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What happens when the pit is full

A story of pits, PETs and managed sludges

WIN-SA
WATER INFORMATION NETWORK - SOUTH AFRICA -

WATER RESEARCH COMMISSION

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Introduction

Rapid urbanisation has outpaced the ability of many African governments to provide essential services - more people now lack access to reasonable sanitation services than in 1990. Yet the provision of new toilets is only part of the challenge facing municipalities across the region - the maintenance of those toilets already built cannot be forgotten. Most urban toilets need emptying within five years or less of being built. While these may not be emptied directly by urban municipalities, it is clear that for health to be safeguarded and the environment protected, the State needs to play a strong role in ensuring that toilets are emptied appropriately and the waste suitably handled.

As urban populations grow and more toilets are built the existing challenge will grow – not only in terms of numbers but with the rising complexity of working in dense urban settlements. Traditionally this is an issue that has attracted relatively little attention and had little prestige. Historically it has also been an area of limited innovation. Things are changing however, and recent years have seen a flourishing of innovation. There are a range of practical steps that can be taken by local government and its allies – this note explores what some of those are and shows, from real experience, that meeting this challenge can help to safeguard the health of today's children, even as we protect the environment for those generations to come.

1 Emptying a million toilets a year in SADC alone

On World Water Day 2011 (March 22nd) came bad news from the United Nations[i]. The number of people without access to adequate water and sanitation facilities in Africa has risen fast in recent decades. It seems that rapid urbanisation has outpaced the ability of many African governments to provide essential services[ii]. Sadly more people now lack access to reasonable sanitation services than in 1990 (the number of those without in Africa has doubled to around 175 million). Indeed, Africa is the continent urbanising most rapidly and four in ten of Africa's one billion people live in urban areas.[iii,iv,v]

Meanwhile, emotions in South Africa have been inflamed over the 'open toilet saga' that has gripped the electorate in the run up to municipal elections. Amidst a welter of recriminations and mudslinging, it seems that the unbreakable link between human dignity and adequate sanitation is being rediscovered. What comes next remains to be seen, but surely it cannot exclude a renewed focus in South Africa, and perhaps in the region, on this most basic of human rights.

Fig 1 : Poor maintenance, drainage and emptying practice jeopardises health.Photos by Nonqaba waka Msimang

The truth is though that African governments are running just to stand still when it comes to providing urban sanitation. If all urban residents are to be provided with urban sanitation, a rough estimate suggests that another 9 million urban toilets need to be built in SADC alone (see table overleaf). At current rates of progress, this will take quite some time. But whilst much of the focus is, understandably, on the provision of new toilets, the maintenance of those toilets already built cannot be forgotten.

In South Africa alone there are, by some estimates, over 3 million 'VIP' latrines. The South African government has committed to 'servicing' (i.e. emptying) these toilets at least once every five years, although many municipalities are struggling to implement this policy decision[vi]. A rough estimate suggests that in the rest of SADC there are perhaps another 5 million urban latrines, many of which will also need emptying within five years or less of construction.

Even before any new toilets are built this means over a million toilets a year need emptying in the region – a figure that is only to grow as new toilets are built and as towns and cities grow.[vii,viii] Although these toilets may not be emptied directly by urban municipalities, it is clear that for health to be safeguarded and the environment protected, that municipalities and their national government counterparts need to play a strong role in ensuring that toilets are emptied appropriately and the waste suitably handled.

A recent World Bank study on infrastructure coverage in Africa gives interesting insights into the patterns of access to sanitation in Africa. As can be seen 65% of the urban population relies on pit latrines – many of which will need emptying once they fill up.

Patterns of Access to Snitation in Africa

percentage population

Area	Open defecation	Traditional latrine	Improved latrine	Septic tank
Urban	8	51	14	25
Rural	41	51	5	2
National	34	52	9	10

Source: Morella, Foster, and Banjee 2008.

Fig. 2: Percentages of access to different types of sanitation in Sub-Saharan Africa © World Bank

What happens when a pit toilet fills? 2

In rural areas when a pit latrine fills, households are generally encouraged to dig a new pit and move both the toilet (or squatting pedestal) and any 'housing' that covers it. This allows the old pit contents to degrade underground undisturbed. They can either be left there for the long term, or, after a suitable period of time, the contents can be dug up and used for fertiliser. Moving the top, while not effortless, remains relatively easy to accomplish.

In urban areas however, it is not always possible to deal with a full pit is this manner. One issue is that urban households generally invest more in the toilet to begin with – pits are more likely to be lined and the housing is more likely to be permanent in nature. Moving the toilet therefore is more of a task. A second issue relates to the way that urban areas grow.

As settlements grow the plots are subdivided and the space available for new pits diminishes. Eventually the density of housing become such that householders faced with a full pit find there is no space to dig a new one – they need to empty the existing pit, rather than covering it over and digging elsewhere.

Fig3: typicalunimproved toilet in Namibia _informal settlements of Katura. Photo by Jay Bhagwan

When urban pits fill up, generally one of three things happen:

i) Those using the toilet revert to previous 'bad' sanitation practice (including open defecation or the use of flying toilets).[1]

ii) The household is able to build a new toilet and this makes more sense to them than emptying the old pit (although it still costs money).[2]

iii) The households empty the full pit so that the toilet becomes usable once more. This can be done 'well' (meaning in a hygienic and safe manner, with the waste from the toilet properly disposed of) or it can be done 'badly' (where the waste is deposited into the close surroundings and the emptying done messily and unhygienically).

