Centre *for* Environmental Rights
Advancing Environmental Rights in South Africa

The Honourable Barbara Creecy
Minister of Environment, Forestry and Fisheries
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30 July 2019

Dear Minister Creecy

THE COST OF AVAILABLE POLLUTION ABATEMENT TECHNOLOGIES REQUIRED TO MEET MINIMUM EMISSION STANDARDS FOR SULPHUR DIOXIDE (SO_2)

1. We refer to our meeting on 24 July 2019, and in this letter provide you with such information as is available to us regarding the assessment of the cost of available pollution abatement technologies required to meet the "new plant" Minimum Emission Standards (MES) for SO_2 prescribed in the Listed Activities published in terms of the National Environmental Management: Air Quality Act, 2004 (AQA) – particularly as this relates to solid fuel combustion installations like Eskom's coal-fired power stations and Sasol's coal boilers.

The MES and FGD

2. The MES were set in a multi-year, multi-stakeholder process (with Eskom and Sasol active and vocal participants) and were essentially a compromise.

3. As you are aware, the MES were published on 31 March 2010 and were phased in – with existing facilities required to meet one set of MES ("existing plant" MES) by 1 April 2015, and another, stricter set ("new plant" MES), by 1 April 2020. During the process of setting the MES, the Department refused industries' request for their facilities to be grandfathered – i.e. exempt from ever complying with new plant standards. Instead, leniency was provided at the outset by allowing plants to apply for an extra 5 years to comply with each set of MES. In addition, since the amendments in October 2018, it was possible for plants that will be decommissioned by 31 March 2030 to apply – by 31 March 2019 - to be exempt from new plant MES if certain conditions are met. Eskom has applied for such "once-off suspensions of compliance" for 5 of its stations. The decisions on these applications – and both Eskom's and Sasol's latest applications to postpone MES compliance – are awaited.

4. In a December 2013 media release,[1] the then Department of Environmental Affairs (DEA or Department) commented as follows on the MES process: "*All affected stakeholders (including Eskom) were part of these processes and they made contributions regarding limits that are achievable with the view of upholding the constitutional right of all people in the country to an environment that is not harmful to health and well-being".* The Media Release further confirms that *"Eskom participated directly in this process, and standards seek to balance the economic, social and environmental imperatives".*

[1] Media Statement: The Department of Environmental Affairs clears the air on the atmospheric emission license (sic) for Kriel Power Station available at https://www.environment.gov.za/mediarelease/atmospheric_emissionlicense_krielpowerstation

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5. Before instituting their first – of many – applications to postpone MES compliance, and despite knowing that this was unlawful, both Eskom and Sasol initially asked for MES exemptions. The then Minister refused this request, reminding them that MES exemptions were unlawful and that they could, instead apply to postpone MES compliance; which Eskom, Sasol, and several other industries did.

6. When Sasol launched a court application in 2014, seeking to review and set aside the MES applicable to its operations – which it instituted whilst its first applications to postpone MES compliance were pending – the DEA vigorously opposed this. Dr Thuli Khumalo commented in her answering affidavit that: *". . . [a]chieving ambient air quality standards (in the sense of bringing ambient air quality down to below the prescribed levels) is not an exercise in economics nor is it a matter for negotiation with the Applicants: that fundamental right [section 24 of the Constitution] may not be infringed by Sasol or any of the other Applicants and their argument or defence, that they are infringing that environmental right because it costs too much to adapt their existing plants and bring them up to standard, must be rejected out of hand. . ."*.[2]

7. We support the above stance adopted by the National Air Quality Officer, and call upon the Department to uphold this position in relation to implementing and enforcing the MES, as it is consistent with sections 7 and 24 of the Constitution of the Republic of South Africa, 1996.

8. We point out that flue gas desulphurisation (FGD) - to abate SO_2 from coal boilers - is used worldwide and accepted as the top SO_2 removal technology. It is well-known and not disputed that FGD is the Best Available Technology (BAT) required to meet the new plant SO_2 MES effective from 1 April 2020.

9. Sasol itself has confirmed that there are no other means to meet these MES, and that "*FGD technology is proven*".[3]

10. This was clear throughout the multi-stakeholder process in which the MES were set, and the cost and other negative impacts of FGD (which can, to a significant extent, be mitigated; for example, by the use of a cooler to reduce water consumption and the sale of gypsum as a by-product to reduce the need for solid waste disposal) were also well-known to all stakeholders involved.

