Inclusive Urban Sanitation Stories

Sanitation technologies in pit emptying, Nakuru, Kenya

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Figure 1 – Septic tank emptying in Nakuru. Source: NAWASSCO.

Summary

On-site sanitation systems (OSSs), such as septic tanks and pit latrines, are a critical component of ensuring access to toilets in both rural and urban areas, and this is not limited to underdeveloped countries. OSSs currently serves more than 2.7 billion people worldwide, with that figure expected to rise to 4.9 billion by 2030. Despite improvements toward the Sustainable Development Goals (SDGs) to increase access to improved sanitation, investments in subsequent steps, such as the safe collection, disposal and treatment of faecal sludge (FS) from OSSs, remain a significant challenge.

In Nakuru, sanitation is a critical urban challenge. There is little support directed towards urban sanitation as most of the political and financial support has been focused towards other avenues not related to sanitation technologies. Much of the efforts by the local and international actors has been particularly focused on rural areas and therefore the situation regarding pit emptying is less controlled which is a major challenge given the exponential rate of urbanization in Kenya.

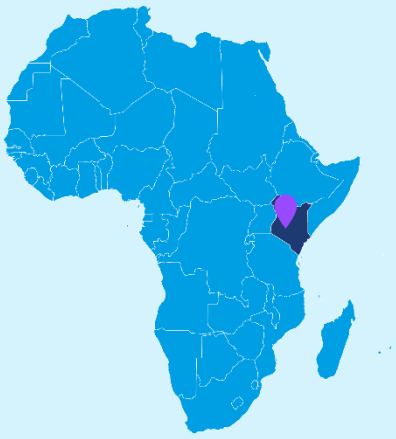
In view of urban growth rates and more populations living in urban areas, proper urban sanitation technology is essential in improving the quality of life in urban areas. Urban geographical locations call for different models of pit emptying. To address this Nawassco, Finish Mondial Kenya and Waterworx have developed different technologies, designs and strategies that cover the technical issues such as rapid population growth, obsolete infrastructure, minimal space, high cost of sustainable materials and insufficient water supply observed in most urban areas. Different pit emptying options are provided to the populace for adoption, depending on geographical, spatial, economic and preference factors.

On-site sanitation methods include toilets that are linked up to septic tanks and pit latrines. Off-site sanitation methods included flush toilets that are hooked up to the sewer system. Most of the people, though, used pit latrines, the cost of which was paid for by the plot owners. In Nakuru, faeces, toilet paper, flush water, grey water, chemicals, and solid waste like clothes, shoes, bottles, sanitary pads, waste vegetables, hair, condoms and other things make up faecal sludge. This therefore provides the need for suitable pit emptying technologies.

Overview

Geographical information

Country: Kenya
City: Nakuru
City population: 570,674



Problem

- Flooding of pit latrines during the wet season, collapsing toilets, sewer blockages, sewer overflow, sewer bursts, vandalism of sanitation infrastructure, open defecation and exhauster truck accidents.
- Inappropriate disposal of non-human excreta solid wastes into the sewer manholes or toilets.
- Lack of or unreliable water supply.
- Limited engagement between the company and the stakeholders
- High risk of ground water pollution due to high water table, depth of pit latrines, leaking containment facilities and unlined pit latrines.
- Lack/limited enforcement of standards.

Solution

- Designing and building toilet facilities according to the principle of universal design that is accessible to all.
- Constructing toilet facilities that are resilient to climate risks based on an approved design catalogue.
- Collaborating with other stakeholders for proper management of stormwater and non-excreta solid waste collection and management.
- Collaborating with other stakeholders for protection of water resources from pollution.
- Renovating dilapidated capture and containment facilities and promoting upgrading of toilets to fully contained systems.
- Increasing access to low-cost water services and ensuring adequate and reliable water supply.

Problem

Sanitation is a fundamental aspect of public health, and pit emptying is a critical component of sanitation in many communities, including Nakuru. The process of pit emptying involves the removal of solid and liquid waste from pit latrines, septic tanks and other containment systems. The waste is then transported to a treatment facility or disposal site where it can be safely treated or disposed of.

Pit latrines continue to be the primary source of sanitation for the urban poor in Africa and many other developing countries, particularly in areas where unplanned or informal settlements predominate (Strande, et al., 2014). When pit latrines become full, the only options are latrine replacement or pit-emptying; where density is high, emptying may be the only option.

