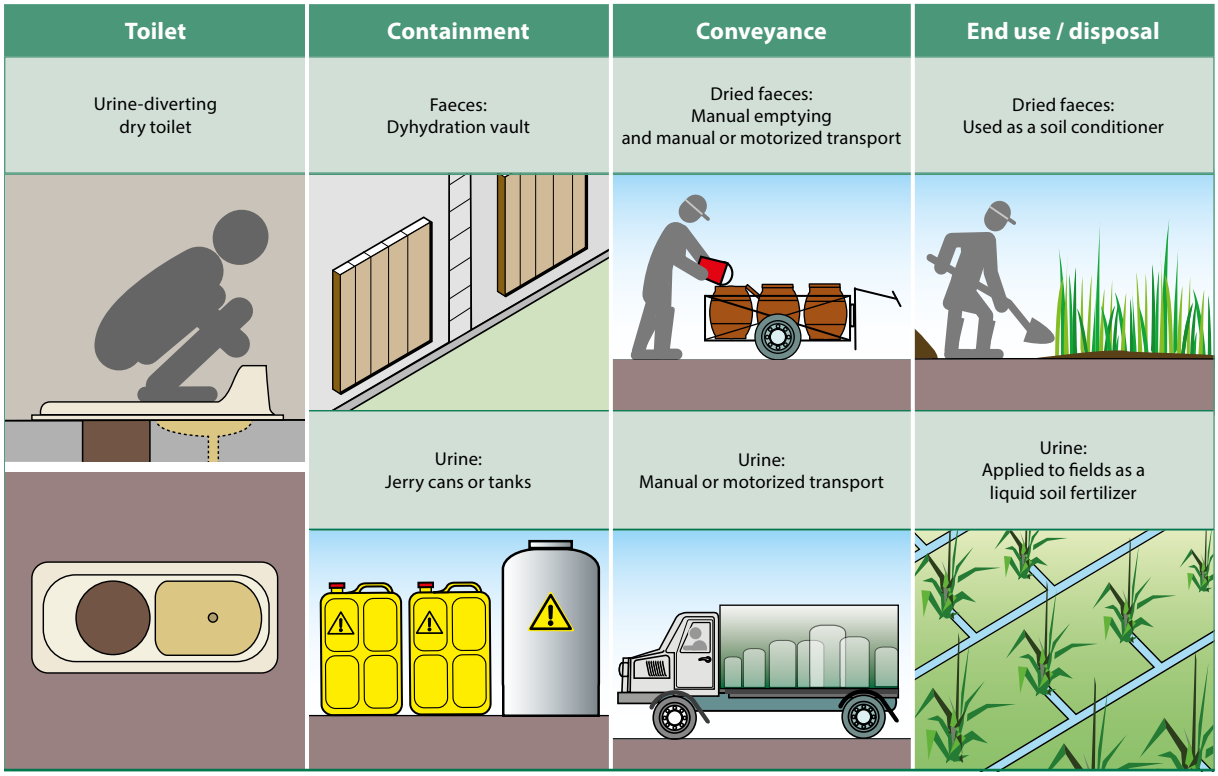
World Health Organization

Fact sheet 4

Urine-diverting dry toilet (UDDT) with onsite treatment in dehydration vault



Summary

This system is designed to separate urine and faeces to allow the faeces to dehydrate and/or recover the urine for beneficial use. Inputs to the system can include faeces, urine, cleansing water and dry cleansing materials.

The main toilet technology for this system is a urine-diverting dry toilet (UDDT), which allows urine and faeces to be separately stored. A urinal can additionally be installed for the effective storage of urine. UDDT designs vary and include adaptations for different preferences, for instance with a third diversion for cleansing water management.

Dehydration vaults are used for the containment of faeces. They should be kept as dry as possible to encourage dehydration and pathogen reduction. After each use, the faeces are covered with ash, lime, soil, or sawdust, which helps to absorb humidity, minimize odours and provide a barrier between the faeces and potential disease carrying vectors. The vaults should be watertight and care should be taken to ensure that no water is introduced – cleansing water should never be put into dehydration vaults.

