can also be solved by shifting the pupils' break so that not all children need to use the toilet at the same time. Additionally it is necessary to place one toilet room for female teachers and one for male teachers which is sufficient in schools up to 500 pupils. Additionally it is recommended to implement one toilet room which provides disabled access. One of the teachers' toilet room could be realised as barrier-free toilet so that handicapped persons can use the toilet easily, too.

Table 1. Minimum recommended number of toilets

No of male pupils	Restrooms for boys		Urinals for boys		No of female pupils	Restrooms for girls	
	WECF	WHO ³	WECF	WHO ³		WECF	WHO ³
25	1	–	1	–	25	1	1
50	1	1	2	1	50	2	2
100	2	2	2	2	100	3	4
150	2	3	3	3	150	4	6
200	2	4	3	4	200	4	8
250	3	5	4	5	250	5	10
300	3	6	4	6	300	6	12
350	4	7	5	7	350	7	14
400	4	8	5	8	400	8	16
450	5	9	6	9	450	9	18
500	5	10	6	10	500	10	20

2.3 Urine Diversion Toilet Devices

There are many different models of urine diverting devices possible but not all are available on the local or national market. Seat risers for sitting as well as slabs/pans for squatting are both options for urine-diversion. For public places and schools, WECF recommends slabs because most users do not sit down on public toilets to prevent contact because of hygienic reasons. The slabs should have a smooth surface for easy cleaning and should be durable. For fixing the slabs, stainless steel screws should be used to prevent stains by rust and oxidation. Unfortunately no urine diversion slabs are available on the market in the EECCA-regions yet. WECF has good experience with a Chinese model. But also self-made urine diversion slabs have shown to work fine.



Squatting slab design by Lin Jiang, China

2.4 Waterless Urinals

Waterless urinals are the best options for boys to properly collect the urine. Waterless urinals have become very common in public places in Germany and other EU countries, but in most of the EECCA countries, they are not yet available on the market. Therefore they have to be imported or, available urinals which are intended for water flushing must be modified to suit the usage as waterless urinals. In any case, the contact area between the pipes and the urine has to be reduced to avoid smell. This is achieved best by smell-traps. Since these are also not yet available in the EECCA region, an improvised odour blocker, e.g. a condom or finger of a plastic glove has to be used. Another method is to reduce the outflow of the urinal by modifying a waterflush urinal.

Installation of a smell trap in the urine pipe under the waterless urinal

Conventional urinal is used as a waterless one, the holes were sealed apart from one left



How to avoid smell in the toilet rooms?

If the UDD toilets and water less urinals are properly installed, used and maintained, there is no smell at all. Please see also the tasks of the care taker and cleaning staff in detail in Annex 1. Smell could only occur from the faeces chamber or from the urine pipes and tank, if proper conditions are lacking. It can be avoided by ensuring the following:

Faeces chamber:

- Covering with sand/ashes/soil after using the toilet by the user
- Proper installation of the ventilation (passive or active)
- Closing doors of the faeces chamber
- Proper sealing of the whole faeces chamber to prevent any uncontrollable vent
- Flattening the heap of faeces by the caretaker from time to time

Urine pipes and storage:

- Proper installation of the piping
- Sealing of the piping system to prevent any uncontrolled urine discharge and uncontrollable vent
- Installation and maintenance of the smell trap

Box 2



2.5 Urine Piping and Storage

All urine-pipes have to be accessible easily for regular maintenance. This is reached with an easily accessible corridor. Important is a slope of minimum 1% and no negative slope in the whole system to prevent stagnant urine, which can cause smell and/or blockages through precipitation. As material Poly-Propylene (PP) wastewater pipes are recommended. If these are not available, PVC⁴ pipes can be used. The diameter should be minimum 50mm where accessible and 110mm underground. For the connection between the slabs and the PP-pipes a flexible hose with a smooth inner surface is a good choice. In general the distance between the tanks and the restrooms should be as short as possible and edges should be smooth, i.e. as few 90°-bends as possible. It is essential that the urine-pipes end at the bottom of the tank and not at the top to prevent smell and ammonia losses.

With UDDT systems the urine has to be collected first and (in public places) then stored before reuse in agriculture ⁵. If the storage is done on site, a minimum of 2 containers have to be installed. One is used for the collection while the other one is used for storage. To switch between the containers a proper mechanism for changing the direction of the urine flow has to be applied. Plastic containers made of Polyethylene (PE) or Glassfibre Reinforced Plastic (GRP) for the collection and storage of urine are the best solution. Urine can also be stored in concrete tanks which are absolutely sealed, e.g. by a lining of plastic. If no containers with high volume are available also several smaller containers can be installed. The size of the tanks has to be big enough to assure a storage time of minimum 6 months. It is recommended to install two chambers so that one can rest during the required period. The table gives volumes for urine tanks that proved to assure a collection time of at least 6 month. These are figures on the safe side, they also depend on the school hours and duration of holiday. If the tanks fill up before, an external storage off-site, e.g. on the farmer's land has to be found.

The tanks are best located underground near the facility in a frost free depth. The tanks can also be placed in the basement of the facility, if a sufficient slope of the urine pipes and protection against freezing is applied.

Table 2. Recommended volume of urine tanks*

No of users [-]	Volume of urine tanks [m ³]
50	2*0,75
100	2*1,25
200	2*2,5
300	2*3,75
400	2*5
500	2*6,25
600	2*7,5
800	2*10
1000	2*12,5

* The recommended volumes are schools where the pupils attend the school in average 5 hours per day, 5 days a week and 9 month per year

2.6 Faeces Collection and Treatment

The faeces are collected together with cover material in the faeces vault under the toilet. The cover material is applied after defaecation and ashes, sawdust, dried soil or a mixture of these can be used. There are two different systems of UDDTs: single and double vault UDDTs. In double vault systems there are 2 vaults below each restroom. The faeces are collected in one vault until it is filled. Then this vault is resting and closed for hygienisation of the content and vault No 2 is filled. After the second vault is filled, vault No 1 is emptied and used again. In single-vault-systems the faeces are collected in a removable container below the toilet. When it is filled, it has to be removed and a new container inserted into the single-vault. The content of the full container has to be stored or composted elsewhere for 2 years. 2 containers are obligatory for single-vault-systems to avoid the contact with fresh faecal matter while emptying.

