ALTERNATIVE ASH DISPOSAL OPTIONS FOR MEDUPI POWER STATION, LEPHALALE, LIMPOPO PROVINCE

SUMMARY REPORT

November 2008

Prepared for
Eskom Holdings Ltd
Generation Environmental Management
Eskom Generation Division
PO Box 1091
Johannesburg
2000

Prepared by
Savannah Environmental (Pty) Ltd
PO Box 148
Sunninghill
2175

TABLE OF CONTENTS

1. PURPOSE OF THIS REPORT

In terms of the Environmental Authorisation (= Record of Decision) issued by the National Department of Environmental Affairs and Tourism (DEAT) on 21 September 2006 for the construction and operation of the Medupi Power Station (DEAT Reference Number: 12/12/20/695), "…*further information on alternatives for the disposal of ash produced by the facility is required before an informed decision can be made on this aspect of the application*" (refer to Section 2.2 of the RoD). In addition, in a letter to Eskom Holdings Limited ("Eskom") dated 27 October 2008, and after having considered Eskom's submission on the issue dated August 2008, the DEAT has found and acknowledged that "…*a new above-ground ash disposal site on the Farm Eenzaamheid 687 LQ, as proposed in the environmental impact report (EIR) for Medupi power station, dated 22 May 2006, is still the preferred option for Eskom*", but that "*The public had not had insight in this substantial new information supplied to the department and may therefore feel excluded from the decision-making process*".

DEAT therefore require that this additional information be made available for public comment for a 21-day period in order to ensure a transparent and legally compliant process.

In response to this requirement, Eskom Holdings Ltd (Eskom) has compiled this summary report on the alternative ashing options for the power station. This report includes consideration of the following:

» Creating a new above-ground ash disposal site on the farm Eenzaamheid 687 LQ (as assessed in the EIR dated 22 May 2006), as well as the environmental issues associated with this/assessed and the way it has been dealt with/presented in the EIR dated 22 May 2006.
» Ashing back to the Exxaro mine pit.
» Eskom's rationale for its preference of above-ground ashing on the Ffarm Eenzaamheid.

This summary report is based on information provided by Eskom, on the basis of the Environmental Impact Assessment (EIA) conducted for the Medupi Power Station (2005/2006) and the joint Eskom-Exxaro feasibility study undertaken for the various in-pit ashing options available. This report serves to inform you, as a registered stakeholder for the Medupi Power Station project, of the findings of the investigations that Eskom has undertaken with regards to these alternative ash disposal options. This summary report is now available for public review. You are invited to review the report at one of the following locations:

Lephalale Municipal Offices	Lephalale Co-op in Botha Avenue
Lephalale Library	Matimba Power Station
Marapong Clinic (Tlou Street, Marapong)	www.savannahSA.com
www.eskom.co.za/eia	

The period for review is **21 November 2008 to 12 December 2008**. Please submit written comment by 12 December 2008 to the contact person below.

Please submit your comments to
John von Mayer P.O. Box 248, Sunninghill, 2157 Tel: (011) 234-6621 Fax: (086) 684-0547 E-mail: john@savannahSA.com
The due date for comments on the Summary Report is **12 December 2008**

Comments can be made as written submission via fax, post or e-mail.

2. BACKGROUND

2.1. Chronological sequence of events (high-level and where deemed critical)

The following provides a summary of the chronological sequence of events in terms of the environments studies undertaken for the Medupi Power Station and associated infrastructure:

