International Journal of Environmental Science and Development, Vol. 8, No. 8, August 2017

Addressing Technical Flaws in VIP Latrines in Lesotho: A Community Intervention in Qacha's Nek District

Sunny Aiyuk and Mathabo Tsepa

***Abstract*—A project was undertaken to improve the livelihoods of communities in the Qacha's Nek District of Lesotho, a small country enclaved within South Africa. Basic amenities that included the participatory provision and rehabilitation of VIP latrines, and knowledge on how to site such sanitation technology in relation to water sources, were provided to double orphaned and other children, together with women and children who were HIV/AIDS patients. Individuals in the communities became more confident of their environment and health, telling that their livelihoods had been upgraded. Intestinal discomforts, for example, had reduced substantially, pointing to an upgrade of public health. Following such community intervention, a country wide sensitization on identification of technical flaws in VIP latrines in the entire country, the siting of such technology vis-a-vis the aquatic environment, and the facilitation of ways to address these flaws, are recommended.**

***Index Terms*—VIP latrine, community intervention, public health, sustainable development.**

I. Introduction

Developing countries face a dilemma regarding the provision of adequate sanitation, especially for the poor, who constitute by far a greater proportion of the population. This is particularly so in rural and peri-urban areas, where sanitation is far from optimal, leaving communities without dignity and exposing them to a plethora of communicable and other diseases, compromising public health and safety.

In Lesotho, a small country with a population of 2 Million and entirely enclaved by the Republic of South Africa, measures to address issues of sanitation, in the midst of general scarcity of resources, have led to the adoption of the cost-effective Ventilated Improved Pit (VIP) latrine [1], commonly called VIP, a technology used by over 90% of the population. This is especially so because Lesotho is one of the poorest countries in the world and is faced with abject scarcity of manpower and financial means for construction and maintenance of complex and more admirable modern sanitary fixtures. With such a setting as highlighted above, there is, therefore, in developing countries like Lesotho, in line with development and urbanization [2], tremendous need to develop cheap reliable technologies that can handle basic sanitation issues adequately. Requirements remain simplicity, non-sophisticated equipment, high system output, minimal footprint size, and low capital and operational costs, thus leaving one to crave for simple sustainable systems like the VIP latrine, a technology that reasonably proliferates in the country. This system provides on-plot sanitation [3], calling for proximity between such and the users. This can easily become imperceptibly problematic in terms of public health, as the users don't usually have the skills in understanding the interconnectivity between the environment and the VIP latrines, nor do they understand the principles that underpin the functioning of these latrines. Aesthetics also easily becomes compromised.

Therefore, in Lesotho, this system, commonplace as it is, is bedeviled by technical flaws that largely compromise its adequacy.

This research followed a community-based Canadian sponsored project (2009-2011) that involved environmental science/engineering students on attachment from Canada. One of the objectives was to construct new VIP latrines for AIDS patients and double orphans who had lost both parents to AIDS, and advise on those already in use, by addressing technological drawbacks inherent in their design and construction. The intervention was made in the Qacha's Nek District, which is one of the 10 Districts of Lesotho. Recommendations for improvement are made for the country, following similar observations of flawed design and construction made around the country.

II. Functional Principles of the Technically Sound VIP Latrine

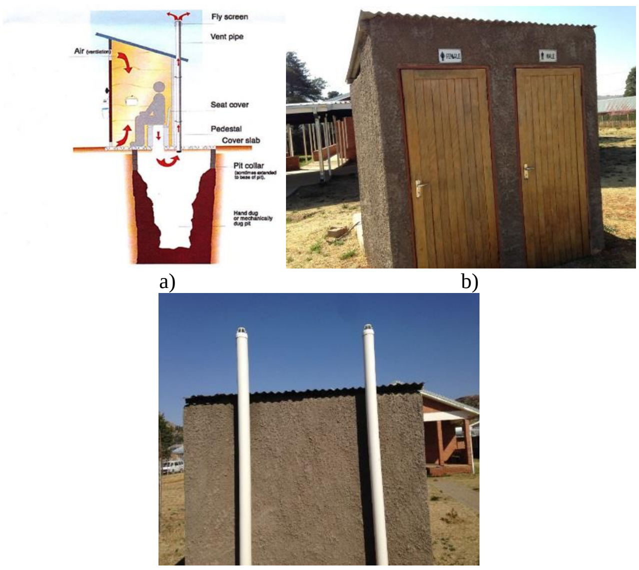

Fig. 1. A-Typical VIP latrine cross-sectional schematic; B & C- Front & Back views of one of best VIP at a large hospital facility in Lesotho (note the white vent pipe and fly screen (capping pipe) with very large holes).