*Urine tanks during
installation in Armenia
(Photo by AWHHE)*

*Urine piping in an easily
accessible inspection corridor
and an easy way to change
from urine tank 1 to tank 2*





Former school pit latrine
for 350 pupils in
Hayanist, Armenia

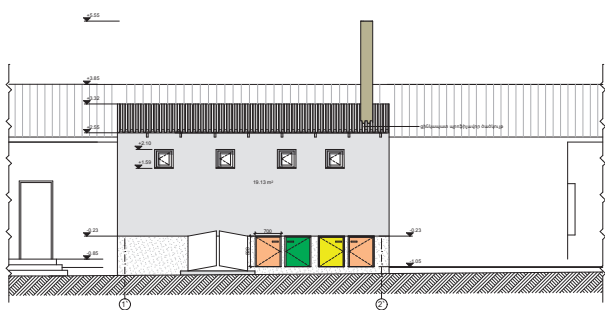
Example Indoor School UDD Toilet

Facility for 350 school children plus
teachers in Hayanist, Armenia



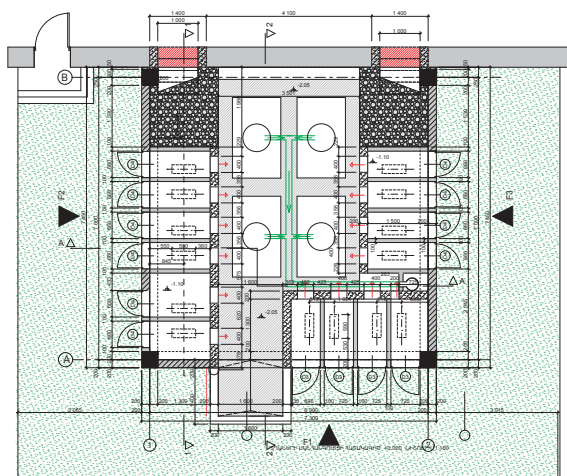
View on the new toilet facility

Floor plan of the toilet block,
design: Quelque-chose architects,
Armenia, with support by
Hamburg University
of Technology



Elevation P1, Scale 1:50.

QUELQUE-CHOSE ARCH



Basement plan Scale 1:50

QUELQUE-CHOSE ARCHITECTS



View into a restroom
with the installation of the
Chinese squatting slab

Detailed information about this case study please check on
<http://www.susana.org/images/documents/06-case-studies/en-susana-cs-armenia-hayanist-school.pdf>



Boys' waterless
urinals at
different heights

A teacher showing
the hand wash basins
(photo by AWHHE)



The boy is happy
about the new toilet



The caretaker in the basement
where four urine tanks (each 2 m³)
are installed (photo by AWHHE)



Sustainable and Safe School Sanitation

UDD toilet facilities by WECF and partner organisations in the EU and the EECCA region

Ukraine

Our partner organisations:
MAMA 86,
BLACK SEA WOMEN'S CLUB

6 school toilet facilities



Uzbekistan

Our partner organisation:
MEHRIBAN



Romania

Our partner organisations:
EURO TELEORMAN,
MEDIUM ET SANITAS, FCV

3 school toilet facilities



1 Kindergarten
toilet facility

Moldova

Our partner organisation:
ECOTOX



Azerbaijan

Our partner organisation:
EKOT

Introducing
sanitation



Georgia

Our partner organisation:
RCDA

1 school toilet facility



Projects

Region

3 school toilet facilities



stan

sation:



uction to sustainable
tion in Azerbaijan



Kazakhstan

Our partner organisations:
MCJM, UGAM



4 school toilet
facility



Kyrgyzstan

Our partner organisations:
CAAW, ULGU, UNISON



6 school toilet
facilities



Tajikistan

Our partner organisations:
SAFO, ASDP NAU



5 school toilet facilities



Armenia

Our partner organisations:
AWHHE, LORE ECO CLUB



5 school toilet facilities



Afghanistan

Our partner organisation:
KATACHEL e.V.



6 school toilet facilities

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- European Commission
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- Federal Agency for the Environment

Water and Sanitation projects by WECF and partner organisations:

- Construction of urine diverting dry toilets for households, public places and schools
- Production of porcelain urine diverting seats
- Construction of solar heated showers
- Demonstrating the effects of urine as a fertilizer
- Building soil filters and constructed wetlands for treatment of wastewater
- Monitoring of drinking water quality
- Cleaning and construction of drinking water wells
- Developing Water Safety Plans with involvement of schools
- Establishment of demonstration centres for sustainable development

WECF the Netherlands, France, Germany, May 2009



Example Outdoor School UDD Toilet

Facility for 200 school children plus teachers in Garla Mare, Romania



The school children are happy with their new toilet facility



View on the new toilet facility



Former pit latrine of the school in Garla Mare



View on the new toilet facility from the back with open doors to the double vault faeces chamber

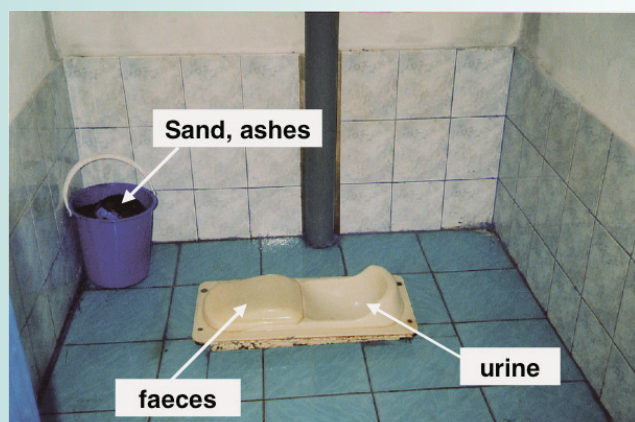
View into the double vault faeces chamber



Construction of the toilet building with local material



Training for teachers before the implementation



View into a restroom with the installation of the Chinese squatting slab

Detailed information about this case study please check on <http://www2.gtz.de/ecosan/download/ecosan-pds-011-Romania-Garla-Mare.pdf>

Installation of the double chamber urine tank (made of glass-fiber laminate) into the ground





*Well maintained
double-vault faeces collection
with insulated door*



*Container for faeces-collection
in single vault systems*

For emptying of the chambers doors with a minimum size of 60cm * 60cm have to be installed. In regions with cold winters the doors should be insulated and sealed well. Instead of doors, easily removable bricks are also used in double-vault UDDTs, although inspection of the vault content is made difficult. For both systems the height of the chamber should be minimum 80cm, better 1m.