» February 2005 – Submission of an Eskom EIA application to the DEAT, and DEAT issue reference number 12/12/20/695 to the project.
» October 2005 – Release of Draft Scoping Report for a mandatory 30-day public review period.
» November 2005 – Submission of Final Scoping Report to DEAT for approval.
» February 2006 – Release of Draft Environmental Impact Assessment Report for a mandatory 30-day public review period.
» 22 May 2006 – Submission of Final EIA Report to DEAT for review and decision-making.
» 19 September 2006 – DEAT issued Environmental Authorisation (=Record of Decision) for the proposed Medupi Power Station, **but specifically excluding environmental authorisation for an above-ground ashing facility, pending further investigation**.
» November 2006 – April 2007 – Eskom/appellants input into the appeal process, in order to resolve issues raised.
» 04 May 2007 – Minister of Environmental Affairs & Tourism dismisses the three (3) appeals against the Environmental Authorisation.
» 08 May 2007 – Eskom sends a letter to the DEAT regarding its "Notice of Intention to commence construction", as per condition # 3.3 in the Environmental Authorisation.
» 29 May 2007 – Commencement of construction on Medupi site.
» July 2007 – Draft Feasibility Report on in-pit ashing released internally.
» August 2008 – Eskom submits a letter to the DEAT outlining reasons for the preferred (above-ground) ash disposal option on the basis of the findings of the feasibility studies undertaken, and as such, requesting environmental authorisation.
» 01 September 2008 – DEAT acknowledges Eskom's letter regarding the alternative ashing options.
» 27 October 2008 – DEAT sends a final letter on the issue, with additional requirements, to Eskom.
» February 2008 to November 2008 – undertake various environmental processes for infrastructure associated with the Medupi Power Station (but unrelated to the ashing options), including:
    * Telecommunications mast – Environmental Authorisation received on 17 September 2008
    * Raw water reservoir – Environmental Authorisation received on 27 October 2008

* Realignment of a portion of Afguns Road – Environmental Authorisation received on 7 November 2008

2.2. Summary of the Consideration of On-surface Ashing throughout the EIA Process for the Medupi Power Station

2.2.1 Background

During the Environmental Impact Assessment (EIA) process for the Medupi Power Station in 2005/2006, on-surface/above-ground ash disposal as an "ash disposal alternative" was extensively dealt with. In the Environmental Impact Report (EIR), dated 22 May 2006, chapter 2, section 2.5.3 of the said report, it is stated that "…disposal to land, i.e. an ash dump…" was the only alternative for ash disposal considered during the Environmental Scoping Study (completed in 2005). The need for a detailed evaluation (by Eskom and the then Kumba Resources) and the consideration of the results from such a study "…prior to reaching agreement to ash back in the pit." by both parties had been acknowledged in section 2.5.3. Furthermore, "…a decision was taken (by Eskom as the proponent) that the EIA would evaluate the aspects associated with an (on-surface) ash dump for the proposed power station and the ancillary infrastructure." At the time of the compilation of the EIA Report, it was also anticipated that "…the environmental study for ashing back into the pit will be completed prior to the operation of the power station." Elsewhere in the document (section 2.1) an (on-surface) ash dump was included as "other related infrastructure", which was assessed as part of the overall project proposal.

It is hence clear from the above that Eskom has never considered in-pit ashing to be a feasible alternative for ashing from the Medupi Power Station, and that on-surface ashing had been considered to be the preferred ash disposal option from the outset of the investigations into this power station.

2.2.2. Impact Assessment of On-surface Ashing Facility associated with Medupi Power Station

On-surface/above-ground ashing was studied comprehensively in the EIA process for the Medupi Power Station and is well-documented in the EIA Report. A summary of where and how on-surface ashing has been dealt with in the Medupi EIA Report, and the extent of the specialist investigations is provided below.

Site selection: Chapter 17 (conclusions chapter) in the final Scoping Report submitted to DEAT in November 2005 concludes that, based on a comprehensive site selection exercise supported by a comparative mathematical model, the farms Naauwontkomen and Eenzaamheid were the preferred sites for development of the power station and/or ancillary infrastructure such as an above-ground ash disposal facility.

The comparative mathematical model used in the site selection exercise assumed a defined set of environmental issues that apply to all options subjected to the model. These environmental issues were ranked in order of importance, relevant to the project. Potential impacts were defined for each of the environmental issues. In order to provide a balanced approach to the site selection process, economic and technical criteria (such as relocating existing infrastructure and the impact of elevated ambient temperatures on the efficiency of the air-cooled condensers, respectively) that played a role in the selection of a site, were included in the overall evaluation of the candidate sites. The end result produced a percentage score that was used to rank the various site alternatives. The option with the highest percentage score was considered to be the most favourable alternative. From this exercise, it was concluded that an on-surface ash disposal facility on Eenzaamheid was the preferred ashing solution.

