EXECUTIVE SUMMARY

Household treatment systems are used to improve the microbiological quality and safety of drinking water in communities where there is no safe treated water supply or the water supply system has been compromised. The most appropriate household system or technology to use will depend on the quality of the raw water source, the availability of the required materials and equipment, the time frame in which it is to be used, the culture and customs of the community and households with their preferences, the educational level of the local population or household members and the availability of adequate training and monitoring on the sustainability for the technology to be successfully implemented. Several research studies has been published on household water treatment and safe storage (HWTSS) which discuss methods for medium to long-term use as well as some methods which are suitable in emergencies. The majority of these technologies have shown to significantly improve the microbiological quality of water. The most promising and accessible HWTSS technologies are believed to be filtration with ceramic pot filters, chlorination with storage in an improved container, solar disinfection in clear bottles by the combined action of UV radiation and heat, thermal disinfection (pasteurization) in opaque vessels heated in solar cookers and combination systems employing chemical coagulation-flocculation, sedimentation, filtration and chlorination.

The ceramic pot water filter was originally designed in 1981 to be as affordable as possible and to be manufactured at a community level, thus empowering the “poorest of the poor” to provide their own potable water in areas where safe drinking water is a problem. In 1998, Potters for Peace, an American based non-profit organisation that is devoted to socially responsible development, began assisting in the worldwide production of the ceramic pot water filter.

The exact ceramic pot water filter which has been used in this study was the Filtron (Potpaz) water filter manufactured by the company Ceramica Tamakloe situated in Ghana. The majority of research which has been conducted and published to date regarding the Potpaz ceramic pot water filter has been linked to the efficiency of the ceramic pot filters with regard to flow rate and how effectively water gets treated on a microbiological scale. The Potpaz ceramic pot filter has already proven to be successful in this regard. However, the Potpaz ceramic pot filter is far from optimal in terms of its usability. **Usability** relates to design considerations for the height of the purifier placement as the rural households have lack of surfaces within their cooking areas, tap height (if purifier stands on the floor, the tap is

inaccessible), operation of the tap, access to the lid, and filling of the new filter. Therefore the design should be inclusive; it should be understood and operated by as many people as possible, from small children to the elderly. It is of great importance as convenience of use will likely ensure a greater chance of habitual use of the improved water purifier. If use of the water purifier proves to be inconvenient for the users, or requires more effort than the user is willing to give, the water purifier may be rejected with the user reverting to consuming unfiltered water.

Another problem lies in the **affordability** of ceramic pot water filters if households are to purchase the units for themselves. Generally, rural households have a very low income. The average income of households within the rural areas of South Africa is below the breadline, being R1 200 per month. The water filter must therefore suit the incomes of these households. Consequently, for water filters to be **accessible** to the households within rural areas, the units would need to be available at the local *spaza* shops where the rural people go to purchase items for household use. The ceramic pot water filter therefore needs to be easily transported from the manufacturer to the *spaza* shop where it will be stocked. The more readily available the water filter, the more likely people are to purchase it. In order for this to take place consideration of the product's distribution channel (from point-of-manufacture to point-of-resale) needs to be included. This relates to product size (it should be suited to shelf space within *spaza* shops); weight (purifier should be easy to carry from *spaza* shop back to household); stackability (improved purifiers are to be stackable, making transportation and storage as efficient as possible) and the possible incorporation of carrying handles (further improving the ease of transportation by hand back to households).

The Potpaz ceramic pot filter was not available in South Africa before this study and was therefore a product unfamiliar to South African rural households. Although it has been proven effective in several other countries, the assumption could not be made that it would be effective within South African rural communities and there were the possibilities that the filter may either be accepted and effectively used within the study households, or be neglected and not persistently used by the study participants.

Consequently, the aim of this study was to assess the Potpaz ceramic pot filter as a point-of-use drinking water treatment device in rural households in the South African context. Specifically the objectives were to:

- Perform quality control of the ceramic pot filters to determine the flow speeds of the filters for effective removal of bacteria from drinking water.

- Observe issues pertaining to placement and location of ceramic filters after implementation.
- Determine whether the filter was accepted as a suitable household water treatment method within rural households using household interviews and focus group discussions.
- Assess the user friendliness of the ceramic pot filter with regards to use and cleaning.
- Assess problems encountered after implementation

During this study, data was gathered in three different forms, which included interview schedules, personal observations and photographs for each household. A total of 248 rural households
(1 315 people) from the same cultural/ethnic background and who collected water from the water source and stored the water in the household were enrolled. Households were randomly divided into two groups. Within each household grouping, a portion of the group received Potpaz ceramic pot filters at the beginning of a 3 month monitoring period (intervention houses) and the remaining households did not receive the ceramic pot filters (control houses). The intervention and control households were paired as to be able to observe the effect of the filter by comparing the two households. The households within each pair were located as nearby to each other ensuring each household was living with similar circumstances, i.e. same water type and environment. This would mean that the data from the two households could be compared to observe the impact of the Potpaz filter on the household. At the end of the 3 month period, the control households received their own ceramic pot filter.

