

The Management, Practice and Environmental Health Implications of the Municipal Solid Waste Dump Site in Alice, South Africa.

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South African municipalities are known to have engineered landfills and to have specific regulations and guide lines of managing them building from the national and provincial legislative framework. Despite the presence of these conditions the municipalities experience several challenges in managing their landfills. This study therefore, wanted to examine the management of the solid waste disposal site in Alice, a town in South Africa. It was observed that the management of the landfill does not meet the Minimum Requirements set by the Department of Water Affairs. There is co-disposal of municipal, hazardous and building waste at the site. The site is not guarded and waste pickers and animals access the site any time of the day. Municipal workers were responsible for burning waste at the site thereby contributing to greenhouse gases. The study recommends that the Alice community be exposed to education and awareness campaigns on the need to minimise the amount and types of waste getting to the site. The council should install a weighbridge to help check on the waste that enters the site.

Key words: Alice, landfill, solid waste, management, impact.

INTRODUCTION

Some of South Africa's municipalities are experiencing problems with the management of their solid waste disposal sites [1]. This is despite the fact that South Africa is touted as the only country in Africa with engineered landfills as well as specific regulations and guidelines in place to govern these solid waste landfills [2-4]. The South African Constitution through the Municipal Structures Act (Act No. 117 of 1998) stipulates that local governments have the responsibility for waste management, although several pieces of legislation, including; The South African Constitution (Act 108 of 1996), Hazardous Substances Act (Act 5 of 1973), Health Act (Act 63 of 1977), Environment Conservation Act (Act 73 of 1989), Occupational Health and Safety Act (Act 85 of 1993), National Water Act (Act 36 of 1998), the National Environmental Management Act (Act 107 of 1998), Municipal Structures Act (Act 117 of 1998), Municipal Systems Act (Act 32 of 2000), Mineral and Petroleum Resources Development Act (Act 28 of 2002), Air Quality Act (Act 39 of 2004) and the National

Environmental Management Waste Act, 2008 (Act 59 of 2008) are currently used to govern waste [5,6]. As such, District and Local municipalities are expected to complement each other in dealing with waste management, which is refuse removal, refuse dumps and solid waste disposal. Surveys conducted in South Africa reveals that dumping of solid waste at most of the disposal sites does not follow the stipulated regulations.

South Africa has approximately 1,280 landfills, and most of these are owned and operated by municipalities and are located on sites such as abandoned quarries and ravines [7]. Only 44% of these landfills are authorised through permits, and of those permitted, compliance with permit conditions is seldom audited and often unknown [1]. Waste disposal in South Africa is supposed to be done in landfills, observations reveals that approximately 10% of landfills in the country are managed in accordance with the Minimum Requirements [8], otherwise the rest are operating as semi-controlled open dumps [9]. Muswema [2] confirms in a study conducted in

KwaZulu Natal that most of the municipalities in the province still use open dumps. Dumping is used in most developing countries (South Africa included) because it remains the cheapest option available [6,10]. Semi controlled dumps are dumps that implement only limited measures to mitigate environmental impacts and do not take into account environmental cautionary measures such as leachate pollution control [11].

Air pollutants emitted from landfills contributes to the emission in the atmosphere of greenhouse gases and other gases that cause serious problems to the human health and the environment. Operations and management at some of the landfills in South Africa are a potential hazard to human health. The surrounding areas to the landfill sites suffer from the impact of air pollution from uncontrolled burning and wind scatter because waste is not covered. Burning of litter is a common practice used to reduce volume of litter at the disposal sites in most South African urban areas. Burning however pollutes the air through the thick smoke that contains carbon monoxide, soot and nitrogen oxides, all of which are hazardous to human health and also degrade the quality of urban air. Combustion of polyvinyl chlorides (PVCs) generates highly carcinogenic dioxins [12]. Burning of litter at the disposal site contributes in the generation of greenhouse gases which ultimately lead to climate change and global warming. In addition, the disposal of organic wastes in deep dumps or landfills results in anaerobic degradation and this produces greenhouse gases namely methane (CH₄) and carbon dioxide (CO₂), contribute towards global warming [1,13].