Chapter 4 in the final EIA Report submitted in May 2006, is a comprehensive summary of the site selection process undertaken during the scoping phase in 2005, and again highlights the preferred sites for the power plant and ash disposal facility as well as the process undertaken to reach this conclusion.

It must be noted that as far as Eskom is concerned, no specific 'site selection" was done for the in-pit option, as it was always assumed that it would be the Exxaro Grootegeluk mine pit, should this be seen as a feasible option.

Surface and groundwater studies: Chapter 6 in the Final EIA Report deals extensively with the impact of on-surface ashing on groundwater and surface water. A detailed risk assessment was conducted to determine the various threats posed by the proposed power station and ash dump on the water resources, and provides information regarding the management of recognised risks and to allow for the optimum management to mitigate these risks.

Air Quality studies: Chapter 9 of the final EIA Report deals with the impact of the power station and ash dump on air quality, during both the construction and the operational phases. The air quality modelling that was undertaken included the modelling of fugitive dust from the proposed ash dump on the Farm Eenzaamheid, as well as wind erosion from the ash dump. Dustfall rates were also determined, and mitigation measures recommended.

Visual Impact Assessment: this study (Chapter 10 in the Final EIA Report) deals with visual impacts from the power station as well as the proposed ash dump on the farm Eenzaamheid. The VIA included the full suite of visual aspects, such as viewer incidence/viewer perception, visual absorption capacity, visual impact index, visual distance/observer proximity to the facility, as well as the potential visual exposure.

Heritage Impact Assessment: The Farm Eenzaamheid was also investigated as part of the Heritage Impact Assessment (chapter 12).

Noise Impact Assessment: Noise impacts from ancillary infrastructure, including from the proposed ash dump on the Farm Eenzaamheid, were studied and included in the Final EIA Report (Chapter 14)

Social Impact Assessment (SIA): The social impacts associated with the entire power station complex, including the ash dump, were studied and recommendations were made regarding mitigation measures to be implemented (Chapter 15 in the Final EIA Report).

Ecology: A detailed and site-specific investigation of floristic and faunal attributes of the selected sites (i.e. Naauwontkomen for the power plant and Eenzaamheid for the ashing facility) was undertaken as part of the EIA, and appropriate mitigation measures recommended (Chapter 7 in the Final EIA Report).

In conclusion, the EIA for the Medupi Power Station included the full suite of specialist studies for both the power station site (on farm Naauwontkomen) as well as for the site for ancillary infrastructure (such as an on surface ashing facility) on the farm Eenzaamheid. As such, although no specific environmental authorisation was given for the on surface ashing facility at the new Medupi Power Station, all the relevant EIA studies have been conducted on Eskom's preferred option for the ashing facility, i.e. the on surface ashing facility. No fatal flaws from an environmental perspective were found to be associated with this proposed activity during these EIA investigations.

Table 2.1 provides an overview of some of the aspects considered during the EIA process, and the resultant outcomes of the impact assessment.

Table 2.1: Overview of some of the environmental aspects associated with an above-ground ashing facility on the Farm Eenzaamheid considered during the EIA process, the resultant outcomes of the impact assessment and proposed mitigation measures

Environmental Aspect / Impact	Description of Risk	Significance	Mitigation Potential	Proposed Mitigation
Air Quality	Fugitive dust from ash dump construction and operations	Low to medium, with latter especially during windy season	High	These impacts can be significantly reduced, and their impact rendered negligible, through the selection of and implementation of effective dust mitigation measures.
Visual	Short distance visual impact	Medium – ash dump would be visible within a 4 km radius from the dump	Medium-High	Creation of a green buffer zone along the Steenbokpan road to shield the viewer from the ash dump
	Potential glare from lights on the ash- depositing devices (ash stackers)	Medium – could have a visual impact on landowners south of the dump.	Medium	Mitigation could be problematic since the ash stacker is not stationary. However, periodic adjustment of lighting shields/covers to compensate for this, should be implemented.
Noise	Noise from ash dump construction/operation	Generally low - noise impacts are seen to be localised	Low-medium	» Equipment design shall consider appropriate noise mitigation. » The insulation of particularly noisy plant & equipment
Groundwater	Contamination of groundwater due to potential seepage from an unlined ash dump	Medium – attenuation and dilution will occur and slow travel time will reduce threat.	High	» Assess in-pit ashing with Exxaro; » Design and install a drainage system below ash dump; » Design optimum toe dam; » Backfill existing holes and install monitoring holes; » Surface water controls to be installed and maintained