The documenting of the study households was undertaken using a GPS to waypoint each household with a unique code. The use of the GPS made it possible to locate the specific households and conduct interviews. Household interviews were conducted only once in each study household and were done generally after the households had been using the Potpaz ceramic pot filter for a duration of roughly 3 months. This was done for all households irrespective if they were in the intervention or control group. Each household interview began with the interviewer explaining what this study was about and the head of the household was presented with an informed consent form which included an overview of this part of the project. If the household was willing to participate in the interview, the trained Venda speaking interviewer continued with conducting the interview which contained both qualitative and quantitative questions. Initially questions pertaining to the use of the ceramic pot filter were asked, as well as questions attempting to observe possible

inconveniences which the households had with the use thereof. While the interview was being undertaken permission was asked to do personal observations of the filter and photographs were taken at the same time. Similarities between the different households, predominantly within their food preparation areas, cooking areas and their water storage methods were observed and documented. Each complete household visit took less than an hour to complete, allowing for roughly 10 households to be visited per day in the field.

The study households were also invited to community focus group meetings, where a group discussion took place with regard to the use of the Potpaz ceramic pot filters. These meetings were conducted once in each of the study villages. A group of 10 water filter users were asked questions, the answers of which was discussed between themselves before responding. This provided a more holistic opinion from the rural community as to their feelings of the Potpaz ceramic pot filter and the use thereof. These meetings were conducted with the chief's permission, together with the assistance of a trained Venda speaking interviewer who assisted in conducting the meeting.

The data have been grouped together and presented alongside, allowing for statistics as well as photographic documentation of each aspect to be observed simultaneously. This combined body of data has been split into sections attaining to general implementation observations (placement and location of ceramic pot filters), user acceptance (sustainability and acceptability), user friendliness of the filter, effectiveness of the educational component of implementation, and post implementation problems. The field testing of the ceramic pot filters provided great insight into how products were received in the rural areas. The implementation of the filters allowed for immediate observation whether the filter system would alter the water management system that households had in place.

Key findings emanating from this study are as follows:

- The quality control testing revealed that the tested filters did not fit into the specified flow rate ranges using three published refereed sources. It is important to have a defined flow rate range. As stated in the colloidal silver section, the effectiveness of the filter depends on the contact time the water has with the colloidal silver contained within the ceramic filter. The ceramic pot filter therefore cannot filter water too quickly, thus preventing the water from being treated by the colloidal silver. If the flow rate were too slow, the user may not be willing to wait long for water to filter, causing him/her to revert to using unfiltered water.

- Household members placed the ceramic pot filter in different rooms and on different types of surfaces, mainly due to a lack of available surface areas. In addition, households kept the ceramic pot filter in different locations in relation to the unfiltered water. Although problems were encountered with regard to ceramic pot filter's location and placement, households generally kept the ceramic pot filter in a place easily accessible to household members.

- Several households chose not to use the ceramic pot filter on a sustainable basis, even though the ceramic pot filter effectively treated the household drinking water.

- Households have effectively used and maintained the ceramic pot filter during the study duration. Training was undertaken upon implementation of the ceramic pot filter, and household members have effectively followed cleaning instructions.

- Very few breakages occurred, showing that households took care of the ceramic pot filters.
- The ceramic pot filter proved to have many positive design aspects as well as several negative aspects. It was evident throughout the field testing and implementation of the ceramic pot filter, that developments can be made which will suit it more to the intended users. These developments, if based around the specific needs and requirements of the users, are possible to provide a ceramic pot filter which effectively treats water, while at the same time is accepted and desired by the intended users.

The Potpaz ceramic pot filter has proved to be a user friendly product, able to be incorporated into the rural households. It is recommended that further research be conducted regarding the implementation of an improved ceramic pot filter design which specifically targets the observed areas of possible improvement from the ceramic pot filter. Furthermore, other alternative household water treatment systems should be investigated and implemented in rural areas. It is also recommended that a rural product intervention toolkit be developed which aids in effective implementation and researching of products in the rural setting. This must include effective types of data gathering tools, the process of data capturing, field research and data analysis, and the formulating of suitable design developments.