According to the Clean Development Mechanism (CDM), established by Kyoto Protocol in 1997 Kyoto Protocol [14], landfills and open disposal sites emit significant quantities of greenhouse gases such as methane (60%) and carbon dioxide (40%). Methane has at least 21 times more effect as a gas than carbon dioxide and it is imperative to effectively address methane gas in order to reduce global warming [13,15]. The presence of methane gas has motivated the South African government to investigate the possibility of collecting the gas at three landfill sites in the municipality of Durban, namely Marianhill, the Bisasar Road and La Mercy landfills [16]. The presence of methane worsens the preponderance of spontaneous fires and explosions at landfills and these fires are difficult to put out because methane gas is highly inflammable [17]. The smoke from such fires contains toxic substances and is inhaled by the surrounding populace.

In South Africa, as in the rest of the African continent, most of the landfills are unlined hence they do not have groundwater protection, leachate recovery, or treatment systems. There is also general lack of monitoring of the levels of landfill leachate. It is important to monitor the presence of leachate as it can easily be leached into groundwater in landfills that are poorly designed thereby exposing individuals and animals that depend on

groundwater to contaminated water [18].

In most South African cities solid waste disposal is controlled. Waste reclaiming also takes place with several waste pickers subsisting on income generated from sorting waste. Waste pickers however tend to interfere with daily operations at the disposal sites. They start fires in order to access metals and glass. Their actions have often prevented landfill operators from making optimal use of compactors at the tipping face [11]. Waste pickers who salvage food disposed of at the landfills also expose themselves to poisonous food. In October 2011, a teenager died after ingesting a toxic substance he picked at a Buffalo City Metro dumpsite [19]. It has been observed also that landfills in South Africa practise co-disposal of hazardous, building and municipal solid waste. Best practice encourages that these different solid waste materials should be disposed of in permitted hazardous waste landfill sites such as Klerksdorp regional waste disposal facility, Necsa Pelindaba Class H:H landfill site and Kynoch Gypsum Dam and Holfontein. Although most organisations are cognisant of these requirements, they are deterred by the high costs that are involved in transporting and disposing of hazardous waste, and they end up illegally dumping or disposing of significant quantities of waste on a general waste landfill site. Studies conducted by [20] show that waste is being dumped in general municipal landfills in some of the urban areas in South Africa. There is a growing e-waste stream due to the fast growing use of ICT and rapid turn-over in technology, especially computers and mobile phones [20]. The challenges facing the developing countries in e-waste management include; an absence of infrastructure for appropriate waste management, an absence of legislation dealing specifically with e-waste [21]. Informal collectors lack basic safety equipment when dealing with e-waste hence they are exposed to serious health hazards [22]. Some studies have reported that hospital waste is dumped in ordinary landfills in South Africa. [23] observes that about 45% of health care waste that is generated in KwaZulu Natal Province cannot be accounted for, which means it could be illegally dumped, or buried or burnt somewhere. [24] State that a hospital in South Africa treated 48 children with azidothymidine (AZT) after some where pricked with needles and others ate potentially lethal pills they found in a field in Elsie's River. Improper disposal of medical waste including open dumping and uncontrolled burning increases the risk of spreading infectious diseases as well as exposing unsuspecting individuals to toxic emissions from incomplete combustions.

Construction and demolition of waste is becoming a major environmental problem in many municipalities as it consumes large amounts of space in disposal site, and this exacerbates the problem as local authorities are running out of space for new landfills [25]. South African cities and towns have over the years been experiencing a shortage of space for landfills [26]. Urban areas have

been growing and this has been concomitantly accompanied increased waste generation. However, the growth has exceeded the available landfill space, with many sites either near or running over capacity. A number of landfill sites in South Africa, especially those around Gauteng, have limited space and, in several cases, pose significant potential health and safety hazards [10]. Johannesburg has less than 12 years of landfill sites left and Cape Town is experiencing similar problems [27]. Strategies have to be adopted so as to mitigate these imminent challenges.