The size of the faeces compartment is defined primarily by the size of the restroom. A typical size of one compartment in double-vault toilets is 1m height, 65 cm width and 1m length. This results in a volume of 650 liter. Compared to single-vault UDDTs, double-vault systems need to provide enough space for the collection and an afterwards storage period of 2 years. Our experience shows, that it takes even longer for the chambers to fill up. The volume of the containers for single-vault UDDTs has to be chosen in such way, that they do not fill up too quickly and thus have to be changed too often. On the other hand the containers need to be transportable, e.g. with wheels. A good volume for containers with wheels is between 300 and 500 liter. Also smaller containers can be used, if the recommended storage time of 2 years is adhered to. For single-vault UDDTs always two containers should be used in order to avoid handling with fresh faeces.

After a storage time of 2 years the faeces can be applied in agriculture or horticulture. While they are safe from a hygienic point of view, one might want a further processing, e.g. by post-composting. In the rare cases where faeces smell was reported, the reason was faulty operation due to water or urine entering the faeces collection chamber.

Before the chamber or reservoir is taken in use, it is advisable to put a 5cm layer with dry soil, ashes or compost on the bottom of the vault for adsorbing abundant liquid.

Another cause of bad smells are insufficiently covered faeces, e.g. when the heap of faeces under the faeces hole has not been flattened regularly and thereby forms a pyramid shape so that faeces roll down to the sides and are not covered. If flies appear in the toilet room, the faeces chamber has to be controlled on uncovered faeces and eventually be covered with extra amounts of cover material.

2.7 Ventilation System

For the ventilation of UDDTs active as well as passive ventilation is possible. Generally the ventilation needs more attention when the toilet is attached to or inside the building. Nonetheless also outside-toilets need a functioning ventilation system.

In rural villages with none or interrupted electricity supply, the use of active ventilation via an electric fan is only recommended if a back-up system with batteries is in place. Alternatively also one or more wind driven ventilators can be used.

The diameter of ventilation-pipes depends on the volume of the vaults and rooms that have to be ventilated. For passive ventilation of an outdoor-toilet each room needs to be evacuated via the faeces-chamber with a minimum 110mm, better 150mm-pipe. The pipes should be as vertical as possible with as few bends and curves as possible. When more than 1 room is ventilated via 1 pipe, active ventilation and bigger diameter pipes (e.g. 200mm or 250mm) are necessary.

*UDD toilet facility
with passive ventilation*



*Wind driven
ventilation*





Applying urine in the school garden

Emptying of one urine tank by a tanker-truck in Ukraine



2.9 Equipment of Restrooms

The restrooms should provide enough space to move around freely. The inside dimensions should be 1.20 m length and for single-vault systems a minimum width of 1 m, for double-vault rooms a minimum widths of 1.20m should be provided.

The floor and at least the lower part of the walls have to be covered with tiles for easy cleaning. It is important to adapt the toilet facility to the users' needs for children this means to adapt the urinals and wash basins to their size.

Every room needs a bucket with cover material and a shovel for the application of it. As cover-material lime, ashes, sawdust, woodchips, dry soil or a mixture of these materials can be used. Of course toilet paper must also be available. And a waste bin is especially important for girls and female teachers to dispose their sanitary material in the bin and not in the faeces chamber.

Further some water and a brush should be available in the girls' restroom.

2.8 Reuse of the Toilet Products

Urine is a liquid fertiliser rich in nitrogen and can be applied in agriculture⁵ after a storage time of at least 6 months. The faeces in the chamber are dried, stored in the vaults and must be post-composted in a separate compost place to produce a high valuable soil conditioner also according to the WHO guidelines⁵. Already when planning a UDDT for a public place like a school the reuse of the considerable projected amounts of urine and faeces generated should be organized. A farmer should be found and informed about the correct and safe reuse of the products. The logistics of the transport have to be organized in time. The toilet products can then be taken by the farmer who applies them on the fields, preferably in spring time into the brown land.

Another recommended opportunity to demonstrate the reuse is a demonstration garden in the school yard or close by. The fertilizing effect can be directly shown and studied by pupils, and interested visitors. Also the application and process of fertilization can be demonstrated. For the pupils a demonstration garden offers the possibility to learn by practice. Such a garden also improves the school yard from the aesthetical point of view. In some cases, the hygienic inspection is reluctant to implement a demonstration garden although the criteria of the WHO guidelines are met. Planting flowers and a fence around the garden or pots with flowers can then be solutions.

2.10 Hand wash facilities

Hand washing with soap is of major importance to prevent the spread of infectious diseases. Every school toilet should have a hand wash facility equipped with soap and towels because of hygienic reasons. The pupils should adapt the habit of hand washing after toilet use as normal and the most natural action. Therefore the sinks should be inside the toilets or close to, so the children have to pass the sinks after visiting the toilet.

When there is no piped water-supply, one or more mobile sinks can be used. The disadvantage of these devices is the limited volume and the maintenance- and labour-intensive filling of the sinks.

In countries with very cold winters and the UDDT built as a non-heated block in the schoolyard, it is sometimes not possible to have the mobile sink in the block because of freezing. During these times the mobile units should be located at the next heated place (school-building) for hand washing.

