

Valuation of Closure Costs of Landfills as a Tool for Improving Landfill Management Practices

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ABSTRACT

Management of waste, including landfills, is one of the functions of local authorities in South Africa. All local municipalities, therefore, are responsible for managing one or more landfills. Municipalities need to make financial provision for the eventual rehabilitation and closure of these landfills. No standard methodology for estimating closure costs for landfills was available. Environmental & Sustainability Solutions and Jones & Wagener Engineering and Environmental Consultants developed a Municipal Landfill Closure Costing Model. During the implementation of the costing model it was found that the valuation process can easily be used to inform management practices that affect closure costs.

Analysing the main drivers for closure costs can lead to recommendations for improving landfill management practices. This paper discusses the eight most important drivers of landfill closure costs. Quantifying the financial impact of landfill management practices can help municipalities to drive operational improvements of landfills.

1. INTRODUCTION

Waste management is one of the typical functions of local authorities in South Africa. A final step in the waste management process is disposal to landfills. All local municipalities, therefore, are responsible for managing one or more municipal landfills.

Landfills are waste disposal facilities specially designed to receive and hold such waste indefinitely. Landfills have engineered designs and a predetermined lifespan (which may run into decades), after which they have to be rehabilitated and closed. A landfill can have negative impacts on the environment, especially water resources, during its operation as well as after closure. Therefore, strict specifications have been laid down for the rehabilitation and closure of landfills. In South Africa this has been codified in the Minimum Requirements for waste disposal by landfill (RSA; 1998) as amended by subsequent regulations.

2. FINANCIAL PROVISION FOR FINAL CLOSURE AND REHABILITATION

When considering the cost of managing landfills, the costs of rehabilitating and closing the landfill after it has reached the end of its operational lifespan is often down-played. There are two main reasons for this. Firstly, the timing of this cost is often not within the short and medium planning timeframes of officials due to the long lifespan of a landfill. Secondly, it is not so easy to determine landfill closure costs, especially because of the long timescales involved and the technical nature of landfill capping requirements.

Making financial provision for final closure and rehabilitation of landfills is a requirement of accounting standards (GRAP 19; 2010). This provision is a financial liability that grows over time until the closure of the landfill. In 2010, the Auditor General started issuing audit qualifications to municipalities for not disclosing a provision for landfill closure in their annual financial statements. This prompted many municipalities to start looking at this issue but no standardised methodology was available.

3. CALCULATING THE FINANCIAL PROVISION FOR LANDFILL CLOSURE COSTS

One of the factors limiting municipalities' ability to calculate the provision to be disclosed was the lack of a standard methodology for determining the scope and quantity of the provision for landfill closure. To fill this gap, Environmental & Sustainability Solutions, in collaboration with Jones & Wagener Engineering and Environmental Consultants developed the Municipal Landfill Closure Costing Model (MLCCM). The model provides a standardised framework for determining the financial provision to be disclosed in the annual financial statements of municipalities.

A comprehensive approach regarding the scope of closure costs is followed, as it provides the best possible information for accounting, planning and management purposes. In this comprehensive approach, landfill closure costs are made up of three main components:

- Pre-closure planning costs
- Actual rehabilitation and closure costs
- Post-closure monitoring and maintenance costs

The model includes 21 cost elements associated with any of the three main components.

3.1 Component 1: Pre-closure planning costs

Planning costs for landfill closure are directly associated with the activity and timing of closure, and should, therefore, be regarded as an integral part of the closure costs itself. These costs usually include the costs for applying for a landfill closure license, the basic assessment with accompanying public participation process, and finalising end-use plans and closure designs. This may be an expensive process, especially if little technical information on the landfill and potential environmental impacts is available.

3.2 Component 2: Rehabilitation and closure costs

Final rehabilitation and closure are expended in the year of closure and a number of years subsequent to closure to ensure effective closure. The landfill needs to undergo final shaping and compacting in order to prevent rainwater from forming pools which can lead to seepage through the landfill into the groundwater. The landfill is then capped with selected capping material (either a suitable type of clay or a geosynthetic material) to reduce rainwater infiltration. Topsoil is added on top of the capping layer which is vegetated to prevent erosion of the landfill capping layers.