Manuscript received February 12, 2017; revised May 27, 2017.

Sunny Aiyuk is with Department of Environmental Health, Faculty of Health Sciences, National University of Lesotho, PO Roma 180, Lesotho (e-mail: se.aiyuk@nul.ls).

Mathabo Tsepa is with Lesotho High Commission, Ottawa, Canada.

The VIP latrine is essentially a pit (~1m^3/capita and up to 4 meters deep) dug (sometimes 2 pits) into the ground, above which a concrete slab is built (Fig. 1).

Usually, a raised part of the slab has a hole, around which there is a toilet seat with a cover (Fig. 1A & Fig. 2A), as was done by the team of this project (Fig. 2B).

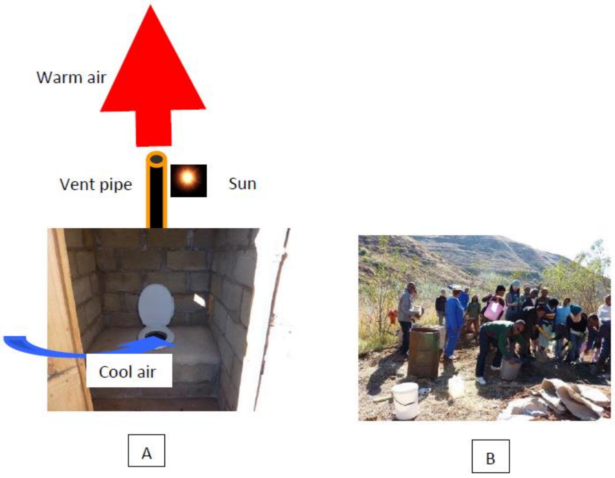

Fig. 2. Newly constructed VIP latrine (A) and Project team (B).

A shelter or superstructure is built on the slab to ensure privacy, with a roof that is conical or slanting backwards. These days, the walls are preferably made of hollow bricks [2] or other insulating material that does not readily get heated up. A black vent pipe or exhaust, just behind the shelter, connects the pit with the outside, to vent out gases arising from chemical reactions in the pit, as the organic contents get degraded. The vent pipe should rise for at least 30 cm above the highest part of the roof, to avoid recirculation of waste gases back into the shelter, thus avoiding a smelly and obnoxious environment in and around the latrine.

Ideally, a well-engineered latrine should be oriented such that the vent pipe faces the direction from where the sun normally rises, so that convection currents are created from the black pipe as the sun heats it. The warm air (red arrow of Fig. 1 and Fig. 2A) leaves the pipe through the top opening, above which a mesh (screen with holes less than 5mm in diameter) is put, to trap flies and other insects in the smelly pit, as they are attracted by the bright light through the pipe opening, and try to zoom out. The mesh is removed periodically and cleaned with a brush, to avoid blockage. During this time, the pipe opening is secured with another mesh, in order not to allow the exit of the aforementioned pests.

During the operation of this technology, as the warm air creates a convection current and leaves through the vent pipe, the smelly air from the pit rises through the pipe, to replace it, and fresh air from the outside (air ventilation arrow of Fig. 1 and blue arrow of Fig. 2A) gets in through the shelter and into the pit to replace it. As such, a continuous air stream flows from outside into the shelter, into the pit, and out through the vent pipe, leaving the shelter in which humans relieve themselves smell free, cool, fresh and free of flies and other disease vectors.

Technical considerations also demand that the height of the water table and the hydrological relationships between the pit and water sources are checked, to avoid water pollution [e.g., 2].

