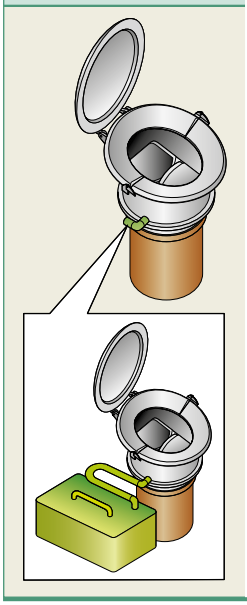
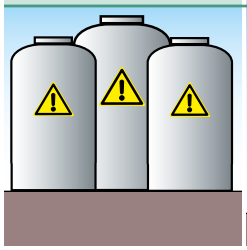
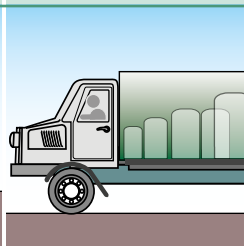
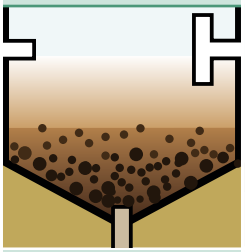
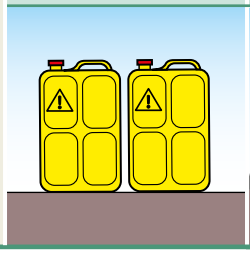
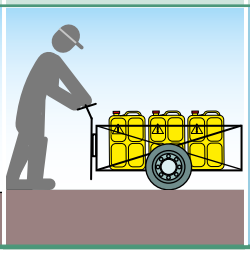
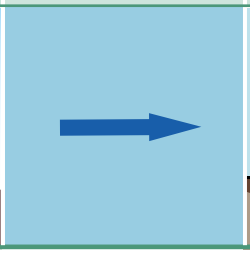
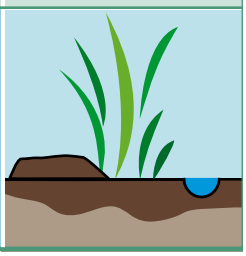
World Health Organization

Fact sheet 8

Urine-diverting dry toilet and container-based sanitation with offsite treatment of all contents

Toilet	Containment	Conveyance	Treatment	End use / disposal
Urine-diverting dry toilet	Brownwater: Portable storage container or cartridge	Brownwater: Collection and motorized (or manual) transport of storage tanks	Brownwater treatment plant – for effluent and sludge	Soil conditioner; solid fuel; building materials; irrigation; surface water recharge*
				
	Urine: Portable storage tanks or jerry cans	Urine: Collection and motorized (or manual) transport of storage tanks	N/A	Urine: used as liquid fertilizer
				

* Sludge: treated and used as soil conditioner, solid fuel or building materials. Effluent: treated and used for irrigation or surface water recharge.

Summary

This system is designed to separate urine and faeces so that they can be managed independently. 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 managed. A urinal could additionally be used. UDDT designs vary and include adaptations for different preferences, for instance with a third diversion for cleansing water management.

The UDDT configuration ensures that the faeces, cleansing water and/or dry cleansing materials, which when combined comprise a relatively thick brownwater, pass into a portable container. This is commonly referred to as a cartridge that is portable. Once a brownwater cartridge is full, it is removed/collected and transported to treatment using either motorized or manual transport. After dewatering and drying, the faeces can be used as a solid fuel or, more commonly, they are co-composted with organics and used as a soil conditioner.

Depending on the demand for urine end use and local requirements, the UDDT diverts the urine to the ground for infiltration through a soak pit. Alternatively, it can be directed into a portable container where it is stored. Stored urine can be collected and transported for use on neighbouring fields [2] using manual or motorized transport technologies, as indicated in the schematic.

Applicability

Suitability: This is a relatively new system typically implemented in dense, informal, urban locations and in emergency contexts, in particular, where there is limited space and/or soil conditions are not appropriate for the construction of underground pits and tanks; where there is a risk of surface flooding; where the water table is high; where there is no sewer network for users to connect to; or where tenants cannot afford the higher capital cost of other containment technologies.

Cost: The users often pay no capital or initial cost. Instead, they pay a weekly or monthly fee to the service provider for removal of full brownwater cartridges and urine cartridges (if any) and replacing them with clean, empty cartridges.

The treatment plant capital cost and operation and maintenance cost will depend on the technology chosen and the energy required to operate it. These costs can be significantly reduced where brownwater treatment can be combined into an existing plant; however, where a new dedicated plant is required then the costs could be considerable.

Overall, this system is most appropriate when there is a high willingness and ability to pay for the container-based service, where there is an appropriate facility for the brownwater treatment and a demand for the end use products.

