

Urine Diverting Dry Toilets (UDDT)

Frequently Asked Questions

May 2008

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1. General questions

In which locations in Ethiopia have ecological sanitation systems been implemented?

SUDEA (Society for Urban Development in East Africa) was the first promoter of Ecological Sanitation (EcoSan) in Ethiopia. Since 1998 a number of pilot projects, responsible for over 300 urine diversion dry toilets, have been undertaken in partnership with local NGOs in Addis Ababa, Jimma, Bahir Dar, Hamusit and Harar. A public private partnership called Ecological Sanitation Ethiopia (ESE) which is partly funded by GTZ, has also been working on urine diverting dry toilets in Ethiopia since 2006. This project has the focus on the implementation in multi-storey buildings. The project constructed urine diversion toilets in Wolayta Soda and Arba Minch and has got convincing results in the use of urine as fertilizer. Another EU funded project called ROSA (Resource Oriented Sanitation concepts in peri-urban areas of Africa) is working in Arba Minch since 2006 on ecological sanitation systems. The project has carried out various activities which include construction of about 6 urine diverting dry toilets and researches on the reuse of faeces and urine. The results found from the researches are encouraging and promising.

In which other countries have ecological sanitation systems been implemented?

In many countries; Ecosan initiatives are currently operating in developing and developed countries, including: Austria, Bangladesh, Bénin, Bolivia, Bulgaria, Burkina Faso, China, Côte d'Ivoire, Denmark, El Salvador, Ethiopia, Germany, Guinea, India, Kenya, Mali, Mexico, Mongolia, Mozambique, Nepal, Netherlands, Norway, Palestinian Territories, Peru, Romania, Senegal, South Africa, Sri Lanka, Sweden, Switzerland, Tanzania, Togo, Uganda, Ukrain, Vietnam, and Zimbabwe. Evaluations reveal considerable achievements and demonstrate that ecosan is viable as an infrastructure application in diverse socio-economic locations in both rural and urban contexts, enabling equitable services for men, women, children, and the elderly.

In which countries the use of urine as fertilizer is common?

In many parts of the world it was a tradition to keep the urine and faeces apart. The old Japanese and Chinese practice of night soil recovery from urban areas separated urine and faeces, with the urine regarded as a valuable. In many European countries, urine was historically often collected separately. Mainly due to practical reasons, it was poured into the drain to avoid smells and to prevent the latrine from filling too quickly.

Why should I consider Urine Diverting Dry (UDD) Toilets for the Universities?

In most of the universities in Ethiopia is a lack of water because of the insufficient water supply and missing facilities and pressure. Urine diversion toilets are best solutions in such situations because such toilets do not need water for flushing and can be efficiently used with out water. Water is only required for hand washing, anal cleansing and cleaning toilet floors. In addition urine diversion toilets produce valuable products (urine and faeces) that can be used as mineral fertilizer and organic fertilizer (soil conditioner).

Is ecological sanitation an appropriate technology for urban areas?

Most definitely! In fact, it is the most logical option where population densities are high. VIP toilets are a problem in confined spaces because one can't simply move them when the pits become full, and they are difficult and expensive to empty. A large number of pit toilets in a densely populated area can lead to foul odors hanging around and may also pollute groundwater resources with organic matter and nutrients. Septic tanks with soakaways represent a similar problem, as the soil may eventually become unable to absorb all the effluent and the groundwater becomes polluted with nutrients, which may be taken up by wells probably. Ecological sanitation technology avoids these problems - there are no odours if the systems are managed properly, no danger of groundwater pollution, maintenance is easy and, best of all, the toilets can be installed inside the house.

Is it possible to use UDD-Toilets in high-raised buildings (e.g. dormitories)?

Yes. In China the Sweden Erdos Eco-town Project (EETP) has installed urine- diversion seating toilets in forty-two 4-5 storey buildings. The 5 year implementation of EETP proved that ecosan is feasible both technically and economically. In Germany and Sweden also there are high rise buildings equipped with dry and urine-diversion toilets. Urine-diversion toilets are also going to be installed by Ecological Sanitation Ethiopia (ESE) in G+2 condominium houses in Awassa.