Using two dehydration vaults, and alternating their use, allows for an extended dehydration period so that when they are removed the dried faeces contain zero, or very low, pathogen levels and pose little human health risk. A minimum storage time of six months is recommended when ash or lime are used as cover material, after which the dried faeces can be applied as soil conditioner [2].

The urine can be stored in either jerrycans or a tank for application in agriculture. With its high nutrient content it can be used as a good liquid soil fertilizer and can be easily handled and poses little risk because it is nearly sterile. Stored urine can be transported using manual or motorized transport technologies. Alternatively, the urine can be diverted directly to the ground for infiltration through a soak pit.

Applicability

Suitability: This system can be used anywhere, but is especially appropriate for rocky areas where digging is difficult, where there is a high groundwater table,

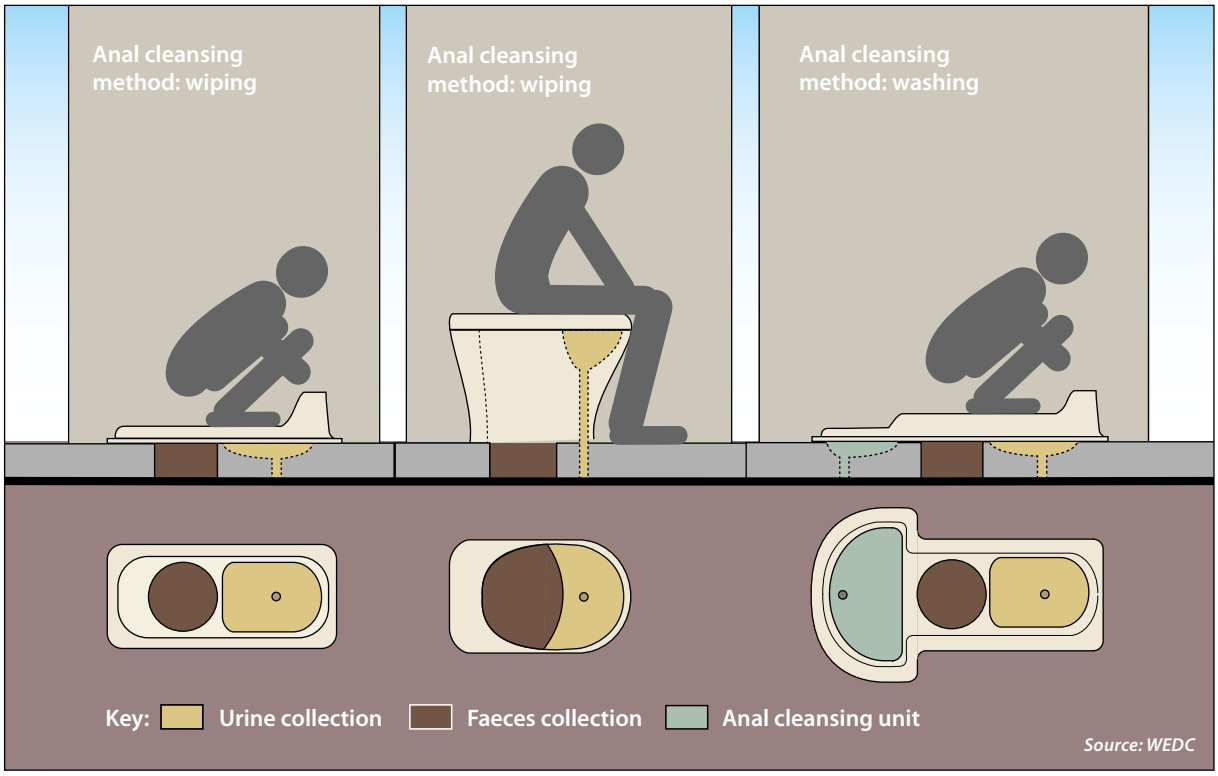


Figure 1. Urine diversion systems

or in water-scarce regions. A dry, hot climate can also considerably contribute to the rapid dehydration of the faeces.

If there is no agricultural need and/or no acceptance of using the urine, it can be directly infiltrated into the soil or into a soak pit.

