APPLICATION FOR POSTPONEMENT OF THE MINIMUM EMISSION STANDARDS COMPLIANCE TIMEFRAMES FOR PARTICULATE MATTER, SULPHUR DIOXIDE AND NITROGEN OXIDES AT TUTUKA POWER STATION

Date: September 2018

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AIR	Atmospheric Impact Report
AEL	Atmospheric Emission License
DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
ESP	Electrostatic Precipitator
FGD	Flue gas desulphurisation
GNR	Government Notice No.
NAAQS	National Ambient Air Quality Standards
NAQO	National Air Quality Officer
NEM:AQA	National Environment Management: Air Quality Act, 2004 (Act No. 39 of
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
PM	Particulate Matter
PM10	Particulate Matter with a diameter of less than 10 µm
SO_2	Sulphur dioxide
NOx	Nitrogen oxides
WHO	World Health Organisation

4 Executive Summary

Eskom herewith formally makes an application to the National Air Quality Officer (NAQO) for postponement[1] of the compliance timeframes associated with the 'existing plant' and 'new plant' Minimum Emission Standards (MES) for particulate matter (PM) and nitrogen oxides (NOx) and for the 'existing plant' MES for sulphur dioxide (SO_2) for its Tutuka Power Station. This application also asks for reconsideration of the limits granted to Eskom in response to Tutuka Power Station's previous postponement application that was made in 2014. A daily PM emission limit of 300 mg/Nm^3 or a monthly limit of 200 mg/Nm^3, and a daily nitrogen oxides (NOx) emission limit of 1200 mg/Nm^3, as well as a limit of 3500 mg/Nm^3 for SO_2 (at 273 K, 101.3 kPa, dry and 10% O_2) is also being requested until relevant abatement technology has been fully installed (as is the case for PM and NOx), or until the site is decommissioned (as is the case for SO_2).

[1] This application is a continuation/ reapplication of the 2014 postponement application made by Tutuka Power Station wherein Eskom indicated its plant design challenges that make it impossible to comply with the MES until relevant abatement technology has been installed on all of its units.

In 2014, Tutuka Power Station applied for postponement from the 'existing plant' MES, for SO_2, NOx and PM for a period of five years motivated by the fact that the plant was not able to comply with such strict emission limits until relevant abatement technology installations had been completed on all units and in the belief that there would be increased opportunity for load reduction. The decision received on the postponement application, as made by the NAQO, granted postponement for SO_2 and only partially achievable limits for NOx and PM emissions:

Consequently, Tutuka complies with the approved emission limits, as stipulated in section 7.2 of its Atmospheric Emission Licence (AEL), but the station will be unable to comply with the more stringent limits (of a daily average PM limit of 200 mg/Nm^3 from 1 January 2019 and a daily average NOx limit of 750 from 1 April 2020 as well as a daily average SO_2 limit of 500 from 1 January 2026). It is for this reason that this postponement application for PM, NOx and SO_2 compliance timeframes is made.

Ambient air quality measurements from Grootdraai monitoring station, which is in close proximity to Tutuka Power Station, indicate that there is currently compliance with ambient air quality standards for PM, NOx and SO_2 on the ground. A dispersion modelling exercise was conducted by independent consultants (**Annexure A**) to predict ground-level ambient concentrations for various emission scenarios. The modelling reveals predicted ambient PM, NOx and SO_2 concentrations for three scenarios. Scenario 1, for current emissions, and Scenario 3, for 'new plant' emissions, both predict compliance with all ambient air quality standards on the ground. Scenario 2, for worst-case emissions, shows compliance with all ambient air quality standards except for the hourly and daily SO_2 limit in a small unpopulated area, which lies 9 km to the east of the power station. Overall the independently conducted study indicates that this application will have negligible measured and modelled health and environmental impacts on the ground. Indeed, Scenario 2, is the scenario that is least likely to realistically occur, as it assumes the site is emitting worst-case emissions around the clock (Table 1).