Well cleaned and equipped restroom in Armenia (photo by AWWHE)



2.11 Greywater Treatment

Greywater is the term to define wastewater coming from hand wash facilities, kitchen-sinks and showers/baths. Greywater is not very dangerous for public health as it does not contain high levels of pathogenic contaminants, unlike toilet wastewater, which contains great amounts of pathogenic bacteria. Nevertheless, it is necessary to collect and to treat greywater according to its characteristics. The treated greywater can then be reused as irrigation water, infiltrated or discharged into surface water. In schools with central water-supply the wastewater is usually connected to the centralized sewer-system or treated on-site in a septic tank with a following infiltration. This septic tank can be used to treat the greywater. If there is no treatment system yet, a natural alternative is to construct a planted soil filter. In schools without centralized water supply, the wastewater quantity is much lower and the greywater can be treated in simple sand- or mulch-filters and be reused or infiltrated afterwards



Example of handwash basin without central water supply from Moldova



Greywater treatment in simplified filter



Inauguration of a UDD school toilet for a kindergarten in Moldova



Explanatory poster for boys in an Armenian school.

Good education information materials and trainings are essential to make school sanitation a success.

3.1 Trainings

For the correct implementation and functioning of UDD school toilets, educational trainings at different levels are needed.

The first training is for engineers or architects who will design the facility. After this the executing construction company has to be trained. These two trainings can be combined.

This is followed by a training for teachers, a training for pupils and a training for cleaning staff.

Training for architects, engineers and construction workers It is essential that the company carrying out the construction work understands the principles of the new system.

Since the technology is new in many countries, it is often difficult for the local engineers and workers to understand what has to be considered. One example is the slope of the urine pipes. So a good training of the company and a control of the works is especially important with the first pilot buildings.

Training for teachers and caretakers

The training for teachers should target not only the understanding of the new toilets but also the acceptance by them. They need to be committed themselves otherwise they can hardly convince the pupils. Therefore it is recommendable that they are provided with a comfortable teachers' restroom and use the UDD system themselves.

Their task in many projects is also to monitor the children if they use the toilets properly.

Some UDDT projects failed, not due to a lack of the system, but due to misunderstanding the system and a lack of maintenance⁶. Therefore the education of the users and caretakers is as or even more important than the training of the architects and engineers.

Training for pupils

It is best if the training for the pupils is carried out by teachers. Teachers should explain the pupils the principles of the UDDT and how to use the toilets. Explanatory posters should be on the wall and on eye level of the pupils. The posters should not be too complicated and easy to understand i.e. not too many pictures should be shown in order to not confuse the users.

The materials should be adapted to local conditions, so the young pupils can identify with it. But it is also possible that one or two pupils (class-representatives) receive training by the teachers and afterwards educate the other pupils. These trainings have to be carried out before the implementation of the toilets and every new semester with the new pupils.

Training for cleaning-staff and caretaker

The caretaker and cleaning-personnel are essential to secure hygienic and clean conditions of the toilets and thus the acceptance of the facility by the users. If the toilets are dirty or smelly the whole project fails. The crucial role of caretaker and cleaning is a fact of any school sanitation independent from the sanitation technology. Bad examples are manifold. Best results are reported when at least one full-time-caretaker is allocated to the facility. Good examples are also experienced with a team of caretakers cleaning in shifts.

3 Education and Trainings

Gender aspects of UDD school toilets

Research has shown that it is of utmost importance for adolescent girls to have hygienic toilets at school otherwise they are likely to drop out school, in particular in the days when they have their period.

It is necessary that a brush, some water and a waste bin for sanitary napkins should be available in the girls' toilets. WECF interviews in schools show that some girls avoid going to the toilet because they feel ashamed if they cannot clean the UD-pans from their menstrual blood. The menstrual blood has no negative effect for the quality of the urine as fertilizer if the recommended storage periods are kept.

In some regions the perception exists that girls or women are not able to use the UDD toilet properly, however all WECF programmes have shown that there is no apparent difference in separation by men or women.

For bigger schools, anyhow a minimum of two trained caretakers should be available, e.g. in case of illness or holiday.

Schools often have a caretaker for maintenance of the building, heating etc. WECF only builds toilets in schools where the director or the administration can guarantee the cleaning and maintenance of the facility after the project-period is finished.

As cleansing agents for the toilets, it is recommended that soda- and acid-based detergents are used. Chlorine based disinfectants are not needed to secure hygienic toilet conditions, also they affect the quality of the toilet products.

A cleaning and maintenance plan is needed for the cleaning staff and caretaker. In the annex, there is a list of recommended tasks.

In general, the caretaker should monitor the faeces chamber and the urine reservoirs and take action if problems occur or if a container or reservoir gets filled.

It might be an option that pupils clean the toilets (partly) themselves as it is planned in one project. This is in general a good tool for children to take responsibility. In this case, special care, training and monitoring are needed to secure the success.

In respect of pupils cleaning the toilets WECF has not gathered any experiences yet.

3.2 Legal Aspects of UDD School Toilets

Since this kind of toilets is new in most countries and no legislation or guidelines for UDDT exists the administration sometimes has problems to give the permission for the facility. In that case it is crucial that all stakeholders are aware of the benefits, maybe after a visit of an existing ecosan toilet, and enable the project implementation successfully.

Generally, for the authorisation of a new toilet facility for schools permissions of following institutions are necessary:

- School authority (Ministry of Education)
- Architectural administration (at regional (Rayon-) level)
- Local government (communal level)
- Health administration
(sanitary and epidemiological administration)
- Environmental administration
- Emergency/utilities services (fire, electricity)

Conditions for successfully planning and building UDD school toilets

- The school ensures the training of all pupils before and after the toilets are constructed.
- All teachers and staff members participate in the trainings. Information on operation and maintenance of the toilet facility is available for school staff and caretakers.
- The school ensures paid cleaning staff who cleans the toilet several times a day, best after each break.
- The toilet products must be re-used by the school or a farmer. The user is responsible for the transport of the products to the field.
- The school is ready and able to provide toilet paper and cover-material.
- The school or community takes the responsibility for maintenance and repair of the facility.
- The school is ready and able to provide the hand wash facilities, clean water soap and towels.
- All legal aspects must be considered in advance.

