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Dear Mr Olebogeng Matshediso

ESKOM'S COMMENT ON DRAFT LISTED ACTIVITIES AND MINIMUM EMISSION STANDARDS

The gazetted Listed Activities and Minimum Emission Standards (No. 32434 dated 24 July 2009) has reference. The standards demonstrate significant progress in more effective air quality management in South Africa. Eskom appreciates the opportunity to comment on the standards.

Eskom accepts the emission standards as the longer term aspiration. However, the pathway and required timeframes to achieve compliance will require an integrated approach, involving various government Ministries that will need to consider the implications and practicalities of achieving these standards on the country and the supply of electricity.

There are a number of issues in the standards which need to be clarified and a few requirements which cannot be practically met by Eskom in the set timeframes. Meeting certain standards in the proposed timeframes is extremely restrictive due to resource constraints including water, limestone and down time of plant to implement retrofitting actions to meet standards. There are also concerns relating to Eskom's existing power stations having to comply with new plant standards within a period of eight years with at most a five-year postponement of this compliance period, as well as the minimum limit values associated with the standards that are proposed for SO_2 and NO_x (NO_2) for existing power stations.

It is further noted that these standards have significant implication to the South African economy in the form of electricity tariff increases to fund the measures that would be required for existing power stations to meet the proposed new plant emission standards.

If the draft standards are legislated as published, the implications will be broader than Eskom and would require input and agreement from various government departments and institutions prior to finalization. The implications include the following:

- The only technology currently commercially available, which can achieve the proposed standards of SO_2 is Flue Gas Desulphurisation (FGD).

- Water required for the operation of FGD plant is an additional 6 to 10 Mm^3/annum per station depending on whether it is dry or wet. No additional water is available for the Highveld area until at the earliest 2018. However, based on long term water availability there may only be sufficient water to retrofit a limited number of plants.
- Sorbent (lime/limestone) required for the operation of FGD plant is estimated at 500 000 to 700 000 tons per year per station. The quality and quantity of locally available sorbent to meet full compliance of all existing and future power stations under the current proposed standards still needs to be determined. Based on current information this is likely to limit the number of plants that can be retrofitted.
- The costs associated with the new standards are significant and will have an impact on the electricity tariff. Estimated capital expenditure to meet the proposed standards at all existing plant is R100 billion. Below is a summary of the costs associated with compliance per power station:
    - R500-600 million for low NOx burners
    - R6-8 billion for wet FGD
    - R1.2-1.6 billion for fabric filter plant
- The operational costs including water and sorbent for FGD will be significant enough to further impact on the electricity tariff.
- To retrofit plant with pollution control technologies requires additional outage time. In the shorter term, while South Africa is short of capacity, this could have a significant impact on electricity supply if the timelines stipulated in the standards are retained.

Guided by the issues outlined above, Eskom requests that the 5-year limit for exemption period be removed, but that a framework for compliance that takes into account a variety of national issues including security of supply, the cost of electricity and environmental performance including resource requirements be negotiated. We also request that the minimum emission standards not apply to the underground coal gasification (UCG) process and gas, and that appropriate limits be set on the basis of the experience with the UCG demonstration plant.

Eskom is committed to continually improving the environmental performance of the existing fleet of power stations. Due to the enormous cost and resource requirements required to reduce emissions, Eskom is of the opinion that emission reduction measures should be prioritised in terms of greatest impact.

We urge the DEA to further engage Eskom and its Shareholder, the Department of Public Enterprises, and other relevant Departments to achieve the desired end state as well as the associated effects of various national policies before the draft standards are enacted. We are more than willing to further engage on these issues as and when required.