Table 1 Overview of scenarios modelled for the atmospheric impact assessment as independently conducted in support of Tutuka's MES postponement application

Pollutant	Code	Scenario 1- Current actual emissions	Scenario 2 - Requested emission limits	Scenario 3 - New plant compliance
		Rate (t/annum)	Rate (t/annum)	Rate (t/annum)
NO_X	Stack 1	47,166	119,368	74,605
	Stack 2	47,166	119,368	74,605
SO_2	Stack 1	80,108	348,157	49,737
	Stack 2	80,108	348,157	49,737
PM	Stack 1	8,581	29,842	4,974
	Stack 2	8,581	29,842	4,974

Eskom is aware that Tutuka is situated within the Highveld Priority Area and is, as such making a substantial financial investment into reducing emissions from Tutuka's operations, through the installation of a fabric filter plant (FFP) and low NOx burners (LNB) on each of the station's units. The complete installation of these technologies will bring the station into full compliance with the 'new plant' standards for PM and NOx, respectively.

Reasonable measures are being taken to ensure that emissions are maintained to levels below the current limits until the relevant abatement technology is installed on each unit. These measures include, but are not limited to taking load losses, undertaking frequent inspections of the ESP, fuel oil efficiencies and testing of the use of brine injection. The implementation of SO_2 abatement technology at Tutuka would cost an estimated R 38 billion and substantially increase the station's water use, with, based on the modelling discussed above, limited improvement in the level of local ambient air quality compliance. As such, Eskom submits that investment into SO_2 abatement technology is not warranted, given the socio-techno-economic and environmental implications.

Eskom submits that the detail in this report and its appendices provides enough information for the NAQO to grant this postponement application since there is compliance with ambient standards on the ground and since plans are progressing for the installation of relevant abatement technology to reduce PM and NOx emissions to 'new plant' standard levels. Eskom believes that it has met the administrative and substantive requirements for the granting of a postponement application and as such requests that the NAQO approve the request as submitted.

5 Introduction

Eskom's Tutuka Power Station is a large coal-fired power station (with an installed capacity of 3600 MW) situated near Thuthukani and Standerton, in the Mpumalanga Province. Tutuka's units were commissioned between 1985 and 1990, with an electrostatic precipitator (ESP) technology to reduce PM emissions. No further emissions abatement technology was included in the original design of the power station, and as such, NOx and SO_2 emissions released from the station have always been emitted unabated.

In terms of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEMAQA), all of Eskom's coal and liquid fuel-fired power stations are required to meet the Minimum Emission Standards (MES) contained in GNR 893 on 22 November 2013 ("GNR 893") which was promulgated in terms of Section 21 of the NEMAQA. GNR 893 provides for transitional arrangements in respect of the requirement for existing plants to meet the MES and provides that less stringent 'existing plant' limits must be achieved by existing plants by 1 April 2015, and more stringent 'new plant' limits must be achieved by existing plants by 1 April 2020 (**Table 2**).

Table 2 Minimum Emission Standards for Category 1: Combustion Installations, sub-category 1, 1: Solid Fuel Combustion Installation

Description:	Solid fuels combustion installations used primarily for steam raising or electricity generation.		
Application:	All installations with design capacity equal to or greater than 50 MW heat input per unit, based on the lower calorific value of the fuel used		
Substance or mixture of substances		**Plant status**	**mg/Nm³ under normal conditions of 10% 0_2, 273 Kelvin and 101,3 kPa.**
Common name	**Chemical symbol**		
Nitrogen oxides	NOx	Existing	1100
Nitrogen oxides	NOx	New	750
Sulphur dioxide	SO_2	Existing	3500
Sulphur dioxide	SO_2	New	500
Particulate matter	PM	Existing	100
Particulate matter	PM	New	50

Tutuka Power Station falls into the 'existing plant' category, and would be expected to meet the 'new plant' standards from 2020, however, as part of Tutuka's previous postponement application from the 'existing plant' standards, as submitted in 2014, the station was granted different limits for PM, NOx and SO_2 than those stipulated in the MES (**Table 3**).