Are there any success stories in the use of urine?

Extensive trials have been performed on various vegetables in different countries all over the world. These trials show nearly the same results. In Africa in Mali, Burkina Faso, Uganda and Zimbabwe these trials were made. Herein urine is a quick-acting fertilizer that can be used for most vegetables and the fertilizing conditions are at least similar to conventional mineral fertilizer. Trials made by ESE in Sodo Wolayta on maize and wheat using urine as fertilizer also revealed that the production of urine fertilized ones is very high when compared to those fertilized with chemical fertilizer.

Can children use UDD-Toilets as well?

The usual designs of the toilets are only suitable for children when squatting toilets are in use. For sitting type urine diversion toilets special seats are manufactured in South Africa to put on the bigger toilet seats when children use the toilet.

Can disabled persons use UDD-Toilets?

The usual UDD-Toilets constructed up to now are not accessible for wheel chair users. However the following provisions will make the use possible.

The rooms for disabled persons using wheel chairs should be larger to accommodate the wheel chair and there should be no steps in the gate instead a sloping riser should be made for access by disabled users. In South Africa attempts are made to make the toilets suitable for disabled persons.

2. Hygienic risks

Is the UDD-Toilet less hygienic than water flush systems?

UDD-Toilets are not less hygienic than conventional water flush toilets. For both misuse/abuse leads to unhygienic conditions. In the case of water shortages water flush toilets become unhygienic very fast, in opposite dry toilets can be operated also without water very hygienically.

What do I have to do to minimize the hygienic risks for me and other users?

I have to be aware of the use of the toilets. Furthermore I have to leave the toilet in a clean condition.

Is urine hygienically safe to use as fertilizer?

Urine is hygienically safe to use as fertilizer, if it is kept free of faeces and regulations and recommendations for its use are taken into consideration (i.e. WHO guidelines).

What kind of diseases may be transferred by use and handling of urine (HIV, Bilharzia, worms, etc.)?

Those that are passed in urine include Salmonella typhi (typhoid), Salmonella paratyphi (paratyphoid fever) and Schistosoma haematobium (bilharzia). The first two do not survive long once outside the body and will be eliminated from urine after it has been stored for a couple of days. The bilharzia cycle is broken when the media (water, urine etc.) does not contain the intermediate host to complete transmission (usually snails). Therefore if urine is stored for a few days and the storage tank is drained at intervals recommended by the WHO-Guidelines the risk of contamination from one of the above organisms is minimal. If cross-contamination with faeces does occur, storage of urine for more than one or two months will render it safe.

HIV AIDS virus also may not survive long once outside the body and will not be active after the urine has been stored for a couple of days.

What kind of diseases may be transferred by use and handling of treated faecal matter (HIV, Bilharzia, worms, etc.)?

Pathogenic species of bacteria, virus and parasitic protozoa will be eliminated by treating faeces. In accordance to the WHO- Guidelines treatment means storage for specific time or composting with an increase of temperature. However there is a minimal risk that eggs (ova) of helmentis especially ascaries and tape worm may persist in low numbers after treatment. Therefore, personal protection equipment should be used while handling and applying the treated faeces and it should additionally be mixed into the soil in such a way that it is well covered.

3. Operation and maintenance (O&M)

What are the operation and maintenance requirements of UDD-Toilets?

The special construction of urine diversion toilets keeps urine and faeces separate. Ash or other additives like dry soil (or a mixture of the two), which is kept in a container next to the toilet, is sprinkled on the faeces. This absorbs the inherent moisture, covers the faeces and assists dehydration. The dehydrated faeces can be easily collected (the collection chamber is generally on ground level) and may be reused as soil conditioner after treatment. If this is not desired, it may simply be bagged and collected by entrepreneurs as a paid service.