Yours sincerely

WILLIE DU PLESSIS
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Eskom's Comment on the National Environmental Management: Air Quality Act: List of activities which result in atmospheric emissions which have or may have a significant effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage, General Notice published in GG 32434 of 24 July 2009, Notice No. 1001

1. Paragraph 3 (2)

As indicated in the covering letter, Eskom accepts the emission standards as the long term aspiration. However, the pathway and required timeframes to achieve compliance will require further consideration. The impact of the draft Regulation will be broader than Eskom. There are requirements which cannot be practically met by Eskom in the set timeframes due to resource constraints including water, limestone and down time of plant to implement retrofitting actions to meet standards. Further, the Regulation has significant implication to the South African economy in the form of electricity tariff increases to fund the measures that would be required for existing power stations to meet the proposed new plant emission standards. We recommend that the 5-year limit for exemption period be removed and this issue will need to be dealt with in an integrated manner with the involvement of other relevant government departments.

2. Ad Paragraph 3(3)

The same concern raised with regard to paragraph 3(2) applies to this paragraph. Eskom's existing fleet of power stations cannot comply, for logistical and financial reasons set out in the covering letter, with minimum emission standards for new plant within 8 years. The extension of the period for initial compliance with paragraph 3(2) should be applied herein to enable a phased approach to achieve compliance, taking into account security of supply of electricity as well as spreading the financial burden over a reasonable period.

3. Ad Paragraph 4(1)

3.1 We propose that the word *"postponement"* be replaced with the word *"exemption"* which is a familiar term used in South African legislation. This obviates uncertain and inconsistent interpretation. The words have been used interchangeably in the Framework using the usual term will not lead to conflict.

3.2 The reality of the situation regarding Eskom's existing fleet of coal-fired power stations need to be considered. This includes enormous financial implications of complying with new plant standards that would impact on the price of electricity, capacity constraints which prevent the shutting down of power stations for extensive periods needed to do the retrofitting, age of plant, type of equipment and the limited water and sorbent resources that are required. In order to retrofit existing coal-fired power stations to meet new plant standards, **Eskom will need to be able to apply for a life-of-plant extension** of the compliance time period for meeting new plant SO_2 and NO_x standards for some of the power stations. This is in line with international norms and is financially prudent given that some power stations do not have

many years of service left and thus once retrofitting is complete, only a few years of life would remain. Given that resources are limited, we propose that limited resources, both financial and environmental be put into those power stations that have a longer residual life.

4. Ad Paragraph 4(3)

4.1 Again our recommendation is that you replace "*postponement*" with "*exemption*" in this paragraph.

4.2 Paragraph 4(3) enables a single extension of no more than 5 years. This is not in the spirit of the principles embodied in the Framework. In 5.4.3.5, on page 48 of the Framework, it is stated that "*any requirement to upgrade is informed by an understanding of any environmental impact of the affected plant. At the end of the extension period granted, a further extension could be made possible subject to a repeat of the impact assessment process*". We recommend that the Regulations enable further extension in line with the Framework, **which should be granted on a case-by-case basis according to merit, feasibility, and prioritisation based on ground-level impact**.

4.3 Eskom's existing fleet of coal-fired power stations have tall stacks (generally ranging between 220m and 300m) that act to disperse pollutants to acceptable ambient levels. Extensive ambient air quality monitoring programmes have shown that these tall stacks are very effective at mitigating potential health impacts.

4.4 In order **for existing plant to comply with new plant standards, they will need to be retrofitted with flue gas desulphurisation (FGD), low NOx burners and in most cases fabric filter plants**. In 2007, the capital costs of financing were estimated at R100 billion. The annual operating costs for a wet FGD with 90% removal efficiency on a 6 by 600 MW power station were estimated in 2007 to be between R205 million and R230 million.

4.5 To operate FGD on a 6 by 600 MW power station requires between 400 000 and 500 000 tons of sorbent (limestone) per annum (depending on the power station the sorbent and the coal used) and around 7 Mm^3 of water per annum. (To put this in perspective, a 6 by 600 MW dry-cooled power station requires between 3 and 3.5 Mm^3 of water per annum). Total sorbent reserves in South Africa have not been well ascertained, but sorbent is in great demand for new coal-fired power stations. Water for FGD retrofits will only be available from 2018 or later once an inter-basin transfer scheme from either the Lesotho Highlands or the Tugela system is constructed. Water resources are limited and there may not be sufficient water to meet the requirements if all power stations were retrofitted.