Table 3 Point source maximum emission rates as listed in Tutuka Power Station's AEL, which represent the NAQO's decision on the last postponement application. These are different to the limits listed in the MES.

Pollutant Name	**Maximum release rate**		
	Limit value (mg/Nm³)	**Date to be achieved by**	**Average period**
PM	350	1 April 2015 – 31 December 2018	Daily
	200	1 January 2019 – 31 December 2019	Daily
	100	From 1 January 2020	Daily
SO_2	3400	1 April 2020 – 31 December 2025	Daily
NOx	1200	1 April 2015-31 March 2020	Daily
	750	From 1 April 2020	Daily

Tutuka Power Station complies with the current emission limits for all of the listed pollutants. As the planned PM and NOx abatement technology has not been installed to date and load reduction opportunities are less than anticipated, the station cannot comply with the more stringent PM emission limits that come into effect from 1 January 2019, and the more stringent NOx emission limits that come into effect from 1 April 2020. Similarly, as it is not considered substantially environmentally beneficial or appropriate from a cost benefit perspective to implement the abatement technology for the SO_2 'new plant' limits, the station will not comply with the more stringent limits in 2026. This document represents Eskom's application for postponement of the 'existing'- and 'new plant' PM and NOx emission standards compliance timeframes, as well as the 'new plant' SO_2 compliance timeframes for Tutuka Power Station. This application also asks for reconsideration of the limits granted to Eskom in response to Tutuka Power Station's previous postponement application that was made in 2014: A daily PM emission limit of 300 mg/Nm^3 *or* a monthly limit of 200 mg/Nm^3, and a daily NOx emission limit of 1200 mg/Nm^3 is being requested until relevant abatement technology has been fully installed. Finally, a limit of 3500 mg/Nm^3 is also being requested for SO_2 (see Table 4 for details of these requests).

The legal basis for the application is outlined below, setting the scene for the requirements to be adhered to for an application of this nature. These requirements include the details of the postponement request as well as the substantiation of the reasons and motivations supporting the application.

An Atmospheric Impact Report (AIR), developed by an independent consultant, and a detailed summary of the public participation processes that were undertaken to bring Eskom's intentions to the attention of all interested and/or affected parties are attached as **Annexures A and B**, respectively[2].

6 Legal Basis for Decision Making

6.1 Overview

In terms of section 14(1) of the NEMAQA, the Minister of Environmental Affairs ("Minister") must designate an officer in the Department of Environmental Affairs ("DEA") as the National Air Quality Officer (NAQO). In this regard, Dr Thulie Khumalo has been designated by the Minister as the NAQO. Accordingly, Eskom submits this application to the NAQO. This application is accompanied by a request for a variation of Tutuka's Atmospheric Emission

[2] This postponement application is being submitted prior to the postponement submission for the remaining Eskom fleet. These submissions will include a thorough cost benefit analysis as well as a cumulative atmospheric impact assessment. The non-availability of these additional documents for the Tutuka application is not considered in any way material to the legal completeness of this application.

Licence, in terms of section 46 of the NEMAQA, which is submitted to the licencing authority in the Gert Sibande District Municipality (**Annexure C**).

Tutuka Power Station is located within the Highveld Priority Area (HPA) in terms of the NEMAQA. Eskom is currently implementing its air quality implementation plan, where it is taking a two pronged approach to reduce emissions at a station level by installing relevant abatement technology and by simultaneously addressing low-level pollution sources through the means of air quality offsets.

