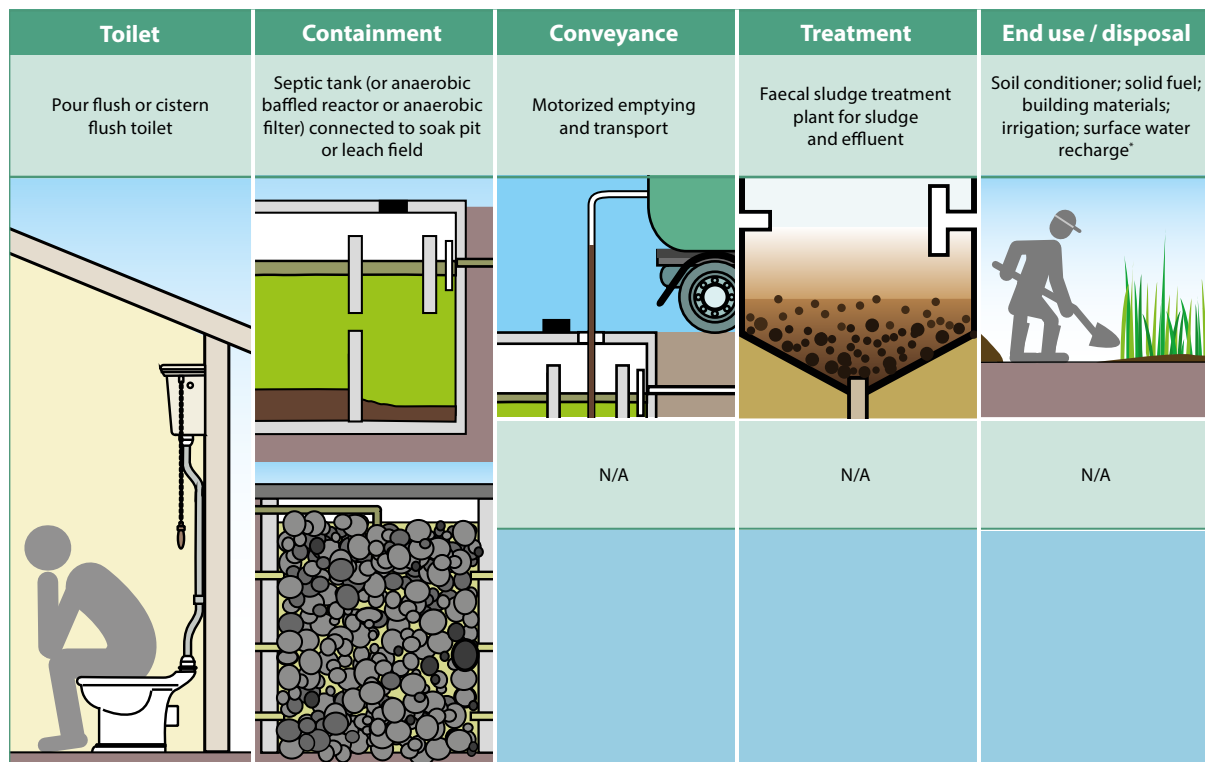


Fact sheet 7

Flush toilet with septic tank and effluent infiltration, and offsite faecal sludge treatment



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

Summary

This is a water-based system that requires a flush toilet and a containment technology that is appropriate for receiving large quantities of water. Inputs to the system can include faeces, urine, flushwater, cleansing water, dry cleansing materials and greywater.

Two toilet technologies can be used for this system: a pour flush toilet or a cistern flush toilet. A urinal could additionally be used. The toilet is directly connected to a containment technology for the blackwater generated: either a septic tank, an anaerobic baffled reactor (ABR), or an anaerobic filter may be used.

The anaerobic processes reduce the organic and pathogen load, but the effluent is still not suitable for direct use; instead, it can be directly diverted to the ground for disposal through a soak pit or a leach field.

The sludge that is generated from the containment technology is also not pathogen free and must be removed with caution and transported for further treatment, where it will produce both effluent and sludge. Depending on the end use, these fractions may require further treatment prior to end use and/or disposal.

Applicability

Suitability: This system is only appropriate in areas where desludging services are available and affordable and where there is an appropriate way to dispose of the sludge.

For the soak pit or leach field (the infiltration technologies) to work, there must be sufficient available space and the soil must have a suitable capacity to absorb the effluent. If this is not the case, refer to Fact sheet 9 (Flush toilet with septic tank, sewerage and offsite treatment of faecal sludge and effluent).

This system can be adapted for use in colder climates, even where there is ground frost.

The system requires a constant source of water for toilet flushing.