Does the system have high operation and maintenance efforts and costs?

The answer to this question depends on the design of the system. In many cases, there will be two, or in some cases three fractions to handle instead of one or two, which in itself may entail more practical aspects since both the urine and faeces should be re-circulated to agriculture. Regarding the toilets, the experience is that the piping for urine needs more maintenance than the conventional piping, in order to avoid blockages. However, with improved design this need may diminish.

If the urine and faeces are to be used locally, operation and maintenance will be geared towards the piping system and collection tanks. If the urine and faeces are to be used in agriculture, operation and maintenance include transportation, storage and use of the products. The costs of maintenance can be covered by selling the products.

Which equipment and tools are necessary for a proper operation?

The following are required for the proper operation of UDD-Toilets and the treatment of the toilet products:

Only additives like ash, sawdust, soil, sand or compost are necessary for the proper operation of the toilets. The regular replacement of the bins under the toilet is a prerequisite for the proper operation. Regular cleaning and a proper condition support the O&M of the toilet.

What happens, if the caretaker doesn't work properly?

Spillage of faeces from faeces container, overflow of urine collection tanks, and leakages in the urine pipes may occur if the caretaker doesn't work properly. This will make things very messy. The result will be unhygienic conditions for the users. Furthermore odour and flies will occur.

What happens, if the cleaning staff doesn't appear to work?

The toilet will become dirty and unpleasant to use. It may stink and attract flies and the users won't be willing to use the toilets and to keep the toilets clean from their side.

What happens, if water enters the urine outlet?

This doesn't affect the proper operation of the toilets. Only the volume for liquid matter will increase and more effort for its transport is necessary.

What do I do, when faecal matter enters the urine outlet?

If a system is clearly mismanaged (i.e. faeces can be seen in the urine bowl or other routes of cross-contamination are observed), prolonged storage of greater than 6 months should be applied before urine is used as fertilizer.

What do I do, if urine pipes are clogged?

The blockages are removed either mechanically by a drain auger or chemically by use of strong solutions of caustic soda (2 parts of water to 1 part of soda) or acetic acid (>24%). For prevention of blockages the pipe should be flushed with water once per week.

What happens, if water or urine enters the faecal outlet?

If water or urine enters the faecal outlet, the faecal matter becomes too wet and the drying process will be disturbed. When faecal matter are too wet this results in development of bad smell and maggots & flies will occur. Therefore entering of water, urine or any other liquid has to be avoided.

In the case that water or urine enters the faecal outlet, ash in a larger amount has to be added to the bins to absorb the moisture. If this fails or is not possible the bins have to be replaced immediately.

What do I do, when water or urine enters the faecal outlet?

One should add a lot of ash to absorb the moisture if water enters the faecal outlet. If this fails or is not possible the bins have to be replaced immediately.

Are there any flies or other insects during the operation of the UDD-Toilet?

If properly used and operated there will be no flies in UDD-Toilet. However, during the wet season those Culicine mosquitoes, which do not carry malaria, can hide in the vault and emerge up the fecal hole during use. The mosquitoes look for dark places to hide but they do not breed there as there is no water.

Can any animals (rats, spiders etc.) affect the operation of the UDD-Toilet?

Spider webs, if found inside the vent pipe, seriously disrupts the air flow inside the pipe. Efficient ventilation is important and helps to reduce odours and also maintains a constant flow of air through the vault which reduces moisture.

Rats and lizards may enter into the fecal container/chamber and may carry disease causing pathogens on their feet and spread these pathogens elsewhere. Therefore the access doors have to be closed during all times of operation.

Are cockroaches a problem during the operation of a UDD-Toilet?

Cockroaches are not reported in proper working UDD-Toilets. They may only occur when the faecal matter becomes too wet. Nevertheless they will not create any problem during the operation of the toilets.

Is there any smell?