Whose responsibility is it?

Although in many countries the direct emptying of toilets is considered the responsibility of the household, local governments do need to be involved at some level.

In South Africa, the right to access basic sanitation is enshrined in the constitution. Policy then interprets this right in such a way that it becomes a responsibility of local government to ensure that the right is maintained through the maintenance of toilets and the provision of an adequate emptying service.

[1]Households can stop using the pit and hope there is some decomposition and draining of the liquid waste over time, in the meantime trying to use a neighbour's facility or reverting to 'wrap and throw' (Kibera's famous 'flying toilets') or open defecation. For many, heavy latrine loading, groundwater infiltration, the effects of 'pit clogging' and disgruntled neighbours make this option unviable. Note, some of these aspects apply too to rural toilets.

[2]Common rural practice is to seal the old one and try building a new one. However a lack of space and the expense tend to discourage this practice in urban areas (for instance, even a drum latrine pit -the cheapest and smallest pit type - costs in Dar es Salaam around $30 USD).

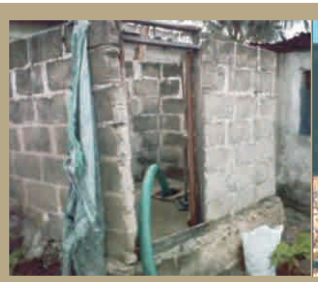

Fig. 4: A typical urban toilet in Tanzania. This needs to be emptied rather than moved.
© David Schaub-Jones

Fig. 5: 'Bad' sanitation practice: 'flying toilets' in Kenya
©http://www.thewindsweptsky.com

In other countries, the right to sanitation is less clearly elaborated. One consequence is that toilet emptying often becomes a market where some services are provided by government, some by the formal private sector and some by informal providers.

But in all cases local government should be concerned to see that toilets are emptied hygienically and the waste disposed of adequately.

If this does not happen then the 'gains' of providing sanitation are easily lost through the health consequences of inadequate maintenance and environmental pollution.

Emptying toilets 3

Although there are various ways of emptying pits, there are essentially three common ways in which it is done.

Natural flushing: On hilly ground or where there are seasonal floods some households practice 'natural flushing'. Where this is done the pit is often built such that the slab is raised a metre or more above ground level and flooding allows water to enter the pit and wash out some of the contents. These end up either into a nearby watercourse or into the flooded neighbourhood. This is, for instance, fairly common practice in Dar es Salaam, which has two rainy seasons.

Manual emptying: A common option for many households, especially in informal settlements, is to empty the pit manually or employ someone to do this. The waste is usually buried in adjacent hole or dumped nearby. In areas where a sewer manhole is found nearby it may be dumped there.

Mechanical emptying: A less frequent option for pit latrines (more common for septic tanks) is to desludge the pit using a mechanical device. The sludge is then transferred from the household plot. If it can gain access, a vacuum truck is typically used for both the emptying and transfer. In a few limited locations within SADC, machines specially designed to empty pits (such as the Vacutug) have been developed and offer this service (with the transfer either included, or done separately).[3]

Natural flushing, while quite commonplace, is clearly not something that municipalities want to encourage. This leaves two ways for them to engage in the technical challenge of emptying full toilets; either mechanical or manual.

Mechanical emptying: a known technology

Mechanical emptying is a 'known technology' and many cities across the region offer an emptying service for septic tanks, using vacuum trucks. In some countries, particularly in the bigger cities, this market has over the last 30 years become 'privatised' (either deliberately or de facto), and there is now a thriving emptying market with a range of trucks competing for business.

Fig 6: Trucks can struggle to access many pit toilets © Manus Coffey

However, mechanical emptying is not ideally suited to the emptying of pit latrines, whether these are 'improved' VIPs or more traditional 'unimproved' latrines (both of which need emptying, whether or not they count towards the Millennium Development Goals!).

Firstly, this challenge is a technical one, as the pumps used on vacuum trucks are designed to deal with very liquid waste and struggle to handle the heavier waste found in pit latrines.

Secondly, pit latrines are not always designed to cope with such emptying and unlined latrines can collapse with mechanical emptying (as the machine sucks away at the walls of the pit as well as the contents).

[3]These three options imply that, unless an affordable tanker service can gain access and remove the stored waste (or the toilet is connected to a working sewer), much of the waste is disposed of in the immediate vicinity of the facility being emptied. This can pose a significant threat to human health (especially where the waste is not buried) thus drastically undermining public benefits of any sanitation or health education programmes active in the area.

Thirdly, this challenge is a physical one – the layout and topography of many informal settlements makes it difficult for these machines to access the toilets in the first place.

