Physico-Chemical Properties of Faecal Sludge from Dry and Wet Pit Latrines

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Introduction

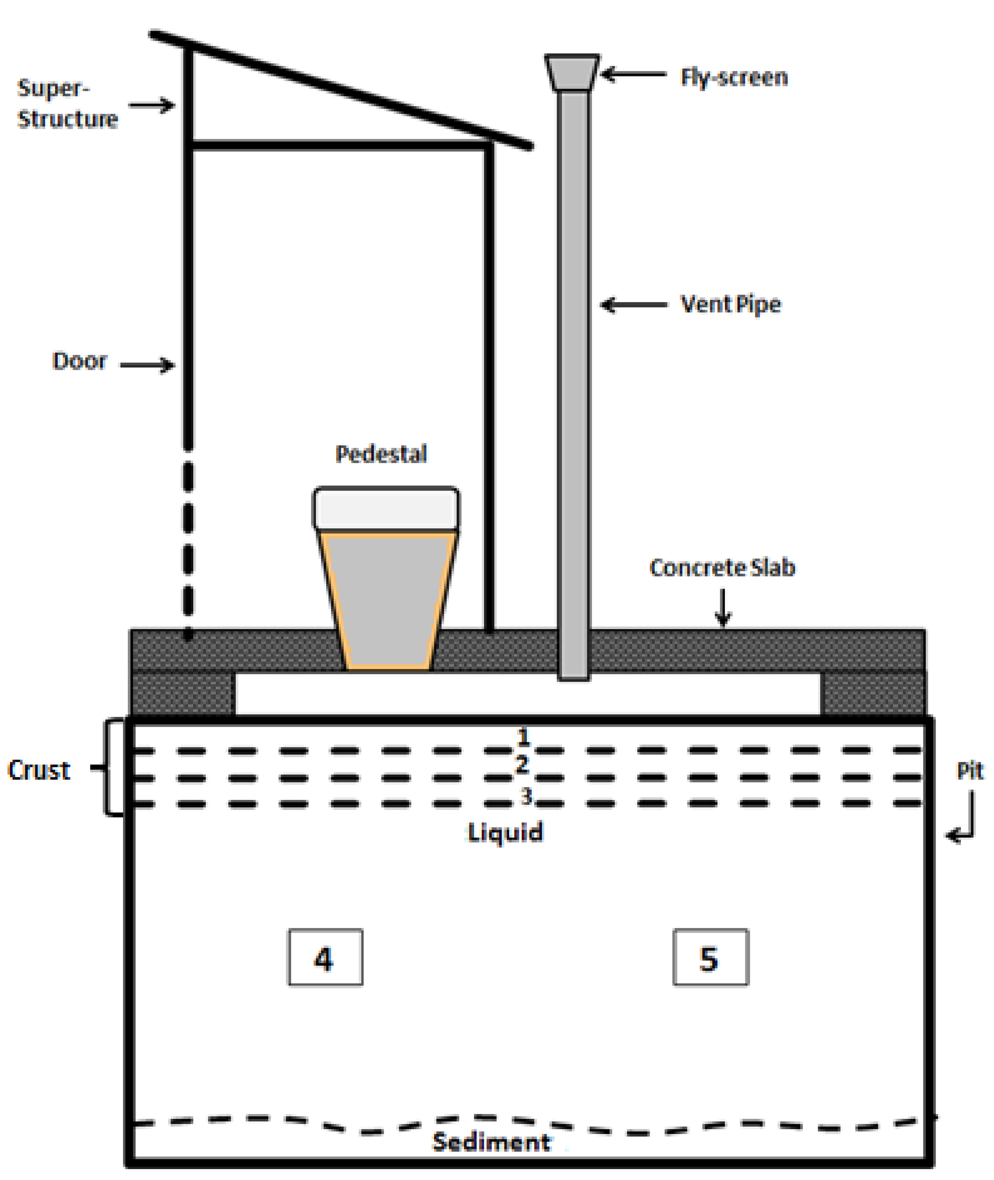
According to UNICEF (2012), approximately 37% of the worlds developing population do not have access to improved sanitation facilities. In order to improve these facilities, including; collection, transportation, treatment and disposal of faecal sludge, a profound knowledge of its physico-chemical properties is needed. The aim of this research was to obtain data from a variety of wet and dry ventilated pit latrines at different stages of decomposition. This data will then be used by design engineers to help propose innovations for the management of on-site sanitation sludge. Samples were collected by manually emptying ventilated improved pits (VIP) from various areas with the Durban eThekweni region and analysed in terms of chemical composition, water content, biodegradability, settling properties and nutrient content. The depth layers of sludge in the pit differ by age and have varying properties; this is related with the degree of stabilisation in the pit with time.