Box 4



*Training for pupils
(photo by Mama-86)*



*A motivated
caretaker is essential
for a good
functioning of
the toilets*

4 More information

WECF Contacts:

Support for Planning and Construction of UDD school toilets

For support in planning, design and training for UDD school toilet facilities, the WECF sanitation coordination team and technical engineers can be contacted. For a number of countries in the region of Central Asia and Caucasus WECF has access to financial support to cover most of the cost related to these services, and in some cases has funds to cover part of the material and building costs. A contribution by the local or national authorities is however always required. For all other countries, WECF can provide support in case a funding scheme exists. It should be taken into account that UDD school sanitation facilities for colder climates will range from 2000 to 5000 Euro per toilet chamber, depending on the location (indoor / outdoor), equipment and the cost of local available materials and skills.

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Further Reading – Case studies

WECF publications

Sanitation: A continuous challenge for the European Region
Chapter of the European Document for the European Regional
Process of the 5th World Water Forum 2009
<http://www.wecf.eu/download/2009/2009WWF5Sanitationregionaldocument.pdf>

Introducing Sustainable Sanitation in Kyrgyzstan
Case Study: An analysis of success factors and barriers 2009
In English and Russian
<http://www.wecf.eu/english/publications/2009/sanitation-kyrgyzstan.php>

Making Sustainable Sanitation work for women and men
integrating a gender perspective into sanitation initiatives
<http://www.wecf.eu/english/publications/2009/genderandsanitation.php>

Europe's Sanitation Problem
WECF report on seminar during Stockholm World Water Week
<http://www.wecf.eu/images/publications/StockholmReportseminarsanitation.pdf>

Safe sanitation: a challenge we can meet together
Policy paper on sustainable sanitation
In German and English
<http://www.wecf.eu/english/publications/2008/pp-safe-sanitation-fue.php>

Report – European Sanitation Policies and Practises in the International Year of Sanitation 2008
Finding solutions for more than 20 million citizens who lack safe and affordable sanitation, Brussels, 29 January 2008
<http://www.wecf.eu/download/2008/2008-07-18report-brussel.pdf>

Summary of WHO "Guidelines for the Safe use of Wastewater, Excreta and Greywater, Volume 4"
In Romanian and Russian
<http://www.wecf.eu/english/publications/2008/who-guide.php>

Safe and profitable toilets – a solution for health and wealth
WECF manual in Russian and English
<http://www.wecf.eu/english/publications/2008/ecosanguide.php>

Sustainable wastewater management in the European Union
Identifying existing regulations and guidelines – by student of the Hague University of Applied Sciences in cooperation with WECF
<http://www.wecf.eu/english/publications/2008/sustainable-wastewater.php>

New Study prepared for WECF: Biogas production in climates with long cold winters
http://www.wecf.eu/download/2008/Biogascoldclimates_WEB-WECF0608.pdf

Further Reading – Case studies

Ecological Sanitation and Associated Hygienic Risks. An overview of existing policy making guidelines and research 2007
In English and other languages (still missing on the website)
http://www.wecf.eu/cms/download/2007/WP_63b_web.pdf

Sustainable Rural Development in Ukraine
Demonstrating solutions for water supply, sanitation and agriculture 2007
http://www.wecf.eu/cms/download/2007/ukrainecases-study_301007.pdf

Urine Diverting Toilets in Climates with Cold Winters
Technical considerations and the reuse of nutrients with a focus on legal and hygienic aspects
http://www.wecf.eu/cms/download/2007/WP-26_web-07.pdf

Case study "Sustainable Development for All"
WECF published the case study: Sustainable Development for All: Reducing effects of polluted drinking water and inadequate sanitation on children's health in rural Romania
http://www.wecf.eu/cms/download/2006/SD_all.pdf

Ecological sanitation: From pit latrine to ecological toilet
Find out about acceptance of and experiences with eco-sanitation toilets 2006
http://www.wecf.eu/cms/download/survey_sanitary.pdf

Dry Urine Diverting Toilets - Principles, Operation and Construction
Find out about the construction and operation of eco-sanitation toilets
In English, Romanian, Bulgarian and Russian
http://www.wecf.eu/english/publications/2006/ecosan_reps.php

Ecological sanitation and hygienic considerations for women
http://www.wecf.eu/cms/download/2004-2005/Menstruation_fs.pdf

Ecosan a New Approach
In English, Bulgarian and Russian
http://www.wecf.eu/english/publications/2005/ecosan_flyer_all.php

Romania Gender Socio Economic Analysis Report
A report on a short survey of the socio-economic and gender situation in Garla Mare, Romania
http://www.wecf.eu/english/publications/2004/Romania_Report.php

Footnotes

1. See criteria by the Sustainable Sanitation Alliance SuSanA, network of organisations working in the promotion of sustainable sanitation systems, www.susana.org
2. PHAST (Participatory Hygiene And Sanitation Transformation) is a worldwide used methodology for hygiene behavioural change that was originally developed by WHO (http://www.who.int/water_sanitation_health/hygiene/envsan/phastep/en/) and was further developed by WECF (<http://wecf.eu/english/articles/2009/04/PHAEST.php>)
3. Draft- WASH Standards in Schools in Low-cost Settings, Guidelines for water, sanitation and hygiene in schools in low-cost settings, by John Adams et al. 2008
4. PVC has the problem of containing chlorine which will emit hazardous substances when burnt, therefore we recommend to avoid PVC whenever possible
5. WHO. (2006) Guidelines for the Safe Use of Wastewater, Excreta and Greywater. Volume IV – Excreta and Greywater Use in Agriculture. http://www.who.int/water_sanitation_health/wastewater/gsuweg4/en/index.html WECF (2008), Translation of the WHO. (2006), Summary of the Guidelines for the Safe Use of Wastewater, Excreta and Greywater. Volume IV – Excreta and Greywater Use in Agriculture. In Romanian and Russian language. <http://www.wecf.eu/english/publications/2008/who-guide.php>
6. Austin, A. (2003). "An unsuccessful sanitation scheme at a rural school: Lessons learned from the project failure." In: 2nd International Symposium on Ecological Sanitation, April 7-11 2003, Lübeck, Germany

Annex 1. Tasks for the cleaning staff of urine diverting dry public or school toilets

A poster with instruction how to use the toilet should be on the walls of the restrooms !!

