

Solid Waste Management in Harare, Engineering and Managing Facilities Progress Challenges and Opportunities

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ABSTRACT

The presentation looks at the current challenges of Solid Waste Management in Harare where lack of investment in infrastructure and engineering of facilities has left the city with a deficit of resources. The problems are being addressed in a reactive manner with a major difficulty in appreciating the magnitude of the challenge ahead. As the population grows and economy develops, so does the deficit.

The paper examines the existing legislation in Zimbabwe for landfill design and reports on the proposal for development of national guidelines focusing on a risk management approach.

It also addresses existing and proposed facilities for solid waste in Harare and how these perform in the context of the engineering, environmental, legal and management domains.

1. BRIEF HISTORY OF SOLID WASTE MANAGEMENT IN HARARE

Harare is the capital city of Zimbabwe with a population of about 2 million having experienced around a 25% increase since 1992. Due to changing lifestyles and consumption patterns, the quantity of waste generated has increased and the quality and composition of waste has become more diverse and changing. Harare City is now facing more rapid population growth, and the implication is inevitably movement in income levels, resource consumption patterns and an increase in the volume of municipal waste. The approach to waste management in Harare has been rather fragmentary and reactive – concentrating more on the collection and disposal aspects of waste management.

In Zimbabwe, many aspects of integrated solid waste management are developing largely spontaneously, being spearheaded by community groups, non-governmental organisations and the private sector. While at government level solid waste management is legislated for, central government is still developing a national strategy that central and local governments can use as a basis for transforming solid waste management operations. Local authorities are slowly diversifying their waste treatment options although waste collection and disposal still remains the dominant waste treatment option.

Zimbabwe urban waste collection rates have dropped from at least 80% (mid 90s) to as low as 50% in Harare. The Harare City Council's failure to collect refuse in high density suburbs has forced residents to dump rubbish on illegal dumpsites. Areas worst affected are low-income residential areas and informal settlements, with some new developments not receiving service at all. The low waste collection levels have triggered wide spread illegal open dumping and backyard incineration. Open waste dumps are prime breeding sites for houseflies, rodents, mosquitoes and other vectors of communicable diseases such as fever, dysentery, diarrhoea, cholera and malaria. Fumes from burning waste cause acute respiratory infections and the odours make the environment uninhabitable. The leachate from the dumpsites pollutes underground water, which is an important alternative water source for the residents. Loose papers and plastic blown by wind result in an aesthetic intrusion of the surrounding environment.

On the road to being a world class city by 2025, the City of Harare Amenities department in 2010, obtained a loan which resulted in the purchase of new waste collection equipment. Thus a reasonable service was effected. To reinforce the capacity of the amenities department, eight zones were created and some directors and managers were co-opted into the task force. All the eight zones of Harare have been characterised in terms of key stakeholders such as business, government institutions, churches and hospitals. Illegal dumps have been identified and mapped in terms of location and tonnage. As a result, key garbage generators have also been identified.

2. LEGISLATION IN ZIMBABWE

2.1 Current Legislation

The Environmental Management Act 2002 is the act of parliament covering all environmental legislation. There are other Acts which also touch on the subject matter including the Water Act. However the Environmental Management Act is the most recent legislation.

Statutory Instruments have since been enlisted to support the Act in specific areas. The areas which are appropriate to this paper are:

- Statutory Instrument 6 of 2007 Environmental Management (Effluent and Solid Waste Disposal) Regulations, 2007
- Statutory Instrument 7 of 2007 Environmental Management (Environmental Impact Assessment and Ecosystems Protection) Regulations, 2007
- Statutory Instrument 10 of 2007 Environmental Management (Hazardous Waste Management) Regulations, 2007.

2.2 Challenges with the Existing Legislation

This paper looks to summarise and simplify the author's interpretation of the existing legislation and regulations currently in Zimbabwe. SI 6 indicates that all new solid waste facilities should be lined and that no person should continue to operate an unlined facility for more than 5 years from the publication, which would be up to 2012. The lining should be adequate to the level of risk, though there is no prescribed grade or type of lining for different levels of risk and this is therefore up to the public or private body to propose (perhaps with the aid of an Engineer) and the Environmental Management Agency (EMA) to approve or not. The categories stated in SI 6 are Blue, Green, Yellow, Red ("Safe" to "High Hazard" respectively) and operating these different facilities requires different levels of monitoring and disposal fees. It is understood that currently these fees have been amalgamated into one fee for each category. It is also worth noting that the municipal waste (domestic) fees for discharge are separate from other waste types and are lower.

