

## The role of the CSIR/WRC Sanitation Technology Demonstration Centre in creating awareness, sharing information and in decision-making regarding sanitation technologies

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Reference: BE14-PO-F

### Abstract

The CSIR is currently developing a Sanitation Technology Demonstration Centre on its Built Environment Innovation Site, Pretoria campus. The development of this Centre, a first in South Africa, was conceptualised and funded by the Water Research Commission (WRC) and implemented by CSIR Built Environment. The objective of the Sanitation Technology Demonstration Centre is to provide practical and visual information on various sanitation technologies in order to bring to light technologies that support sustainable human settlements. The Sanitation Technology Demonstration Centre presents a one-stop centre of full-scale examples of sanitation technologies. Existing and new sanitation technologies will be open for viewing by concerned stakeholders and the general public, possibly creating a better understanding, appreciation and acceptance of alternative technologies through an educational and awareness approach. The targeted stakeholders are communities, councillors, NGOs, technical professionals and other interested stakeholders.

The sanitation technologies exhibited will show different approaches to dealing with human waste such as composting, desiccation and digestion. The Centre also presents products of commercial manufacturers that purport to operate according to one or more of these principles. The selection process for the sanitation technologies included a desktop study, consultation with professionals in the field of sanitation and consideration of sanitation guidelines as published in the White Paper for Basic Household Sanitation (DWA, 2001) by the government of South Africa. The selected technologies therefore meet the requirements stipulated by the Department of Water and Environmental Affairs (DWA).

Sanitation technology demonstration will play an important role in assisting stakeholders in decision-making processes with regards to sanitation options and general design issues related to sustainable human settlements.

### 1. Introduction

The Sanitation Technology Demonstration Centre (hereafter referred to as the 'Centre') is funded by the WRC and implemented by the CSIR in order to provide a cutting-edge environment for bringing to light old and new sanitation technologies. This Centre is intended to support organisations and institutions that take part in the provision of sanitation services to obtain awareness and education on the principles of sanitation technology and to be better informed when making decisions regarding sanitation solutions for different contexts. Practices adopted in South Africa and around the world reinforce the perception that certain sanitation technologies are superior to others. For example, the concept of collecting domestic human waste in water-borne sewer systems, and discharging the treated effluent into surface water bodies, became the accepted norm in urban and peri-urban areas in South Africa. Although these conventional sewer systems effectively reduce sanitation-related diseases they are highly technical, and

thus unsuited for rural contexts. In addition to that they also aggravate the water scarcity problem in the country.

With current increased populations, changes in consumer habits and increasing pressure on potable water supply, the disposal of human waste through sewer systems is no longer able to meet the pressing needs of the South African government to provide adequate sanitation services. South Africa's commitment to global needs on alleviating environmental pollution is likely to be compromised if this situation continues (Innovation Insights, 2004).

Currently, it is a priority to for the government of South Africa to:

- Identify appropriate, simple, affordable decentralised sanitation systems and promote their adoption and acceptance
- Implement appropriate technologies with the participation of communities to be served, and
- Focus on health and hygiene education so that physical facilities would be properly used and maintained, and that hygienic behaviour would support the improvements brought about by the infrastructure.

(Innovation Insights, 2004).

Through a Centre, communities may be educated about new sanitation technologies and those sanitation technologies of which the potential has not been fully explored. The value of the social investment, through subsidies made by the government for basic sanitation services, may also be supported through a visual exposure of implementing agents to the various sanitation technologies as well as comprehensive documentation and information sharing. Gathering of information from the Centre by various role players should improve technical and institutional capacity to assess, introduce, and manage sanitation options when implemented while not ignoring the impact of such technologies on the environment.