6.2 Regulatory requirements

In terms of paragraph 12 of GNR 893, the postponement application must include –

1. An air pollution impact assessment compiled in accordance with the regulations prescribing the format of an Atmospheric Impact Report (as contemplated in Section 30 of NEMAQA), by a person registered as a professional natural scientist in the appropriate category
2. Detailed justifications and reasons for the Application; and,
3. A concluded public participation process undertaken as specified in the NEMA Environmental Impact Assessment (EIA) Regulations

In respect of these requirements, the documents listed below accompany this motivation:

1. As Annexure A, a copy of the AIR, as well as its Appendices, prepared in respect of the station. The AIR provides, inter alia, an assessment of how ambient air quality is likely to be affected by Tutuka Power Station's point source emissions;
2. Detailed justifications and reasons for the Application (see Section 8 below); and,
3. As Annexure B, a copy of the detailed report outlining public participation process undertaken as part of this application.

6.3 Request for condonation of late submission of MES application

The National framework for Air Quality Management section 5.4.3.3 indicates that any postponement application must be submitted to the NAQO at least one year before the specified compliance date.

Eskom initiated the project to submit the Tutuka postponement request in January 2018 with the first round of public meetings being held in February 2018. Due to project delays, and the well documented significant financial pressures and organisational challenges it was necessary for Eskom to formally revise its approach in respect of the MES postponements. As such, a revised Eskom Air Quality strategy was approved by the new Eskom Board in June

2018 and based on this, Eskom was able to further engage on its postponement applications with external parties. Given the need for comprehensive and defendable administrative processes, Eskom will only be able to submit the MES postponement application for Tutuka in October 2018 (two months before the specified compliance date).

If the processing of the postponement is delayed as a result of the late submission is such that the stations operations are limited, this would limit the nationally available electricity capacity which would, under present circumstances, increase the risk of load shedding nationally.

Furthermore the station is a crucial station for Eskom's grid stability, as it is a black-start station. As such, closure of the station would place an unacceptable risk on the recovery of the national grid in the case of national or regional load shedding or blackouts.

Eskom apologises for the late submission of this postponement and asks that the authorities condone the late submission of this MES application given the history and issues described above.

6.4 Proposed changes in regulatory framework

Eskom is aware of proposed changes to the regulatory environment in respect of applications for MES postponements. At the date of compiling these submissions, these proposed changes had not been affected and as such, Eskom reserves its rights to amend it submission based on any changes to the regulatory requirements.

6.5 The need to amend variation requests

In terms of timing, Eskom is required to submit an AEL variation request parallel to the MES postponement application. The variation request is prepared based on the assumption that the requested MES postponement is granted by the NAQO. If the NAQO decision is substantially different from the requested postponement, Eskom reserves its right to amend its variation request.

7 Previous postponement application

In February 2014, in response to Tutuka's design-based inability to meet the MES, Eskom requested postponement from the 'existing-' and the 'new plant' standards for PM, NOx and SO_2. As part of these applications, it was requested that Tutuka's SO_2 emission limit be relaxed indefinitely and that the site's PM and NOx limits be relaxed until the completion of the relevant abatement technology would bring the station into full compliance with the 'new plant' standards (**Table 4**).

Table 4 Requested emission limits as per Tutuka Power Station's last postponement application (2014)

	Requested emission limits	
	Limit value (mg/Nm^3)	**Averaging period**
PM	350 until 31 March 2024	Daily
	50 from 1 April 2024	Daily
SO_2	3400 until decommissioning	Daily
NOx	1200 until 31 March 2025	Daily
	750 from 1 April 2025	Daily

The decision on the postponement application received from the NAQO in February 2015 (**Table 3)**, granted Tutuka Power Station leniency in terms of the SO_2 emission limit until 2025, however, the granted leniency for PM and NOx was not in line with the abatement technology retrofit timelines as presented in the postponement application. Instead, it presented more stringent limits that need to be complied with earlier than Eskom's committed retrofit programme's completion date (**Figure 1**). The station is unable to comply with the 'new plant' NOx standard until after the installation of LNBs at each of its units has been completed, and the 'new plant' PM standard until after the full installation of a fabric filter plant on each of its units.

