NO FLASH IN THE PAN:

How pour flush toilets are driving away SA's sanitation backlog

Maluti Water

While the ventilated improved pit (VIP) toilet has become symbolic of basic sanitation in South Africa, with millions of these units being constructed all over the country in the last 20 years, it is the flush toilet that most South Africans aspire to. A new technology developed with funding from the Water Research Commission (WRC) aims to bridge this gap on the sanitation ladder while restoring dignity, privacy and safety to people who have been left behind in the drive towards basic services for all. Article by Lani van Vuuren.

In South Africa, waterborne sanitation is often perceived as a standard representing the equality and dignity to which people aspire – the top of the sanitation ladder. However, considering the cost of constructing such infrastructure for every person and the fact that South Africa is a water-scarce country, providing everyone with a flush toilet is neither attainable nor desirable.

So the humble VIP toilet has become the symbol of basic sanitation in South Africa. While it is certainly a step up from having no access to sanitation at all, imposing a 'one-size-fits-all' solution on households can cause people to reject the technology and thus be unwilling to take care of it.

Moreover, recent studies published by the WRC have highlighted the challenges associated with emptying of VIPs, and the safe disposal of sludge. Many pits ultimately have to be manually emptied – a job that is not only messy and unpleasant, but also dangerous, as sludge typically contains a range of infectious human pathogens.

It is estimated that over 70% of the approximately 2 million VIPs constructed in the last 15 years are now older than five years, and with municipalities reporting that 80% of VIPs require emptying after five to eight years, they may soon be faced with a situation where the gains achieved through basic sanitation delivery are reversed: if pits reach capacity and are not emptied, households will effectively revert to being without sanitation.

Partner in Development's (PID's) David Still is part of a wave of innovators bringing renewed attention to this oft neglected service. He explains the challenges of working in the sanitation sector: "A general problem is that engineers and planners mostly only think in terms of either full waterborne sanitation or VIPs, a kind of binary thinking," notes Still.

"Although both options have their place, they each have their drawbacks. The problem with full waterborne sanitation is that it is very expensive to build and maintain. When sewers or wastewater treatment plants are poorly maintained, as regrettably they too often are, the environmental impact is extremely significant."

On the other end of the scale VIPs, apart from not being as acceptable as waterborne sanitation politically, fill up after a period of time. Users also have the habit of using them for solid waste disposal, especially with the move towards disposable nappies, which makes pits fill up even faster, as well as harder to empty.

POUR FLUSH – A CLIMB UP THE LADDER

An alternative solution was required, says WRC Executive Manager for Water Use & Wastewater Management, Jay Bhagwan. "The WRC recognised the need for an on-site sanitation option which addresses the aspirations of many South Africans for a flush toilet while overcoming the logistical challenges involved with standard sewerage systems, and simultaneously working responsibly within the limits of the country's water resources."

The Commission turned its attention to pour flush toilets, a popular on-site sanitation option in Asian countries. Led by Still, a WRC project, initiated in 2009, investigated the possibility of adapting pour flush sanitation for use by South Africans. Bhagwan explains that a pour flush toilet can be viewed as a significant step up the sanitation ladder from VIPs.

Similar to a full flush toilet, with pour flush sanitation water is poured in by the user rather than coming from a cistern. The system uses significantly less water – only 1-2 litres rather than the 5-7 litres needed for conventional flush toilets. Since it is an on-site sanitation system, there is no complex sewerage and wastewater treatment network required making it much cheaper to install, operate and maintain.

Some changes had to be made to the pour flush toilets usually used in Asia – for one, South Africans prefer to sit rather than squat, so a pedestal had to be provided. The toilets also had to be able to handle anal cleansing material, such as toilet paper or newspaper.

Courtesy PID

***Above:** The poster created to demonstrate the use of the pour flush toilets to new users.*

***Below:** The prototype pour flush toilet during initial testing.*

The WRC-PID pour flush toilet is designed to be as simple as possible to avoid parts which can break or block. While looking very similar to a full flush toilet, there is no water tank, cistern, flusher or 'liquefier' (a problematic feature of certain low flush systems which were introduced to South Africa in the last 20 years). Since there is no plumbing no leaks are possible. The toilet is flushed by pouring one or two litres of water into the pan. The pan funnels steeply to a 70 mm-diameter outlet. Greywater can also be used for flushing.