This paper explores the roles of the Centre being constructed on the CSIR Built Environment Innovation Site (hereafter referred to as the 'site') at the CSIR Pretoria campus in creating awareness, sharing information and decision making regarding sanitation technologies. The Centre will present sanitation technology providers and users an open process to understanding comparable and accessible sanitation technologies with assistance of the personnel on site. Visits to the site should lead to overcoming the barriers to accessing proper sanitation through exposing, educating, and supplying information to all role players in the field of sanitation, and this is also discussed in this paper. In a bigger picture it is hoped that this Centre, by educating officials and decision makers in the field of sanitation, will play a role in the reduction of sanitation-related problems in the provision of sanitation services. Education will create awareness about alternative ways of providing sanitation services besides the conventional sewer systems.

The outputs of the Centre will include:

- Demonstration of various sanitation technologies suitable for implementation in different communities in South Africa
- Hands-on construction training of toilets e.g. the ventilated improved pit latrine (VIP) and some composting toilets
- An on-site stakeholders' and beneficiaries' workshop after the construction work is completed
- Guided tours of the site for visitors.

## **1.2 Background**

Historically, many reasons have led to the establishment of sanitation demonstration centres. For example, Sulabh Academy in India was established as a result of the problem of scavenging in India. It was initiated by Dr. Pathak who first modified and developed a technology of two-pit pourflush toilets popularly known as Sulabh Shauchalaya in an effort to find an alternative to scavenging (Ecosan-Services-Foundation, 2008). Today, Sulabh Academy has well established infrastructure to provide

training and demonstration on sanitation and related fields. The academy has a set of different models (of varying costs) of household toilets and other technologies, such as biogas from human waste, effective and sustainable treatment of biogas plant effluent, composting technology, wastewater treatment through duckweed etc. Currently, people from different backgrounds regularly visit the Sulabh Academy for on-site training and demonstration. (Sulabh International, 2010)

Through the inspiration of the Sulabh Academy and other demonstration centres such as the Philippine Centre for Water and Sanitation and the Ecosan Centre, the CSIR and the WRC Centre in South Africa is expected to be an effective way of spreading knowledge and improving understanding of sanitation technologies, including low-cost sanitation technology options. This Centre should be of relevance because of the country's diversity of language, culture and economic clusters that tend to determine the type of toilet suitable in any particular community.

The full range of sanitation technology options for providing adequate basic sanitation is a matter of interest due to the country's diverse climatic conditions and cultural norms. Limited understanding of the characteristics of the different sanitation technology options may affect acceptance of certain technologies in certain cultures. As a result there may be little appreciation of the long-term financial, environmental and institutional implications of operating and maintaining the various sanitation systems by the end-users. Currently, in some cases communities and local governments choose technical options that, in the long term, are unaffordable and/or unsustainable probably because of raised expectations by the political environment and lack of education on understanding sanitation in general. This has led to a disturbing increase in the number of poorly designed and poorly operated sanitation technologies across South Africa, in both rural and urban areas.

The Centre will house and accommodate examples of existing sanitation technologies, where they can be accessible to all interested people. The products on display will include examples of various sanitation technologies, such as composting, desiccation, digestion and some products by commercial manufacturers that purport to operate according to one or more of these principles. The Centre will afford stakeholders, including government representatives, an opportunity to acquaint themselves with the various sanitation systems available by visiting the Centre, as well as through training and workshops that will take place at the Centre in future.

## **2. Motivation**

Concerns regarding health, hygiene and environmental aspects of faecal sludge management and sewage disposal have been raised in South Africa, yet these concerns have often been given limited attention. Lack of proper management in water-borne sewer systems led to negative downstream effects of effluents from sewer systems. Increased operational problems, as reported in the Spot check assessments of water and sanitation services prepared by the CSIR and the Department of Water Affairs and Forestry (DWAF) in 2007, reduced the health improvements expected of these technologies (Council for Scientific and Industrial Research Institute (CSIR) and Department of Water Affairs and Forestry (DWAF), 2007). This initiative fits in well with the larger CSIR objectives for increased impact and relevance.