Finally, this challenge one of affordability – vacuum trucks are quite costly, at least in relation to the incomes of poor communities. In Dar es Salaam the average client pays around $40 USD.[ix]

Organised Pit Emptying in Durban:

Ethekwini metropolitan municipality, centred on Durban in South Africa, has roughly 3 million people. An estimated 35 000 pit latrines serve the urban poor or more rural residents, often on hilly ground. The city committed itself some time ago to providing all residents with an acceptable toilet by 2010, providing many for free (in line with the government's free basic services policy). However a growing number of eThekwini's toilets, especially urban ones, are full.

In 2003 the department in charge of water and sanitation, EWS, recognised that this posed a significant risk to both public health and the environment. In response the municipality made a commitment to empty every pit latrine in the city, free of charge, once every five years and started pilot projects to see how best this could be done. Although it was able to offer a municipal desludging service using a suction tanker service, it soon came to the conclusion that in most of the crowded and hilly informal settlements that a manual emptying service was more appropriate: cheaper, more robust and with the added benefit of creating local jobs.

By working through community structures and local politicians the municipality get the communities 'on board' with its emptying programme. It schedules a given community for emptying and then sends in trained local labourers, equipped with gloves, safety masks and special shovels, who go from house to house emptying pits. The waste is sometimes buried on site, but these days more often it is transferred via drums to an 'exit' point, from where a truck takes it to a disposal point.[4,5]

[4]It is currently being stored here while ways of appropriately treating the waste are assessed. Previously EWS screened out the solid waste and washed the liquid waste into the sewer system – but stopped after quickly realising that this damaged its wastewater treatment plants, which were not designed for such waste.

[5]This approach is clearly specific to South Africa, where an emptying service is provided free by the municipality. Yet efforts are being made to adapt similar models to other contexts (such as Dar es Salaam) where a public sector role in encouraging sanitation provision and in assisting with the removal and transfer of waste is harnessed to a market approach to emptying pits. The logic is that households pay for the direct cost of both the latrine and immediate emptying, whilst public money is used to support the market, to provide education and awareness, and to contribute to the full cost of removing the waste to an appropriate treatment process (and paying for this).

As the box highlights, eThekwini (who have won international awards for their sanitation work) have explored the issue of pit emptying in some depth and, after testing different approaches, have decided that manual emptying is, for now, the solution.

Practicality is a major reason for this – it remains difficult, if not impossible, for vacuum trucks to get in and access many pit latrines. But manual emptying is not without its dangers and certainly not without its detractors. So one of the key issues for sanitation managers is how best to assist and oversee any manual emptying, how to make it safer and how to make the process cleaner and easier.

Fig 7 : VIP toilets in Bester's camp, eThekwini © K. Eales

Manual emptying – the practical option

Until recently there was little attention paid to manual emptying – practitioners typically used a bucket and spade to empty pits, often climbing into the full pit in order to do so. Recently however, more organisations have begun to take an interest and this 'low end of the spectrum' is becoming a focus for innovation, with new technologies for improving manual pit emptying being developed and tested in the field.

The London School of Hygiene and Tropical Medicine have gone as far as to develop specifications for an 'ideal' advice to assist with manual emptying. This would be able to access pit contents without demolishing the latrine, would not require direct contact with the sludge, would allow local manufacturing and maintenance and would cost less than $200 USD.[x]

The Gulper, figure 9, was the first of a few new options developed in order to improve the traditional manual emptying of pit latrines.

Other technologies are also promising, including 'rope washer' technologies, indirect action hand pumps and screw augers. Several of these are being piloted, in Durban and elsewhere. Together these devices are known as PETs (Pit Emptying Technologies).

Fig. 8: Unregulated pit emptying (outside South Africa)
© Jay Bhagwan

Fig. 9: The 'Gulper', being field tested in Tanzania
© S. Sugden

Fig. 10: Formalised pit emptying in eThekwini
© Jay Bhagwan

Fig. 11: Undesirable outcome #1 – a sadly typical means of waste disposal, often into streams and wasteland
© Unknown

Fig. 12: Undesirable outcome #2 - sludge 'dumped round the corner'
© S. Bongi © Unknown

4 Once the toilet is emptied

Putting natural flushing aside, manual emptying remains the predominant form by which sludge is taken out of pits. Manual emptiers are typically paid by the drum and are usually contracted only to empty as much sludge as is needed to make the pit usable again in the short- to medium-term. Often this leads to only the top metre or so of a pit being emptied. While the cost of emptying the pit can be brought down in this way, the cost of transporting the waste to a treatment works often remains high (especially, by volume, where only small amounts are being emptied).

In most countries, the cost of dealing with sanitation falls to the household

In the informal markets that develop, households are typically only prepared to pay the cost of solving their immediate problem. This means getting enough waste emptied from their pit to make it usable again in the short-term. They are typically less concerned with (and less willing to pay) for the further costs of properly transporting and treating the waste. The result is behaviour that is undesirable from a public sector point of view. Sludge gets buried in a newly-dug hole near the pit emptied, or transported round the corner and dumped.

Mechanical emptying, which is more visible and easier to monitor, does offer easier opportunities for regulation. By law trucks are usually obliged to take the waste to designated dump sites (where, in theory at least, it is either treated and disposed of, or at least kept separate from people and the wider environment). Practice can be another matter however, and illegal dumping of waste remains a grave challenge.