EVERY DAY

- Check if there is enough dry material (soil or sawdust and/ashes)
- Check if all the faeces is covered with dry material
- Check for clogged urine pipes
- Clean the urinals, seats/slabs, and floor

WEEKLY

- Level the faeces heap
- Clean walls, pipes, and under side of the urinals
- Check level of urine / faeces in container or chamber

WHEN FULL

- Change the urine reservoir
- Change the slab/seat to the 2nd faeces chamber

Issue	Clarification
Soil or sawdust and ashes	A bucket with sawdust or better a mixture of dry soil or sawdust and ashes and a cup or small shovel must be placed in the toilet rooms. There must be always enough of this material because the fresh excreta must be kept covered.
Levelling	It is important to level the heap, which is formed by the falling excreta. The faeces must be levelled weekly with a stick or shovel. Maybe you must add some more soil or ashes to cover the excreta.
Cleaning	The urinals must be cleaned daily - on the end of the day - using a sponge or brush and one or two cups of water and two spoons of vinegar (or citric acid). Make sure that there are no clogged holes or pipes. The slabs or seat risers can be cleaned daily using brush or sponge and little water. It is important that no water enter the faeces chamber of container. The toilet floor must be cleaned daily with water and eventual some caustic soda or detergent. The tiles of walls, pipes and under surface of the urinals must weekly be well cleaned, using a brush, sponge, water and eventual some caustic soda or detergent.
Women toilets	In women's toilets a bottle with water and a brush must always be available to remove traces if necessary. Wrapping material and a bin must be available for disposing of sanitary napkins and /or tampons
Urine reservoir	If the urine reservoir in use is almost full / filled, the urine pipe must be connected with the other compartment of the reservoir. After an additional 6month storage time the urine can be pumped out the in-rest reservoir and used as a fertilizer.
Emptying	If both chambers are full you must empty the one, which has been out of use. The product can be used as soil conditioner. It looks like dry soil and doesn't stink. It is good to leave some material on the bottom of the chamber before using it again. Important for climates with cold winters: before the faeces can be used as a safe soil conditioner the material must be stored in the chamber at least 2 years or well composted on site.

Annex 2. What to do with a smelly UDD toilet?

Principle 1:

A clean, well-maintained and well-constructed urine diverting dry toilet has no bad smell.

Principle 2:

If a bad smell appears the problem can be solved: check and act!

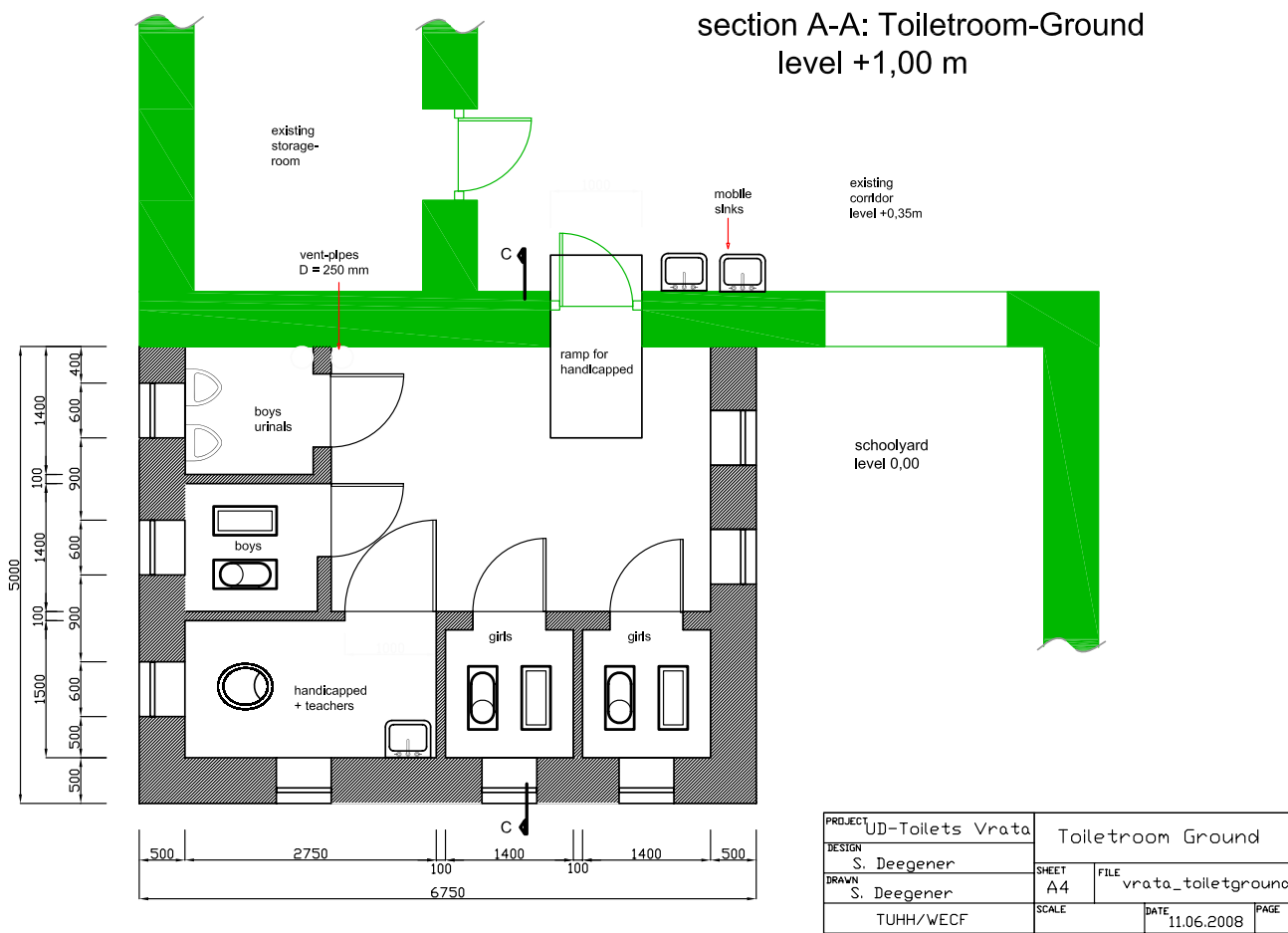
Old urine stinks: the restroom has an urine-ammonia smell