11. Notwithstanding this, the committee set the new plant SO_2 MES at the relatively-weak 500mg/Nm^3, as the health impacts and other consequences of not adequately abating SO_2 far outweighed the negative effects of the abatement technology. The health impacts caused by the pollutants, individually and cumulatively, are significant.[4]

12. In addition, the MES for solid fuel combustion installations have not changed since 21 March 2010 (apart from the doubling of the SO_2 new plant MES in October 2018, which was reversed after groundWork instituted litigation in relation to the failure to advertise this proposed change as required by law). A decision is awaited as to whether the Minister intends to double these MES again, having now invited public comment on the proposal as required by AQA.

13. We also strongly dispute that it is lawful to weaken the MES. In this regard, please refer to our March 2018 letter addressed to the Director-General setting out our reasons for opposing the establishment of an expert panel on SO_2 abatement solutions,[5] and the June 2019 written submissions opposing the new plant SO_2 doubling (also outlined below).[6]

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[2] See paragraph 49.13 of the National Air Quality Officer's answering affidavit available at https://cer.org.za/programmes/pollution-climate-change/key-information

[3] See PCEA minutes available at https://pmg.org.za/committee-meeting/25766/); see also the Sasol presentation during this PCEA briefing at https://cer.org.za/programmes/pollution-climate-change/key-information.

[4] See, for example, the June 2019 report by Dr Peter Orris: https://cer.org.za/wp-content/uploads/2019/06/Peter-Orris-Report.pdf

[5] https://cer.org.za/wpcontent/uploads/2019/07/Annexure2_CER_letter_to_DEA_re_SO2_panel_5_March_2018.pdf

[6] https://cer.org.za/news/doubling-so2-pollution-standards-would-have-deadly-consequences-for-highveld-communities

14. SA's MES are already weak - significantly weaker even than other developing countries:

"Existing Plant" ratios: SA/Country		
	SO_2	PM
SA/China	17,5	3,3
SA/Germany	17,5	5
SA/India	5,8	1
SA/Indonesia	4,7	0,7
SA/Thailand	1,7	0,6
SA/EU IED	17,5	5

"New Plant" ratios: SA/Country			
	SO_2		PM
SA/China	14,3	28,6	5
SA/Germany	3,3	6,6	5
SA/India	5	10	1,7
SA/Indonesia	0,7	1,4	0,5
SA/Thailand	1	2	0,6
SA/EU IED	3,3	6,6	5

Notes: comparisons and ratios are approximate due to differences between jurisdictions with respect to: a) the reference oxygen content (for eg, the MES reference value is 10% oxygen; the EU and China reference value is 6% oxygen); b) the averaging period (for eg, the MES is based on daily averages; shorter averaging periods may apply in other jurisdictions; and c) applicable boiler size. Due to these factors, the calculated ratios are generally conservative or understated.

15. This table shows, for example, that SA's existing plant SO_2 MES are about 17.5 times weaker than China's; almost 6 times weaker than India's; and more than 4.5 times weaker than Indonesia's. Our new plant SO_2 MES – of 500mg/Nm^3 – are, for example, more than 14 times weaker than China's and about 5 times weaker than India's. If the new plant $S0_2$ MES are doubled, so will these comparisons be doubled – meaning our SO_2 MES will be more than 28.5 times weaker than China's and 10 times weaker than India's.

16. Both Eskom and Sasol have received 5 year postponements of compliance to meet new plant SO_2 MES – meaning that they are only required to do so by April 2025, 15 years after the MES were published on 31 March 2010. In other words, industry has had ample time to prepare to meet the relatively lax standards. The Department acknowledges, in the 2017 National Framework for Air Quality Management in the Republic of South Africa, that even 10 years for compliance is adequate; noting "*that the year 2020 marks 10 years since the publication of the 2010 AQA Section 21 notice (Listed activities and minimum emission standards). Therefore, sufficient time has been afforded to industry towards compliance with the initial MES by 2020. In upholding the objectives of the AQA, the Department provides certainty regarding postponement or suspension of compliance timeframes ...*".[7]

Costs of compliance

17. Industry – particularly Eskom and Sasol, South Africa's biggest polluters – claims that compliance with the MES is too expensive, and/or that the negative impacts of abating SO_2 pollution from coal boilers through FGD (consuming water and creating waste) outweighs the benefits.

    11.1 Please see the following information and evidence relating to the cost and feasibility of complying with the mandatory MES limits and the consequences of further delaying compliance or further weakening the limits. This information has previously been submitted to the Department in support of various written submissions:[8] **A February 2019 report by** Dr Ranajit Sahu on Eskom's latest application to postpone MES compliance:[9]

    - On capital costs, he points out that Eskom's costs are unrealistic:

[7] See page 61 of the 2017 National Framework.