## **3 The development of the Sanitation Technology Demonstration Centre**

The WRC Sanitation Technology Demonstration Centre project commenced in 2008/09 and will be completed in 2010/11.

The first year of the project consisted of planning and preparation for the establishment of the Centre. This included a review of literature on various other centres dedicated to the demonstration of sanitation technologies internationally; the development of selection criteria for the selection of sanitation technology options to be constructed and the writing of a report.

The second year of the project consisted of the design and construction of the Centre and the development and preparation of material to be disseminated (i.e. pamphlets, brochures, etc.).

### 3.1 Background on the CSIR Built Environment Innovation site

The Centre is being constructed on the CSIR Built Environment Innovation Site (hereafter referred to as the 'site'). The site is approximately 2 hectares in size and is located south of the CSIR Pretoria campus east gate. The site has, for many years, been used as an area for researching and testing various building materials and methods to support the housing sector. Figure 1 shows a site plan, indicating (with a red dotted line) the location of the dry sanitation platform part of the Centre. Figure 2 shows an image of the site from the north-eastern view, with the red dotted line indicating where the Centre will be located.

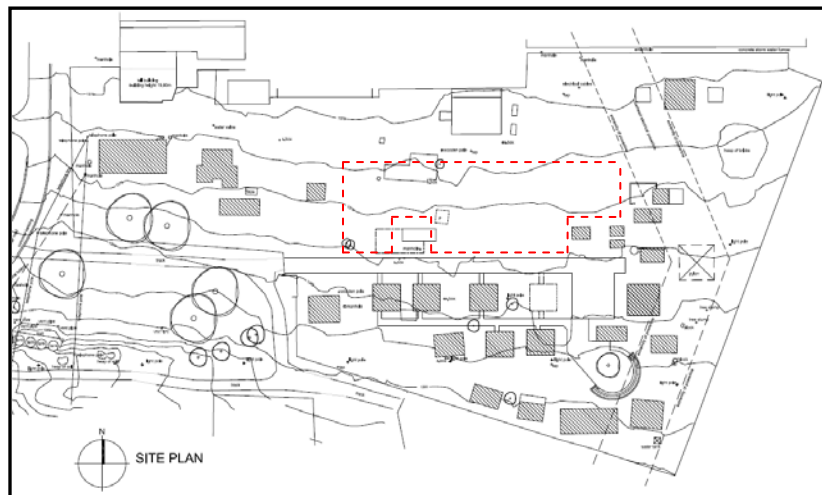


Figure 1 The general site plan of the CSIR Innovation Site (Drawing by Sebake, 2010)



Figure 2 North eastern view of the CSIR Innovation site (Photograph by CSIR, 2010)

### 3.2 Policy and design guidelines for developing sanitation technologies

All the sanitation technologies that will be exhibited on the site adhere to the following policy and design guidelines:

- (a) The national imperative: The South African government has set the targets of clearing the basic sanitation service backlog by 2014. Access to adequate, safe, appropriate and affordable sanitation

services is part of the vision guiding the National Strategic Framework for Water Services (DWAF, 2003) that underpins the national imperatives for the water sector (including sanitation) of the country.

The national imperatives include (i) Meeting the needs of the people, (ii) The nation's growth and development imperative, (iii) Statutory requirements, (iv) Health imperatives, (v) Gender mainstreaming, and (vi) Water for Growth and Development initiatives (CSIR and DWAF, 2007)

- (b) Policy context: The following water sector policies and regulations affect the provision of sanitation in the country; (i) Water Services Act 108 of 1997, (ii) White Paper on Basic Household Sanitation (2001), (iii) National Strategic Framework for Water Services (2003), and (iv) National Water Resources Strategy (2004) (CSIR and DWAF, 2007)
- (c) Minimum design standards and norms for sanitation technologies: Public funded projects must at least provide a basic level of service based on the Strategic Frameworks for Water Services (CSIR and DWAF, 2007).