7.1 Previous commitments

As part of Tutuka Power Station's postponement application of the 'existing plant' emission standards, commitments were made that the station would, in time, conduct LNB and FFP retrofits to ensure that the plant would come into full compliance with the 'new plant' standards for NOx and PM from 1 April 2025 and 1 April 2024, respectively (**Figure 1**). These commitments did not include technology installation for SO_2 abatement. Implementation of this programme is being tracked and reported to the NAQO.

The timelines associated with the retrofits and the phased manner in which the retrofits would be effected (one unit is retrofitted per year) mean that, though Tutuka would see a progressive reduction of total NOx and PM emissions year after year. Each unit has the technology installed in sequential years, and so the power station in its totality, would only be able to fully comply with the 'new plant' limits after the retrofits have been completed, and after technology optimization has been completed, on *each* of the units. The units that have not been retrofitted yet would continue operating unabated, whilst the abated units would comply with the limit. In other words, each *unit* will be able to comply with the required limits once it has been fitted with the respective technology types, but the entire *station* will only be able to comply once all 6 (six) units have been completed.

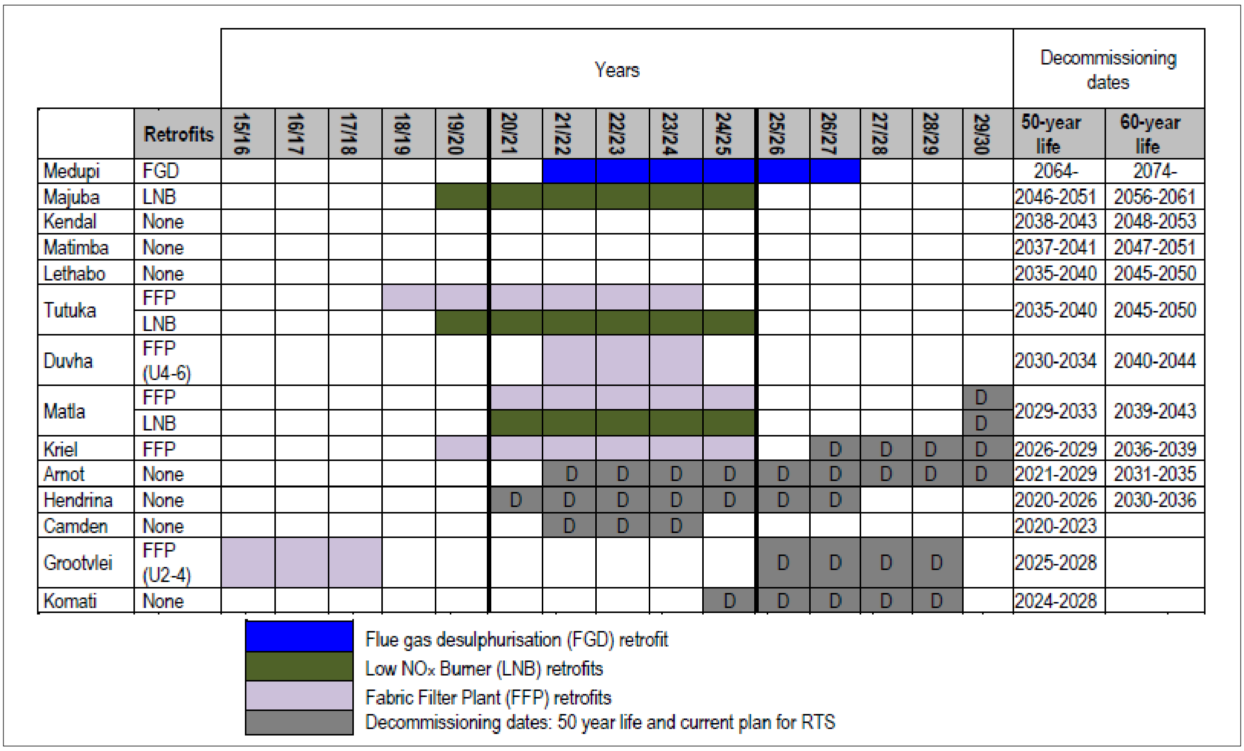

Figure 1 Committed emission abatement retrofits and power station decommissioning dates to illustrate Eskom's overall atmospheric emissions reduction plan as presented in Eskom's last postponement application to the NAQO