[8] This includes the February 2019 submissions by the Life After Coal Campaign and 2 community organisations opposing Eskom's latest – its 4th – set of applications seeking to postpone MES compliance: https://cer.org.za/wp-content/uploads/2019/02/LAC-Eskom-MES-Postponement-Submissions_4-February-2019.pdf and https://cer.org.za/news/eskoms-latest-attempt-to-avoid-pollution-standards-met-with-vigorous-opposition

[9] https://cer.org.za/wp-content/uploads/2019/02/Annexure-1.pdf

"*First, the problem with Eskom's presentation of costs above is that it provides no technical backup or support for the fleet-wide costs for SO2 (via FGD); NOx (using low-NOx burners; burner optimization, etc.); and PM (using FF retrofits, where needed) noted above. Therefore, it is difficult to simply accept them. And, as noted above, non-FGD options such as DSI can be implemented at a fraction of the capital cost of FGD – and Eskom simply did not consider the capabilities and/or costs of DSI. Second, and more substantially, Eskom's costs appear to be substantially inflated. As comparison, I will consider air pollution control costs for coal-fired power plants being incurred in India. As background, Indian coal units which intend to remain operating have recently committed to installing various air pollution controls (such as FGD for SO2 control, low NOx burners with or without over-fire air and SCR for NOx control, and upgraded ESPs for PM – as needed to meet standards promulgated in 2015) – all within the next three to four years"*.

Dr Sahu then sets out the 2018 costs of various air pollution controls in India, and finds that Eskom's estimates are significantly inflated:

"*I considered the costs of installing low NOx burners at each unit at each of the following Eskom plants: Acacia, Ankerlig, Arnot, Camden, Duvha, Gourikwa, Grootvlei, Hendrina, Kendal, Komati, Kriel, Kusile, Lethabo, Majuba, Matimba, Matla, Medupi, Port Rex, and Tutuka. Collectively, the cost of low NOx burners for all of these plants should be around 4.6 billion Rand, using a current exchange rate between Indian Rupees and the Rand. Contrast this with the cost estimate provided by Eskom (quoted earlier) which ranged from 10-40 billion Rand. I note that even this inflated estimate considered the use of low NOx burners for some of the plants and burner optimization (which would cost even less) for other plants. I believe that Eskom's costs for NOx control via low NOx burners are inflated by a factor of 2 to 8 at least".*

"*For FGD, I considered the following plants with their corresponding decommissioning dates in parentheses (which are more than 5 years into the future): Matla (2031), Duvha (2034), Tutuka (2037), Lethabo (2040), Matimba (2041), Kendal (2043), Majuba (2049), and Medupi (2050). I assumed that all of the units at the Duvha, Lethabo, and Matla plants would install dry FGD while units at the other plants would install wet FGD – again, consistent with Eskom's assumptions. Using plant and unit sizes specified in Eskom's reports, and using the Indian cost data, and using a current currency conversion, I estimate that the total FGD costs for these plants would be just less than 30 billion Rand. Again, this is a far smaller capital cost estimate than Eskom's 140-170 billion Rand. Eskom's estimate is off by a factor of 4 to almost 6. Of course, when one is proposing to retrofit these large numbers of air pollution controls, vendors and suppliers will also provide additional discounts and preferential commercial terms. I am not included these aspects, which would make my estimated costs even lower – and Eskom's estimates, even higher by comparison".*

"I did not separately calculate the costs for fabric filter retrofits, mainly because there is less recent data available from India to make this comparison. But, the range of 15-40 billion Rand provided by Eskom for this upgrade appears vastly inflated as well. In summary, from a cost standpoint, there is simply no doubt that Eskom's estimated for FGD and low NOx burners at is various plants is vastly overstated. It is also likely that Eskom's costs for fabric filter upgrades is similarly inflated".

- On <u>water availability</u>, he comments on the "*great benefit to using wet or dry FGD is the substantial reduction in SO2 emissions – i.e., reductions of 98% or 99% from the very large SO2 emissions from local high-sulfur coals – which simply cannot be obtained by any other means. SO2 is a significant air pollutant, directly and via conversion to PM2.5 or fine particulate matter. Thus, for all plants which do not have immediate actual decommissioning dates, either wet or dry FGD should be installed by Eskom*".