III. Discussion of Some Common VIP Technical Defects in Lesotho

As Lesotho is basically a very poor country, recourse to cheap technologies for livelihood are commonly sought. One of these, to provide basic sanitation, is the VIP latrine, a technology that has been employed for many decades in the country. However, right from inception, as has been observed in this study, the conception of the technology has been done with many technical flaws that compromise the efficiency of the technology and pose environmental and public health threats. Some of these problems are highlighted below (Fig. 3).

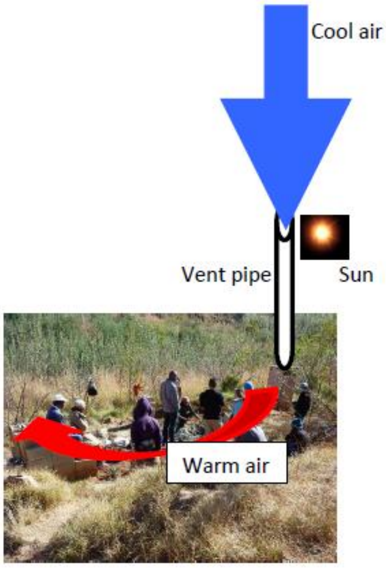

Fig. 3. Project team with students on attachment from Canada evaluating a flawed VIP latrine.

There is commonly the use of metal to build the walls of the superstructure which is above the slab. In this case, convection currents, instead of being initiated at the exhaust or vent pipe that receives heat, they are being formed from the toilet's metallic walls that absorb more heat and heat up more than the vent pipe does. Following the creation of the convection currents, there is a reversal of current flow, and warm air thus leaves from the superstructure outwards, whereby smelly air leaves the pit to replace the warm air, leading to obnoxious smells in the superstructure's space. As the air from the pit leaves, fresh air gets into the vent pipe from outside, through the top, to replace the air from the pit, and the flow continues in this opposite manner. This problem is mostly not recognizable by government officials of the country, who usually supply some latrines to very needy communities. Such latrines usually have walls made of lustrous zinc sheets that absorb heat and reflect some heat rays effectively, thereby reducing the heating up of the superstructure. However, as the toilet ages, usually within a year or two, the zinc metal becomes easily corroded (urine-caused and other corrosion), loses its lustre, and then absorbs much more of the heat it receives, increasing the heat inside the superstructure and accentuating the reversal of the convection current. So, following the use of metal for the walls, the inside of the superstructure remains quite hot and inconvenient for use.

Again, as the vent pipes of the latrines in the country are generally not painted black (Fig. 1C) and don't face the direction of sunrise, such a situation favors the counter convection flow highlighted above.

Also, in the country, a large majority of the VIP vent pipes are without a mesh to cover their openings. Even, for those that have a mesh, the holes are very large, and thus serve no purpose in trapping flies and other pests, thus only becoming decorative (Fig. 1C). As such, flies exit freely from the pits to nearby homes (usually not more than 20 meters from latrine) and back, continuously, leading to easy pathogen transmission, and compromising public health. In many cases also, the vent pipe is not tall enough, leading to smelly air recirculation within the shelter space.

The latrines are also generally not sited with consideration of possible water pollution, and are usually just upstream of water bodies [3]. As the subsurface lithology of Lesotho is mostly sandstones and clayey sand with high porosity and transmissivity, water pollution remains a big concern.

A. Case Study

As already noted, the VIP latrine technology is quite common in Lesotho [4], as expected for low-income countries [3]. This system, simple as it is, needs some basic principles to be considered in its design and construction, for it to function adequately in providing basic sanitation and public health protection. However, in the country, many of the technological requirements are missed during conception and construction, leading to nuisances like obnoxious smells, fly infestation and heat discomfort during the summer months. The incidence of disease is also very favored under such situations.