To further prevent erosion of the landfill, a storm water control system needs to be installed (if not yet in place). In areas with high rainfall, leachate seepage control systems need to be added. In the case of large landfills where the risk of gas formation is higher, a gas control system may also have to be added. It also includes costs associated with the erection of a proper fence (if not yet in place), decommissioning of any infrastructure and erection of end-use related infrastructure.

3.3 Component 3: Post-closure monitoring and maintenance costs

This component includes costs associated with post-closure environmental monitoring, as well as ongoing maintenance and management. When the landfill subsides over time, it needs to be rectified to prevent water ponding on the surface. Drainage systems must be maintained, vegetation managed and fires controlled to ensure continued stability and prevent erosion. Leachate and gas that may emanate from the landfill also needs to be managed, and, lastly, water and gas monitoring (if applicable) needs to take place. This phase usually lasts for 30 years after closure as specified in the Minimum Requirements.

4. VARIABLES THAT AFFECT THE COST OF LANDFILL CLOSURE

The various components of landfill closure costs are affected by quite a number of variables. The MLCCM includes 19 such variables. These include, for example, obvious aspects such as size of the area already used for disposing waste, the expected remaining lifespan of the landfill, the current condition of the fence, and whether the landfill is situated in a water deficit (where rainfall is lower than evaporation) or water surplus (where rainfall is higher than evaporation) area. The quality of available information, the quality of operational management of the landfill and availability of closure material also impact on several cost elements.

5. MUNICIPALITIES' ABILITY TO INFLUENCE LANDFILL CLOSURE COSTS

Some variables that affect closure costs are outside the control of municipalities, such as whether the landfill is situated in a water surplus or water deficit area. However, most variables can be influenced by municipalities who, therefore, have an opportunity to manage future closure costs. Recommendations to improve landfill management practices are included in the report on the financial provision disclosures. The impact of improving landfill management practices on the financial provision is quantified by means of scenarios. This enables municipalities to prioritise improvement measures to maximise the potential

reduction in landfill closure costs. Other considerations such as regulatory compliance are also taken into account when developing an action plan for improving the management of the landfill.

6. MAIN DRIVERS OF LANDFILL CLOSURE COSTS AND HOW TO MANAGE THEM

Although circumstances between landfills differ, an analysis of the results of 58 valuations of 35 landfills since 2011 reveals generic trends that can be used in developing strategies to improve landfill management practices and at the same time minimise future landfill closure costs. It was found that eight variables affect cost elements that account for 5% or more of total closure costs (Table 1). Several variables affect more than one cost element. The relative importance of variables at different landfills differs vastly.

Table 1. Impact of variables on landfill closure costs

Variable	% of total closure costs affected by variable
Size of landfill already used	90.8
Environmental impacts	31.3
Availability of capping material	19.2
Availability and management of topsoil	12.5
Availability of technical data	7.9
Existence of monitoring committee	7.9
Compacting and trimming practices	5.6
Licensed or not licensed	5.4

6.1 Size of landfill already used

The size of the area of the landfill that has already been used for waste disposal is by far the most important driver of landfill closure costs, and should receive top priority in any landfill management action plan. Reduction of the volume of waste entering the landfill also increases the lifespan of the landfill. This increases the discounting period and reduces the discounted provision disclosed in the financial statements.

The most effective way of reducing the size of the landfill is reducing the volume of waste deposited on the landfill. Awareness programmes for the reduction of waste generation, separation of waste at source and accompanying recycling programmes are the most effective strategies to reduce the waste streams to the landfill. In addition such programmes can create entrepreneurial opportunities and employment, and it is good for the environment.

The size of the portion of the landfill used for disposal can be reduced by dumping waste in a concentrated area rather than spreading it all over the landfill and by using the current disposal area or cell to its maximum height before opening a new area or cell.