8 Reasons motivating this postponement application

8.1 Current PM, NOx and SO_2 emissions

Particulate matter (PM) emissions are a function of the installed abatement technology against the amount of coal that is burnt and the amount of ash in that coal. Depending on the energy content of the coal (i.e. the calorific value), more or less coal is burnt to achieve specific energy output. In 2017, Tutuka's daily average PM emissions ranged between 65 and 500 mg/Nm^3, with more than half of its daily average PM emissions reaching levels above 200 mg/Nm^3 (**Figure 2**).

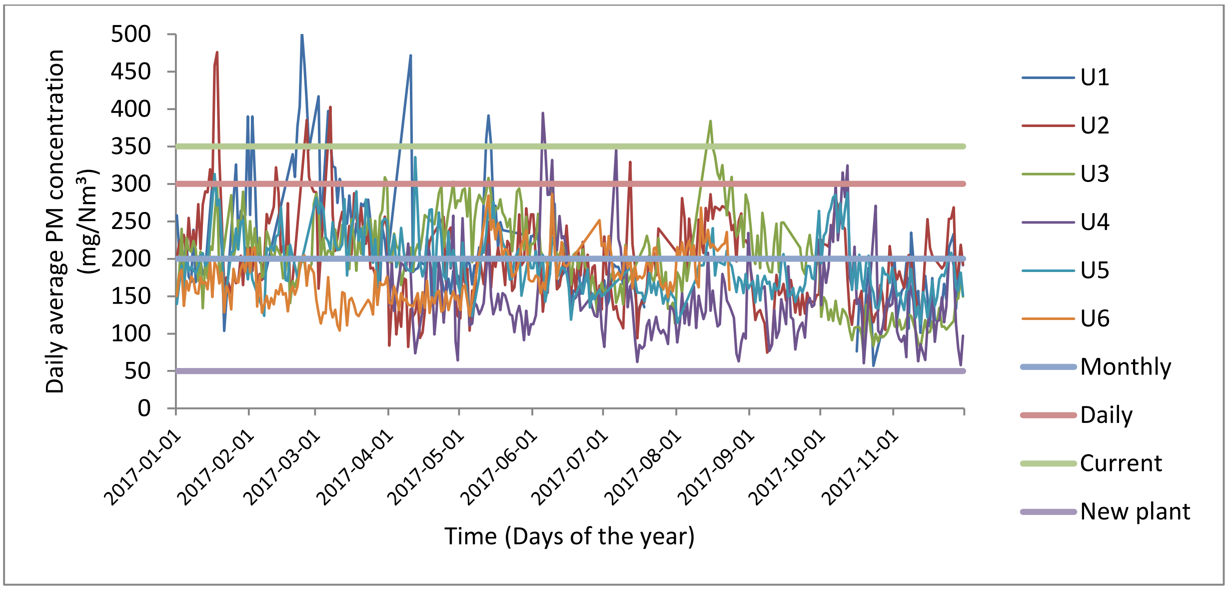

Figure 2 Daily average PM emissions (mg/Nm^3) as measured at all six units at Tutuka Power Station from January to November 2017 against respective PM limits

Thermal NOx formation occurs when oxygen reacts with nitrogen at high temperatures during combustion processes in coal fired power station boilers. NOx emission levels are a direct function of the combustion temperature, and so the higher the combustion temperature, the higher the NOx emissions. Similarly, thermal NOx formation is a function of the quantity of oxygen in the combustion zone. The nitrogen content of the coal that is burnt will also contribute to the formation of NOx in a flue gas chamber, fuel-bound NOx formation, however, is not limited to high temperature combustion processes.