4.6 The total cost of a low NO_x burner retrofit is estimated at R540 million for a 6 by 600 MW power station. The immediate negative effect of retrofitting low NO_x burners is the reduced combustion efficiency and increased levels of unburnt carbon in the ash.

4.7 The current Particulate Matter (PM) abatement technology and the PM emission limits achieved at Eskom's power stations are as follows:

Power stations	Flue gas cleaning plant	Emission limit
Hendrina, Majuba, Arnot, half of Duvha	Fabric filter plants	50 mg/Nm^3
Kendal, Lethabo, half of Duvha	Electrostatic precipitators	75 mg/Nm^3
Camden (RTS station)	Fabric filter plants	75 mg/Nm^3
Grootvlei, Komati (RTS stations)	Fabric filter plants and electrostatic precipitators	100 mg/Nm^3
Matimba, Matla, Kriel, Tutuka	Electrostatic precipitators	>100 mg/Nm^3

4.8 PM emission limits for new plant are already achieved at the three and a half power stations which have fabric filter plants. Major upgrades valued at several hundreds of millions of rands per power station are in progress for Matimba, Matla and Kriel with limits of over 100 mg/Nm^3 in order that they may achieve an average of 50mg/N m^3 and a limit of at least 75 mg/Nm^3.

4.9 In order to comply with the new plant PM emission standards, fabric filter plants would need to be retrofitted to five and a half power stations, as well as to some of the units at Grootvlei and Komati. The capital costs of retrofitting a fabric filter plant to a 6 by 600 MW power station are estimated to be between R1.2 and R1.8 billion.

4.10 **Eskom's existing fleet of power stations should be evaluated as a collective, and emission reductions prioritised and optimal national solution sought taking into account natural resource availability, the cost on the tariff and electricity supply capacity.**

5. Ad Regulation 5

The conditions for continuous emission monitoring are challenging yet practical, and should remain unaltered. We would like to clarify that Eskom would like to be responsible for its own continuous emission monitoring, and we are happy to have the reliability and accuracy of the measurements verified by an independent audit every two years. In future, when the SANAS accreditation system for continuous emission monitoring is in place, Eskom intends applying for SANAS accreditation.

6. Ad Regulation 6(2)(b)(i)

The paragraph requires the person who monitors emissions to be accredited but there is no indication of how and by whom the accreditation would be done. The paragraph must clarify what accreditation is required in order to be considered to be an accredited measurement service provider.

7. Ad Regulation 6(2)(c)(i)

The proposed annual tests are not practical. Internationally stations are not required to carry out correlation tests every year. The annual tests are also costly and will have a financial implication on the electricity tariff. We recommend that spot measurements or correlation tests not be conducted every year to verify the results of continuous emission monitoring. To verify the results of the particulate measurements, correlation tests need to be conducted every four years, and spot

checks at two-yearly intervals between the correlation tests. Calibrations should be conducted to ensure the accuracy of gaseous emission measurements.

8. Ad Regulation 7(1)(a)

8.1 There is only one provision under this paragraph and this renders the numbering of sub-paragraph (a) superfluous. Retain 7(1) as the numbering and merge the two parts of the provision into one paragraph.

8.2 Upset conditions frequently persist for longer than 48 hours. The licensing authority should be informed if this is the case, but again, it is fundamental that the condition in section 7(1)(a) not prohibit unavoidable upset conditions which last longer than 48 hours. For example, during a cold start of a power station after an extended outage, tests need to be run on various components of the plant in order to ensure compliance with the grid code. Under such circumstances, the entire light up period can be up to 96 hours. In order to ensure safe operation of the power station, this period cannot be reduced but must be considered normal light-up procedure.

