

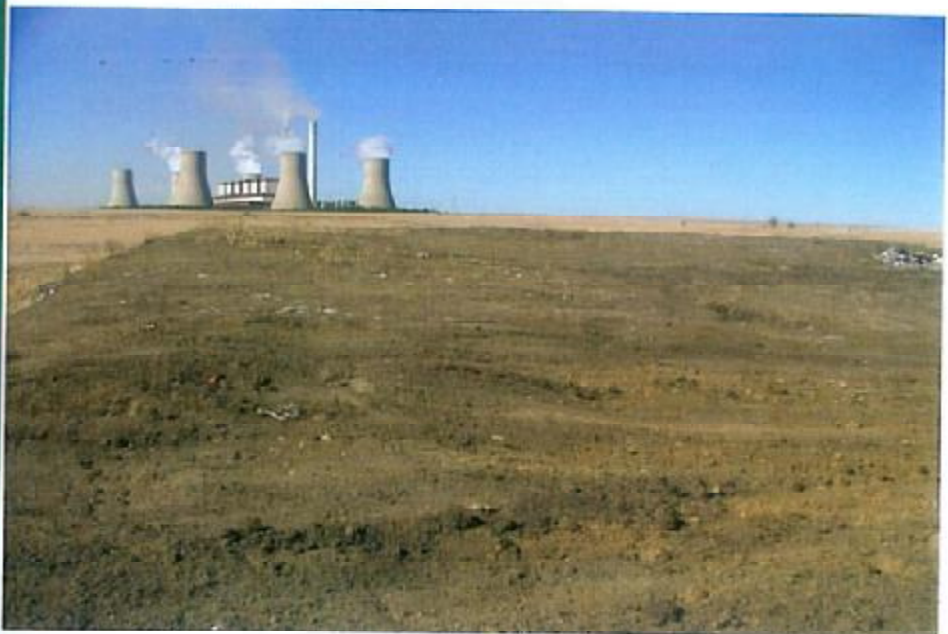


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TUTUKA LANDFILL

Determining the Future of the Tutuka Landfill Site

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REPORT



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1.0 INTRODUCTION

1.1 Background

Eskom's Tutuka Power Station is currently operating a landfill site for the disposal of general waste. The site was permitted by the previous Department of Water Affairs and Forestry (DWAF) in August 1994 (permit number B33/2/310/45/P147).

A permit for a Class II landfill site was issued in terms of Section 20(1) of the Environment Conservation Act, 1989 (Act 73 of 1989)(ECA) using the old classification system which differentiates between three classes namely Class I to Class III. This classification has been superseded by the First Edition of the Minimum Requirements for Waste Disposal by Landfill by the Department of Water Affairs and Forestry, which was first implemented in September 1994.

The Tutuka Power Station landfill Site was therefore established before the advent of the Minimum Requirements and consequently was not designed and constructed in accordance with the standards in the Minimum Requirements (as required for the different classes of sites, based on the new Minimum Requirements classification system).

In accordance with the philosophy in Minimum Requirements in respect of the future of the landfills that were established before ECA and as a result were not adhering to the Minimum Requirements, the future of such a site has to be determined (should the question arise whether that site could proceed operating or must be closed).

In the case of the Tutuka Site which "technically" has ran out of airspace, the site selection process pointed out that the present site is best positioned considering all site selection criteria as prescribed. For this reason it was proposed that the potential airspace at the location of the present Site should be optimised in terms of airspace by raising the site height and extending the site laterally.

However this option of extending the site laterally and vertically cannot be finally considered without assessing the future of the current site in terms of its ability to meet the objectives of the Minimum Requirements through site engineering and/or by other upgrading or mitigatory means.

Hence the need for this Report in respect of determining the future of the existing Tutuka disposal site.

It is important to also record that Eskom is in constant pursuance of environmental protection and hence their objective to:

- Remain legally compliant with regard to current and future waste disposal activities; and
- To ensure the sustainable management of their waste stream through *inter alia* the provision of appropriate authorised landfill airspace

1.2 Objectives

The overall objective of this Report is to ensure legal compliance in respect of providing additional airspace for the disposal of general waste generated by the Eskom Tutuka Power Station.

Since the existing Site has been running out of airspace the Site needs to be extended or otherwise altogether replaced with a new site to provide for airspace for the foreseeable future (at present general waste is transported to a waste disposal site at Kriel town, approximately 200 km away).

As stated above, the site selection process identified the current site as a best option.