By the mere fluctuating nature of the factors that determine the combustion process as outlined above, it follows that NOx emissions at Tutuka Power Station would fluctuate at each unit. Consequently, daily average NOx emissions at Tutuka units typically ranged between 200 and 1400 mg/Nm^3 in 2017 and were above 770 mg/Nm^3 50% of the time (**Figure 3**).

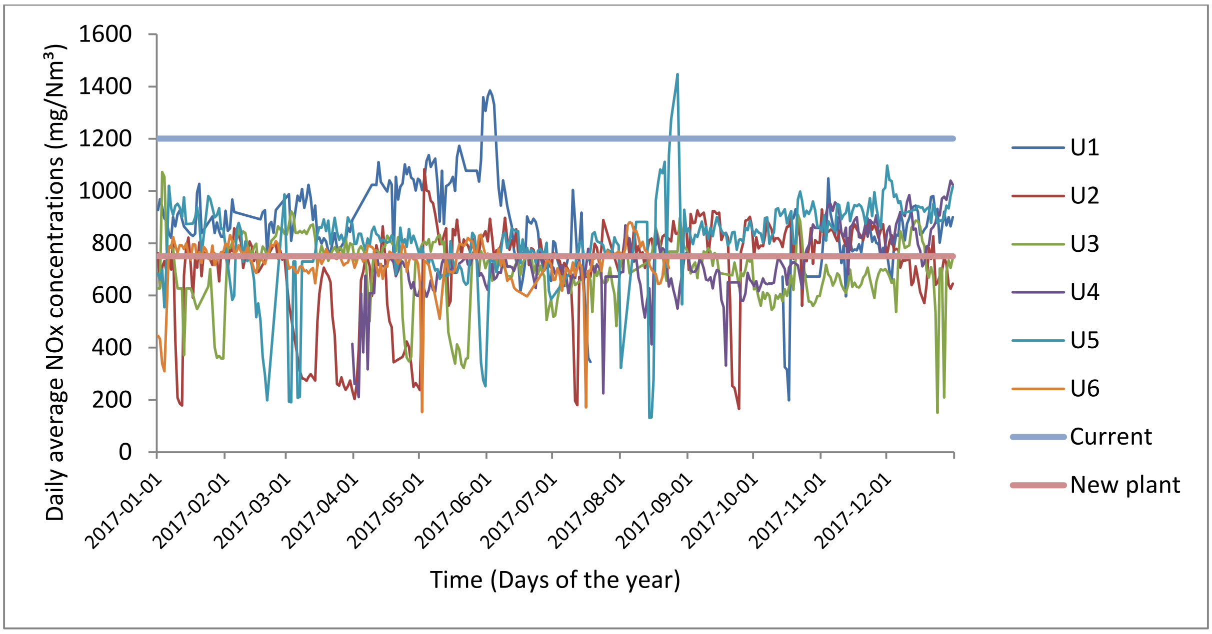

Figure 3 Daily average NOx emissions (mg/Nm3) as measured at all six units at Tutuka Power Station from January to December 2017 against respective NOx limits

SO_2 emissions are highly dependent on the sulphur content of the coal that is burnt and this causes SO_2 emissions to be highly variable in time. The station's historical SO_2 averages are generally below a limit of 3500 mg/Nm^3, however, if it were necessary in future for Tutuka to receive coal from other sources, with a higher sulphur content, this could result in the station exceeding the current emission trend. FGD is the only abatement technology that would reduce SO_2 emissions to levels that comply with the new plant standards. Given the socio-economic considerations, as well as the fact that load losses and coal beneficiation practices will not substantially reduce the emissions, Eskom is requesting a limit of 3500mg/Nm^3 (**Figure 4**).