Some pilot studies that were conducted by the Department of Environmental Affairs, formerly (Department of Environmental Affairs and Tourism) as part of the South African waste information system project, highlighted that many medium and large general waste landfill sites in South Africa are operating without weighbridges, although required to, under the minimum requirements for landfilling [28]. The lack of weighbridges at landfills results in municipalities having inaccurate solid waste data and this contributes towards both uninformed and misinformed planning processes and ultimately the formulation of policies that are irrelevant to the municipalities. Few municipalities such as Ekurhuleni Municipality have effective and accurate waste data collection systems in place as they have two weighbridges at Platkop landfill, the one for incoming and the other for departing vehicles ensures accurate information on waste entering the landfill site. Besides their usual function weighbridges can be utilised to limit the type of waste that enters the landfills. The vehicle transporting the waste can be checked to see whether its contents are in compliance with the minimum requirements for landfilling. [28] Propose that since municipalities may not afford to set up weighbridges they could instead utilise in-motion weighing technology as "portable landfill weighbridge". This technology is currently available in South Africa and it is used traditionally by trucking companies to ensure that vehicles are not overloaded, or unevenly loaded when leaving the trucking yard [28]. The amount of waste recycled in 2002 was 2% as a result of informal salvaging activities.

Based on assessment made on the rate of collection for different recyclables, materials without subsidies like glass always had the lowest recovery rate [28]. Currently, there is no recycling programme implemented by the Municipality of Polokwane City. It has been found that 60% of waste disposed in the landfill consists of recyclable waste. Although the Municipality does not have a formal waste recycling system, it was found that the disposal site has informal waste reclaimers that are collecting recyclable wastes on a daily basis [29].

Description of the study site

The Alice solid waste disposal site is located approximately

6km south west of the town centre in the Eastern Cape. It is about 2km from the built up area of Happy Rest residential area. The site occupies about two hectares. The site is a recovered quarry which was converted into a solid waste disposal site in 1999. Municipal records indicate that the Nkonkobe Municipality applied to the Department of Water Affairs (DWA) (formerly Department of Water Affairs and Forestry DWAF) to utilise the quarry for disposing of solid waste and an environmental impact assessment was conducted before the disposal could commence. The site is registered with the DWAF as G:C:B- and is expected to be managed in accordance with the Minimum Requirements [6,8]. The site is fenced but has a broken gate. The guardroom has been vandalised and is no longer functional. The underground lining had been laid in places. There is a seasonal stream which lies less than 200 metres in the eastern side of the site.

METHODOLOGY

The study which is qualitative in nature gathered data through interviews, observations and content analysis of municipal records. Interviews were conducted with the Nkonkobe Municipality health inspector whose department was responsible for running the Alice solid waste dump site. This was intended to get information on the position of the municipality concerning the management of the site. Waste pickers were always on the site; hence they had valuable information on the site. Furthermore they were affected by poor management of the site. Observations were used so as to obtain first-hand information on what was going on at the site. This was also used as a way of verifying information obtained through interviews. Document analysis was important as it provided information on the minimum requirements expected by the municipality. It was used to check whether the municipality adhered to these standards.

Findings And Discussions

The composition of waste

Alice solid waste disposal site operated as an open dump site where rubbish from the town and the surrounding environs was dumped and often burned. The site was an eyesore due to visual ugliness that was caused by the scatter litter. The site was also a breeding ground for vermin like flies, cockroaches, mosquitoes, rats and mice and these have the potential to transmit diseases into the neighbouring residential areas. It had a foul atmosphere caused by the fetid odour from the rotting organic waste. Leachate from the site was likely to pollute a nearby stream through runoff, and it polluted the air from the burning of rubbish. Dumping at the site was uncontrolled, and building rubble, domestic and medical waste was

Table 1. Waste types and compositions at the Alice dump site.