5 Transporting the waste out of the community

The previous section highlights the challenge of waste being indiscriminately dumped.Unless waste is buried on site, once it is evacuated from a latrine it needs to be transported to somewhere where it can be disposed of properly.

Where the latrine has been emptied by a vacuum truck, this truck can continue directly to the final disposal site. But where emptying has not used a vacuum truck, it generally needs to be transferred into a suitable container and transported. There are three means to transport it: manual, animal and mechanical.[6] Each approach has advantages and disadvantages – and broadly, the further the waste needs to be transported, the more advantageous the more 'advanced' forms of transportation (and vice versa). [xi]

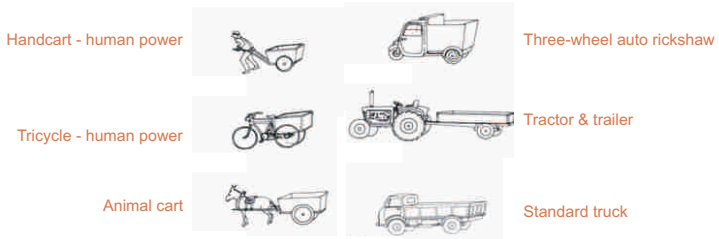

Fig 13: Options for transport of waste © UN-Habitat

[6] Whilst vacuum tankers are commonplace in the sanitation sector there are potentially significant benefits in looking at other options, including tractors and trailers, motorbikes etc.

Fig. 14: Vacutugs (centre) are unsuited for long trips to dispose of sludge © Schaub-Jones

Fig. 15: There are strong parallels between the management of liquid waste and that of solid waste. In solid waste the challenge of efficient collection and transport has been much studied and there are valuable lessons for the sanitation sector. © Unknown

Often the final dump site is some distance from the latrines being emptied, often as far as 10-20 kilometres. This favours large traffic-worthy vehicles for the transport. Yet in peri-urban areas there is often an access problem, making it difficult for such larger vehicles to get to the latrines.

If waste is to be transferred into a container upon emptying, transporting it directly to its final disposal point is not always possible.

For instance, some 'adapted' forms of mechanical emptying are unsuited to travelling on public roads (for instance the Vacutug pictured travels at walking pace).

Nor, depending on how it has been emptied, does direct transport always make sense from operational and cost perspectives. For instance, while vacuum trucks are better suited to the 5, 10 or 20 kilometres that waste must often travel to get to its final disposal point, where these are used to empty pits they tend not to be filled by one load. To be efficient they must therefore empty several different pits before making the trip to the disposal point (and neighbouring clients are not always this easy to come by).

A case for temporary storage?

One solution to the challenge of emptying than moving waste is to adopt a two-stage system – with small, highly manoeuvrable machines operating within the area (such as the Vacutug pictured) and then a larger vehicle to move the waste on.[xii, 7]

[7]Furthermore, this 'split' solution lends itself to separate tanks being used for the final transport – this allows the smaller vehicle taking waste from latrines to shuttle back and forth and a tractor (or other vehicle) to transport the tank only once full. This saves on transport costs and means that fewer emptiers are 'held-up' by the absence of a dumping point during transfer.

But for operational and cost reasons, it may be sensible to consider the temporary storage of pit sludge within or near the locale from which it comes – with later transport taking place 'in bulk'. This tends to bring transport costs down (and allow more suitable vehicles to make the long trips).

It also adds a new link to the sanitation chain – one of temporary storage. This can pose other challenges and as yet there are few instances of 'successful' transfer stations, that store waste in a hygienic manner and in a fashion that is accepted by the surrounding community.[xiii]

Arguably this is an area ripe for innovation, and one which an international NGO, Water for People, are looking into. They are exploring the potential for using 'solar stills', hypothesising that there is sufficient energy in solar radiation to dry out wet pit latrine sludge and kill off all pathogens. This could allow micro- treatment plants to support small neighbourhood-based emptying services, an approach that another international NGO, WSUP, are currently exploring in Nairobi (without the drying function, but by connecting transfer points to existing sewer connections).

6 What to do with waste collected

There are three basic options in dealing with the treatment (and / or reuse) of sludge

Burial nearby: The waste can be buried on site where space allows (and where the waste can be considered safely separated from both people and groundwater). This can be a very practical and simple option.

Local reuse: Another option is to reuse the waste locally – but for this the waste needs to decompose within the toilet to a state that it can be handled safely. This is the significant selling point of urine-diversion (UD) toilets, which help turn human waste into a dry and perhaps safe 'product' that can be used as a fertiliser at best (and at worst, be more easily disposed of). Recent research in Durban, where there are over 80 000 such toilets, does however call into question the ability of most UD toilets to destroy hardy Ascaris parasites in regions where these are endemic. Although if the waste is co-composted with other organic waste this will, generally, render the pathogens harmless.

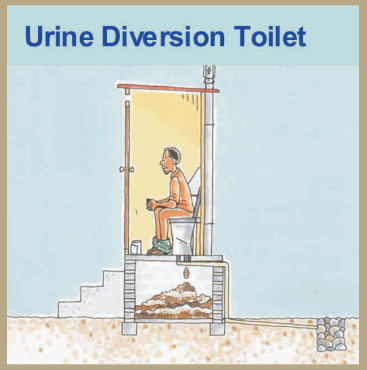

Fig 16 : Common UD toilet used in Durban

Fig 17 : Waste from a fossa alterna, which operates on the same principles as the UD toilets used in Durban © Peter Morgan

Fig 18. a,b: Semi-dried sludge being loaded into the machine © EWS.