Objectives

- Undertaking the comparative study of properties for wet and dry ventilated improved pit latrines, in the Durban eThekwini region.
- Obtain a baseline for wet and dry VIP's in the eThekwini area

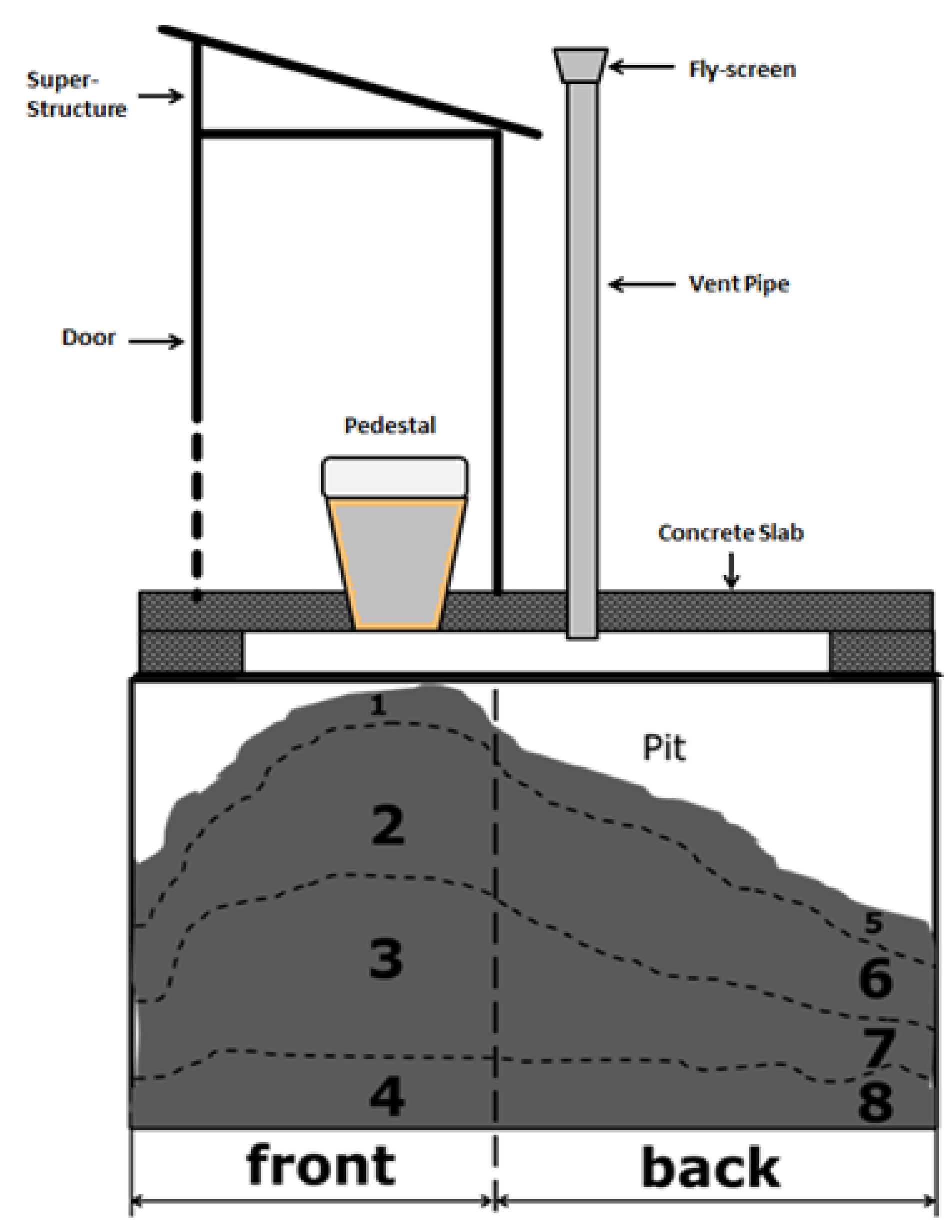
Materials and Methods

Faecal sludge samples were selected from various wet and dry VIP latrines during manual pit emptying using shovels and long-handle forks. A vacuum tanker was occasionally used to extract the liquid from the wet VIPs after the solids had been removed. The selected Samples were analysed in the Pollution Research Group laboratories according to APHA (1998) standards, including: Moisture content, Volatile solids, Total solids, Suspended solids, Ash, TKN, Ammonia, COD, pH,, Nitrates, Nitrites, Potassium, Orthophosphates, Total phosphates, TOC, Calorific value, Thermal conductivity, Plastic and liquid limits, Rheological properties, Density, Sludge volume index and Parasite content. Some of the data of these tests are graphically presented in the results section.



WET VIP

Figure 1: Diagrams of Wet VIP latrines showing how samples were selected.