Design considerations

Toilet and containment (cartridges): Container-based urine-diverting toilets are generally prefabricated, modular units that connect directly to the cartridges into which they discharge. They are often made from fibreglass or rigid plastics, which are relatively light in weight, portable, durable and easy to clean.

A separate system is required for stormwater and greywater, neither of which should enter into the cartridges. The toilets should be designed to prevent rain or stormwater from entering the cartridges.

This system is suitable for cleansing water inputs, and easily degradable dry cleansing materials can be used. However, rigid or non-degradable materials (e.g., leaves, rags) could block the system and should not be used. In cases when dry cleansing materials are separately collected from the toilets, they should be collected with solid waste and safely disposed of, for example through burial or incineration.

Conveyance: As the untreated brownwater is full of pathogens, human contact and direct agricultural application should be avoided. The (ideally) sealed containers should be transported to a dedicated treatment facility using either manual or motorized transport.

Treatment: Treatment of brownwater will produce both effluent and sludge, which may require further treatment prior to end use and/or disposal. For example, effluent produced from dewatering could be co-treated with wastewater in waste stabilization ponds or in constructed wetlands.

End use/disposal: Treated brownwater can either be used in agriculture as a soil conditioner or used as a solid fuel or as an additive to construction materials.

Operation and maintenance considerations

Toilet and containment (cartridge): The toilet, containment and conveyance steps are commonly operated by a private company (service provider) who is responsible for providing the user with a toilet, cartridge(s) and instructions on their operation and maintenance.

The user is responsible for cleaning the toilet and maintaining the toilet cubicle. At shared toilet facilities, a person (or persons) to clean the toilets and carry out other maintenance tasks (e.g. repairs to superstructure) on behalf of all users needs to be identified.

Conveyance: The provider's service will also include regular (either demand–based or fixed interval-based) replacement of a full brownwater cartridge with a clean, empty cartridge and the removal and transport of the full cartridge to treatment. Where urine is stored in a cartridge, the service may also include removal and transport of a full urine cartridge and replacement with an empty one. The service provider will be responsible for cleaning of all cartridges and maintenance of all transport equipment.

Treatment: Functioning, properly maintained treatment technologies are a key requirement. In most situations these are managed at the municipal or regional level. In the case of more local, small-scale systems, operation and maintenance of the collection and transport service and the treatment plant, is managed and organized by private service providers at the community level. All machinery, tools and equipment used in the treatment step will require regular maintenance by the relevant service provider.

End use/disposal: Farmers and the general public will be the main end users of the treatment products and will be responsible for maintenance of all tools and equipment they use [2].

Mechanisms for protecting public health

Toilet: The toilet separates the excreta from direct human contact, and squat-hole covers or lids can reduce disease transmission by preventing disease carrying vectors from entering and leaving the cartridges.

Containment (cartridges): The urine requires storage before use in sealed cartridges or direct discharge to the ground; both methods will protect public health when operated correctly [2].

The watertight cartridges isolate the brownwater from physical human contact and ensure surface waters and groundwater are not contaminated. The conveyance step then removes the pathogen containing brownwater from the neighbourhood or local community to a treatment plant.

Conveyance: To reduce the risk of exposure from spillages when moving and transporting full cartridges to treatment, all workers require personal protective equipment and must follow standard operating proce-

dures. For instance, the wearing of boots, gloves, masks and clothing that cover the whole body is essential, as well as washing facilities and good hygiene practices [2].

Treatment: In order to reduce the risk of exposure of the local community, all treatment plants must be securely fenced to prevent people entering the site, and to safeguard workers' health when operating the plant and carrying out maintenance to tools and equipment, all treatment plant workers must be trained in the correct use of all tools and equipment they operate, wear appropriate personal protective equipment and follow standard operating procedures [2].

End use/disposal: If correctly designed, constructed and operated, treatment technologies can be combined to reduce the pathogen hazard within the brownwater by removal, reduction or inactivation to a level appropriate for the intended end use and/or disposal practice. For example, the thick brownwater will require dewatering and drying followed by co-composting with organics before use as a compost-type soil conditioner, but for use as a solid fuel or building material additive, it will only require dewatering and drying [3, 4].

To protect the health of themselves, co-workers and the general public, end users must wear appropriate protective equipment and follow standard operating procedures in accordance with the actual level of treatment and end use [2].

References

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

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. World Health Organization (2015). *Sanitation Safety Planning – Manual for safe use and disposal of wastewater, greywater and excreta.* Geneva, Switzerland.

3. Strande L (2017). *Introduction to Faecal Sludge Management.* Online Course available at: www.sandec.ch/fsm_tools (accessed March 2017). Sandec: Department of Sanitation, Water and Solid Waste for Development Eawag: Swiss Federal Institute of Aquatic Science and Technology.

4. World Health Organization (2006). *WHO Guidelines for the safe use of wastewater, excreta and greywater. Volumes I to IV.* Geneva, Switzerland.