Fig.19 : Dried sludge pellets © EWS

Central treatment or disposal: The third option is to treat the sludge from pits centrally (and then either dispose of the treated waste or find ways to reuse it safely). In some contexts partly digested sludge of a similar nature to that found in pits has been added direct to farmland, but there is a non trivial risk of pathogens involved.[8] In others it is disposed of at the main water treatment works – either by diluting it and adding it to sewage influent or by treatment with special ponds designed to accept sludge.[xiv]

Sludge disposal in eThekwini - reviewing the options.

The progress of eThekwini's pit emptying programme threw up a significant challenge in how best to deal with the significant quantities of digested sludge it unearthed. Early hopes that rudimentary primary treatment of the sludge would allow it to be discharged to sewers and the existing sewage treatment plant proved unfounded. The concentration of pit sludge differs greatly from sewage and it is therefore very easy to overload a treatment plant with such sludge. Consequently a large backlog of pit sludge has accumulated in Durban (under temporary storage), but recent trials of two technologies offer significant promise. One option is to dewater, heat treat and pelletize the sludge, using a mobile plant patented by EWS and partners. The pellets can potentially be used as fertiliser for agriculture. A second option is the entrenchment of the sludge along with agroforestry.

In Cape Town, South Africa, there is a sludge pelletizer that deals with sludges from the Cape Flats wastewater treatment works and Durban are now looking at using a similar method to deal with VIP sludges. A portable machine they have developed compacts semi-dried pit sludge, heat treats it (using infrared radiation) and turns it into pellets that can be used in agriculture.

This offers a portable solution that can deal with large numbers of people (around 60 000 people per machine) and one that is effective at removing harmful pathogens from the waste.

A second option is to burial untreated faecal sludge (but in a controlled manner). While this raises concerns about the environment, recent experiments in South Africa suggest that the supervised burial of faecal sludge along with careful planting offers a promising means for its safe disposal.[9] Tests in Kwa-Zulu Natal, South Africa, have suggested that the addition of digested pit sludge enhances the growth of the trees (with borehole monitoring confirming that this can be done without polluting groundwater).

On top of the practical benefits of being able to dispose of such sludges safely, there is an added benefit. Research into the impacts of such disposal techniques suggested that *"faecal sludge is a valuable nutrient source with sludge-enhanced tree growth comparing favourably that aided by traditional fertilisers."*[xv]

Fig.20 : Deep row entrenchment of pit sludges © D. Still

Fig. 21: Caption: sludge application. Photo by Jay Bhagwan

[8]In Durban the risk of pathogens, the presence of large quantities of detritus and the difficulty of repeated material handling eliminated direct disposal to farmland as an option.

[9]In South Africa dealing with sludge is essentially the role of the municipality – in other countries it is hoped that sludge emptied by private providers is delivered to the 'public system' in order to be treated (and possibly, reused).

Unlocking the value in pit sludge could have important consequences. For instance, it may provide a means to add valuable 'financial energy' into whole waste management system.[10]

As it stands, households typically only pay (where required) for the local costs of waste removal. This implies that the public sector must contribute to the costs of transport and treatment. If the value inherent in sludge can be unlocked, this could help the State to pay for these later costs.[11]

7 Not just a technical challenge, but a societal one

As the above sections describe, there are clear technical challenges involved in emptying toilets, particularly in the context of informal settlements.

Yet, clearly, the challenge cannot only be seen as a technical one. It is often stated that demand for sanitation is less than the demand for other basic services, such as water, or electricity. While this can be true, it is not always the case (recent World Bank surveys in Kenya's crowded and unsanitary slums saw poor communities put access to sanitation at the top of their development priorities).[xvi]

What is true is that there is much need for health and hygiene campaigns, for two main reasons. The primary reason is that without improved hygiene behaviour the advantages of providing improved sanitation are rapidly undermined and health gains remain elusive.

[10]As SME consultant John Meadley put it, "No system can work without energy circulating within it. This can be considered from two angles. The first is financial energy. If sanitation is simply about collecting sludge and disposing of it responsibly then there is no income flowing into the system other than provided by those who produce the sludge (user fees) or by government, or by a combination of both. The private sector cannot bring in investment unless there is sufficient money flowing within the system to generate an acceptable return on that investment.

The second angle relates to energy itself. Although there are cultural and other reasons for simply disposing of sludge, this sludge has both an energy value and a financial value. The sludge of 100 people produces approximately 1 ton of urea equivalent (46% nitrogen) per annum for which the current price to farmers is around £300 (US$450). With oil being 90% of the cost of production of urea, this price can only go up. Utilising the sludge in this way brings some additional funds/energy into the system and must become more important in the future" (Personal communication, 2008).

[11]Some argue that, if all goes well, the value in sludge could reverse incentives across the entire chain (making the extraction and treatment of sludge a profitable business) but this remains to be seen in practice.

