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The WRC operates in terms of the Water Research Act (Act 34 of 1971) and its mandate is to support water research and development as well as the building of a sustainable water research capacity in South Africa.

TECHNICAL BRIEF

Water reuse

Greywater reuse for toilet flushing in high-density urban buildings in South Africa: A pilot study

A WRC-funded study investigated dual grey and drinking water reticulation systems for high-density urban buildings in South Africa.

Greywater

Greywater is wastewater from showers, baths, spas, hand wash basins, laundry tubs, and washing machines and may or may not include wastewater from dishwashers and kitchen sinks but definitely excludes toilet wastewater.

Source of renewable water

Water demand has traditionally been met with water from the best available sources, however, it has become evident that high quality water sources in many provinces (e.g. Western Cape, Northern Cape and Limpopo) are inadequate to meet demands, and that not all uses require the same water quality. Some water uses can be supplied with water of an inferior quality, which frees the high quality sources for higher quality uses.

Domestic toilet flushing consumes between 20-40% of domestic water demand and between 50-70% of commercial water demand. The replacement of high-quality water with greywater to meet toilet flushing is broadly encouraged by national government.

Greywater reuse for toilet flushing growing

In contrast to the reasons put forward for greywater reuse, some reasons against reuse include long payback periods, unpleasant odours, and negative perceptions. Despite these reasons against reuse, greywater reuse for toilet flushing (amongst other uses) continues to grow worldwide.

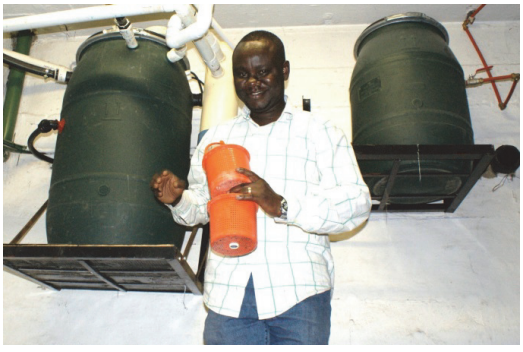
Internationally, greywater reuse for toilet flushing has been implemented (successfully or not) in several places. In South Africa, greywater reuse for toilet flushing has not been as popular as greywater irrigation.

Viability of greywater for toilet flushing

In South Africa, greywater reuse for toilet flushing has not been as popular as greywater irrigation. This is despite results from extensive surveys which recorded domestic respondents' preference for toilet flushing similar to irrigation. This study therefore attempted to answer the following question: *Given the increasing scarcity of high-quality water resources in many South African communities and the need for sustainable supplemental water resources for large quantity but lower quality water requirements (e.g. toilet flushing), how viable are greywater reuse systems for toilet flushing in high density urban buildings?*

Pilot plants

The pilot systems were installed in the Witwatersrand University (Wits) non-residential (public) and University of



Ola Olanrewaju of Wits University working on the pilot dual grey- and drinking water reticulation system.

Johannesburg (UJ) residential (private) buildings. The quality of treated greywater, and consequently beneficiaries' perceptions, is bound to vary due to the diverse range of locally available technologies employed for greywater reuse.

The low-technology, low-cost greywater reuse systems used in the study were easy to modify to suit site conditions and the systems required no specialised skill to conduct weekly maintenance.

Pro-active and regular community engagement, awareness and maintenance /repair interventions by implementing agencies and the effective functioning of these systems ensured that problems and/or discomforts experienced by the respondents (e.g. turbid/foamy greywater in the toilet bowls often forming an unsightly ring and unpleasant odours during flushing at certain times) and concern about hygiene sustained beneficiaries' confidence in greywater reuse for toilet flushing (or similar reuse interventions).

Cost analysis

The payback period at Wits was achieved 17 years after implementation while at UJ payback could not be achieved within the 20-year design life for the infrastructure. The payback at Wits resulted from larger savings in both potable water and sewage treatment due to greywater reuse for flushing two toilets, and the lower initial cost of the greywater system in comparison to UJ. Therefore, on the basis of users paying the full costs of the reuse systems and a preferred payback period of 8 years, the systems at Wits and UJ were economically unviable unless subsidies are provided.

Critical implemention issues identified:

- Develop (or adopt) and enforce regulations and/or guidelines for greywater reuse;
- Incorporate greywater reuse for toilet flushing into the design of new buildings;
- Do not take the technology for granted;
- Select a greywater treatment technology only after a broad scrutiny and clear understanding (on the part of both the implementing agency and beneficiaries) of available technologies, how they function, operation and maintenance requirements, and the expected greywater output quality. **There is no "*one size fits all*" greywater reuse technology;**
- If possible, only select greywater treatment technologies that have received local certification by e.g. SABS or JASWIC;
- Insist on a purchase and prolonged (e.g. 12 month) service agreement with the supplier/manufacturer of the greywater system;
- Budget for regular operation and maintenance, modification, and replacement costs when installing especially low-technology and low-cost greywater treatment systems;
- Aim to achieve payback within 8 years;
- Payback periods of more than 8 years will be unattractive to potential beneficiaries and decision-makers;
- Ensure greywater is collected from the correct sources within the building and that sufficient quantities of greywater for the intended use(s) can be collected;
- Aim for greywater quality that is visually similar to municipal potable water. If not possible, ensure there is regular monitoring and assurance of treated greywater quality and the monitoring of users' perceptions towards the quality;
- Ensure there is regular engagement and awareness with beneficiaries before and after implementation;
- Target young people; and
- Target non-residential buildings.

Further reading:
To obtain the report, *Greywater Reuse for Toilet Flushing in High-density Urban Buildings in South Africa: A Pilot Study* (**WRC Report No. 1821/1/11**) contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: orders@wrc.org.za or Visit: www.wrc.org.za to download a free copy.