Properly used and operated UDD-Toilets do not smell as the fecal matter in the container/chamber is semi-dry and any odors are carried out by the vent pipes. For the avoidance of smell by urine remaining on the toilet's surface the urine bowl has to be flushed daily with approx. 0.5 – 1.0 Liters of water.

What do I do, when smell arises (odour problem)?

Odour may have different reasons:

Urine:

- Leakage of the pipes
- Blocking of urine pipes
- Insufficient cleaning of the toilet (urine part)

Faecal matter:

- Insufficient cleaning of the toilet
- Faecal matter is too wet (liquid has entered the bin)
- Poor ventilation

4. Planning and design

What do I have to consider for planning of urine-diverting systems?

Urine diversion, with subsequent collection and reuse of the urine, is one way to collect nutrients from the wastewater fraction for use in agriculture or the home garden. Urine diversion should be considered among different options. Urine diversion will emerge as the best solution when aspects such as protecting the environment, generating fertilizers and recycling on the small scale are prioritized. Cases where urine-diverted dry systems have been promoted are where the wastewater treatment plant has limited capacity, where the surface and ground waters need to be protected, and where there is a demand for urine and faeces as fertilizers.

Does the planning of UDD-Toilets need more effort than conventional toilets (VIP-latrines, Pit-latrines)?

Yes. In opposite to flush systems working as an end-of-pipe technology the treatment is nearby the source – by these short cycles may be achieved. The planning of a urine-diverting system takes into account various issues such as improved environment, food security for households and safer handling of a waste flow from the household. The planning includes not only the design of the toilets and pipes but also the transportation, storage and treatment of the toilet products (urine and faeces).

Is urine diversion equipment (moulds etc.) available in Ethiopia?

Currently there are different options available in Ethiopia:

1. Awassa Tabor ceramic factory ceramics starts the production of a squatting type toilet (Turkish toilet).
2. One Fiberglass factory in Addis Ababa is offering toilet seats both sitting and squatting types made of glass fiber

3. AquaSanTec in Addis Ababa imports squatting type toilet pans made of plastics (Polyethylen) which are produced in Kenya.

What do construction companies need to consider when constructing a urine diversion system?

Since urine-diverting systems are seldom included in building codes, special care needs to be taken by the builders to ensure proper running of the system. The sizing and inclination of pipes, documentation and accessibility, are some of the aspects where mistakes can lead to failure of the system.

Users should be supplied with a simple manual that explains the concept, as well as operation and maintenance routines. If there is a choice between suppliers, take care to choose a supplier where spare parts and support can be given. If there is no municipal collection of urine, you must plan for an adequate space where the urine can be used for crop production, and establish routines in order to put the urine to use.

The construction should cater for appropriate collection and storage capacity for the urine.

5. User's behaviour

Can one use a UDD-Toilet where people are not interested in reusing excreta?

Yes. While reuse of sanitized excreta for agricultural purposes should be encouraged, it is not a precondition for implementing this technology. Human excreta represent a valuable resource, but can also be regarded as an “optional extra” available for free. Dehydrated faeces can easily be disposed or incinerated, while urine can also be led into a shallow soakpit if reuse of these products is not desired. Urine is generally fairly sterile and does not present a danger to groundwater, when the soak pits are installed with the necessary distance to each other. In an urban area, collection and disposal of dehydrated faeces can also be seen as an entrepreneurial opportunity, and need not be an expensive service.

Can I put items used for cleaning (toilet-paper, stones etc.) into the faecal-outlet?

Yes. Anal cleaning material like tissue paper, paper, and leaves can be deposited into the vault, because they decompose when wetted afterwards in the composting process. Stones can't be decomposed and won't affect the composting process. Other non decomposable material like plastics should not be put in the fecal chamber but may be deposited into the waste bin nearby.

Can I put sanitary pads into the faecal-outlet?

No. Sanitary pad should be put in a basket which is meant for collecting it.

Does menstruation blood affect the operation of the UDD- Toilets and the use of the outputs?