6.2 Environmental impacts

Environmental impacts associated with landfills also have a major impact on closure costs. This relates in particular to impact on groundwater and surface water sources, leachate emanating from the landfill and gas problems. The installation of liners and the prevention of water pools in the landfill will reduce impacts on groundwater. Monitoring of the formation of gas and installing gas control systems, where appropriate, will also minimise negative impacts. Proper compacting and covering practices will help prevent negative environmental impacts.

A major contributing factor that contributed to increased closure costs was the absence of proper groundwater monitoring at many landfills. In the absence of proof to the contrary, based on water monitoring, it must be assumed that negative impacts on groundwater sources are occurring. This automatically increases closure costs. By investing in effective water monitoring municipalities can often reduce the calculated provision.

6.3 Availability of capping material for closure

The presence or absence of suitable capping material on-site or in the vicinity of the landfill has a major impact on capping costs. In none of the municipalities investigated was information on availability of capping material available. By assessing the availability of capping material and securing future access to such

material, for example by establishing a capping material stockpile area on site where selected soil can be placed over the life of the facility, capping costs can be reduced significantly.

6.4 Availability and management of topsoil for closure

The availability of suitable topsoil for closure is equally important. Assessing the availability and securing future access to such material will reduce future closure costs. If suitable topsoil for closure is available on-site it should be managed properly in order to ensure that it retains its useful characteristics for future use during closure.

6.5 Availability of technical data

Technical data similar to that which was generated during the license application process are needed for the development of the closure plan, for example a geotechnical investigation. If such information is lost, expensive technical investigations may need to be conducted again when planning for closure.

The loss of organisational memory in municipalities over the past decades has resulted in the loss of valuable technical data. Municipalities would do well to initiate actions to retrieve such technical information, for example from the consultancies which generated the information in the first place. Municipalities should ensure that all technical data and reports remain available for later use.

6.6 Existence of a landfill monitoring committee

The existence of a landfill monitoring committee including all relevant stakeholders during the operational phase of the landfill would make the process of consultation with interested and affected parties in the closure planning process more effective. This does have a positive impact on pre-closure planning costs.

The establishment of landfill monitoring committees is a minimum requirement for all large and hazardous landfills. However, municipalities that manage smaller landfills can also benefit from such committees, during the operational phase as well as during the closure planning process. Municipalities could establish a landfill monitoring committee with relative ease. In this way future closure costs would be reduced and current landfill management practices and stakeholder relations would be improved simultaneously.

6.7 Compacting and trimming practices

Current compacting and trimming practices directly affect compacting and shaping costs during closure of the landfill. It also reduces post-closure maintenance costs. As purchasing and/or maintenance of compacting equipment is expensive this aspect of landfill management is often neglected.

Municipalities should ensure that the necessary equipment is available to do compacting and that such equipment is maintained in a serviceable state. During landfill operation attention should also be given to trimming of the slopes so as to avoid erosion and enhance stability of the landfill.

6.8 Licensing status

Apart from a compliance perspective the licensing of a landfill also affects future pre-closure planning costs. In the absence of an operating license for the landfill, a separate license for closure of the landfill will have to be obtained at significant additional cost.

Municipalities that control landfills that are not yet licensed, should commence proceedings to obtain waste management licences for such landfills.

7. CONCLUSION

The annual valuation of the closure costs of a landfill can be used for much more than only to calculate the financial provision for the final closure and rehabilitation of the landfill. By quantifying the financial impacts of various variables on closure costs the main drivers of closure cost at a specific landfill can be identified. This enables the municipality to develop landfill management improvement plans to reduce future closure costs and simultaneously to improve current landfill management practices and enhance compliance with regulations. In this manner the valuation process can develop into a powerful tool to drive operational improvements of landfills. Sections 6.1 to 6.8 provide indications of such improvements associated with their impact on closure costs.

REFERENCES

- GRAP 19. (2010) *Provisions, Contingent Liabilities and Contingent Assets*, Accounting Standards Board.
RSA. (1998). *Minimum requirements for waste disposal by landfill*, 2nd ed., Department of Water Affairs and Forestry, South Africa.