This Report therefore has the objective to determine the future of the existing site as a potential option to provide such airspace, but within the requirements of and compliant to the relevant legislation and hence obtain legal authorisation as required for the selected option pertaining to the future of the existing Tutuka landfill.

Legal compliance in the context of the preceding paragraphs relate to the following:

- Complying with the existing ECA permit conditions;



- Compliance to Minimum Requirements for the Disposal of Waste by Landfill (DWAF 1998). These Minimum Requirements not only establishes requirements for acceptable waste management practices and applicable standards, but also provides the underpinning objectives and basis for determining the future of a site analogous to the Tutuka site;
- Obtain legal authorisation for the most acceptable future option for the existing Tutuka Site through which the required future landfill airspace could be provided; and
- Any other relevant environmental legal requirements.

Therefore the objective of Tutuka Power Station is to follow the Minimum Requirements and related legislation in order to ensure that with the envisaged Tutuka site extension legal compliance is maintained throughout the process i.e. both in terms of procedural approach and engineering and or /mitigatory measures.

2.0 LEGAL AND TECHNICAL REQUIREMENTS UNDERPINNING THE OPTIONS TO CREATE NEW AIRSPACE

Additional airspace could be created by assessing and selecting one or more of the following options:

- Creating a new site altogether.
- Using the current footprint of the present Tutuka Site and increase the height of the site.
- Do not use the present Tutuka Site as basis on which to place a new waste body, but extend laterally only and create adjacent footprint
- A combination of using the current site on which to place a new waste body and extending laterally.

The most suitable of the above options are dictated by two considerations:

- Site selection criteria through negative mapping and consideration of fatal flaws, critical factors and eventually scoring individual candidate options against each other to select the best option;
- To determine the ultimate suitability of the best option by assessing it against the specific legal requirements pertaining to such an option (for example if the current site is to be used for continued operation the specific requirements include that it must meet the objectives of the Minimum Requirements with or without engineering and/or related measures).

The most suitable option was therefore identified in accordance with the first consideration explained above. Based on this site selection process it was established that a combination of using the current site on which to place a new waste body and extending the site laterally is the best option.

This best option therefore has to be assessed against the second consideration which is the specific legal requirements pertaining to using the current site on which to place a new waste body and thereafter to extend the landfill laterally.

The specific legal requirements for a site that has not been established in accordance with the Minimum Requirements, in this case the Tutuka Site, if such a Site is considered for continued operation, is to establish whether such as it will conform to Minimum Requirements.

A generic layout of this process is explained in Figure 1.

The approach in figure 1 as followed for the assessing and using the legal and technical requirements to determine the acceptability of the Tutuka site under different scenarios is briefly explained as follows:

2.1 Scenario A:

Under this scenario, the objective was to determine whether the current site, if operated as is, could conform to the objectives of the Minimum Requirements. If this is possible then the Department of Environment Affairs could be approached to consider amending the current permit for extended site operation without requirements for additional engineering and mitigatory measures.



In considering this scenario, it was found that the site is already showing signs of impacting on downstream groundwater quality, most probably due to an absence of engineered liners as required in the Minimum Requirements. It follows that, proceeding to operate the site, as is, will not only portray total ignorance of Minimum Requirement standards, but failure to address the groundwater contamination through appropriate engineering and capping of the current waste body.

Therefore, in terms of the future of the existing site, scenario A is not regarded as acceptable.

2.2 Scenario B

Since the existing site, cannot comply with the Minimum Requirements in its current state under "A", two alternative options were considered namely scenarios "B" and "C".

Scenario "B" involves creating a totally new footprint.

This option was already indirectly addressed during the site selection process and shown not be the best option.

If the option under scenario n "B" was selected as the best option, it would have implied that a new licence for a totally separate site should have been applied for as well as a licence for the closure of the existing Tutuka Site.

2.3 Scenario C

Since scenario "B" was already indirectly dobarred during the site selection process, scenario "C" was considered.

Scenario "C" is to close and cap the existing waste body which requires that an application needs to be submitted to DEA for a permit amendment to extend the site both vertically and laterally.

Selecting scenario "C" as an option therefore implies that the current ECA permit needs to be amended.

Since the current ECA permit, present an existing lawful use it was reasoned that it would be inappropriate to apply for a "new" license (as if no authorisation presently exists).

The NEMWA is also silent on the matter of existing lawful uses that may require an amendment and how these need to be dealt with.

However since ECA has been repealed it must simultaneously be acknowledged that the application for the amendment of the current ECA permit (where the same is regarded as an existing lawful use), will be dealt with in terms of NEMWA and as a consequence a NEMWA license will be issued by DEA to provide for license conditions pertaining to the amendment.