Cost: For the user, this system is one of the least expensive in terms of capital cost and produces end products that the user may be able to use or sell. As the containment technology does not include a pit or underground tank, there is no excavation cost, however, this saving may be offset by the cost of constructing the above ground tank or vault and urine separation arrangement, which will also require a reasonable level of technical expertise.

The only maintenance costs will include cleaning of the toilet, upkeep of the superstructure and arranging for periodic emptying of the vaults and urine containers (if any).

Design considerations

Toilet: The toilet should be made from concrete, fibreglass, porcelain or stainless steel for ease of cleaning and designed to prevent stormwater from infiltrating or entering the vaults. Where there are no suppliers of prefabricated UDDT pedestals or slabs, they can be locally manufactured using available materials.

Containment: The dehydration vaults should be watertight and fitted with a vent pipe to reduce nuisance from smells and preventing access to disease carrying vectors. Any urine tanks should also be watertight and sealed to reduce nuisance from smells.

All types of dry cleansing materials can be used, although it is best to collect them separately as they will not decompose in the vaults and use up space. Cleansing water must be separated from the faeces, but it can be mixed with the urine if it is transferred to a soak pit. If urine is used in agriculture, cleansing water should be kept separate and infiltrated locally or treated along with greywater. A separate greywater system is required since it should not be introduced into the dehydration vaults.

Conveyance: Manual emptying equipment is required for the removal of the dried faeces generated from the dehydration vaults (the material is too dry for motorized emptying), which can then be transported using manual or motorized transport, and used in agriculture as a soil conditioner.

Operation and maintenance considerations

Toilet / containment: The user is commonly responsible for the construction of the UDDT, dehydration vaults and providing the urine tanks (if any), although they may pay a mason to carry out the work. The user will be responsible for cleaning of the UDDT and are most

likely to be responsible for removing the dried faeces, although they may pay a labourer or service provider to do this.

At shared facilities, a person (or persons) to clean and carry out other maintenance tasks (e.g. repairs to superstructure) on behalf of all users needs to be identified.

The success of this system depends on the efficient separation of urine and faeces, as well as the use of a suitable cover material. Therefore, the urine separation plumbing must be kept free of blockages to prevent urine from backing up and overflowing into the dehydration vaults, and there should be a constant supply of ash, lime, soil, or sawdust available to cover the faeces.

End use/disposal: The dried faeces removed from the container should be in a safe, useable form with a zero to very low pathogen content, although workers would be advised to wear appropriate personal protection during removal, transport and end use.

Mechanisms for protecting public health

The toilet separates users from excreta and the dehydration vault isolates the excreta and pathogens within from physical human contact.

The main mechanism for pathogen reduction in the vaults is through long storage time. The dehydrated conditions in the vault are not favourable for pathogen survival, which die off over time. If ash or lime is used as a cover material, the related pH increase also helps to kill pathogens. The urine poses little health risk as it is nearly sterile, and storage before use in sealed containers or disposal to the ground via a soak pit will protect public health. However, in areas in which schistosomiasis is endemic, urine should not be used in water-based agriculture, such as rice paddies.

During rains, the slab and vaults contain the fresh excreta and prevent it from being washed away into surface water bodies, while squat-hole covers or lids and a screened vent pipe can reduce disease transmission by preventing disease carrying vectors from entering and leaving the vaults.

Any non-degradable solid waste removed from the vaults needs to be disposed of properly, for example through a regulated solid waste management service or, where this is not available, through burial.

Since it has undergone significant degradation, the dried faeces should be safe for end use as a soil conditioner in agriculture. If there are concerns about the pathogen level or quality of the dried faeces, they can be further composted in a dedicated composting facility before it is used.

References

The text for this fact sheet is based on Tilley, et al. [1]

1. Tilley E, Ulrich L, Lüthi C, Reymond P, Schertenleib R, and Zurbrügg C (2014). *Compendium of Sanitation Systems and Technologies. 2nd Revised Edition.* Swiss Federal Institute of Aquatic Science and Technology (Eawag).

2. Stenström T A, Seidu R, Ekane N and Zurbrügg C (2011). *Microbial exposure and health assessments in sanitation technologies and systems*. Stockholm Environment Institute (SEI).