- For plants to be decommissioned within the next 5 years, "*Eskom should consider SO2 removal technologies such as dry sorbent injection (DSI) which can remove SO2 from the exhaust gas stream using no water at all. Using reagents such as trona, lime, or sodium bicarbonate, in dry powder form, DSI can remove as much as 50% SO2, which would go a long way (but not all the way) towards achieving compliance with the MES. I suggest this option so that, for these plants, which will not have long remaining lives – DSI will nonetheless provide some SO2 reductions as opposed to having the units at these plants simply emit high levels of SO2 uncontrolled. Further, the capital costs of DSI are substantially lower (less than 10%) of the capital cost of wet FGD and DSI can be installed in less than 12 months, including design. While DSI does require the use of the aforementioned reagents and thereby incurring operating costs, the benefits due to substantial SO2 (and also acid gas such as hydrochloric and hydrofluoric acid) reductions in a very short time frame – is an attractive option that Eskom should consider. To reiterate, this technology can apply to plants/units that have upcoming decommissioning dates in the next few years so that in the interim while they are still in operation, substantial SO2 reductions can be realized*".

- On the additional adverse environmental impacts of FGD, Dr Sahu comments that "*Eskom tries to make the case that the use of additional limestone and the generation of gypsum as well as incremental increases in CO2 emissions means that FGD is not appropriate. Of course, this is disingenuous. FGD is used worldwide as the top SO2 removal technology because of its high degree of SO2 removal from coal-fired power plant exhausts, even given the adverse impacts pointed out by Eskom. Eskom's reasoning in this case is merely self-serving*".

- Dr Sahu's report also sets out realistic timeframes for installing pollutant controls.

11.2 A February 2019 review of a Report Providing Health Impact Assessment and Cost-Benefit Analysis (CBA) of Eskom activities by Dr Michael Holland and Dr Joseph Spadaro[10] finds that Eskom, in its 4th round of applications to seek postponement of the MES, **under-estimates the benefits of MES compliance by at least a factor of 5:**

"*Accounting for the biases towards underestimation of benefits identified in the Eskom report, we calculate that benefits would exceed costs by a significant margin, a factor of 5 or more, which is sufficient to reverse the conclusions drawn from the Eskom CBA*".

11.3 **A March 2019 report by Lauri Myllyvirta** on the air quality and health impacts of Eskom's 4th (and latest) request to postpone compliance with MES,[11] finds that:

"*the excess emissions allowed if Eskom's requests for non-compliance with the MES are fully granted will lead to the following avoidable health impacts:*

- *5,600 premature deaths due to increased risk of lower respiratory infections, including in young children*
- *1,500 premature deaths due to increased risk of stroke*
- *1,500 premature deaths due to increased risk of death from diabetes*
- *2,300 premature deaths due to increased risk of chronic obstructive pulmonary disease*
- *3,000 premature deaths due to increased risk of ischaemic heart disease, and*
- *1,900 premature deaths due to increased risk of lung cancer associated with chronic PM2.5 exposure, as well as*

[10] https://storage.googleapis.com/planet4-africa-stateless/2019/03/4228e243-review-of-health-impact-assessments-of-eskom-activities-18022019.pdf; The report is summarised here: https://www.greenpeace.org/africa/en/press/6495/eskom-intentionally-misleads-the-public-and-decision-makers/

[11] https://storage.googleapis.com/planet4-africa-stateless/2019/03/8a84b69a-air-quality-and-health-impacts-of-eskoms-non-compliance.pdf

- *500 premature deaths due to increased risk of death associated with acute NO2 exposure."*

"In total, an estimated 16,000 premature deaths (95% confidence interval: 13,000 to 18,000 deaths) could be avoided by requiring full compliance with the MES. This represents a 40% reduction in the health impact of air pollution from Eskom's power stations". He also comments that: "*China retrofitted approximately 250 gigawatts of existing coal-fired capacity with FGD between 2005 and 2011, bringing share of capacity with SO_2 controls from 14.3% to 89.1% in six years. These installations were in response to the national emission standards introduced in 2004. Similarly, after the emission standards were updated in 2011 to levels that required selective catalytic NOx controls (SCR), these retrofits were carried out on approximately 480GW of capacity by 2015, raising penetration from 18.2% to 84.5% in four years".* Subsequently, China has been retrofitting existing power plants to meet "ultralow" emission standards of 26 mg/Nm3, which were 100 times as strict as South Africa's MES for sulphur dioxide in 2015, which was 3 500 mg/Nm3 at the time. In addition*, "now India is targeting to bring its entire coal fleet to compliance with stricter standards than the MES by 2022, requiring retrofits in much of its 220GW of operating capacity*."