It does not affect the operation of the toilets and the use of the outputs. If there are some remains of blood on the urine bowl, rinsing it with small amount of water or wiping it with tissue paper is necessary for cleanliness.

Is the use of ash (dry bulking material) obligatory?

Adding dry bulking material is obligatory; otherwise, any excreta will be too wet. This may attract insects for breeding and odour may occur. The bulking material also helps to cover the fresh faeces and thus lower the potential for fly contact and breeding, reducing the risk of disease transmission.

As adding dry bulking material can be use: ash, sand, soil, sawdust, compost.

Do I have to add ash after each use of the toilet?

It is not compulsory to add ash after each use. However it can be applied two or three times per day. At the universities this will be done by the caretaker.

What shall I do, when no ash is available?

If ash is not available the following material can be used: Saw dust, wood chips, dry soil, sand, compost, etc.

6. Cost aspects

How does the investment-, operation- and maintenance costs of a UDD-Toilet compare with other toilets (VIP-toilet, water flush toilets)?

There is no reason for a urine diversion toilet to cost any more than a VIP toilet, as far as capital expenditure is concerned. Space requirements are similar, while the pedestals can be produced quite cheaply. Even though the toilet needs to be raised slightly above ground level in order to provide access to the collection chamber, which represents an additional expense, no pit is required, which can be a substantial saving. The superstructures of the two types of toilet may be identical. In actual fact, because urine diversion toilets can be installed inside a dwelling, and not constructed separately outside, savings may be realized on walls and roof. Of course, if one compares O&M costs, the urine diversion toilet wins by a wide margin, as there is never any pit to empty or superstructure to be moved/rebuilt. So if one compares lifecycle costs, a urine diversion toilet is actually more economical.

Since water flush toilets require expensive wastewater treatment facilities and water supply of ample amount and adequate pressure. The investment cost will be greater than that of urine diversion system.

Is the operation and maintenance more costly than traditional toilets?

Yes. In most parts of the world, basically two options to tackle sanitation problems are applied which can be described as "drop and store" and "flush and forget". These conventional forms of wastewater management and sanitation systems are based on the perception of fecal material, which is considered as repulsive and not to be touched. In the case of the UDD-Toilets the urine and the fecal matter are checked, stored, treated and transported regularly increasing the O&M costs when compared to the traditional toilets.

However, sanitation systems should not be chosen only on economic criteria. Health and risk of disease transmission, short and long term environmental and resource aspects are essential for the long term sustainability, as are institutional and socioeconomic factors. And all of these should be evaluated for the whole systems, including sustainable treatment.

7. Reuse of output products (irrigation & agriculture)

Are there any restrictions concerning the application of urine?

When spreading urine, it should not be applied on leaves or other parts of the plants, as this can cause foliar burning due to high concentrations of salts when drying. Spraying urine in the air should also be avoided due to the risk of Nitrogen loss through gaseous emissions of ammonia and the hygiene risk through aerosols.

Are there any harmful substances in the urine?

In excreta the content of heavy metals and other contaminating substances such as pesticide residues is generally low or very low, and depends on the amounts present in consumed products. Faeces contain a greater amount of these substances than urine does. Even so, the concentrations of contaminating substances in faeces are usually lower than in chemical fertilizers (e.g. cadmium) and farmyard manure (eg. chromium and lead).

A large proportion of the hormones produced by our bodies and the pharmaceuticals that we consume are excreted with the urine. It is reasonable to believe that the risk for negative effects on crop quality and quantity from hormones is negligible. All mammals produce hormones and the vegetation and soil microbes are adapted to, and can degrade, these hormones. Thus, both fertilizer experiments and evolutionary history strongly indicate that there is no real risk.

Is there any risk associated with pharmaceuticals from using the urine as fertilizer?

Different research projects have or are investigating the affects of pharmaceutical residues. These substances are excreted by the human beings via the urine as well as via the faecal matter. Their concentrations depend on the amount uptaken by the human beings.

The degradation of these substances depend on the environment and the concentration of microorganisms.