In line with the policy and design guidelines, the Centre should therefore, present sanitation facilities that are safe, reliable, environmentally sound, easy to clean, provide privacy and protection against the weather, are well ventilated, keep smells to a minimum, prevent entry and exit of flies and other disease-carrying pests, enable safe and appropriate treatment and/or removal of human waste and are accompanied by appropriate health and hygiene education.

### 3.3 Designing and constructing the Sanitation Technology Demonstration Centre

The exhibitions of the sanitation technologies will range from posters to the physical construction of either the sanitation technology, including the substructure and the floor, or of a superstructure. These sanitation exhibits can be divided into three areas; namely, a general section, dry sanitation technologies and wet sanitation technologies.

These three areas are briefly described below:

3.3.1 The **general section** provides a platform for exhibiting posters and photos. The posters and photos in this section will display the effects of the lack of sanitation and incorrectly constructed sanitation facilities.

3.3.2 The **dry sanitation technologies platform** will display all the sanitation technologies that are used to dispose of human waste without the use of water as a carrier (Mema, 2009). Often, the end product is used as a fertilizer although, in most instances, it is disposed of or ignored. Recently, increasing international environmental concerns, especially water scarcity, have led to a number of countries considering using dry sanitation technology options as an alternative to conventional sanitation systems. Acceptability of these technologies is enhanced by low construction, operation and maintenance costs, as well as high environmental suitability (Mema, 2009).

Dry sanitation technologies are generally affordable technologies for both rich and poor (Jenssen et al., 2004 in Mema, 2009). They are also able to support both sanitation needs and food security, making them more suitable for developing countries that are struggling to ensure food security.

Dry sanitation technology options, including pit latrines, dehydrating toilets, urine diverting toilets and wet sanitation technologies, are classified according to their principles of operation as indicated below:

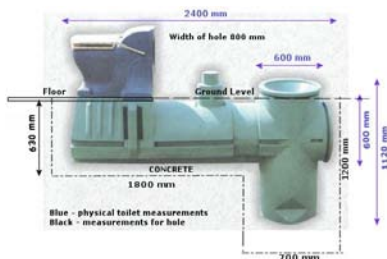
- Not all **pit latrines** consider human waste a valuable resource. In some cases pit latrines are just used to dispose of human waste e.g. the VIP latrine (Figure 3). Human waste from other pit

latrines, such as Fossa Alterna, may be used as compost. For the Centre, a **VIP sanitation technologies platform** has been constructed. This is divided into two parts; the first part exhibits the VIP sanitation technologies (e.g. the pit, lining and slabs over the pit) and the second part exhibits the superstructures that are constructed over the VIP sanitation technologies.



**Figure 3 Superstructures constructed from cement bricks, wattle and/or adobe (CSIR and DWAF, 2007)**

- Dehydrating toilets consider human excreta a valuable as garden compost. Faeces and urine are not separated at source but are separated through a dehydration process, which is achieved either by sieving the urine through the sieve plate and/or evaporation of urine from faeces through desiccation and/or circulating air. The resulting product is a dry compost of faeces. An example of these toilet systems would be the Ecosan system, shown in Figures 4a and 4b.



a.

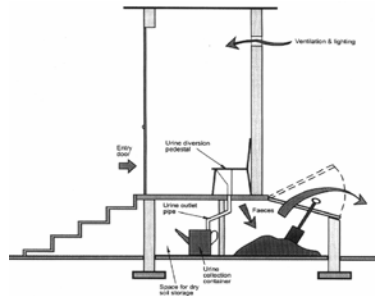


b.

**Figure 4 a. A general design of Ecosan system (EcoSan, 2003), b. Ecosan finished product (Photograph by CSIR, 2009)**

For the Sanitation Technology Demonstration Centre, an ecological sanitation technologies platform which includes urine diversion and composting toilets has been constructed. It is divided into two parts; the first part exhibits the ecological sanitation technologies and the second part exhibits the superstructures of ecological sanitation technologies.