Scenario "C" presents a suitable option (see Section 3 and table 1) since it meets the objectives of the Minimum Requirements after proper engineering and capping (for the existing waste body) and complies with the Minimum Requirements for the new adjacent extension.

If it was found that the scenario "C" was not suitable as an option, the only avenue would have been to revisit scenario "B" and the initial site selection process and reconsider the establishment of a totally new site. This would have resulted in the creation of a new waste site and hence a new waste body. Generally speaking and from an environmental management point of view, this is strongly discouraged since it would have resulted in a satellite facility which will reduce the efficacy of any *post* closure control and increase environmental risks.

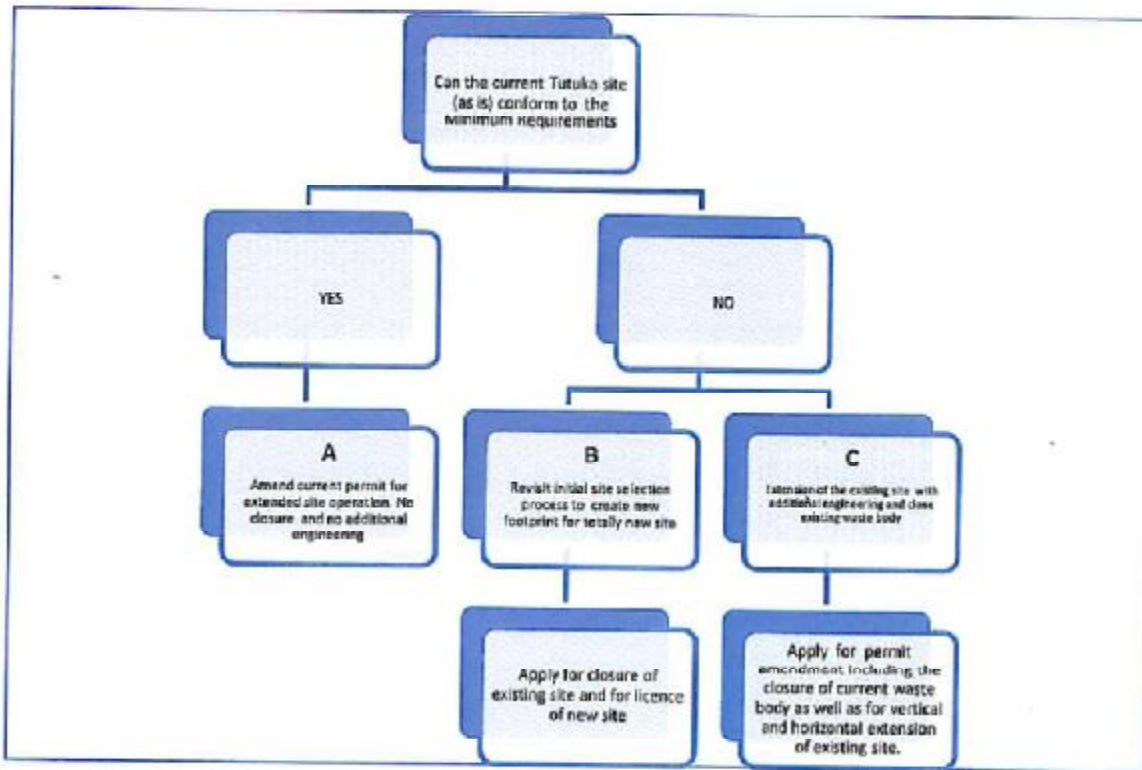


Figure 1: Summary of available options

3.0 ASSESSMENT OF THE ACCEPTABILITY OF THE CONTINUED OPERATION OF THE EXISTING SITE AS A FUTURE OPTION

The ability of the existing Tutuka Site to meet the objectives of the Minimum Requirements, *post* capping of the existing waste body and appropriate engineering, must be evaluated in order to determine an acceptable future option.

More specifically the individual factors that have been considered have been described and summarised in table 1 below.