11.4 **June 2019 submissions by the Life After Coal Campaign and 4 community organisations** opposing the doubling of the SO_2 new plant MES.[12]

11.5 **A July 2019 report by Dr Ranajit Sahu** on the proposed doubling of the SO_2 new plant MES.[13] He disputes the following claims:

- that consumptive water use of the technology required to meet the lower (500 mg/Nm3) standard (flue gas desulfurization - FGD) is significant relative to its benefits;
- that the proposed alternative technology for meeting the relaxed standard of 1000 mg/Nm3 (dry sorbent injection - DSI) is significantly cheaper; and
- that there are no adverse impacts to using DSI in quantities that would be necessary to achieve SO2 reductions of around 70% as contemplated by the relaxed standard.

In summary, Dr Sahu finds:

"*<u>FGD and water consumption</u>: There is no justification for doubling the MES to the proposed higher limit based on a broad-brush (i.e., without plant by plant assessment) indictment of FGD technology, simply by presuming that it has high consumptive water needs. Consumptive water needs of FGD are not large compared to other water uses in a power station if the thermal cycle relies on water cooling. And, focusing on just the water use by FGDs while minimising or not weighing the tremendous SO_2 reductions that they can achieve – 99% or more – is misleading and unbalanced. If, in some cases, even the small additional consumptive water needs of wet FGD plants would be problematic, dry-FGD designs can provide the requisite 85% reductions needed to achieve the 500 mg/Nm^3 MES. Dry-FGDs, while not as efficient as their wet counterparts, can still easily achieve reductions in the range of 90-95%.*

<u>Impacts associated with Direct Sorbent Injection (DSI):</u> DSI was initially developed and is mostly applied in order to remove a range of acid gases such as hydrochloric acid (HCl), hydrofluoric acid (HF). Any SO_2 reductions were an ancillary co-benefit as a result. DSI was not developed to be a primary SO_2 reduction technology as the DEA media release suggests. The DSI process results will cause an increase in Particulate Matter (PM) emissions from electro-static precipitators (ESPs); will adversely affect ESP ash handling systems; cause increases in toxic mercury emissions; and result in adverse impacts from the disposal of ESP sorbent wastes. Mitigating these dramatically raises the costs of implementing DSI.

[12] https://cer.org.za/news/doubling-so2-pollution-standards-would-have-deadly-consequences-for-highveld-communities
[13] https://cer.org.za/wp-content/uploads/2019/07/Annexure-4_-Ron-Sahu_Report_on_MES_Increase_July-2019.pdf

Costs: capital costs of FGD appear to be significantly inflated. Recent, mass application of FGD, in countries such as India (presently upgrading a large fraction of its coal-fired units with FGD) show that FGD capital costs can be significantly lower, if proper procurement strategies are followed. While capital costs for DSI are indeed lower than FGD, the operating costs (including costs to mine/produce the sorbent, transport it to the coal-plant, properly condition it including reducing its size to fine power by grinding, storing it onsite without exposing it to moisture, etc.) are sizeable, especially to achieve the presumed 70% SO_2 reduction. Based on this, and coupled with mitigating the adverse DSI impacts noted in the previous paragraph, government's expectation that DSI would be a much cheaper option than FGD is not only not unsupported, but is incorrect.

Instead, for coal-fired plants that intend to continue to operate in South Africa, I recommend that the 2020 stack MES should be reduced to levels in the range of 200 mg/Nm^3, the norm in most other jurisdictions around the world, and a level that can readily and cost-effectively be achieved by implementation of FGD."

11.6 **A July 2019 report by Lauri Myllyvirta** on the health impacts of the proposal to double the SO_2 new plant MES.[14] He finds that over time, the higher SO_2 MES limit of 1000mg/Nm^3 will lead to the following avoidable health impacts, compared with compliance with the current regulation (of 500mg/Nm^3):

- 950 premature deaths due to increased risk of lower respiratory infections, including in young children;
- 350 premature deaths due to increased risk of stroke;
- 320 premature deaths due to increased risk of death from diabetes;
- 560 premature deaths due to increased risk of chronic obstructive pulmonary disease;
- 720 premature deaths due to increased risk of ischaemic heart disease; and
- 520 premature deaths due to increased risk of lung cancer associated with chronic $PM_{2.5}$ exposure.

- "*In total, an estimated 3,300 premature deaths (95% confidence interval: 3,000 to 3,500 deaths) would be caused by doubling the SO2 emissions limit. Annual excess health impacts peak at 170 premature deaths in 2025-26*."

18. Please contact us with any queries about this information. We can also put you in touch with any of the experts referenced above and/or provide copies of any of the referenced reports, if that would be of assistance.

Yours faithfully
CENTRE FOR ENVIRONMENTAL RIGHTS

per: 

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[14] https://cer.org.za/wp-content/uploads/2019/07/Annexure-3_Lauri-Myllyvirta_Report_July-2019.pdf