1. Control if all the urine pipes have enough slope for a guaranteed quick flow off of the urine. No spot where urine is standing is allowed!
2. Control if there are no pipes or connections leaching
3. Control if the outlet of the urine pipe is close to the bottom of the urine reservoir.
The pipe should end approx.
5 cm above the bottom of the urine reservoir.
If the pipe is not ending in the urine, bad odour can enter the pipe and the restrooms
4. Give the urine pipes an extra treatment. Make a hot caustic soda solution:
approx. 1 part soda 3 parts hot water.
At the end of the day or before the weekend pour a half liter of the solution through each
urinal and each urine bowl of the seat or slab.
Do not use the toilet for at least 12 hours.
Before use another half liter warm water can be poured.
5. Make sure that no urine is collected some where under the floor cover or tiles or slab
6. Make sure that the floor, walls, urinals and other toilet equipment are clean

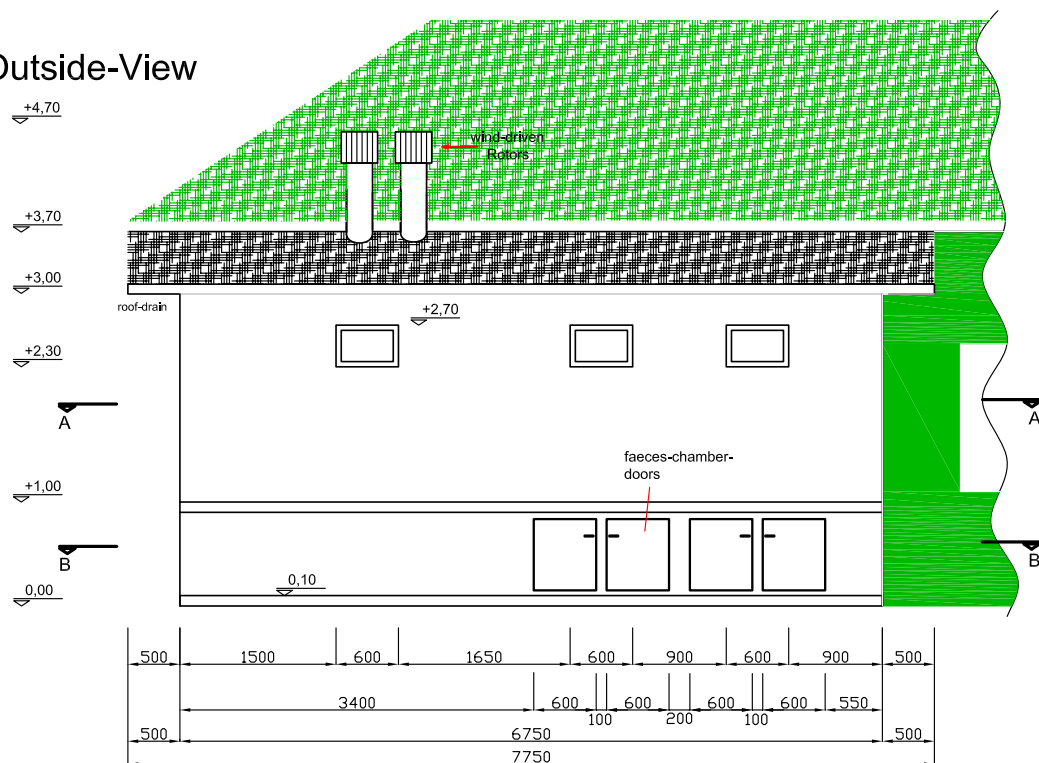
Humid faeces stinks: the restroom has a mouldy faeces smell

1. Make sure that no liquid is collected on the bottom of the faeces collector
or that the heap has no too high humidity.
The faeces should be as much as possible be dry!
2. Make sure that all the faeces are well covered.
3. Add eventually ashes or lime to the heap. Ash is a good smell and liquid absorber.
If no ashes is available add other dry well adsorbent organic material or lime
4. Make sure that the ventilation is working well and that the pipes are well connected with the faeces chamber.
The air from the faeces chamber should be aspirated easily by the ventilation pipe.
This can be tested by a burning cigarette.
5. Make sure that the doors of the faeces chambers close tight and are insulated.
No air from outside should enter the faeces chamber.
6. Make sure that no air can enter through holes being in the wall around the ventilation pipe.
7. In climates with low temperatures insulate the ventilation pipe at least outside.