Urine and faecal fertilizers are mixed into the active topsoil, which has a microbial community just as diverse and active as that in wastewater treatment plants, and the substances are retained for months in the topsoil. This means that there is plenty of time for the microbes to degrade any pharmaceutical substances and that risks associated with them are small.

Concerning both hormones and pharmaceutical substances, it thus seems far better to recycle urine and faeces to arable land than to flush them into recipient waters, where the concentration of microorganisms is very low.

There are many indications that the possible risk from pharmaceutical substances in the agricultural system is small and far smaller than the risks associated with the present system. Furthermore, the human use of pharmaceutical substances is small compared to the amount of pesticides (insecticides, fungicides, bactericides and herbicides) used in agriculture, which are just as biologically active as pharmaceutical substances.

How and when do I apply urine to my plants?

The urine should be incorporated into the soil. This could in practice be done mechanically or by subsequent irrigation with water. A close to the ground application/fertilizing method is recommended to minimize aerosol formation. On a large scale this is often done by using special agricultural equipment, while on a smaller scale it is often applied manually.

Urine can be applied on arable land without any dilution before seeding. After seeding dilution of urine with water (approx. 1:4) is recommended.

Urine can be applied in the same period as chemical fertilizers are applied. As a rule of thumb, fertilization should stop after between 2/3 and 3/4 of the time between sowing and harvest. Some vegetables, notably the leafy ones, are harvested before they reach their reproductive stage and therefore fertilizer applied closer to the time of harvest can be utilized. However, a waiting period of one month between fertilization and harvest is very advantageous from a hygiene point of view and recommended for all crops eaten raw.

Is Urine acidic and will hurt my plants?

In general an application of too much urine will affect the plants because of the addition of too many salts to the plants. Urine will hurt some sensitive plants (seedlings) when the leaves will have contact with urine. Before application to plants, urine should be diluted with water (ration 1: 3 – 1:5) for the protection of the roots.

How can I convince farmers to use urine and faecal matter as fertilizer?

One can convince farmers to use these products as fertilizer by showing them farms where the use of urine and faecal matter as a fertilizer is successful or by doing a crop trial with and without the use of urine and faecal matter as fertilizer on one or two of selected farmers' plots.

How do I know, when the composting process is finished and the compost can be used?

We know that the composting process is finished and the compost can be used if the compost is dry, and look and smell like very rich garden soil. When it is time to remove the composted material, it should not look or smells at all like the original waste material that went in. No fecal matter should also be identifiable.

What do I do with the other outputs like greywater?

The greywater can be treated by simple treatment techniques such as soil infiltration, gravel filters, constructed wetlands or ponds. More complex methods, such as activated sludge, rotating biological contactors or membrane filtration, may also be used.

Can I use the greywater?

The treated greywater can be used for irrigation of agricultural crops in water-scarce regions. It can also be used for groundwater recharge or industrial or urban reuse or discharged into surrounding watercourse.

May detergents (e.g. from soaps and cleaning substances) affect the greywater treatment and pollute the groundwater?

Detergents will not affect the greywater treatment. They will also not pollute the groundwater as they are trapped in the treatment unit and degraded by the microorganisms.

8. Cultural, religious and gender aspects

Does the toilet fit for both genders?

Yes. The toilet units which are available in the market are designed in a way that urine is collected in an appropriate way from both women and men using the toilet.

Where do anal washers do their washing procedure after the use of the toilet?

The UDD-Toilet has three holes for fecal matter, urine and anal washing use. So, anal washers can use the respective hole for anal cleansing in front of the toilet. .

Does the anal cleansing affect the operation of the UDD Toilet?

It will not affect the operation as long as the hole meant for anal washing use is used. A problem will arise if and only if the anal washing water gets mixed with the fecal matter or urine.

Where can Muslims make their cleansings before praying?

Muslims can make their cleansings in UDD-toilets which are having facilities for anal washing. They should not splash water in the faecal chamber while doing their cleanings.

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