DRY VIP

Figure 2: Diagrams of Dry VIP latrines showing how samples were selected

Results

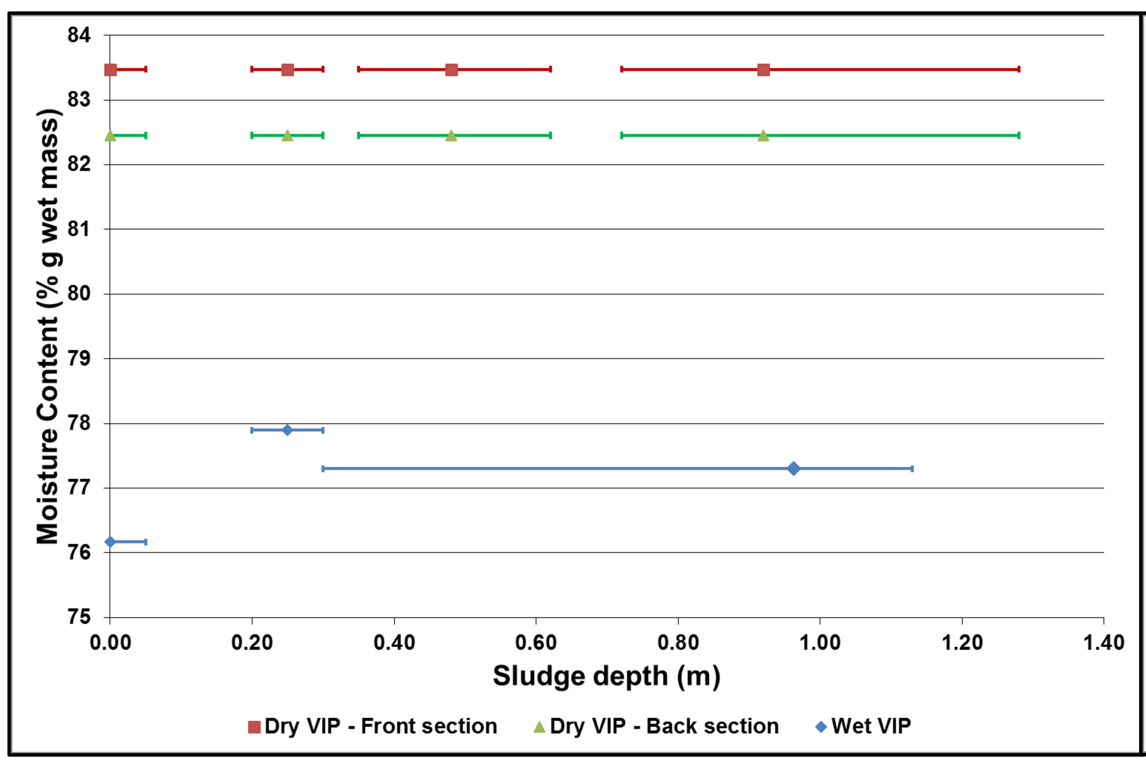


Figure 4: Moisture Content for VIP's

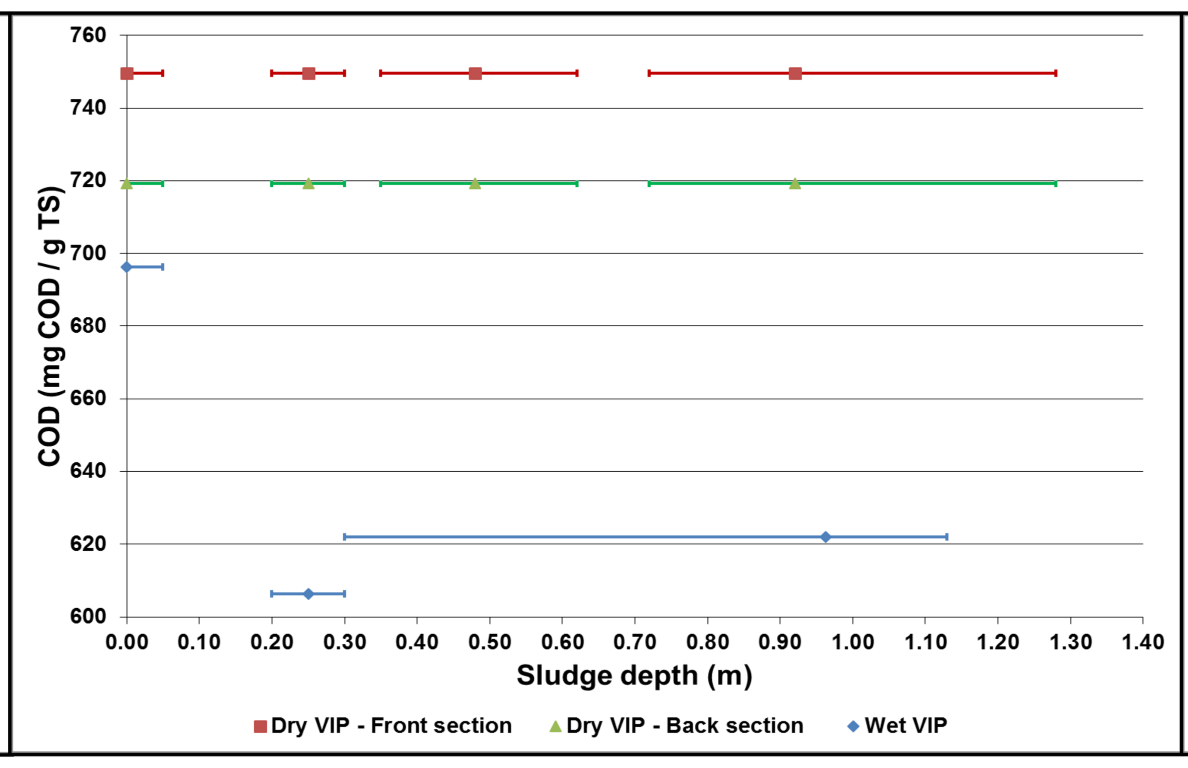


Figure 5: COD for VIP's