A particular case in point, that was found to be common and to corroborate the problems highlighted previously, was when a resident of the project area approached the project environmental engineer, Dr. Sunny Aiyuk, and complained that her latrine was very new and she was appalled by the fact that it was very odorous and badly infested with flies. Following this concern, a thorough evaluation of the situation by the project team revealed that the convection current was flowing through her latrine in reverse direction (see Fig. 3 above). The reason for this was that she had built a beautiful looking latrine with expensive corrugated iron sheets used on the walls, an action which, together with many of the other drawbacks cited above, caused the convection currents to be initiated from the walls, instead of the vent pipe (that was white), following heating by the sun. Warm air (red arrow in Fig. 3) thus left the latrine shelter and was replaced by rising smelly air from the pit, which was in turn replaced by cool air from outside (blue arrow), leaving an environment that was very smelly and conducive for flies that were found in large numbers within the latrine shelter. A decision was the made by the project team to rectify the situation, whereby her walls were replaced with hollow bricks, her exhaust pipe was made black, and other corrective measures were also effected. Following this intervention for corrective action, things were brought back to normalcy and the VIP latrine operated admirably.

B. VIP Latrine Construction Skills

It is noteworthy that, in Lesotho, the task of erecting and operating VIP latrines rests with the owners, who usually invite low-wage unskilled workers for their construction, or do the construction themselves [1]. The government sometimes provides such for communities, but mainly assumes the role of providing education and training [4]. Nevertheless, with a general lack of skilled manpower and financial resources in the country, these latrines are generally not well conceived. Indeed, similar observations, pointing to the same technical drawbacks, as have been documented for the Qachas' Nek District, have been made for other districts within the country.

Although surveys to assess communicable disease incidence and water pollution were not part of this intervention, it is inferred, from the flaws discussed above, together with the inherent country topography, lithology and proximity of these latrines to water bodies and human habitations, that these are very likely [e.g., 5]. Reports received from some community members do corroborate such inference.

IV. Conclusion and Recommendations

The VIP latrine technology is a good sanitation technology for developing poor countries like Lesotho, but the system is largely compromised in terms of its adequacy for provision of basic sanitation and protection of public health, due to technical flaws.

Design and construction of the system should adhere to basic technical/engineering principles, as discussed in this work.

As this work is the first of its kind in the country and bears on very salient environmental, public health and developmental issues, a country-wide campaign for education and rectifying the technical flaws should be carried out.

Acknowledgment

This work was partly sponsored by the National University of Lesotho, Lesotho.

References

[1] I. C. Blackett, "Low-cost urban sanitation in Lesotho," World Bank, Washington DC, USA, 1994.

[2] S. Aiyuk, "Urbanisation fingerprinting on environment and health," Lehakoe Recreational Complex, Maseru, Lesotho, on 24th July, 2010.

[3] A. Cotton *et al*., "On-plot sanitation in low-income urban communities; a review of literature," Water, Engineering & Development Centre, Loughborough University of Technology, Leicestershire, UK, 1995.

[4] Water & Sanitation Program-Africa Region, "The national sanitation programme in Lesotho: How political leadership achieved long-term results," World Bank, Nairobi, Kenya. 2002.

[5] EAWAG, Single Ventilated Improved Pit (VIP) Latrine, EAWAG, Switzerland, 2014.

Sunny Aiyuk was born in the city of Kumba in Cameroon, on 20th November, 1962. He holds a Ph.D in environmental technology from the Ghent University, Belgium (2004), a master in advanced management from the Vrije Universiteit Brussel & Solvay Business School, Belgium (2007). Professor Aiyuk also holds the M.Sc. in water resources engineering from both the Vrije Universiteit Brussel

and the Catholic University of Leuven, Belgium (2000) & an M.Sc. in applied sedimentology & petroleum geology from the University of Nigeria, Nsukka-Nigeria (1993). In addition, he has a B.Sc. in geology from the University of Yaounde, Cameroon (1985) & a certificate in prevention & management of communicable diseases from the African Medical Research Foundation (AMREF), Nairobi, Kenya (2012).

Sunny Aiyuk is presently an associate professor of environmental health at the National University of Lesotho, Lesotho. Prof. Aiyuk is presently the Dean of the Faculty of Health Sciences at the National University of Lesotho. He has previously been Deputy Dean, Head of Department of Environmental health, Senior Environmental specialist and Project Environmental engineer. Professor Aiyuk is an expert in environmental technology/engineering, public health & project management. He is a global scholar and prolific researcher, and has published widely in the fields of Environmental and Public Health. He is member of various high level committees in Lesotho, such as the National Committee on Waste Management (COWMAN) and the National Committee on Chemicals Management (CHEMAC).