Table 1: Summary of factors with respect to existing site

Minimum Requirement aspect to be considered	Description of existing site	Compliance of existing site to MR	Possible mitigating factors that could be implemented to achieve compliance
SITE SELECTION			
Topography and drainage	Situated on a topographic high on gradual slopes	Suitable however site drainage needs to be improved	Interception drainage will be constructed to control surface and sub-surface run-off to prevent pollution for the extension.
Climate	Water deficit area	Suitable	None required, however a leachate detection and collection system will be installed for the extension to reduce the likelihood of



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Minimum Requirement aspect to be considered	Description of existing site	Compliance of existing site to MR	Possible mitigating factors that could be implemented to achieve compliance
			pollution.
Vegetation	Previously used for cultivation. Grassland and scattered aliens.	Extending the current site has the least environmental impact.	None required if extending the existing site.
Infrastructure	Required infrastructure available	Suitable as no further infrastructure requirements other than fencing as the different phases are developed.	None required as existing infrastructure will be utilised for the extension.
Soil (permeability) and geology	Soil is thin as some has been removed for site rehabilitation. Soil and dolerite highly permeable.	Soil is highly permeable therefore not ideal. Soil not suited as liner material.	An additional liner layer will be installed to compensate for the permeability of the soils. Soil is suitable for use as cover material.
Geohydrology	Aquifers in the area have low yield therefore limited potential. No nearby major water users or communities therefore low significance. 300 m to the groundwater divide to the north of the site. Estimated will take 37 years for pollutants to reach groundwater.	Marginal to suitable classification	Additional engineering such as leachate detection and collection can be implemented to reduce the risk of pollution potential in the extension. An additional liner will be installed in the extension.
Air quality (landfill gas)	Atmospheric conditions in the area are not conducive to rapid dispersion of pollutants. Landfill gas not expected to be generated.	Suitable	Ventilation to be provided in the extension by means of rock filled gabion chimneys for managing any landfill gas that might be generated as an additional precautionary measure.
EIA/IAPs	Indicates that the current position (or adjacent to the site) i.e. extending the current is the most suitable. IAP's were most concerned about visibility.	Existing site position is suitable and ranks as the top candidates. Scores the most highly out of 7 alternatives. Meets requirements for disposal need.	None required.
SITE DESIGN			
Prevention of pollution	Designed prior to Minimum Requirements	Not compliant.	Upgrade design of extension to comply and use precautionary principle to ensure no



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Minimum Requirement aspect to be considered	Description of existing site	Compliance of existing site to MR	Possible mitigating factors that could be implemented to achieve compliance
			further environmental degradation. Closure and capping of the existing site will limit further pollution occurring and thus design of the extension will be compliant. However existing site cannot comply, but can meet objectives of Minimum Requirements after proposed capping and engineering.
Site layout and technical design	Designed prior to Minimum Requirements	Not adequate because of pollution	Design of extension will be compliant. Capping of current waste body will be compliant and contain current waste body so as to limit/prevent further leachate formation and hence potential water contamination.
OPERATION			
Airspace (site life)	Requires approximately 12 Ha. (should vertical extension be allowed) to cater for 40 years total life of site. Adequate cover material required.	The extension will provide sufficient airspace for the next 40 years.	Existing site has run out of airspace therefore cannot comply. Extension vertically and horizontally will provide the required airspace.
Liner	Existing site does not have a liner	G.S.B' does not require a liner, only a compacted clay layer.	Install geosynthetic clay liner as a precautionary measure to prevent pollution for the extension and piggy back liner over existing waste body area where site will be extended vertically. The latter is to meet the objectives (through flow rate) of the Minimum Requirements.
Slopes (stability)	Slopes steeper than 1:3.	Not compliant	Outer slopes of existing waste body to be capped and rehabilitated. This will enable current site to meet objectives of Minimum Requirements. Slopes of extension will be compliant.



Minimum Requirement aspect to be considered	Description of existing site	Compliance of existing site to MR	Possible mitigating factors that could be implemented to achieve compliance
Leachate generation	Existing site is in a B' area.	Leachate detection not required.	Additional engineering measures that exceed the Minimum Requirements will be installed as a precaution as pollution is occurring and hence to make total facility including current waste body compliant to respectively the Minimum Requirement and the objectives of these Requirements.

The most critical factors relevant to this site are discussed in more detail below.

3.1 Site selection

Economic, environmental and public acceptance criteria must be considered when determining the suitability of a site.

Economic and public acceptance criteria have been met for the existing site, however environmental criteria have not all been met and hence the reason for engineering the current Site to meet the objectives of the Minimum Requirements.

Environmental factors include the geohydrology of the area in which the landfill is situated and must be suitable for establishing a landfill site. If the factors are not considered suitable then it must be established if engineering measures can be implemented to mitigate negative environmental impacts should other factors indicate that this is the most suitable position for the site (as have been shown to be the case through the site selection process).

In this case the aquifers in the area surrounding the landfill have been classified of low significance and the area has been classified as marginal to suitable for this purpose. There is however the potential to impact on the groundwater as the soil and dolerite is relatively permeable.