A secondary reason relates to the demand for sanitation. Health and hygiene campaigns, if conducted well, can help increase the demand for sanitation. In turn, this can stimulate the public or private 'market' for hygienic and safe emptying (partly by increasing the willingness to pay for improved services). Campaigns can also teach householders how to safely deal with waste themselves. Even in contexts where households contract out the job of emptying, these campaigns can help to put pressure on providers to do a better job of dealing with the waste.

User education is a vital component

A particular challenge, at least in South Africa, is the sheer volume of household rubbish that gets dumped into pits. Inorganic rubbish does not degrade in a pit and makes both manual and mechanical emptying more challenging (blocking pumps etcetera).

Health and hygiene campaigns can perhaps bring about change here too, persuading householders to find other ways to deal with their rubbish.[12]

Sanitation marketing can explain and increase the demand for sanitation

Social marketing has its origins largely in the health sector, where it has been applied to issues like anti-smoking campaigns over more than three decades. In the last ten years there has been growing interest in applying the same concept to sanitation, leading to a new term, 'sanitation marketing', being coined. According to Wikipedia, social marketing is *"the systematic application of marketing, along with other concepts and techniques, to achieve specific behavioural goals for a social good".*

Sanitation marketing is primarily about understanding why and how households adopt certain hygiene behaviours. It also focuses on the triggers for and barriers against households investing in sanitation infrastructure. Using this information, organisations hope to better promote demand for sanitation and to influence the supply chain of sanitation goods and services. They hope that more households will then 'adopt' improved sanitation (or good hygiene practices). A lot of recent demand studies on sanitation have happened as part of such programmes. To achieve its wider goals the approach often mixes 'social' approaches (promoting a social good) with 'private sector' techniques (using private sector marketing techniques and the private sector to deliver goods and services). (Adapted from Schaub-Jones, 2010)

[12]More generally, misuse of latrines complicates matters. For instance, some households pour in bleach to deal with the smell, even though this kills of the bacteria needed for digestion to take place. Technical solutions can arguably address the rubbish challenge; for instance the introduction of pour flush toilets would deter households from throwing rubbish into the toilet bowl.

8 Not just a societal challenge, but an operational one

Some of the operational challenges surrounding pit emptying have been dealt with above. The waste often needs to be moved out of the communities from where it is emptied, which poses a logistical and operational challenge. Mechanical means are not always appropriate across the whole community and may need mixing with manual emptying techniques.

Pay attention to the 'business' of emptying pits

But beyond these considerations it pays to heed the fact that, in many contexts, the business of emptying is exactly that – a business, run by private individuals. Even where emptying is done by municipal authorities it makes sense for them to adopt certain basic business principles and to seek operational models that help them reduce costs and scale up their service.

The emptying business faces a particular challenge in that demand for the emptying of toilets is fragmented. For instance the demand from any individual household for emptying a toilet tends to be almost once-off in nature – happening every few months at best (and more often measured in years). This is in stark contrast to a household's daily demand for water. A consequence of this is that the 'order book' for a typical emptying provider sees clients in any given week geographically scattered throughout a city. Demand on any given day is not found all in one location (as it may be for other service providers).

This phenomenon of fragmented demand stands as a significant barrier to efficiency in service delivery and retards any scaling-up of existing sanitation enterprises. Durban has overcome this by 'sweeping' through a particular community and emptying all pits there, whether they are full, nearly full, or only part filled. It can do this as the service it provides is free and it does not rely on community demand in the same way. Doing so allows it to 'aggregate' its service delivery in a way that a private provider cannot.

How often to empty for an effective service?

Some argue that smaller pits can enable stronger, more resilient and more sustainable business approaches. Reducing the size of the pit means that it needs to be emptied more frequently. This in turn permits a closer relationship to be created between households and emptying businesses. Businesses can develop an order book that sees them return more frequently to known clients and better able to smooth demand for their services. Beyond this, as the nature of the 'transaction' becomes less once-off and a more customer relationship developed, providers are arguably motivated to provide better services and not risk losing loyal clients. WSUP, along with the design firm IDEO, are currently piloting a scheme in Ghana that explores these principles, aiming to use smaller toilets and more frequent emptying to provide tangible benefits for both householders and providers and, by extension, for health and the environment. See http://www.wsup.com/news/ghanasan.htm for more.

Dealing with a hazardous waste

The emptying of pit latrines and urine diversion toilets exposes both emptiers and nearby householders to hazardous waste and pathogens. Until recently the full risks of doing so were poorly understood, but recent research (studying eThekwini's pit emptying programme) has quantified these risks and allowed a better understanding of what protection measures are needed.

This research showed that in order to bring the risks within reasonable bounds workers must not only wear heavy duty gloves and boots but use heavy duty breathing masks (basic dust masks are insufficient protection). These measures, along with regular health checks and regular deworming after exposure, provide adequate safety to manual emptiers in Durban's programme. How such measures can be introduced in more informal, private, emptying markets elsewhere in the region remains an open question, but one that governments and NGOs will increasingly need to address.