Cost: For the user, the capital investment for this system is considerable (excavation and installation of a septic tank and infiltration technology), but several households can share the costs if the system is designed for a larger number of users. The maintenance costs may be considerable, depending on the frequency and method of tank emptying^{2,3}.

The capital cost of the treatment plant may also be considerable, while the treatment plant maintenance costs will depend on the technology chosen and the energy required to operate it.

Design considerations

Toilet: The toilet should be made from concrete, fibre-glass, porcelain or stainless steel for ease of cleaning and designed to prevent stormwater from infiltrating or entering the pit ^{2,3}.

Containment (septic tank and soak pit): The septic tank is sealed and impermeable but the soak pit is permeable and designed to leach effluent into the surrounding soil. Therefore, the water table level and groundwater use should be taken into consideration in order to avoid contaminating drinking water. If groundwater is not used for drinking or alternative cost-effective sources can be used, then these options should be explored before assuming that groundwater contamination by the soak pit is a problem. Where groundwater is used for drinking and to prevent its contamination, the bottom of the soak pit should be at least 1.5m above the water table ³. In addition, the pit should be installed in areas located down gradient of drinking water sources, and at a minimum horizontal distance of 15m ⁴.

This water-based system is suitable for cleansing water inputs, and, since the solids are settled and digested onsite, easily degradable dry cleansing materials can also be used. However, rigid or non-degradable materials (e.g., leaves, rags) could clog the system and cause problems with emptying and, therefore, should not be used. In cases when dry cleansing materials are separately collected from the flush toilets, they should be collected with solid waste and safely disposed of, for example through burial or incineration. Greywater can be managed along with blackwater in the same containment technology; alternatively it can be managed separately.

Conveyance: As the untreated sludge is full of pathogens, human contact and direct agricultural application should be avoided. The emptied sludge should be transported to a dedicated sludge treatment facility. The conveyance technologies that can be used include both manual or motorized emptying and transport. In the event that a treatment facility is not easily accessible, the sludge can be discharged to a transfer station. From the transfer station it can then be transported to the treatment facility by a motorized transport technology.

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

End use/disposal: Options for the end use and/or disposal of the treated effluent include irrigation, fish ponds, floating plant ponds or discharge to a surface water body or to groundwater. Treated sludge can be used in agriculture as a soil conditioner, as a solid fuel or as an additive to construction materials ⁵.

Operation and maintenance considerations

Toilet and containment: The user is responsible for the construction of the toilet and the septic tank, but they are most likely to pay a mason to carry out the work. The user will be responsible for cleaning and repairs to the toilet, including the slab, seat/squatting plate and superstructure, and for employing an emptying service provider to empty the septic tank periodically ².

At shared facilities, a person (or persons) to clean and carry out maintenance tasks on behalf of all users needs to be identified as well as an emptying service provider.

Conveyance and treatment: The conveyance and treatment part of the system is typically operated and maintained by a combination of private and public service providers working together; for example, emptying and transport may be done by private and/or public service providers who deliver faecal sludge to treatment plants operated by public service providers. All plant, tools and equipment used in the conveyance and treatment steps will require regular maintenance by the relevant service providers.

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 ⁶.

Mechanisms for protecting public health

Toilet and containment (septic tank and soak pit): The toilet separates users from excreta and the septic tank isolates the blackwater and pathogens within it from physical human contact.

During rains, the toilet and the impermeable septic tank contain the fresh excreta and prevent it from being washed away into surface water bodies, while squat-hole covers or lids reduce disease transmission by preventing disease carrying vectors from entering and leaving the septic tank ^{2,3}.

The septic tank is impermeable but the permeable soak pit allows effluent to leach into the surrounding soil. Pathogens contained in the liquid are filtered out, adsorbed onto particles, or die off during their slow travel through soil ^{2,3}.

Conveyance: The conveyance step removes the pathogen hazard from the neighbourhood or local community to a treatment plant. Motorized emptying using vacuum trucks (or similar) fitted with long-reach hoses is the preferred method, as this reduces direct contact by emptiers with the sludge. Nevertheless, emptying and transport workers must wear personal protective equipment and must follow standard operating procedures. 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. The emptiers should not enter a septic tank but use long handled shovels to remove any hard to shift sludge at the bottom ⁶.

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. 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 ⁶.

End use/disposal: If correctly designed, constructed and operated, treatment technologies can be combined to reduce the pathogen hazard within the effluent or sludge by removal, reduction or inactivation to a level appropriate for the intended end use and/or disposal practice. For example, sludges 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, they only require dewatering and drying. Effluent will require stabilization and pathogen inactivation in a series of ponds or wetlands before use as crop irrigation water ^{5,7,8}.

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 ⁶.

References

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

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