The urine diversion toilet (Figure 5) separates urine and faeces at source. Both urine and faeces may be used in garden crop production. However, in some instances urine is disposed off in a soak-away while the faeces are buried in the earth. The most common system in South Africa is called the urine diversion (UD) toilet presented in Figure 5 below.



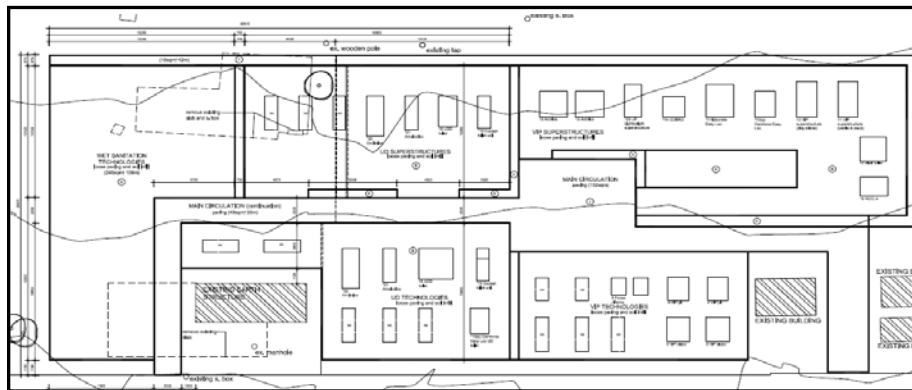
**Figure 5 A typical design of a standalone structure of a urine diversion toilet (Austin, 2006)**

3.3.3 The **wet sanitation technologies platform** exhibits wet sanitation technologies (e.g. septic tanks, pour flush toilet unit) which may generally be constructed within a building.

Wet sanitation technologies are all the sanitation technologies that require water to wash down faeces from the pedestal either to a septic tank or centralised treatment works. In decentralised treatment systems like septic tanks, the treatment of wastewater occurs at a localised treatment facility close to the source of waste generation. Due to environmental concerns, careful selection of a flush toilet system is required before this service is implemented in any community. The Sanitation Technology Demonstration Centre will play a role in the selection of suitable flush toilet systems as the variety of these systems and information about flush toilets will be available at the Centre.

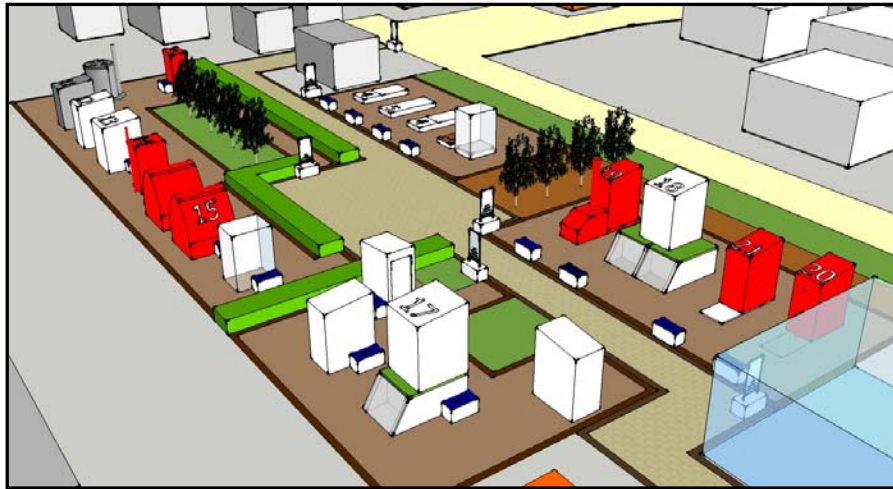
All the sanitation systems to be considered for use in South Africa must meet certain requirements, which are clearly stipulated in the White Paper for Basic Household Sanitation (DWA, 2001).

