

## EXECUTIVE SUMMARY

The objective of this project was to establish sludge build up rates in various on-site sanitation systems under South African conditions. The sludge build up rate is an important design criterion in sizing on-site sanitation systems, for example septic tanks, pit latrines, etc. Comparison of data obtained on various other projects carried out by CSIR Building and Construction Technology (Boutek), indicated that the design criteria currently in use in South Africa were generally inappropriate because they are based largely on experience in other countries. There are many factors affecting the performance of on-site sanitation systems which have not been sufficiently quantified. Climatic and socio-economic factors, for instance, play a major role in the rate of sludge build up, and these differ from country to country. It is not satisfactory, therefore, to simply apply design criteria applicable to other countries. Furthermore, claims by commercial manufacturers of on-site sanitation systems about the design life of their products needed appraisal.

The project commenced with a literature survey which yielded mainly information concerning septic tanks. Less data on pit latrines was available. Factors considered to affect the rate of sludge build up were generally considered to be the number of users, anal cleansing materials used, diet, soil conditions, seasonal effects (temperature, moisture, etc), retention time, influent characteristics and toilet cleaning materials.

Boutek designed a perspex sampling tube which enabled a core to be taken of septic tank and digester contents, from which the depth of sludge could be directly measured and the clarity of the liquid layer established. The contents of VIP latrines were measured by lowering a steel tape with a weight into the pit and measuring the average depth from the toilet seat to the sludge.

The project measured the sludge build up rate in VIP latrines at Constantia Park and Soshanguve (Pretoria), septic tanks at Marselle (Eastern Cape) and Warden (Free State) as well as two kinds of "Loflo" digesters at Umbumbulu (Durban) and Ivory Park (Midrand). Various problems which affected the capture of data were experienced during the monitoring programme; these mostly concerned aspects such as tank emptying routines, reliable information on the number of users, the improper emptying of tanks, as well as political instability. Despite these problems, however, sufficient information was obtained for the purpose of establishing acceptable design guidelines.

The research enabled the following predictions for average sludge build up rates to be recommended:

- VIP latrines: 0.07 litres/person/day
- Septic tanks and "Loflo" systems: 0.08 litres/person/day

It was furthermore possible to suggest that provision for scum accumulation is not necessary. Outlet T-pieces are, however, essential items of equipment.

The research also yielded some important aspects on which recommendations could be made:

- User education is of crucial importance in order to ensure correct operation and maintenance of sanitation systems;
- correct installation of sanitation systems should be enforced by quality control on site;
- tanks connected to Loflo systems should have a minimum volume of 1 000 litres, while tanks receiving sullage in addition to toilet wastes should be at least 1 750 litres; and
- pits for VIP toilets should be as large as possible in order to reduce desludging frequencies, given site and cost constraints.

It is also recommended that further research be conducted into the optimum size for Loflo sanitation systems, as it is suspected that 1 000 litres may be inadequate. Additionally, there is an urgent need for research and information dissemination on low-maintenance sanitation systems, as many local authorities have insufficient funds to carry out maintenance tasks properly.

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## **PROJECT TEAM**

The following staff from CSIR Building and Construction Technology contributed to this project:

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