A further question is how to reduce the exposure of poor communities to the various pathogens found in faecal sludge, particularly durable pathogens such as Ascaris. Burial on site, which is common practice, is unlikely to meet rigorous protection criteria. This reinforces the argument for the public sector to support public and private emptying operations so that a reliable, hygienic and practical system for transporting the waste elsewhere for final treatment can be developed.

9 Conclusion

While most discussion of how to reach the MDGs for sanitation focus on the building of new toilets, it is clear that the servicing (emptying) of those toilets already built cannot be overlooked, at least in urban areas.

As urban populations grow and more toilets are built the existing challenge will grow – not only in terms of numbers but with the rising complexity of working in dense urban settlements. [13]

The diagram below shows the sanitation chain that develops for sanitation – for whom the on-site sanitation context applies to the majority of urban dwellers within SADC. In urban areas it is much rarer for new pits to be dug once old latrines fill (for a variety of reasons). The issue of how to manage the faecal sludge accumulating in urban latrines is therefore a crucial one.

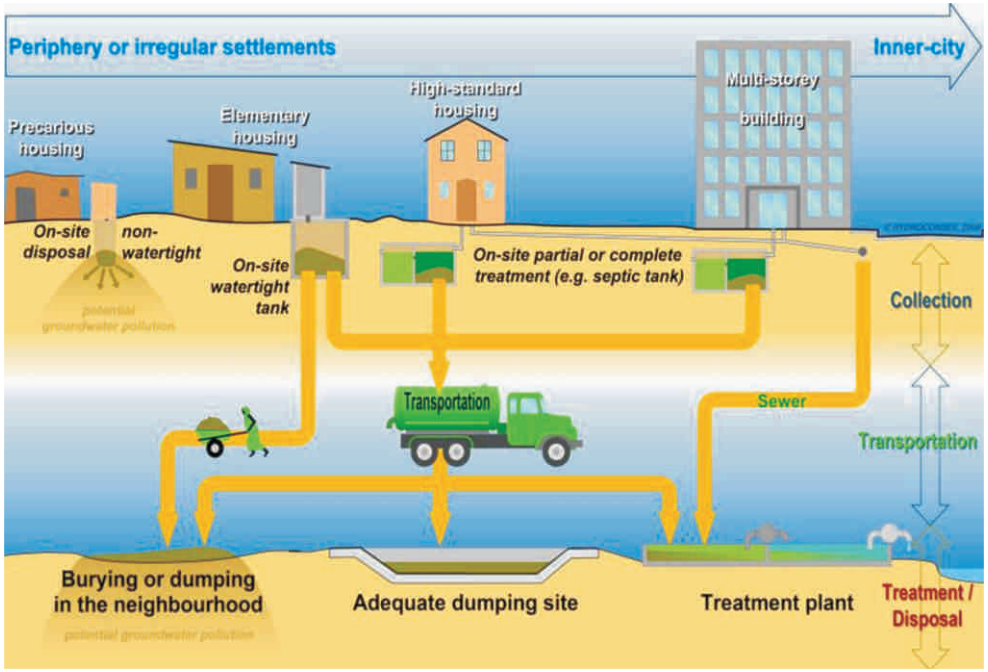

Fig. 22: Simplified diagram of the various ways that human waste is typically collected, transported and disposed of within a city © Hydroconseil

Traditionally this is an issue that has attracted relatively little attention and had little prestige. Historically it has also been an area of limited innovation. As the challenge of faecal sludge management (FSM) grows, things are changing however. Recent years have seen a flourishing of innovation across a range of issues. This has bettered our understanding of what happens in pit latrines, how sludge accumulates and degrades and how it can best be managed.

[13] Africa has the highest annual slum growth rate (4.53% per year), more than twice the global average, and is expected to have the largest number of slums by 2020. Source: UN-Habitat

New ways of getting sludge out of pits, in a more hygienic and efficient manner, are being pioneered in many countries worldwide. The final link in the chain, the important issue of how to deal with the sludge collected, is also under the spotlight, with new or better ways of dealing with pit sludge emerging.

The city of Durban has been a focal point for much of this innovation and learning. It was therefore an appropriate place to gather over 140 practitioners dealing with FSM in March 2011. The participants - from local government, NGOs, research organisations and academia –discussed the latest developments and shared experience across four continents. [xvii]

Their message was, on the whole, a positive one. The adequate management of waste from both existing toilets and those not yet built is vital to ensure that society actually benefits from the public goods of sanitation. Once a toilet is built the work of the public sector (and the NGOs that support them) is not done. Putting in place reliable and equitable systems for emptying toilets once they fill and dealing with the waste they contain is vital to ensure that there is no backsliding on the MDGs.

It is also an area ripe with innovation and potential. A lot of the market outside South Africa lies in the hands of local entrepreneurs – some informal, some more formalised with much capital invested. There are ways to encourage the growth of this sector even as steps to oversee and regulate the business are reinforced. All agree that there is a crucial role for local government; this note and others highlight a range of practical steps that can be taken. There is much to learn and much to do but experience shows that this is a challenge that can be met and, by doing so, local municipalities and their allies can safeguard the health of today's children whilst also protecting the environment for those generations still to come.