SI 6: The classifications of solid waste sites – suggested factors, Third Schedule, Table 4 is difficult to clearly interpret. The Yellow category requires testing of the leachate but as the base of the facility can be permeable under this category it may not be feasible in all circumstances and in some instances may only be possible in the rainy season when perched water tables are much higher and potentially the leachate is more diluted. It may also be noted that as all solid waste sites should be lined from 2012 this category should theoretical no longer be required. However most sites operated by local authorities in Zimbabwe are currently unlined therefore contravening these regulations. The Green Category indicates that the facility can contaminate the environment but requires the site to be classed as remote and with limiting effects. This would be very difficult for an individual to categorise and would, in the opinion of the author, require a wide variety of experts to perform an extensive investigation as part of an Environmental Impact Assessment (EIA). In most cases concluding that a landfill does not cause adverse effects to the environment would be difficult. The Blue category can only be achieved with impermeable substrate which is then covered with a sealed surface. It would be an EMA decision whether a facility with a full composite engineered lining system, leachate control and treatment facility could actually be classed as Blue during its operation, before the engineered cover system and the closure of the facility. All of the classifications listed above are "suggested factors" and are therefore open to revision as well as individual interpretation.

SI 10: The classification of Hazardous Waste states that "where the landfill is lined and leachate is managed, the classification shall be of the leachate, but where there is no lining, the classification shall automatically be red class"(Government Gazette 2007). This does not give consideration to the robustness of the lining and the risk of leakage based on that liner. The Third Schedule, table 4 in this SI is identical to the domestic waste classification and therefore the same interpretation can be made. It is however worth commenting that the leachate concentration of elements hazardous to health and the environment would be expected to be higher in hazardous waste than solid waste, this is demonstrated in the concentration levels of different parameters. If one facility is classed as Domestic waste-Yellow, and another facility is classed as Hazardous waste-Yellow, why is it then, if one takes the "suggested factors" literally, it is more acceptable for a hazardous waste facility to discharge harmful substances than a Domestic facility? The effect on the environment from each facility is not equal. This is a very provocative way of interpreting these regulations and it is not the opinion of the author that EMA are interpreting them in this way. It does however highlight the missing link in the regulations, between the different types of waste and how the facilities should be designed. This is not clear in these regulations. It is also worth noting that the regulations do not take into account the transition of local authorities operating unlined solid waste facilities to the safe closure of these facilities and operation of new engineered facilities with appropriate lining systems. The missing link as seen in other countries could be in the form of standards or guidelines which give anyone operating or designing a

solid waste facility the tools and information required. This should be on a risk assessment basis to ensure the lowest possible pollution of water sources.

2.3 More Positive Aspects of the Legislation

All other environmental impacts for a landfill site are covered in SI 7 and the Environmental Impact Assessment must hold the key information to influence the design of the landfill site, from a suitable location to the details of the impacts and risks that affect the design decisions made for the chosen site. The EIA is now accepted in Zimbabwe as a requirement which is not necessarily the case in all countries. The process is the pinnacle to the landfill design process and the requirement to undertake an EIA reflects the robustness of the Environmental Management Act in not accepting pollution to the environment and the wide ranging expertise which are required in Landfill design in Zimbabwe. Furthermore the Environmental Management Act put all emphasis on the polluter whether that be an individual, an enterprise or an authority acting against the requirements of the Act.

SI 6 has set the requirements for the local authorities to be compliant to the regulations giving 5 years for compliance and has therefore left no uncertainty in the basic requirements for a Solid Waste facility. The difficulty in the current situation is for local authorities to maintain the resources to fulfil the requirements.

SI 10 indicates the requirements for Hazardous Waste Licences and indicates in great detail the requirements for Hazardous Solid Waste Facilities with regards to the allowable limits of pollutants. Most municipal facilities in Zimbabwe do not have a separated domestic and hazardous waste facility or cell at the landfill site and therefore the mix of waste means that the requirements of the facility are set by the Hazardous Waste regulations. This shall be discussed in more detail later with regards to specific facilities. The introduction of different categories of facility, in the form of the colour coded scheme in both SI6 and SI10 means that local authorities can work to achieving the best standard of facility with a staged approach and this is a good basis for improving facilities. The requirements of the categories need to be expanded further in the form of guidelines or national standards but the principle is a positive initiative.