According to a report published by the Nakuru County Government in 2019, it was estimated that less than 10% of the households in Nakuru had access to sewerage services, while the remaining households relied on pit latrines or septic tanks. The report also highlighted the challenges faced in ensuring that these households have access to safe, hygienic and affordable pit emptying services.

In Nakuru, pit emptying has traditionally been done manually using basic tools, such as shovels and buckets. However, this method is not only labour-intensive but also poses significant health risks to workers. Exposure to faecal matter and gases can result in serious health problems, such as respiratory diseases, skin infections and gastrointestinal disorders. Additionally, the manual pit-emptying method is time-consuming, which means that some pits remain unemptied for long periods, leading to health hazards for the community.

Solution

To address these challenges, there is a need for innovative technologies that can improve the efficiency and safety of pit emptying in Nakuru. One such technology is the use of a mechanical desludging unit which can empty pits quickly and efficiently while minimizing health risks for workers. This machine uses powerful suction pumps to remove waste from the pit and transport it to a treatment or disposal facility Figure 2.

Figure 2 – PuPu pump in action. Source: NAWASSCO.

Another option is the development of a low-cost, locally appropriate technology that can be used to improve pit-emptying practices in the community. For example, In the year 2020, the Practica

Foundation in Holland developed the PuPu pump in order to make it possible to empty pits by mechanical means in areas that were previously unreachable. Because faecal sludge is 'pushed' from the pump to the delivery truck, continuous pit emptying is not only conceivable but also highly likely. It is possible to move the equipment in a compact vehicle that does not need a vacuum tank. The technology allows for the entry of small businesses in underdeveloped regions into the market for professional emptying services. The PuPu pump is an innovative new combination that consists of a (small) compressor, a reservoir with automated duckbill-type non-return valves, and a suction/pressure valve that is controlled manually. Because the reservoir has such a tiny capacity, it is easy to achieve a high vacuum in a relatively short amount of time to pull the sludge out.

In addition to introducing new technologies, it is also important to provide training and support to communities on safe and effective pit emptying practices. This can help to ensure that the technology is used correctly, and that the community is able to maintain and repair the equipment as needed.

Overall, addressing the technology gap in pit emptying in Nakuru will require a combination of innovative technologies, community engagement and technical support. By improving the efficiency and safety of pit emptying practices, we can help to improve public health and promote sustainable development in the region.

Below is a comparison chart.

Table 1. Comparison chart of manually operated mechanical equipment, source: (Mikhael, et al., 2014)

Systems	Technical capacity	Operational Expenses and capital cost	Limitations
Gulper	✓ Capable of pumping fluids with a lower density Sludges ✓ Typical flow rates of 30 litres per minute ✓ The optimal pumping head is determined by the specific design.	✓ Low initial investment 40-1400 ✓ Operational cost: varies as per the location	✓ Difficulty in accessing with a small super structure ✓ Trapping when there is a lot of non-biodegradable material ✓ Sludge splashing between the pump's spout and the container it goes into ✓ Unable to desludging thick sludge
PuPu Pump	✓ It can pump High viscosity sludges ✓ It has a tiny reservoir of 25L which can help the pump to pull toward the tanker ✓ The amount of flowing (discharge rate) is between 60 and 100 litres per minute.	✓ Operational cost: 6110$ per year ✓ Initial investment: <10,000$	✓ It has some gas leakage on the reservoir and it affect the time of pumping ✓ The pigging ball sometime get stuck in the hoses ✓ Due to lack of handler usually needed to carry by two people ✓ Financial feasibility depends on strong customer relationships
Pedal Gulper	✓ Sludges of high viscosity may be pumped with ease. ✓ 50–100 l/min is the maximum flow rate it can manage.	✓ Operational cost: unknown ✓ Initial Investment cost: unknown	✓ Its 1.5m length, slow emptying rate, and low sludge performance ✓ The lack of availability of local materials and labour ✓ Unable to desludge thick sludge
MAPET	✓ The maximum flow rate varies on the pumping head and ranges within 10 and 40 litres per minute.	✓ Operational cost: 175$ per year ✓ Initial Investment: 3000$ (1992)	✓ There must be strong support for the service providers from the institution. ✓ Importing key parts is necessary. ✓ Financial infeasible
Nibbler	✓ Suitable for pumping sludge with moderate viscosity	✓ Operational expenses: unknown ✓ Initial Investment: unknown	✓ Unsuitable for dry or High TS concentration fecal sludges
Modified Auger	✓ The maximum flow rate is 40L/min ✓ It can pump variety of waste consistencies	✓ Operational cost: unknown ✓ Initial Investment cost: unknown	✓ The cutting head ignored the trash instead of shredding it, so the trash wasn't shredded.