10 Where to go for more information

www.afrisan.org:
The Southern Africa Knowledge Node on Sustainable Sanitation

Various outputs and reports dealing with faecal sludge management can be found on the WRC website: **www.wrc.org.za**

For a glossary of terms relating to sanitation, pit sludges and treatment, etcetera see **www.water.worldbank.org/water/shw-resource-guide/glossary**

For a factsheet on the emptying of latrine pits and treatment of the waste see **www.lboro.ac.uk/well/resources/.../54-emptying-latrine-pits.pdf**

For discussion of how to go 'beyond storage' of latrines and a depiction of on-site sanitation as an urban system, see **www.bpdws.org/web/w/www_127_en.aspx**

For some practical information on Pit Emptying Systems: **http://practicalaction.org/practicalanswers/product_info.php?products_id=395** & **http://www.unhabitat.org/categories.asp?catid=548**

For discussion of pit emptying techniques and challenges, including information on the ePLEP programme in Durban and common practise in Nairobi, see 'Sanitation Partnerships: Bringing pit emptying out of the darkness' at **www.bpdws.org/bpd/web/d/doc_131.pdf?statsHandlerDone=1**

For discussion of transportation aspects see: UN Habitat's 'Collection of Municipal Solid Waste in Developing Countries' at **www.unhabitat.org**

For a website that looks at the re-use of toilet compost and urine see **http://aquamor.tripod.com/DurbAgPap.htm**

For issues of deep-row entrenchment & agroforestry see **http://www.biosolids.com.au**

For information on sanitation marketing see **http://www.lboro.ac.uk/well/resources/fact-sheets/fact-sheets-htm/Sanitation marketing.htm** and related reading in a factsheet on 'Why promote sanitation?' **http://www.lboro.ac.uk/well/resources/fact-sheets/fact-sheets-htm/wps.htm**

Endnotes

[i] World Water Day is on March 22 each year.

[ii] Source: http://allafrica.com/stories/201103240873.html

[iii] UN HABITAT have stated that by 2050, 60% of Africans will be living in cities. Joan Clos, the Executive Director of UN-HABITAT, said: *"No African government can afford to ignore the ongoing rapid urban transition taking place across the continent. Cities must become priority areas for public policies, with hugely increased investments to build adequate governance capacities, equitable services delivery, affordable housing provision and better wealth distribution"* (March 22, 2011).

[iv] Six in ten of those live in slums, where water supply and sanitation are severely inadequate. This means that almost 250 million people now live in African slums (eight times the total population of South Africa). See *'Green Hills, Blue Cities: An Ecosystem Approach to Water Resources Management for African Cities'*, Rapid Response Assessment, UNEP & UN-HABITAT, 2011.

[v] Globally, despite an increase of almost 40% in the number of people served with improved sanitation over 1990-2004, the deficit of urban unserved is growing. According to current projections, the number of urban dwellers without access to improved sanitation will see an increase of almost 50% from 1990 to 2015.

[vi] See http://www.pmg.org.za/node/22065. The cost for this was cited, in Parliament, at between $120 and $170 USD per toilet.

[vii] Assuming SADC prices are at the lower end (or even less) of South Africa's, the size of the total SADC 'emptying' market would still be around $100 million USD a year.

[viii] For progress on the MDGs to not go into reverse, we need to manage this challenge (and, maybe, see the opportunities)

[ix] For more, see *'Partnerships involving small-scale providers for the provision of sanitation services: Case studies in Dakar and Dar-Es-Salaam'*, Emeline Bérézia t, 2009, UNESCO- IHE

[x] Ideally these innovations should also allow for operation by one person, withstand huge misuse and be capable of emptying at least the top metre of the pit. See the WIN-SA / PID report on the March 2011 Faecal Sludge Management conference in Durban, South Africa, for more details: www.win-sa.org.za

[xi] The distance that needs to be travelled and the load are the prime considerations, as is the speed of traffic on transport routes.

[xii] The disadvantage of such an approach is that it undermines one of the key principles of waste handling – which is "Handle Only Once". As often the case then, certain tradeoffs are required.

[xii] There are some examples in Ghana. See *'The use of transfer stations for faecal sludge management in Accra'* by Niall Boot, Waterlines, Volume 27, 2008

[xiv] See Earth and Environmental Science Environmental Management, Volume 30, Number 5, 0609-0620, DOI: 10.1007/s00267-002-2685-8 for an article on *'Excreta Disposal in Dar-es-Salaam'*, by Chaggu et al, which discusses the ability of ponds there to deal with pit and septic tanks sludge.

[xv] Craig Taylor, during presentation to a seminar on *'What Happens When the Pit is Full? Developments in on-site Faecal Sludge Management, 14-15 March 2011, Durban, South Africa*'. A further practical benefit is that deep row entrenchment can deal with the large amount of plastic waste typically found in pits without significant problems.

[xvi] Source: Sumila; Debomy, Sylvie; Farvacque-Vitkovic, Catherine, *'Inside informality: Poverty, Jobs, Housing and Services in Nairobi's Slums,'* The World Bank, 31 May 2006

[xvii] See www.wrc.org.za, www.win-sa.org.za and www.pid.co.za for the proceedings of the two day seminar, a report that shares the insights discussed and which makes the assorted research, learning and best practice accessible to a wider audience.