3. SOLID WASTE FACILITIES IN HARARE

3.1 Pomona Dump site/Landfill

3.1.1 Description of the Site

Pomona Dumpsite is situated in the north east side on the outskirts of Harare and is a large open dumpsite unlined, uncovered and not fenced. The site was established in 1984 before the current level of understanding and research of potential pollution and hazards to health from open dumping. The natural soil below is clay¹ and the surrounding area is varied with quarry to the south, golf course to the west, agricultural land to the east. The site is used for the disposal of domestic and hazardous waste with no separation before disposal. There is no cover material on the site and limited machinery for compacting. Despite the difficulties at the site it has so far provided a facility for City of Harare for 30 years.

3.1.2 Compliance with Legislation

The site is currently contravening the Environmental Management Act (2002) and the Statutory Instruments SI 6 and 10 as it is an unlined facility with no leachate collection and treatment.

3.1.3 Management Issues with the Facility

The site does not have internal infrastructure to assist in the operations and management of the facility. For example there is no fence to prevent intruders and the internal access road is covered in wind-blown litter. The lack of cover material has led to wind-blown litter in the surrounding area and the site is plagued with fires, both spontaneous and initiated by human activity, every year. On 20th October 2013 a fire at the site started and reportedly burned for two weeks causing a plume of smoke which polluted much of the city. The incident was widely discussed in the press. However the City of Harare are currently no closer to reducing the risk of fire at the site. Despite this, the incident showed that the authorities could work together in the case of an emergency at the site and control the situation.

3.1.4 Environmental Issues with the Facility

The incidents of fire at the site are fuelled by the build-up of gas and the lack of compaction leaving air pockets in the waste body. Air pollution is the main consequence of these fires with potential for hazardous and toxic smoke/vapours. A recent journal documented research into the effects on soil and surface water from the waste. In the journal heavy metal concentration were reported on soil samples up to 40cm deep and water samples were taken from ponding water. Soil samples were taken upslope, downslope and on the dumpsite the results showed there is an increased presence of Iron, Chromium and Lead. Other heavy metal concentrations were not found to be affected by the dumpsite. (Mpofu, et al, 2014).

3.2 Golden Quarry Dump Site

Golden Quarry dump site is an old gold mine which was used from 1985 for the dumping of solid waste. The facility is now closed. However dumping of liquid waste and fly tipping is still taking place. A research paper by Moyce et al 2004 indicates "that the levels of coliforms, Cd (>0.4 ppm), Fe (3 – 9ppm), Pb (>0.15ppm), and pH (5.5-6.5) were generally unsafe for domestic consumption/use". The rehabilitation of the site has not been completed and hence the facility poses potential risks. An EIA for the site needs to be undertaken to establish the current and future risks associated with the facility. There needs to be an engineering solution for the cover material to minimise leachate production and percolation into the ground. Stormwater control measures will then deal with surface water run-off. Monitoring of the site needs to assist with the management of the facility and minimum allowable leakage rates need to be established in the EIA.

3.3 Proposed Landfill Site at Mount Hampden

3.3.1 The Site

The proposed site for a new landfill at Mount Hampden is currently in the process of undergoing an EIA. From information in the prospectus for this EIA it is anticipated that guidance on the engineering of the facility is required as part of the process.

3.3.2 Compliance with Legislation

Currently the legislation in Zimbabwe does not comprehensively detail the requirements of a landfill and as discussed in section 2, there is a need to give more specific guidance. The design proposals do comply with current legislation as it stands. However the risks involved with a reported high water table may require the design to be looked at in more detail after the EIA stage. It is anticipated that sub-surface cut-off drains and a composite liner need to be integrated into the design. Consideration should also be given to separation of the hazardous waste to make the facility as economical and technology efficient as possible.