Lessons learned

- Pit emptying is a complex challenge: The major lesson in Nakuru is that it is a very complex social and technical issue that needs to be addressed with caution and in an incremental way. The previous approaches looked at ‘bits of solutions’, like building toilets, without considering the entirety of the pit-emptying challenge in towns. This means developing different solutions for the different challenges, such as school sanitation, health facilities sanitation, and industrial waste and household level waste management issues. The achievements made in pit-emptying technologies have been hampered by the lack of an appropriate enabling environment and the complexity of addressing sanitation solutions in urban areas.

- Rural solutions do not work in urban areas: the approaches adopted in rural parts of the country and that have brought significant success do not work in towns unless supplemented with other interventions. In rural areas, the hygiene promotion-based awareness creation has led to sanitation improvement. However, in towns awareness promotion is only a starting point and needs follow-up with appropriate service delivery models and capacity building. The challenge is moving from efforts focused on behaviour change of individuals to establishing an effective service delivery model for pit emptying in the urban context.

Useful links

https://thedocs.worldbank.org/en/doc/932861595953186546-0090022020/original/G.NakuruCountywideSanitationStrategyFINALwithFOREWORDMarch2019.pdf

https://www.facebook.com/mbcitv/videos/1025000608317362

https://wasreb.go.ke/impact-report-issue-no-15/

https://pupu-pump.com/

Further reading and references

- Strande, L., Ronteltap, M. and Brdjanovic, D. (2014) Faecal Sludge Management; Systems Approach for Implementation and Operation. IWA Publishing, London.
- https://www.practica.org/wp-content/uploads/EN-PuPu-pump.pdf
- Mikhael, G., Robbins, D. M., Ramsay, J. E. & Mbeguere, M., 2014. Methods and Means for Collection and Transport of Faecal Sludge. In: L. Strande, M. Ronteltap & D. Brdjanovic,

eds. Faecal Sludge Managment: Systems Approach for Implementation and Operation. London: IWA Publishing, pp. 67- 96

About the author

Zaitun Kanenje is a sociologist by profession, she holds diploma in Community Development, Bachelor of Arts in social work and social administration and pursuing MA Community development. She is the Low-Income Consumer Manager at Nakuru Water, having a passion working with Communities, am gratified when people's lives change for the better. She has been in the WASH sector for over 10years and mainly developing and implementing pro poor water and sanitation strategies.

About the institution / organisation

NAWASSCO is a water and sanitation service provider in Nakuru. NAWASSCO is responsible for providing water supply and sanitation services to Nakuru City and its environs and is committed to improving the quality of life for the residents of Nakuru through the provision of reliable and sustainable water and sanitation services.
https://nakuruwater.co.ke/

About the IWA Inclusive Urban Sanitation Initiative

IWA's Inclusive Urban Sanitation initiative responds to a huge and growing public need - safe sanitation in combination with access to safe drinking water and hygiene underpins good health. The aim of this initiative is reshaping the global urban sanitation agenda by focusing on inclusive sanitation service goals--and the service systems required to achieve them - rather than the traditional singular focus on expanding sewer networks and treatment works. This forms part of IWA's larger agenda to promote inclusive, resilient, water-wise, and sanitation-secure cities.

About the Inclusive Urban Sanitation Stories

The Inclusive Urban Sanitation stories are documenting some of the policies, practices, and approaches that demonstrate how stakeholders especially those in urban areas (e.g., public sector, operators, academics, regulators, and other key actors) are taking part or contributing to Sustainable Development Goal 6 which require water and sanitation concepts and norms to look beyond technology and the usual focus on building infrastructure. Increased focus is on safety, inclusion, environment, public health, and multiple technology solutions tailored to different geographies and socio-economic contexts for building climate-resilient cities. The stories aim to inspire urban stakeholders to discuss ways for advancing inclusive urban sanitation, especially in low- and middle-income countries.