The water seal works just like a regular flush toilet: water is trapped in the bend of the pipe sealing off

PID

PID

The pour flush toilet is similar to a conventional waterborne toilet, except that it does not have a cistern.

any smell from the pit coming back up into the toilet. After the water seal, the pipe continues straight to a leach pit. A significant advantage over a VIP toilet is the fact that users cannot use the toilet as a rubbish pit, leaving the resultant sludge essentially free from general household solid waste.

"One of our greatest considerations when funding this development was for a sanitation option that would be safe for women and children to use," notes Bhagwan. Since there is little smell, the pour flush toilet can be attached to or even located inside a household. Women and children no longer need to fear assault when having to go to the toilet at night. The pour flush toilet can also be used safely by little children – there is no risk of them falling in as with a VIP.

Rather than a conventional sewerage system, the pour flush toilet block is attached to two leach pits. When one leach pit becomes full, then a switch is made to the alternative pit. The full pit is allowed to dry out normally over a period of two to four years and then emptied, ready to be used again once the operational pit reaches its capacity. The leach pits are fully offset from the structure, making them easier to access for maintenance. Studies indicate that the pits have a lifespan of around five years before they need to be emptied.

After extensive testing, the first two toilets were installed in Pietermaritzburg in September 2010. They have been in operation since then without problems or blockages. Consequently, a further 20 household demonstration units were built as well as three toilets at a crèche. According to Still, all are working well. For the users of the technology it adequately addressed the wish for a flush toilet.

Moreover, the technology costs considerably less than installing a full flush toilet connected to a sewer or a standard septic tank. In addition, it is not dependent on piped water supply, and can be used even if the water supply is cut off occasionally, as a small amount of water is required and greywater can be used. It is also less complicated than a VIP in terms of installation.

FROM KWAZULU-NATAL TEST TRIALS TO THE WESTERN CAPE

In a follow-up project funded by the WRC and undertaken by Maluti GSM Consulting Engineers, the pour flush toilets were piloted in three high-density settlements in the Western Cape, namely in Klipheuwel informal settlement, Cape Town; the Klein Begin community, Grabouw; and Enkanini informal settlement, Stellenbosch. In the first community the pour flush toilets discharged into soak pits, while in the second community the toilets connected to a biodigestor. In Enkanini , the toilets were connected to the municipal sewer. This indicates the versatility of pour flush technology.

A total of 14 toilets were installed. Some of the toilets were for private household use, but in Klein Begin two toilets were constructed for a crèche, while the toilets in Enkanini were constructed for communal use. A significant amount of effort was involved in liaising with the community, partner organisations and municipal officials to explain the technology and receive community endorsement.

The project team reports that the homeowners benefiting from the project took great pride in their new toilets, with the units kept extremely clean throughout the monitoring period. Some neglect and misuse was reported at the communal units in Enkanini, however. Despite this, the toilets continued to work well, to the extent that Stellenbosch Municipality was considering incorporating pour flush into its standard specification for informal settlements.

FROM HOME TO SCHOOL

In order for the technology to work in an institutional setting, such as a school, the pour flush was converted to low flush technology – i.e. a small cistern was added so that users would not need to fill a bucket in order to flush. The low flush toilet developed still uses much less water than

Advantages of pour flush technology

- Unlike a pit latrine pour flush toilets can be built onto a house.
- Unlike conventional waterborne systems, pour and low flush sanitation use only a litre or two for flushing.
- These technologies are cheaper to build than full flush toilets with septic tank and soak pit.
- Because pour flush latrines are often flushed manually using a bucket, greywater can be used for flushing without the need for a piped recycling system.
- The water seal prevents smells and flies, as well as trash and solid waste entering the pits.
- Users cannot use the pit as a receptacle for domestic waste (unless they access the pit separately).
- Pits are smaller, so there is no need for deep excavations. This also allows for easier access and emptying.

an ordinary flush toilet – only around 2.5 litres, although the cistern introduced the risk of leakage. The prototype was piloted in two schools in the Durban area in partnership with eThekwini Municipality, namely Sizimesele Primary School and Thandaza High School.