Type of waste	Examples of waste	Percentage of total amount (%)
bottles	Plastic, glass and metal cans	23
Hospital waste	Swabs, medicine containers, oxygen masks and catheters	8
Car parts	Tyres, oil filters, broken seats, batteries	6
E-waste	Computer parts, cables, cartridges, ink jets, printers	8
Building waste	Rubble, bricks, broken asbestos sheets, timber, fluorescent bulbs, PVC gutters, and electric cables	17
Clothing materials	Rugs,	3
Paper	Cardboard boxes, plastic paper	25
Organic waste	Food, compost and dead animals	10
Total		100

seen strewn all over the dumping site. The waste stream at the dump contained the following items; bottles, cans, hospital waste (swabs, medicine containers, oxygen masks, catheters), cardboard boxes, plastic paper, car parts (tyres, oil filters, seats), e-waste (computer parts, cables, cartridges, ink jets, printers), by both humans and animals. However at the time of the study it was observed that there was no one responsible for manning the site. This was contrary to the Minimum Requirements for waste disposal by landfill [8] which stipulate that the operation of all landfill sites must be carried out under the direction of a responsible person building waste (rubble, bricks, broken asbestos sheets, timber, PVC gutters, and electric cables), and clothing materials. Table 1 shows the estimate composition of the waste types at the dumpsite.

The Management Of The Dump Site

The waste disposal site had a 2m high perimeter fence around it which was installed with the intention to catch wind-blown litter as well as to stop free entry into the park who might be a gate controller or a security guard. A security guard controls access to the site and all pickers have to obtain a permit from the waste manager. Regulations further state that the responsible person must, in all cases, be supported by suitably qualified and competent staff compliment which is determined by the size and type of the operation as well as the facilities involved [8]. These requirements were not obtain at the Alice disposal site. Some waste pickers who operated at the site on a regular basis revealed during interviews that the municipality had not assigned someone to work at the site for a period extending beyond three months. The gate to the site was broken down and the perimeter fence was also broken in

some places and vagrants and poor people from the town and the nearby villages of Kyahamunandi, Bhakaneni, Sheshegu, Phumulani, Smith and Gugwini had free access into the dump site, where they salvaged food to feed their families, as well as recover any materials they could reuse in their homes. The health inspector from the Nkonkobe Municipality explained that the waste pickers found at the disposal site were not involved in the recycling business as they were not involved in the recycling businesses as they were not registered with the council. He explained that according to DWAF regulations all recyclers had to be registered with the municipality responsible for the site. This confirmed observations made by the research team on their visits to the site. As soon as the team got to the site the waste pickers simply disappeared from the site, while some were overhead discussing among themselves that the research team was probably a group of undercover police that had come to arrest them. This signified that their practices were illegal.

The presence of waste pickers at the dumpsite could have a major impact on how the site operates. They were accused of starting fires in their quest to recover wire from dumped vehicle tyres. This practice produced prolonged and polluting fires and it also reduced the aesthetic value of the place as the disposal site was covered in soot. The use of fire at the site was a potential danger as there were several discarded pressurised containers (spray cans), and these can explode when heated. It was also observed that waste pickers did not care to put out the fire once they had recovered the wire from the tyres and in the past this had caused veld fires around the disposal site. Waste pickers pose a safety hazard to themselves as they use bare hands to dig into the waste in search of salvageable materials. They risked being injured as there were several sharp objects in the