Environmental Aspect / Impact	Description of Risk	Significance	Mitigation Potential	Proposed Mitigation
Ecology	Ecological impacts range from the destruction of natural habitat, destruction of areas of high biodiversity, destruction of red data flora and fauna species & habitat, destruction of protected tree species and destruction of ecologically sensitive habitat types	Medium to high, due to the localised extent and permanent nature of the impact	Low to medium, due to the permanent nature of the impact	» Remove, relocate, protect and utilize as many of the other protected tree species as possible, preserving existing integrity of natural vegetation; » Contain all construction and operational activities within the boundaries of the specified areas; » Utilise trees that normally grow to extensive heights for screening effects; » Implement a collection and re-establishment programme of bulbs and geophytes for rehabilitation purposes;
Heritage	No impact – Eenzaamheid was found to be ideal from a heritage perspective	Very Low	Very High	» The cemeteries should be avoided. Alternatively, if that is not possible, mitigation measures can be implemented by relocating the graves. » If archaeological sites are exposed during construction work, it should immediately be reported to a museum, preferably one at which an archaeologist is available, so that an investigation and evaluation of the finds can be made.

3. SUMMARY OF THE FINDINGS OF THE COMPARISON OF ALTERNATIVE ASH DISPOSAL OPTIONS FOR MEDUPI POWER STATION

3.1. Summary of the In-pit ashing Feasibility Studies

Eskom and Exxaro (previously Khumba Resources) have initiated a joint "Feasibility study of expected geochemical and geohydrological impacts related to the proposed backfilling of mixed mine discard and power station ash into the open cast void at Grootegeluk colliery" in 2006, with a final report released in August 2007. A full copy of the feasibility report, including an Executive Summary, is available on request.

3.1.1. Final Conclusions from the In-pit Ashing Feasibility Studies

It was concluded from the feasibility study undertaken that the layered option (first discard and then ash on top) is the preferred in-pit ash disposal option, due to a better seepage quality resulting from lower water content of the discard materials beneath a thick surface ash layer. However, this is the most expensive in-pit ash disposal option.

It must be noted that no specific 'site selection" was done for the in-pit option, as it was always assumed that it would be the Exxaro Grootegeluk mine pit, should this be seen as a feasible option.

The feasibility studies did not include any modelling of potential mitigation measures associated with the in-pit ashing options, for the following reasons:

» Due to timeframes for Medupi ashing, initial ashing on a conventional ash dump will be needed. Modelling of the various mitigation measures would an extended period of time (at least 2 years – sampling, trending, chemical lab analyses, modelling).
» Sufficient information for a decision is available to conclude that conventional ashing is an environmentally acceptable solution. This option was assessed as part of the EIA for the Medupi Power Station (refer to EIA Report dated May 2006).
» Modelling indicates that in-pit ashing potentially slows down the spread of pollution, but does not halt it altogether. In-pit ashing with mitigation is therefore not expected to have significant environmental benefits when compared to that for conventional ashing.