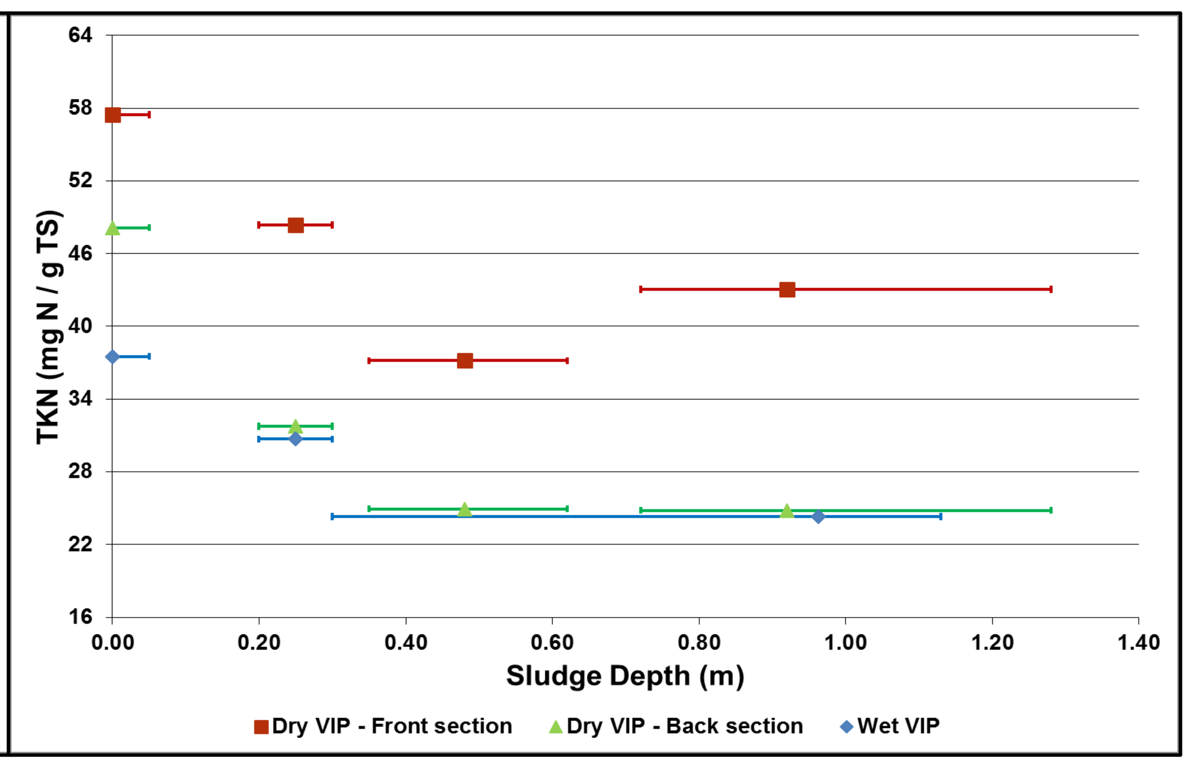


Figure 6: TKN for VIP's

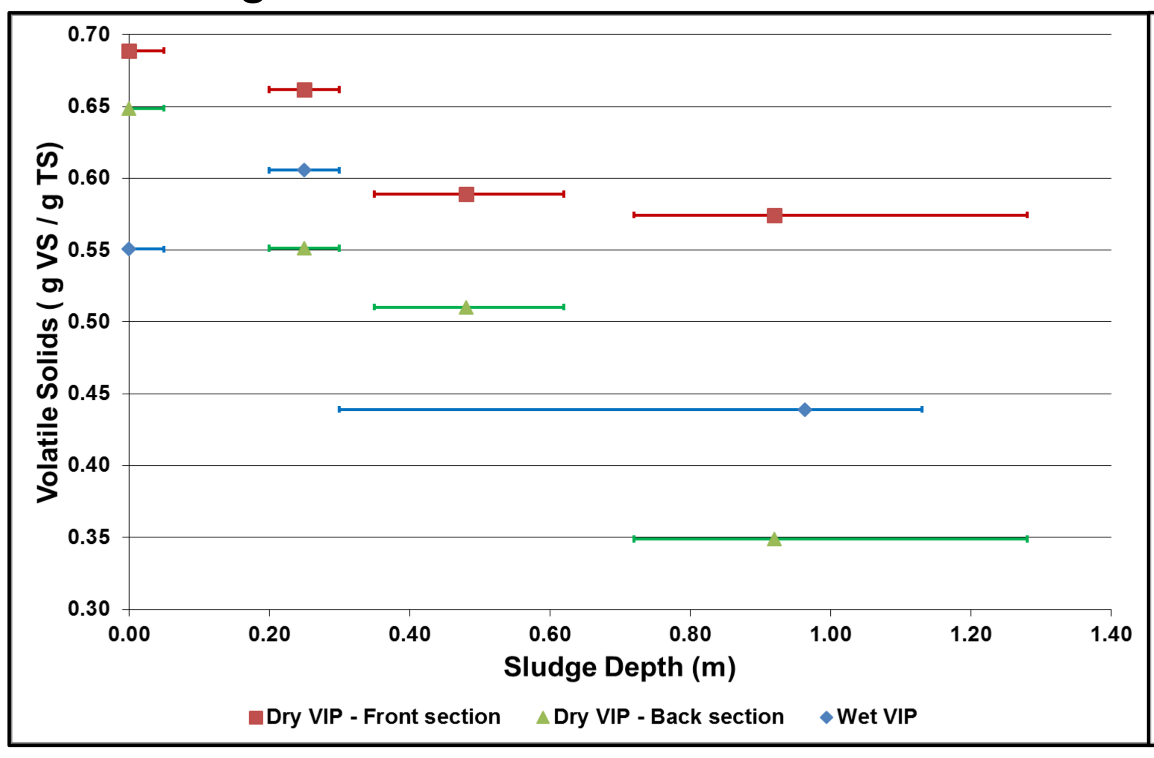


Figure 7: Volatile Solids for VIP's

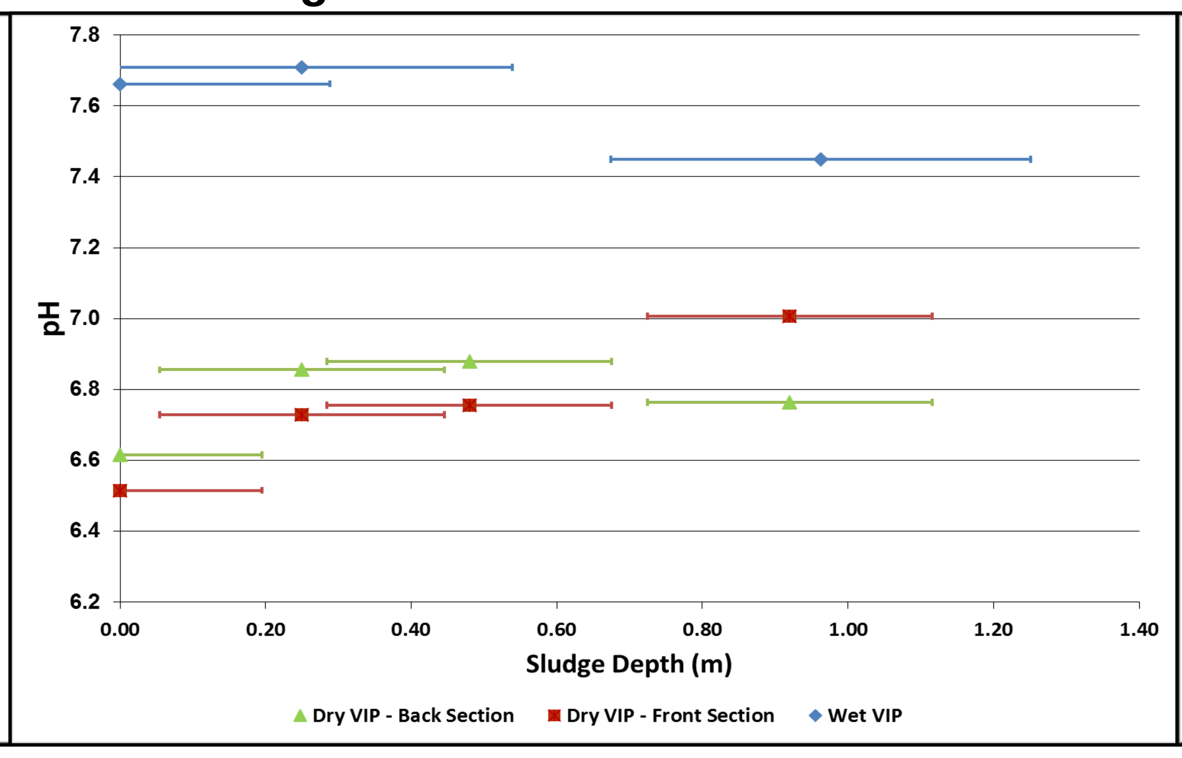


Figure 8: pH for VIP's

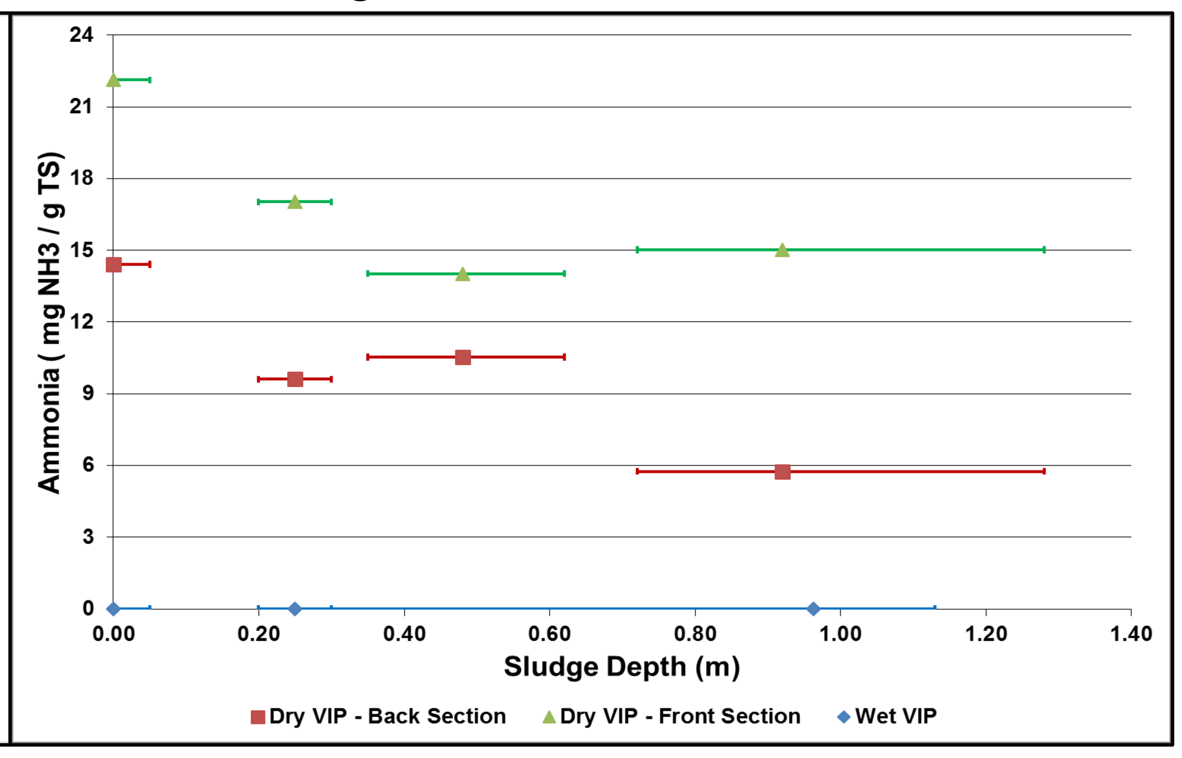


Figure 9: Ammonia for VIP's

Conclusions

- The degree of degradation within the dry pits increase with distance from the drop hole both horizontally and vertically.
- The front and back sections of the dry pits showed a tendency of a decrease in physico-chemical properties with depth.
- The wet ventilated pit latrines do not show any clear trend however three distinct regions were observed: crust of sludge (top layer), liquid (middle layer) and sediment (bottom layer).
- The most distinct difference between the dry and wet pits was expectedly found to be moisture content, however the wet VIP's moisture content had a wider range than the dry VIP's.

Acknowledgements: The Pollution Research Group would like to thank The Bill & Melinda Gates Foundation for the funding of this project.