8.3 Eskom's emissions licences will have the following requirement for start-ups:

The duration of a hot start-up is limited to 12 hours from fires in to synchronization, while the duration of a cold start-up is limited to a maximum of 48 hours from fires in to synchronization. Particulate matter emission levels should be ... below the limit value within 48 hours of synchronizing with the grid.

8.4 We recommend that the Minimum Emission Standards not apply during the commissioning of a new plant. In many instances, the monitoring equipment can only be calibrated once the plant has been stabilised. The abatement technology cannot be continuously operated during commissioning.

9. Category 1: Combustion Installations

9.1 Section 8 (1) Subcategory 1.1 Solid fuel combustion installations

9.1.1 We recommend that the application: "*All installations with design capacity of 50 MW heat input per unit, based on lower CV of the fuel used. These include small installations with a combined capacity of 50 MW heat input, and ~~more~~*" be substituted with the following bold wording similar to that in 8(2) of the gazette in order to make the provision clear and understandable: "*All installations with design capacity of* ***more than*** *50 MW heat input per unit, based on lower CV of the fuel used. These include small installations with a combined capacity of 50MW heat input* ***and greater'***.

9.1.2 All the new plant limits are acceptable. However, the PM limit for existing plant can only be achievable after planned upgrades. As indicated in the covering letter and in paragraphs 1 to 4 above, upgrades have significant consequences that need to be considered. Therefore, it is requested that the NO_x and SO_2 standards for existing plant be revised in that light.

9.2 NOx limit for existing plant

9.2.1 A NO_x emission limit of 1100 mg/Nm^3, expressed as equivalent NO_2, for existing plant is too low and inconsistent with measured emissions from

existing plant. A monthly average concentration limit of 1700 mg/Nm^3 NO_x, expressed as equivalent NO_2, is realistic for existing plant. (A limit of 1100 mg/Nm^3 of NO_x ***as NO*** was originally proposed by Eskom as a suitable NO_x emission limit for existing plant. This translates to 1687 mg/Nm^3 of NO_x ***as NO_2*** – hence the request for a NO_x emission limit of 1700 mg/Nm^3).

9.2.2 NO_x is currently monitored at nine of Eskom's SANAS-accredited ambient monitoring stations which are sited in the vicinity of power stations, and there has not been one exceedance of the ambient hourly NO_2 limit of 200 μg/m^3.

9.3 SO_2 limit for existing plant

9.3.1 It is not clear whether sufficient sorbent of adequate quality is available in South Africa to retrofit Eskom's entire existing fleet of coal-fired power stations with FGD. There is a country-wide lack of sorbent, and the good quality sorbents that do exist are already used by industry, and are remote from the coal deposits. Similarly, FGD requires increased water usage, and water resources are also very constrained. Indications are that there will only be sufficient water available on the Highveld to consider retrofitting FGD from 2018, when the new Lesotho Highlands or Tugela transfer scheme is completed. These strategic realities need to be debated.

9.3.2 Eskom's position, based on these being minimum standards, is that the limit value for NO_x (expressed as NO_2) be set at 1700 mg/Nm^3 and SO_2 at 4000 mg/Nm^3, as per our original submission which was based on actual measured values.

9.3.3 The proposed particulate emission limits are challenging yet realistic and should remain unaltered. However, as stated above, Eskom wishes to determine with the department the timing for complicance.

9.4 Ad Paragraph 8(2) Subcategory 1.2: Liquid fuel combustion installations

9.4.1 Emission limits for combustion turbine installations running on liquid fuel should be set at 15% O_2, rather than 6% O_2, since international standards for gas turbines are set at 15% O_2, and the stations run at 15% O_2. The values themselves should remain the same, as the values were proposed on a basis of 15% O_2.