The platforms for the VIP, UD and wet sanitation technologies have each been divided into two parts in order to exhibit separately the substructure and the superstructure of each sanitation technology (see Figure 6 and Figure 7 below). The aim of this division is to enable a visitor to see a sanitation technology from a technology platform and look at the parallel superstructure platform to see the various types of superstructures that may be constructed with a specific technology.



**Figure 6 Layout plan of the Sanitation Technology Demonstration Centre (Drawing by Sebake, 2010)**





**Figure 7 Image showing the NW perspective of the initial design layout of the Sanitation Technology Demonstration Centre (Drawing by Sebake, 2010)**

Unfortunately, due to concerns regarding maintenance, none of the sanitation technologies displayed in the Centre will be operable – they are only exhibits.

CSIR Built Environment has been responsible for the construction of the common areas for the Centre, including the main circulation paths, the finish of each exhibit platform and the landscaping; see Figure 8 showing the north eastern view of the site.



**Figure 8 View of the Sanitation Technology Demonstration Centre under construction (Photograph taken by CSIR, 2010)**

The VIP, UD and wet sanitation technologies and superstructures to be displayed on the platforms described above have been designed and will be constructed by the CSIR or manufacturers of selected sanitation technologies who were invited and are willing to demonstrate their sanitation technologies at the Centre. All sanitation technologies that are or will be made available to the Centre have been and will be constructed according to the policy requirements outlined above.



## **5 The Intended impact of the Sanitation Technology Demonstration Centre**

The Centre is intended to have an impact on a variety of aspects in South Africa which include; (a) communicating information about sanitation technologies, and (b) providing a means for decision making regarding the selection of sanitation technology options for implementation in South Africa.

### **5.1 Communication**

To encourage a process of communicating with communities, fact sheets and brochures describing the Centre, the three platforms and the individual exhibits will be provided. In addition to this, a website will be developed.

Opportunities will be made available for communities to visit the site, in the form of tour groups, including government officials, municipal authorities, learners and students.

### **5.2 Decision making**

Government and other decision makers are faced with a vast number of problems and challenges, including water pollution and sanitation-related disease outbreaks. In the provision of sanitation services, the correct decision can make the difference between life and death. The potential of the Centre includes the ability to establish contact between research and decision-making processes. The Centre will create a platform to transmit information to decision-making bodies including politicians about relevant sanitation technologies and delivery process to be undertaken within the service delivery process.

## **6 Conclusion**

The knowledge transferred at the Centre about various sanitation technologies is important in the decision-making processes regarding provision of adequate sanitation services to communities. Information-sharing by the Centre will enable stakeholders to choose technologies that can be understood and maintained by the users with minimal effort. When the information is passed on to rural communities, it will enable authorities, decision makers and rural communities to settle for a technology option best suited for the community and its environment. This process will ensure that their technology choice considers the fact that rural communities do not have enough resources to spend on maintaining their toilets. However, options are also available for users not facing severe financial limitations.

Provision of information through fact sheets, brochures and the web page may be an effective way of creating awareness and assisting in decision-making processes. An informed decision-making process will in turn assist in the provision of sustainable sanitation to the communities of South Africa. On the other hand, communities could become more receptive to alternative technologies because of their improved understanding of the various sanitation technologies.

In the housing sector, the intended impact of the Centre is to improve the sanitation technology choice in the design and construction of houses. Decision makers in the housing sector will be exposed to various sanitation technologies, besides waterborne sanitation, that are suitable for inclusion in the design of the house. If communities are well informed about these sanitation technologies it should not be a challenge to convince them to accept new sanitation technology models as part of their houses.

## **7 Acknowledgements**

The authors would like to acknowledge the contribution of Dr Aussie Austin, Louiza Duncker and Tinus Kruger. It was through the efforts of Dr Austin and Louiza Duncker that this project came to be. Tinus and Louiza also assisted in the editing of this paper and provided important information.

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