waste. The food they took home to their families could also be contaminated as some of it would have been condemned from hotels and restaurants in the town of Alice. The lack of guards at the site and the broken gate and fence made it possible on the one hand for animals to access the site at any time of the day. Cattle and dogs were observed foraging for food in the disposal site. One elderly waste picker revealed that cattle from the surrounding villages died from ingesting plastics and some poisonous materials that were dumped at the site. On the other hand the absence of the gate and an attendant meant that prohibited waste could be dumped at the site; hence hospital waste was dumped at the site in large quantities. Dead animals such as dogs were dumped here making Alice disposal site a health time bomb. Observations made at the disposal site showed that solid wastes were disposed of in a manner that did not protect the environment. Plastic bags and paper were all over the dump and trees a kilometre away had plastic bags hanging on them. The municipal health inspector said that the casual workers who were hired to work on the site often lit fires to deliberately dispose of unwanted waste such as plastic bags and paper. This resulted in thick, noxious smoke that polluted the air around the site. Fires at the site must be avoided as they are difficult to control due to the presence of landfill gas. Fires also contribute in the production of greenhouse gases that could have an impact on climate change and global warming. There were about six trenches that were excavated so that waste could be deposited into them. These were used in place of cells. However, the practice of covering waste in the trenches with soil on a daily basis was not being effected, hence it was exposed to the elements, disease vectors and scavengers. Furthermore, the trenches collected water and this encouraged the rapid decay of organic waste. This attracted disease vectors such as flies, mosquitoes, cockroaches and rats. Flies and mosquitoes can fly for a distance of up to five kilometres [30,31], which meant Happy Rest residential area, which was about two kilometres from the site was exposed to the threat of diseases that were spread by flies and mosquitoes. The site was also engulfed by a heavy stench that emanated from the decaying organic matter. Moreover, there was a high probability that as water passed through the landfill it picked up soluble portions of the decomposing waste which was toxic, and was likely to contaminate either groundwater or surface water that could be used for human activities in one way or another. Observation made at the site revealed that large volumes of construction and demolition debris were being dumped either within the site or a few metres outside the disposal site. The debris consisted of bricks, rubble, broken asbestos sheets, fluorescent tubes, timber, PVC gutters, and electric cables. Traces of paint were observed on some of the rubble and bricks. Disposing of construction and demolition material in dumps or landfills greatly

reduces their lifespan, while residual paint, fluorescent tubes and asbestos may make the debris toxic. This poses a threat to humans who dig in the rubble with bare hands while increasing chances of polluting underground water.

The presence of hospital waste at the site was evidence of poor management. The waste included swabs, medicine containers, oxygen masks and catheters. Wastes from hospitals and healthcare facilities may be contaminated therefore potentially infectious as they may carry microorganisms that can infect the people who come in contact with the waste as well as the community at large. Usually swabs from hospitals are associated with blood, pus, urine, stool and other body fluids, since they are usually used to clean and dress wounds and vomit in clinics and hospitals. E-waste was also identified at the disposal site. This was mainly in the form of computer parts, cables, cartridges, ink jets and broken printers. Electronic gadgets such as computers contain significant amounts of material that are hazardous to human health which include polyvinyl chloride (PVC plastics), copper, lead, mercury, arsenic, cadmium, manganese, cobalt, gold, and iron. These heavy metals can leach into the soil, evaporate into the air, and enter the air through burning. It was noticed that at the Alice solid waste disposal site there was no weighbridge to weigh all the incoming waste to the landfill. It means therefore that the waste that was received at the landfill was not registered according to category, weight (by tonne or by kilograms), and source, name of transporting company and time and date of delivery. These data are important as they form the basis for determining how the landfill should be managed in terms of the requisite equipment needed and in determining the lifespan of the landfill. The weighbridge is also useful as waste collection vehicles on top of being weighed on arrival, their load is also inspected for wastes that do not accord with the landfills acceptance criteria. Hazardous waste such as hospital waste would be detected and directed to the appropriate landfills. Moreover the lifespan of the disposal site would be lengthened as some waste such as building rubble will not be allowed into the site.

Recommendations

The Nkonkobe Municipality together with key stakeholders such as Ministries of Cooperative Governance, Environment Health and Education should have awareness and education programmes which inform Alice residents on the importance of waste management. According to [5] education and awareness are important in the success of any reduce, re-use and recycling initiative. Residents should be educated on the importance of waste minimisation and recycling. In essence they should be made aware that waste is not rubbish but a resource that has an economic value.