Also soil in the vicinity of the site is not suitable as liner, it can however be utilised as cover material.

Engineering measures as discussed in the site design will be implemented to compensate for the marginal suitability of the position.

3.2 Site design

Certain aspects of the current site design have resulted in groundwater pollution and thus non-compliance with the Minimum Requirements. The existing landfill therefore needs to be capped and engineered to separate any potential leachate formation from the leachate that may result from the waste in the new adjacent cells that needs to be developed in future.

The construction of the cap and associated infrastructure will entail (extent and details of this development are shown on Drawing Nos 12333/05 and 1233/06 in the "Permit Amendment Report for the License Application for the Tutuka Waste Disposal Site", Report 12330-9629-2 dated February 2010):

- A "piggy-back" liner over the existing landfill;
- Leachate sump is to be installed as part of this development;



- Raising and shaping the surface of the existing landfill and a "piggy-back" liner is to be constructed on this shaped surface;
- Perforated HDPE leachate collector pipes will be installed on the "piggy-back" liner and connect into the main leachate drain running along the western toe of the existing landfill; and
- The outer slopes of the landfill will be cleared of vegetation, trimmed and the outer capping constructed as detailed.

The design for the extension based on the site assessment indicates that further degradation of water quality can be avoided by improved engineering. These are as follows:

- Upgrade of the site drainage;
- Adjusting slopes by cutting back existing slopes to 1:3;
- Installation of a liner system; and
- Installation of a leachate detection and collection system.

These measures will result in minimising the potential environmental risk.

3.3 Site operation

The Minimum Requirements objectives for operation of a landfill are to dispose of waste of in an environmentally and socially acceptable manner.

While most of the requirements can be met by correctly operating the existing landfill, monitoring results have demonstrated that past operation of the site may have contributed to groundwater degradation, indicating that the operation (and design) of the existing Site are not acceptable. However as reflected in the Permit Amendment Report for the License Application for the Tutuka Waste Disposal Site the future operation the Site (post capping and subsequent footprint extension) will conform to Minimum Requirements and best practise pertaining to landfill site operation and hence avert potential environmental impacts.

4.0 CONCLUSIONS

The conclusions to the consideration of the three future scenarios for in respect of the future of the existing Tutuka Site are as follows:

4.1 Scenario A: Proceed operation at the current Site, as is

The preceding discussions shows that the site, as currently designed and operated, cannot comply to either the Minimum Requirements or their objectives and therefore DEA cannot be approached for a permit amendment for the continued operation of the existing Site as is.

This scenario as a future option for the existing Site is therefore not legally and environmentally feasible.

4.2 Scenario B: Establish new totally separate footprint

From an engineering point of view a new disposal site on a totally new footprint, completely separate from the existing Site, is possible.

This would imply, applying for closure of the existing Site and for the licensing of a new totally separate site.

This option is however not regarded as feasible for the following reasons:

- The EIA considered alternative footprints for sites and the conclusion was that the existing position is the most favourable for a new site.
- Creation of a new waste site and hence a new waste body would result in a satellite facility which reduce efficient post closure control and increase environmental risks.



The establishment of a completely new disposal site, although possible from an engineering point of view, is not considered as environmentally responsible.

It therefore follows that the closure of the existing Tutuka Site (subject to a license application) as a consequence of establishing a new Site (also subject to license application) is not regarded as an acceptable option for the future of the existing disposal Site.

4.3 Scenario C: Extend the existing site vertically and horizontally

The option of capping the existing waste body and subsequently extending the footprint vertically and horizontally is the most suitable and feasible option.

This option is regarded as the most feasible and appropriate, due to the following reasons:

- The site selection process as executed within the EIA process (impact assessment and public participation) indicated that the existing Site presents the most suitable position (least potential environmental impacts and public acceptance criteria are best fulfilled)
- The existing Tutuka Site meets the objectives of the Minimum Requirements once the current waste body has been capped and properly engineered(e.g. site slopes and stability) and the new and adjacent footprint will be designed to fully conform and even exceed the latest standards in the published Minimum Requirements(DWAF, 1998)
- Extending rather than establishing a new site on a new footprint presents an economically feasible option because of the existing infrastructure; and
- Disposing future Tutuka waste arisings into a single consolidated waste facility rather than creating new satellite facilities, present best practise, optimise control (especially *post* closure) and reduce environmental risks.

It is recommended therefore to cap the existing waste body and apply for a permit amendment for the existing site for continued operation extending the site vertically and laterally but subject to proper engineering that meets and in even exceed the standards in the latest published Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998).

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