ABSTRACT

This thesis presents a scientifically based approach into the management of ventilated improved pit latrine sludge before and when the pit becomes full. The purpose of this study was to investigate processes within VIP latrines in order to understand the nature of sludge that is dug out of pits and thus be able to propose suitable disposal options for the sludge.

The components of this research work includes; an investigation into sludge accumulation rates in ventilated improved pit latrines, the characterization of ventilated improved pit latrine sludge collected at different locations within the pit, investigation into the entrenchment of ventilated improved pit latrines sludge for agroforestry and the efficacy of commercial pit latrine additives on ventilated improved pit latrine sludge content. Three hypotheses were proposed: that (i) significant biological stabilization occurs in a pit latrine with time, such that further biological treatment of sludge dug out of pits is not appropriate, (ii) VIP latrine sludge can be used in deep row entrenchment for agroforestry since the sludge contains nutrients that are available to plants, and that the sludge is sufficiently stable to not cause a negative environmental impact; and (iii) through biological action of microorganisms present in pit latrine additives (biological products), the overall mass of pit latrine contents could be reduced much faster than could be achieved by natural degradative processes mediated by microorganisms already available in the pit latrine contents

The main findings of this research work were:

- The overall average sludge accumulation rate obtained in this research work was 31 ± 10 ℓ/person·year. By comparing this value with an estimated volume of material (600 ℓ/person·year or more) added to the pit by an individual, indicates that only 5 % of the materials added to the pit by an individual per year eventually accumulate as sludge and out of this 5 % only 1 % of the estimated solids volume accumulates as sludge. This

clearly suggests that significant biological stabilization must have occurred in the pit latrines investigated with time.

- Laboratory characterization of collected sludge from various pit latrines indicated that, characteristics of sludge varied significantly within a pit and between different pits. It was observed that below the surface layer in a pit additional stabilization of sludge content does exist and the degree of stabilization within a pit increases from the surface layer of the pit down through the bottom layer of the pit. It was also found that the material buried well below the pit surface, to be specific sludge samples from the bottom of the pit are well stabilized.
- Unlike the disposal of VIP latrine sludge into wastewater treatment works or anaerobic digestion of VIP latrine sludge, deep row entrenchment of VIP latrine sludge for agroforestry was found to be a feasible and potentially beneficial disposal and/or reuse option for VIP latrine sludge.
- Neither laboratory trials nor field trials provided any evidence that the use of pit additives can significantly reduce the rate at which sludge accumulates in VIP latrines or reduces the volume of sludge in the pits.

It was concluded that the sludge content in pit latrines have naturally undergone significant degradation, this challenges the common assumption that pit latrines act only as storage vessels for faecal waste in which no biodegradation takes place. Consequently the option for the disposal of pit latrine sludge are limited by the characteristics of the sludge, thus based on the characteristics of pit latrine sludge obtained in this study further biological treatment of sludge dug out of pits is not appropriate; Rather deep row entrenchment of VIP latrine sludge for agroforestry seems to be an appropriate option for the disposal of VIP latrine sludge.