3.1.2. Eskom's Preferred Option with Regards to the Ash Disposal Alternatives

As per the DEAT request, Eskom has undertaken a comparative analysis on risks associated with in-pit ashing (layered) and conventional ashing. This comparative analysis is contained within Appendix A. The findings of this comparative analysis are outlined below. Eskom's preferred option for ash disposal is a conventional above-ground ashing facility, on the Farm Eenzaamheid 687 LQ. The rationale and motivation for this is as follows:

- Layered in-pit ashing cannot commence before 2016 due to:
  - Exxaro having to cover a substantial area of the pit with mine discards up to a certain height before Eskom can place a layer of ash on top
  - Ashing into pit cannot commence until ~ 3 years after 1st Medupi unit commercial operation
  - A temporary ashing solution would thus be required
- Only one party (Eskom) is involved with the design, operation and maintenance of a conventional above-ground ashing facility, i.e. no sharing of liabilities (in the short-term and long-term) with Exxaro.
- No management contracts need to be drawn-up between Eskom and Exxaro.
- A conventional above-ground ashing facility would, over its life cycle, pose less operational and strategic risks to Eskom.
- A conventional above-ground ashing facility is well understood by Eskom from an operational and risk management perspective.
- There would be a cost penalty to Eskom for the layering option: R200 M (capex and opex).
- Environmental aspects/impacts of above-ground ashing are documented and well understood.
- Extensive groundwater monitoring and pollution plume modelling is ongoing at existing power stations and will be undertaken at Medupi once this facility is operational.
- Medupi ash dump design will include technologically-advanced drainage and monitoring systems.
- There is a possibility that ash could be utilised in future – research into this aspect is ongoing – hence the ash would be available for this purpose.
- Benefits from a water/effluent management perspective, i.e. using the conventional ashing facility as an effluent sink.

3.2. Conclusion

Eskom concluded that, for the Medupi Power Station, the conventional (above-ground) ashing method as proposed on the Farm Eenzaamheid 687 LQ is the preferred solution from an environmental, technical, legal and financial perspective, but is committed to, if needed, further investigate and evaluate the in-pit ashing option for possible application in the future. Furthermore, Eskom is of the opinion that it has fulfilled all requirements from the DEAT, including the requirement that "*…further information on alternatives for the disposal of ash produced by the facility is required before an informed decision can be made on this aspect of the application*" and therefore now would further pursue its discussions with the DEAT to authorise the above-ground ashing facility on the Eenzaamheid, as per the original set of "listed activities" applied for and the undertaking in the Environmental Authorisation dated September 2006 that this aspect of the Environmental Authorisation "*…will be addressed in an amended or supplementary record of decision*".

APPENDIX A:
COMPARATIVE ANALYSIS ON RISKS ASSOCIATED WITH IN-PIT ASHING (LAYERED) AND CONVENTIONAL ASHING

Comparative Analysis on risks (without any mitigation) between the best In-pit option and Conventional Ashing

1 = Issue is relatively environmentally, technically or financially easy to manage or implement, or it is environmentally benign.	**2 = Issue is moderately difficult to implement and/or manage or have moderate environmental impacts**	**3 = Issue is relatively complex, it is difficult to implement and/or manage from a technical, financial and environmental perspective, and the environmental impacts are significant.**

(1=preferred option; 2=not preferred; 3=no preference)

Risk (Environmental and Others)	Best In-pit Ashing option (layered)		Above-ground Ashing	
Seepage (from the facility into the groundwater)	Limited amount of seepage generation and groundwater contamination will occur, although area is limited.	2	Operation above water table. Ash dump will be lined if necessary – hence low risk of seepage generation and groundwater contamination.	2
Groundwater inflow (into the facility)	There will be a greater groundwater inflow into the pit area but the water table will remain below the ash layer.	2	No groundwater inflow into the ashing facility.	1
Extent (area) of groundwater pollution migration	There will be a groundwater pollution plume of limited extent (but more than with an ash dump) after a long time (more than 100 years)	2	This will be very limited. Groundwater modelling studies for Matimba and Medupi have indicated that in terms of the extent of groundwater pollution migration, there is a very limited zone of impact due to the fact that pollution plume migration is very slow (as a result of the non-aquifer system, low permeability of rocks in the area and hence low groundwater gradients and limited rainfall recharge).	1
Timing (date of availability of ashing facility for Medupi units)	In-pit ashing facility only available in 2016 for Medupi ash	3	Ashing facility available when the first Medupi unit is commissioned.	1
Uncertainty around Life cycle Costs (capital, operational, maintenance and decommissioning) for the options	Great uncertainty around life cycle costs for in-pit option, due to negotiations on a range of issues not being started as yet.	3	Greater degree of certainty on life cycle costs for conventional ashing systems – capex and opex on these systems are well-known to Eskom	1

