

EXECUTIVE SUMMARY

Introduction

This literature review forms part of the Water Research Commission project number K5/1439 entitled "Strategy for the furtherance of knowledge and good practice of ecological sanitation (ecosan) technology in South Africa". The aims of this research project are as follows:

- 1.1.1 To establish the current "state of the art" in ecological sanitation by means of a literature review.
- 1.1.2 To determine:
 - (a) the nature of processes taking place in the vault of a urine-diversion (UD) toilet; and
 - (b) the relevant pathogen destruction parameters in order to increase understanding of the health aspects of toilet operation and maintenance (O&M), as well as safety criteria for re-use of the processed excreta.
- 1.1.3 To explore appropriate practices for faeces collection and disposal, in order to facilitate the abovementioned safe O&M of the toilets.
- 1.1.4 To produce a research report and design/O&M recommendations, aimed at improving the future implementation of urine-diversion sanitation projects.

This literature review represents the results of the aim 1.1.1 above. The review begins with a general overview of the South African sanitation experience, with specific reference to on-site technologies and the relationship between sanitation, the environment and public health. Design and management practices for UD toilets are then investigated, with examples from both South Africa and abroad. This is followed by a review of perceptions and experiences of UD toilet users around the world in order to establish how they are affected by design, implementation practices or other factors.

Agricultural and horticultural practices that re-use human excreta are examined, with experiences from various countries being described. This is followed by a review of the health aspects of UD toilets, with particular attention being paid to the re-use of urine and processed faeces in food gardens.

General conclusions from the literature review

The final section of the literature review summarises the pertinent issues concerning ecosan and indicates what matters remain unresolved. This is followed by an assessment of how the review should influence and guide present research activities.

There is a vast amount of literature on pollution of water resources, particularly on problems caused by inadequate sanitation provision or, where sanitation exists, by poor implementation practices, operation and maintenance. An increasing awareness worldwide of the environmental problems associated with inappropriate sanitation implementation has led to the development of ecological sanitation technology. This

technology is not really new, being rather a refinement of an ancient practice. It has been promoted for environmental reasons, as well as for issues such as water conservation, recycling of nutrients to arable land, easy operation, negligible maintenance costs, dignity and convenience. Ecosan represents a conceptual shift in the relationship between people and nature. It has been implemented successfully in many countries and regions in various stages of development, and among communities of different socio-economic strata, religions, cultures and practices.

Some handling, at household level, of urine and faeces is required. The people that plan, design and build the toilets need to fully understand the basic principles involved and how they relate to local conditions, otherwise inappropriate selection of options may be made. Appropriate social interventions in the form of promotion, support, education and training are also prerequisites for successful implementation.

Human excreta are usually easier to handle when urine and faeces are kept separate, as in urine-diversion toilets. Urine may be handled in various ways, and guidelines exist for hygienic storage and agricultural use of urine.

Faeces need to be sanitised as far as possible within the toilet vaults in order to facilitate safe removal and further handling, especially where their re-use as a soil conditioner is required. Various methods can be employed to ensure this, including the use of additives such as ash, lime, sawdust, dry soil, etc, as well as the judicious use of heat-absorbent building materials, ventilation, moisture control and storage.

Human excreta, especially urine, are excellent fertilisers and soil amendments, and their efficacy has been proved in many countries, under a variety of climatic conditions. Many researchers and practitioners view ecosan as a means of returning essential nutrients such as nitrogen, phosphorus, potassium, etc. to the lands where the consumed crops were grown and harvested. As such, excreta should be regarded as a valuable resource, not simply as a waste product destined merely for disposal.

Poor handling practices may result in infection from faeces, and it is therefore essential that persons emptying the vaults and disposing of the products exercise the necessary caution. Adequate education and hygiene awareness campaigns in communities receiving ecosan toilets are therefore a prerequisite for the maintenance of public health.

Despite the vast amount of research that has been carried out on inactivation of faecal pathogens in ecosan toilets, differences of opinion still remain on the minimum storage periods and storage conditions required to ensure safety for handling and re-use. Further research is required in order to establish practical guidelines on the best designs and management methods for achieving these conditions in the vaults, which can be used with confidence in all types of settings.

Ecosan problems and challenges

The literature review indicates that ecological sanitation is firmly established as an accepted technology in many countries. There are, in most cases, no socio-economic barriers to its continuing implementation, as people of all income groups, in both developed and developing countries, have installed ecosan toilets in their homes. Also, farmers of all types, rich and poor, are successfully using human excreta in their fields and food gardens to benefit the soil and enhance crop production.

One of the major challenges of ecosan technology is to find ways of reducing the health risks attached to handling of faeces. Innovative solutions need to be found. Improved building methods and materials that encourage higher temperatures in the faecal piles should be developed. Environmentally friendly additives that enhance pathogen destruction could, if suitably priced and promoted, find a ready market in areas where electrification has replaced the need for cooking fires, or in more urbanised communities where ash may not be readily available.

Aside from the health risk, handling of excreta, especially faeces, remains a social taboo in some communities. If ways can be found to treat the faeces inside the vault such that the end product does not resemble the original material any more, it may be possible to increase the general perception and acceptance of ecosan technology. This treatment should also include the easy disposal of anal cleansing material.

In developing countries where there is a growing interest in the technology, better quality pedestals need to be introduced and actively marketed. If ecosan is going to be promoted as a superior sanitation technology, then superior fittings should be available. Good quality ceramic products will help create the perception of ecosan as an upmarket system. This is of particular importance in South Africa, where dry systems are often regarded as second class.

Implementation practices for ecosan projects presently suffer from the same shortcomings as conventional sanitation projects, in that the approaches used, coordination between implementing agencies, skills building, training, hygiene awareness, etc are often not given sufficient attention. Local authorities need to thoroughly understand the needs and interests of their communities before making investment plans, otherwise the services provided will often be inappropriate. The operation and maintenance of urine-diversion toilets, especially, is a crucial issue, and it is thus essential that proper training programmes be provided in order to ensure project sustainability.

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