9.4.2 In the European Union (EU) Directive for Large Combustion Plants, emission limits are set for an oxygen content of 3% in the case of liquid or gaseous fuels, 6% O_2 in the case of solid fuels, and 15% in the case of gas turbines. In the International Finance Corporation of the World Bank (IFC) Guidelines for Thermal Power Plants, emission limits are similarly set at 3% O_2 for liquid and gaseous fuels, at 6% O_2 for solid fuels, and at 15% for combustion (gas) turbines and reciprocating engines. We recommend that the limits be set on a similar basis in the South African Minimum Emission Standards.

9.4.3 In the EU standards and the IFC guidelines for thermal power plants, emission limits for combustion installations are dependent on both the fuel and the technology used. It is recommended that limits are set in the similar fashion in the next revision of the Minimum Emission Standards. In the meantime, it is recommended that the emission limits be set to reflect the minimum emission standards across the technologies and fuel types, so as

not the hinder the establishment of new types of power stations, and that they are not applicable to reciprocating engines.

9.4.4 In particular:

- The SO_2 emission limit for new plant is more stringent than the SO_2 emission limits in the EU standards or the IFC guidelines. We recommend that the SO_2 limit for new plant be set at 850 mg/Nm^3 or 1% sulphur content in the fuel.

- The NO_x emission limit for new plant of 250 mg/Nm^3 is also more stringent than the EU or IFC limits. We recommend that a NO_x limit of 750 mg/Nm^3 be set for new plant (in line with the NO_x emission limit for solid fuels).

9.4.5 We recommend that the limits proposed herein do not apply to reciprocating engines, since the limits for reciprocating engines in the IFC Guidelines are more lenient than the limits recommended here, and one would not want to prohibit the development of power stations utilising such technology.

9.5 Ad Paragraph 8(4) Subcategory 1.4: Gas combustion installation

9.5.1 As for liquid fuel combustion installations, it is requested that the emission limits for gas turbines be set at 15% O_2.

9.5.2 The limits set for gas combustion installations in subcategory 1.4 are appropriate for installations burning natural gas, but not appropriate for installations burning other types of gas. We recommend that the limits either be made more lenient to reflect the fact that they are minimum emission standards, or that the limits only apply to natural gas-burning installations, and that the limits for other gaseous fuels be compiled when the standards are revised.

9.5.3 If it is decided that the limits are to apply to all gaseous fuels, we recommend the following limits on the basis of EU and IFC limits:

- PM emission limit for new and existing plant: 50 mg/Nm^3
- SO_2 limit for new and existing plant: 400 mg/Nm^3 or fuel with less than 1.5% sulphur content (Majuba's coalfield resources, where the UCG projects are being developed, have an average sulphur content of 1.3%, requiring greater leniency than the EU and IFC emission guidelines)
- NO_x limit for new plant: 240 mg/Nm^3

9.5.4 As mentioned above, these limits should not apply to reciprocating engines (a NO_x emission limit of up to 2600 mg/Nm^3 is permitted for reciprocating engines in the IFC Guidelines).

9.6 Emission limits for underground coal gasification

9.6.1 There are two options to consider when applying the proposed subcategories to UCG:

Option 1 : UCG and power station perceived as one entity	**Option 2 : UCG and power station perceived as separate entities**
Subcategory 1.1 – solid fuel installations, based on the concept that UCG essentially converts coal (solid fuel) into a gas, for subsequent combustion in gas turbines	**Subcategory 1.4** – gas installations, based on the concept that the UCG gas turbine power plant is dealt with hereunder, and the UCG coal mining is dealt with under sub-category 3.2
Subcategory 2.2 – applicable to UCG liquid by-product storage	Subcategory 2.2 – applicable to UCG liquid by-product storage
Subcategory 3.1 – applicable to UCG flarestack	Subcategory 3.1 – applicable to UCG flarestack
	Subcategory 3.2 – applicable to UCG itself – fugitive emissions and wellhead flaring

9.6.2 Option 1 (sub-category 1.1) is the preferred option, as UCG is essentially a coal-based (solid fuel) technology. UCG is operational in the former Soviet Union (small scale commercial, 1950's vintage) and Australia (pilot scale), and is still being proven under local conditions by Eskom. The Eskom demonstration plant being trialled in 2014 will confirm the emissions potential, and we recommend that the Department of Environmental Affairs and Eskom conclude the appropriate sub-category and emissions limits on the basis of confirmed data.