Risk (Environmental and Others)	Best In-pit Ashing option (layered)		Above-ground Ashing	
Level of confidence in forecasted life cycle costs	Low level of confidence due to the many uncertainties	3	High-level of confidence due to known capex and opex	1
Requirement for of a temporary ashing solution	A temporary ashing solution is required	3	No need for a temporary ashing solution	1
Contractual complexities	Due to the nature of the operation, there will be many and significant contractual complexities	3	One owner-operator, hence no contractual complexities	1
Operational risks				
Reliability/Availability of facility	Due to complex nature of operation, there is a higher degree of uncertainty around the level of plant reliability/availability	3	Operations and operating regimes are known, and hence a high degree of certainty around plant reliability/availability.	1
Different operations/maintenance teams	Eskom and Exxaro teams working simultaneous on either side of the ashing facility. This would be a logistical challenge.	3	Only Eskom team(s) working on the facility. Operating and maintenance philosophies on conventional ashing facility are well-entrenched in Eskom	1
Legal framework (OHS Act vs. Mining safety and related legislation) within which facility needs to be managed and operated	Adherence to OHS Act and mining safety, environmental and other related legislation – legally complex	3	Adherence to OHS Act and known environmental and other related legislated. Eskom is well aware of the requirements and have systems in place to ensure continued compliance	1
Available operational experience i.t..o. ash disposal	Limited operational experience in terms of in-pit ashing and management of risks associated with this kind of operation.	3	Extensive experience in terms of operating and maintaining conventional ash dumps, both technically and environmentally	1
Realisation of benefits for power plant water management practices	No benefits from a power plant water management perspective, i.e. in-pit ashing cannot assist with power plant water management	3	Huge benefits for power plant water management – it assist Eskom in achieving its ZLED (Zero Liquid Effluent Discharge) philosophy, in that a conventional ash dump acts as an effluent “sink”.	1
Visual (impact from the facility on the surrounding environment)	Operation is less visually-intrusive. It would be a “sunken” operation for a relatively long time until ground-level is reached.	1	Due to the nature of the design and operation of this type of facility, it is visually intrusive. However, with appropriate mitigation measures, this could be reduced (i.e. could be rated a ‘2’).	3

Risk (Environmental and Others)	Best In-pit Ashing option (layered)		Above-ground Ashing	
Land-use (land take associated with the facility)	Operation takes place on already-disturbed land (mine pit), hence no additional/minimal land-use is foreseen.	1	Additional land-use for the ash dump, however, if the in-pit option is chosen, additional land is needed for the temporary ashing facility.	3
Air quality (dust) (emanating from the construction and operation of facility)	Dust will be generated during operations, however, due to the elevation of the operation (inside the pit), the impacts would be minimal.	2	Due to the relatively high elevation of the operation, dust could be generated especially during high wind conditions	3
Noise ((emanating from the construction and operation of facility)	There will be operational noise, however, due to elevations of the operation, the impact from this would be greatly reduced.	1	Operational noise, due to the location and elevation of operation, would have impact on ambient noise levels.	3
Ease of rehabilitation (after closure of operations)	Although this would be the responsibility of the mining house, costs and risks associated with this are unknown to Eskom.	2	Rehabilitation practices for conventional ash dumps are well-known and entrenched in Eskom, and extensive research has been done on it.	1
Clarity on liability (for Eskom and authorities)	Low confidence in terms of clarity on liability (no negotiations as yet on this aspect), hence may uncertainties from a cost and legal perspective	3	One single party involved, hence absolute clarity on what the liabilities are and how to make provision for these.	1
Future ash utilisation (i.e. the potential to use this “old, mature” ash for other purposes)	Low potential for future ash utilisation once “dumped” into the mine pit (ash is critical for mine pit rehabilitation efforts, hence low chance of the mine agreeable to this)	3	Potential for future ash utilisation – research is ongoing, and the ash would be “readily” available for this purpose.	1