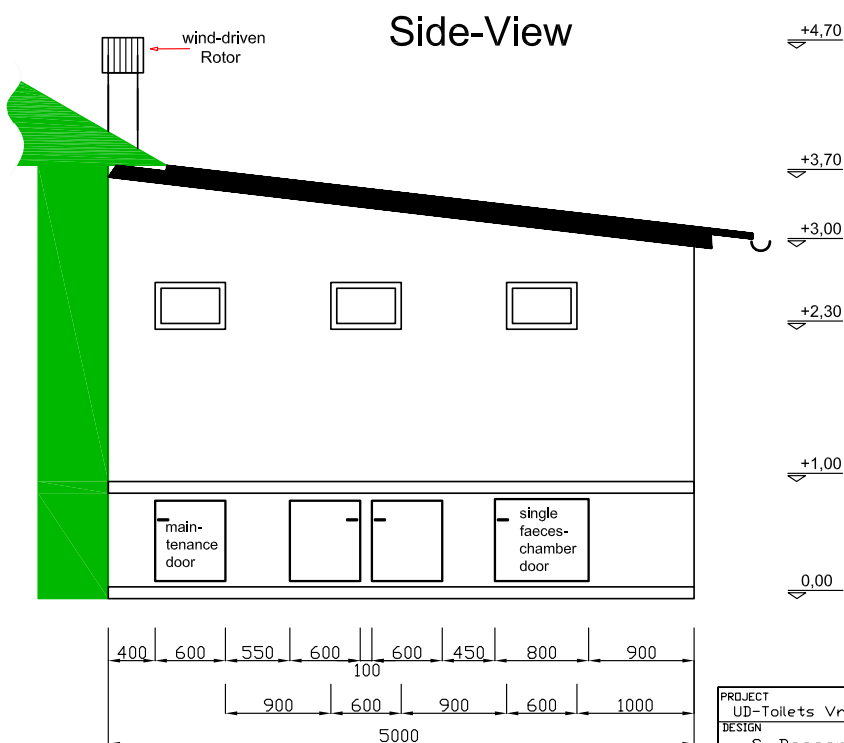
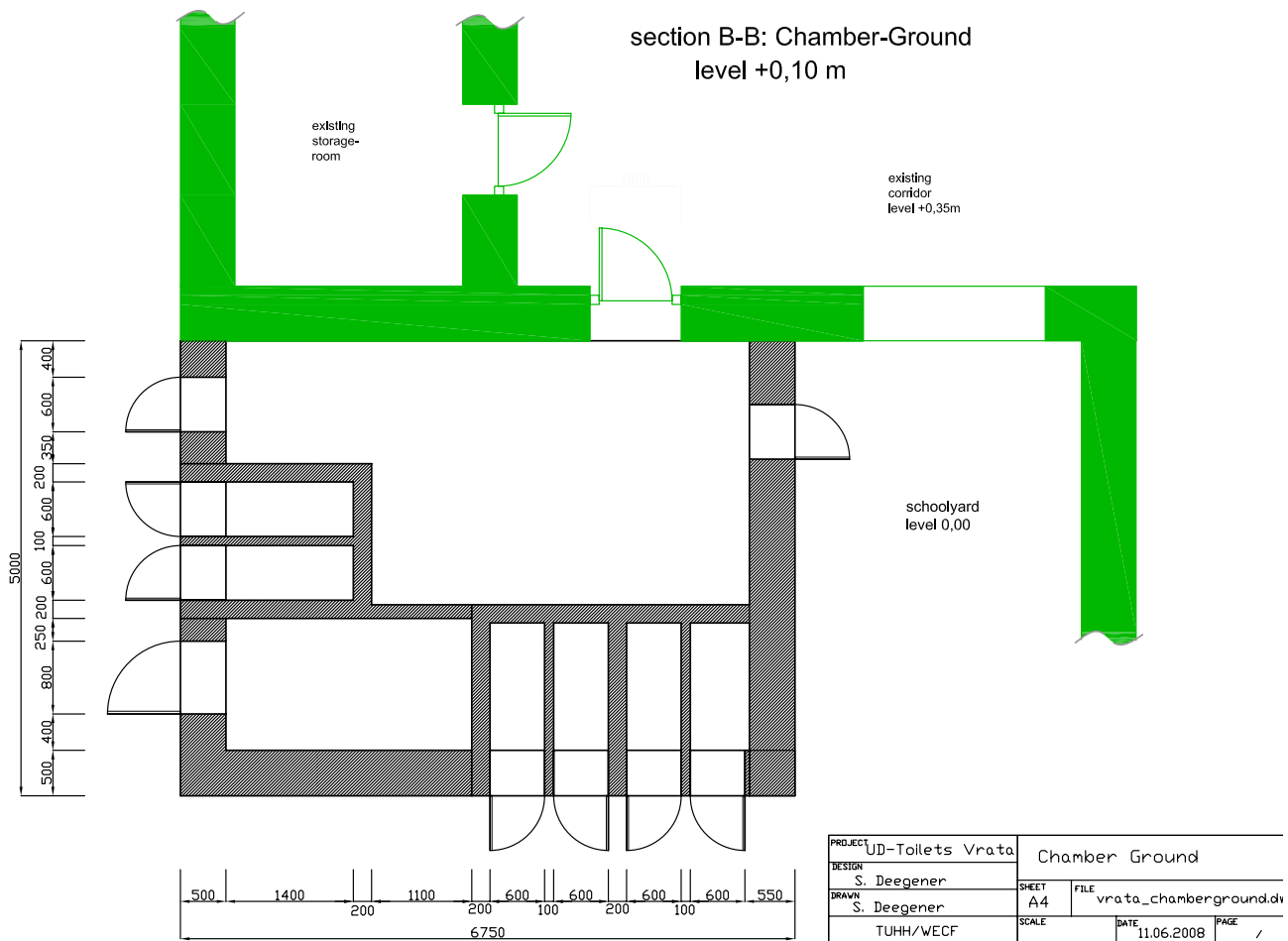
Annex 3. Design details from toilet facility in Vrata, Romania



Outside-View



PROJECT	UD-Toilets Vrata School	Outside View		
DESIGN	S. Deegener	SHEET	A4	FILE
DRAWN	S. Deegener	SCALE		DATE
TUHH/WECE				15.06.2008



PROJECT		UD-Toilets Vrata School		Side View	
DESIGN		S. Deegener		SHEET	
DRAWN		S. Deegener		A4	
TUHH/WE CF		FILE		vrata_sideview.dwg	
		SCALE		DATE	
				17.06.2008	
				PAGE	
				/	