Apart from drastically improving access to sanitation at the schools the provision of the new toilet blocks created an opportunity to educate teachers and learners about the transmission of disease and how it can be prevented, so motivating them to shift to new behaviours at the same time as the shift to a new sanitation system. Presentations were made at the schools on disease transmission and control as well as how to take care of the new sanitation system.

Still explains that a pour flush or low flush system addresses a number of needs, for example, it provides an on-site flush system which can be installed in many contexts, including rural or crowded communities where laying sewers is not an option. In addition, it provides a competitively priced alternative to the VIP.

ROLLOUT OF TIMBER FRAME SANITATION BLOCKS

Following the successful piloting of the low flush technology in the Durban schools, Still and his team have moved on to a new project for the WRC whereby the possibility of providing timber frame pour flush sanitation blocks for use in schools being tested. Constructing sanitation structures from timber opens up the possibility of a rapid response to the needs of schools facing a sanitation crisis.

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Toilet positions are discussions with residents of Enkanini informal settlement.

Safe sanitation for Africa – A Gates Foundation-WRC collaboration

The WRC, through funding from the Bill and Melinda Gates Foundation has established the Sanitation Research Fund for Africa (SRFA).

The fund is a direct result of the gap identified that Africa lags behind in terms of research and innovation (knowledge creation) due to the lack of dedicated sources of funding and support. The SRFA aims to stimulate local competency and capacity in the sanitation sector in the Eastern and Southern African Regions, and to provide solutions based on good scientific evidence related to up-scaling dry sanitation technologies.

To date, 12 research projects have been commissioned from the US$2.8 million fund.

The first focus area for the projects is pit latrines, used by the majority of Africans. Six research teams from Botswana, Ethiopia, Kenya, Malawi, Uganda and Zambia are evaluating the pit processes in peri-urban areas in their region to gain insight into the mechanisms occurring in pit latrines across a variety of conditions. By improving our scientific understanding of these on-site sanitation systems, they can be better managed.

A second research focus is developing innovative solutions for removing and treating faecal sludge while developing local capacity and competency for faecal sludge management. Six research teams from Malawi, South Africa, Uganda and Zimbabwe are exploring and piloting pit emptying and beneficiation routes for faecal sludge.

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Construction of the demonstration pour flush toilet in Klipheuwel.

Timber frame structures can be prefabricated off site and can also be moved at a later data if needs be.

An assessment was conducted by Mvula Trust of the water and sanitation infrastructure at six schools in the Vhumbedzi, Malamulele central and Lepelle circuits in Limpopo province. Timber frame sanitation blocks containing pour flush are now being constructed at these schools.

At the time of writing, construction was progressing steadily. The timber is being sourced from the Department of Environmental Affairs' invasive alien plant clearing programme.

Following construction, a trained health and hygiene educator will be appointed at each of the schools while the cleaning staff will be trained in how to effectively sanitise the ablution blocks while protecting themselves from diseases and harmful chemicals. In addition, the cleaning staff will be trained in how to remove blockages.

"If this project is successful, there may be extensive application for timber frame sanitation blocks in informal settlements where sanitation needs are critical, but authorities are opposed to interventions involving brick and mortar," notes Still.

The WRC-funded pour flush technology has considerable potential for commercialisation, more so following Durban plastics manufacturer Envirosan's investment into the project over the last two years. The company has invested over R2 million in producing an injection moulded plastic pedestal and P-trap that can function as either a low flush or pour flush toilet, and full production is expected by August this year.

Still's hope is that this technology will spread itself through its own logic, with affordable pour flush pedestals becoming available at local plumbing and building supply stores. "If pit emptying is neither affordable, desirable nor practical, VIP owners can simply close them up and retrofit pour flush with offset pits."

It is believed that this innovation can go a long way towards alleviating South Africa's persisting sanitation backlog.

- To access the related reports, *Piloting and testing the pour flush latrine technology for its applicability in South Africa* (**WRC Report No 1887/1/12**), *Developing a low flush latrine for application in public schools* (**WRC Report No. 2198/1/13**) and *Pour flush trials in the Western Cape* (**WRC Report No. KV 322/13**) contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565; Email: laniv@wrc.org.za or Visit: www.wrc.org.za to download a free copy. ❑