Residents should be encouraged to separate waste at source, which is their homes. The council should therefore supply households with receptacles that cater for different types of waste. This will reduce the amount of waste that ends up at the Alice disposal site; hence it will take long to fill up and there will be less of flying litter in the form of plastics.

The council should endeavour to have a weighbridge installed at the Alice waste disposal site. A weighbridge serves multiple purposes which include assisting in accurate record keeping of the incoming waste types and quantities. It also allows for the monitoring of the types of waste being dumped at the site so that only relevant waste should be disposed of at Alice and hazardous waste should be taken to appropriate sites. This is important for planning and reporting purposes. If a weighbridge is too expensive for the municipality then ways of estimating waste volumes or weights must be explored. It is essential to have access control at the gate to monitor the types and volumes of waste being dumped at the site. The council must have a sign at the gate which indicates the types of waste allowed and the operating hours of the site as stipulated in its by-law (By-Law to Solid Waste Disposal: Gaz nr 1477/29/20060220). This means the site must be gated so as to restrict the entry of people and animals into the facility. This also stops unscrupulous individuals and organisations from dumping their prohibited waste at night.

The council should ensure that it abides by its own bye laws and national regulations. The council prohibits the use of fire at public places yet its own employees are guilty of this offence as they use fires on the landfill site. The council should make an effort to cover the waste with soil on a regular basis so as to protect it from rodents and disease vectors such as flies, cockroaches, mosquitoes and rats. The soil cover is also important as it reduces the level of odour at the landfill. The number of birds that prey on the landfill will be reduced as well. It is also necessary to compact the waste both before and after dumping, so as to reduce the amount of scatter waste, as well as lengthen the lifespan of the landfill. Furthermore, there is need to spray the waste with chemicals to eradicate pests and disease vectors. There is also need to devise ways of collecting leachate so as to mitigate pollution of underground and the nearby surface water.

The security fence at the disposal site must be repaired so as to keep people and animals out. Pickers, children and domestic animals should not be allowed onto the disposal site for safety reasons. If necessary there should be a measure of structured access to waste pickers by registering waste pickers who operate within the disposal site. The municipality of Nkonkobe could devise a programme that reduces the problem of scavenging at the dump site by formalising waste picking as a form of employment. Waste pickers should therefore organise themselves into cooperatives or groups that recover waste for recycling purposes. They will be monitored and they will be provided with appropriate protective clothing.

The responsible authorities at Alice could take cues from a landfill in San Mateo, in the Phillipines, which employs some of the inhabitants from the nearest squatter community to work at the site [11]. There is need to encourage Private-Public Partnerships (PPPs) so that the private sector is roped into the waste management system. The private sector has the capacity to set up recycling centres, which create employment for mainly women and the youth, while simultaneously attending to the solid waste problem. Although the recycling industry is developed in South Africa there is need to set up some industries in Alice or the nearby King Williams Town. Moreover, the recycling business should be made more sustainable by remunerating waste collectors fairly. Observations reveal that waste pickers are generally exploited; hence they are not motivated and committed to remain in the trade on a regular basis.

The Nkonkobe Municipality should have a dedicated area for dumping of builders' rubble as building and construction waste shortens the life span of landfills. A dedicated area enables some waste pickers to salvage some usable materials such as bricks and timber that could be sold. Timber could be used to make dog kennels. Building rubble could also be put to good use at the Alice disposal site. Some of the recovered bricks could be used to maintain the fence while some concrete and broken bricks could be crushed and used as cover material as is done at Bisasar Road landfill, in eThekweni (Durban Solid Waste) [5].

To sum it all Nkonkobe Municipality needs to adopt and adhere to the internationally acclaimed Integrated Solid Waste Management (ISWM), which is a comprehensive waste prevention, recycling, composting, and disposal program and it endeavours to protect human health and the environment.

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