3.3.3 Management Issues with the Facility

Provision has been made in the planning for upgrade/establishment of external roads as well as internal roads. There may be requirement for traffic management, though the layout of the site has not yet been considered. There is also provision for a site office and weighbridge both of these will aid the operation and management of the new facility and are currently not at the Pomona site. It is assumed that the new site will have separate domestic and hazardous waste which does require separation at source. There is concern from this review that the reduced available resources currently faced within City of Harare will however not be solved through a new site, and may even be exacerbated. This paper is not concerned with resource management and this subject is excluded from the discussion.

3.3.4 Environmental Issues with the Facility

It is internationally recognised that landfill is the most credible option for dealing with the volumes of waste that are produced in modern day society. There should be no unusual risks associated with this particular location. The site will be a fully engineered design facilitated through the collaborative approach with the EIA and design engineers working closely. This will mean that environmental risks are minimised or mitigated.

3.4 Recyclable Materials Handling Facilities in Harare

There are several private companies linked to collecting recyclable materials in Harare. Reports from one company are that approximately 40% of recyclable waste is exported and 60% is recycled or reused locally. The gap in manufacture of materials especially glass, means that currently the demand is not high enough for all recyclable materials. All recycling, whether collected from businesses or houses or from Pomona

dumpsite, is done independent of City of Harare. Waste pickers at Pomona have to be registered with City of Harare to try to control people entering the site. The waste pickers work in co-operatives and are not employees of City of Harare.

3.4.1 Proposed Biodigester in Mbare

An 800m³ Biodigester has been proposed for Mbare identified as a suitable location as a high density suburb south of the city centre with a busy farmer's market. The biodigester will be managed and operated by City of Harare and the electricity produced will be fed into the network. Local residents will be free to take their biodegradable waste to the facility. Farmers who contribute to the facility bringing their agricultural waste will be given the organic fertiliser produced by the digester (Marunya 2014).

As is the case with all facilities, making the bio-digester secure will be paramount for the success of the project. Community engagement and information should promote the City of Harare in an area of Harare where waste collection faces some challenges. This project is currently underway but no construction has yet taken place.

3.4.2 Shortfalls in the Engineering of Existing Facilities

All the dump sites do not comply with the current legislation in Zimbabwe and as a result there is a great importance held in a new engineered facility to bring the City of Harare to a suitable environmental standard in this regard. The proposed Mount Hampden Landfill site needs to give City of Harare the engineering facilities to act in a positive way dealing with both domestic and hazardous waste appropriately. All existing sites which do not comply with current legislation need to be looked at in a holistic way to develop an environmentally sound decommissioning and rehabilitation plan.

3.4.3 Shortfalls in the Management of Existing Facilities

The organisation in City of Harare will need to develop and adapt to cope with the management of a new facility and the pro-active attitude and understanding of the need for this facility is apparent. There is a great importance in separation and safe disposal of hazardous waste to avoid any harm to the environmental and protect drinking water sources. The waste management plan for City of Harare needs to address cleaning up any illegal dumping of hazardous waste and engaging with the companies producing the waste in a joint approach with EMA as the authority governing these issues.

4. THE FUTURE OF SOLID WASTE MANAGEMENT IN HARARE

There is an obvious need for consensus in the understanding of what the detailed requirements are for an engineered landfill in Zimbabwe. Operators of existing facilities that do not comply with the legislation are finding the challenge of upgrading on the same site a difficult thing to start. Where new facilities are proposed the guidelines need to be set out to make the conception process smoother and easier. The basic infrastructure is in place and is generally sufficiently understood. The difficulty is knowing what is required in terms of the specific materials for landfill lining.

The attitudes in councils are positive and working towards a new engineered and environmental future for solid waste management. Some areas of solid waste management do provide more challenges than others and the upgrading of facilities is an area where City of Harare does not anticipate internal funding to be available. The facilities upgrade is of utmost importance to improving the integration and has to be implemented in a way that elevates the standards in Harare.

Collection facilities, equipment and probably manpower need to be increased. Accessibility to homes and/or collection points in high density areas requires improvement.

Promotion of Reduction, Re-use and Recycling and provision of opportunities for the related activities could be developed further with City of Harare being more actively involved, on the back of a willingness by many companies and NGOs to be involved. The Zimbabwe Chapter of The Institute of Waste Management of Southern Africa has recently been established. Many volunteers have the vision of improving all features of solid waste management and disposal throughout the country. The focus on technical aspects, which will include liaison with EMA has to be the introduction of appropriate guidelines for the design of landfills and any other disposal facilities.

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