9.6.3 We submit that the UCG-Integrated Gasification Combined Cycle (IGCC) is a coal-based (solid fuel) technology, and should be required to meet the limits of sub-category 1.1 (solid fuel technologies).

9.6.4 We propose that the limits of **sub-category 1.1** (solid fuel technologies) include a relaxation on pilot/demonstration plants, by inclusion of the statement "except test or experimental installations". This will reduce the cost of researching and developing new technologies. The limits of sub-category 1.4 (gas technologies) are very low for a UCG plant.

9.6.5 We recommend that the minimum emission standards for gas combustion installations not apply to combustion installations burning UCG gas. This request is in line with international precedent: in the EU Directive for Large Combustion Plants, there is no SO_2 emission limit for gas from gasification of coal. It is stated that, "*The Council will fix the emission limit values applicable to such gas at a later stage on the basis of proposals from the Commission to be made in the light of further technical experience*". Eskom has plans to construct a 40 MW demonstration UCG plant, with a view to building a 2100 MW commercial plant running on UCG gas in future. This technology provides a way of utilising coal reserves which can otherwise not be utilised. **We therefore recommend that emission limits for UCG gas be set in an interactive process between Eskom, the Department of Environmental Affairs and other relevant stakeholders, based on the experience gained with the 40 MW UCG demonstration plant.**

10: Category 2: Petroleum Industry

Ad Paragraph 9 Subcategory 2.2: Storage and handling of petroleum products

10.1 The emission standards in this subcategory potentially apply to the storage of UCG by-product liquids on site.

10.2 Eskom has presently just contracted the preliminary design of the demonstration gas treatment plant to an international architect engineering company. It is therefore premature at this stage to comment on the severity or otherwise of the proposed emissions limits. The legislated limits will be given to the design company as input.

10.3 The Eskom UCG demonstration plant being trialled in 2014 will confirm the emissions potential, and it is recommended that the Department of Environmental Affairs and Eskom conclude the appropriate sub-category and emissions limits on the basis of confirmed data.

11. Category 3: Carbonization and Goal Gasification

11.1 Ad Paragraph 10 Subcategory 3.1: Combustion Installation (carbonisation and coal gasification)

11.1.1 We propose that these limits not apply to the flarestack used for emergency flaring of UCG gas, since overly stringent standards may make a promising technology unviable. We further propose that appropriate standards for UCG gas be developed using the technical experience gained with the UCG demonstration plant.

11.1.2 The stipulation in paragraph 10(1)(a)(i) that "*sulphur-containing compounds to be recovered from gases to be used for combustion with a recovery efficiency of not less than 90% or remaining content of sulphur-containing compounds to be less than 400 mg/m^3 measured as hydrogen sulphide, whichever is the strictest*" appears very strict in comparison to international legislation. The USA-EPA 60-33b stipulates *"(i) The emission limit for sulphur dioxide contained in the gases discharged to the atmosphere from a designated facility is 31 parts per million by volume or 25 percent of the potential sulphur dioxide emission concentration (75- percent reduction by weight or volume), corrected to 7 percent oxygen (dry basis), whichever is less stringent. Compliance with this emission limit is based on a 24-hour daily geometric mean"*.

11.1.3 We recommend that:

- the removal efficiency of sulphur-containing compounds be reduced to 75% by weight or volume; and
- the UCG flarestack be intended for emergency use, and should not be designed for the removal or reduction of PM, SO_2 or NO_2 due to its infrequent use.

11.2 Ad Paragraph 10 Subcategory 3.2: Coke production and coal gasification

As for subcategory 3.2, we also propose that these limits not apply to the UCG coal gasification process, but that appropriate limits for the UCG process be developed on the basis of confirmed results from Eskom's UCG demonstration plant.