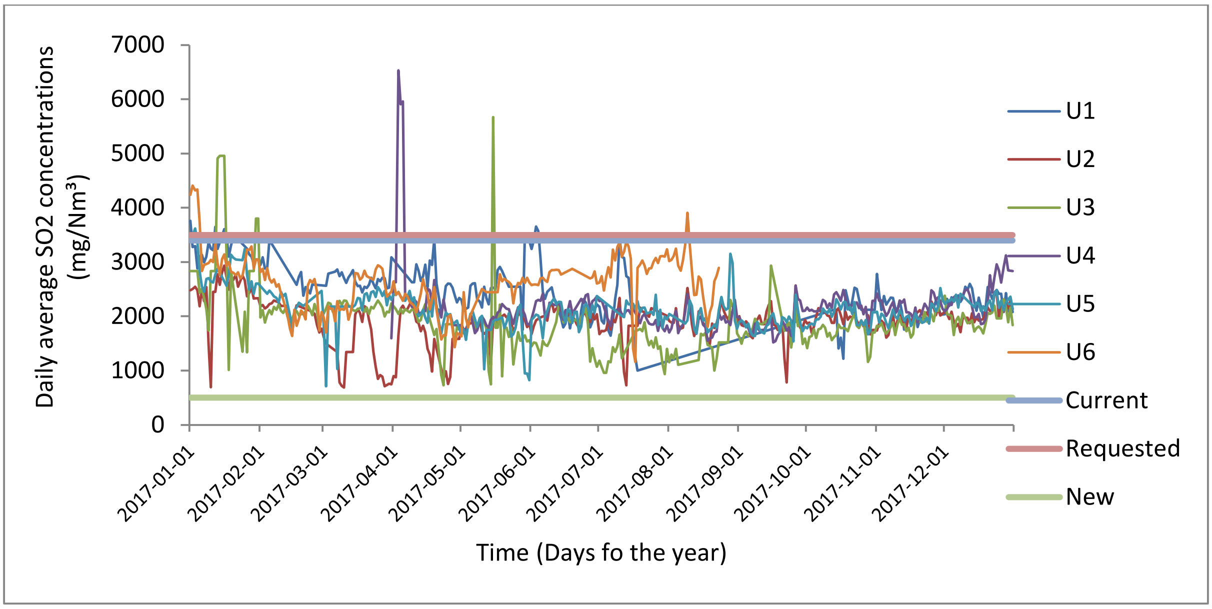

Figure 4 Daily average SO_2 emissions (mg/Nm^3) as measured at all six units at Tutuka Power Station from January to December 2017 against respective SO_2 limits

8.2 Technology options for emission reduction

8.2.1 PM emission reduction

Eskom's fleet currently utilises two different methods to reduce the particulate matter: 1) Electrostatic precipitators (ESP) and 2) Fabric filter plants (FFP).

1) An ESP removes particles from the flue stream using the force of an induced electrostatic charge on the ash particle that is then attracted to, and held on, a plate (**Figure 5**). The efficiency of ESPs is dependent on the electrical resistivity and the size of the ash particles. Eskom introduced sulphur trioxide (SO_3) injection, which decreases the resistivity of the particles, and significantly improves the performance of the ESP. With the exception of Tutuka power station, all of Eskom's existing ESP stations have been retrofitted with SO_3 flue gas conditioning plants.

ESPs have formed the backbone of Eskom's PM control efforts and have resulted in significant reductions in PM emissions from various power stations in the fleet. That notwithstanding, ESPs do not provide the same level of performance a fabric filters do, which present a physical barrier to the PM in the gas stream. Importantly 'poor' ESP performance translates into direct emissions to atmosphere, but 'poor' fabric filter plant performance means that filter bags have to be replaced more frequently (increasing operating costs) without necessarily translating into increased emissions to atmosphere.

Despite the improvements brought about by SO_3 injection, the effectiveness of ESPs is dependent on maintaining a range of process parameters specifically temperature, velocity, ash loading and ensuring adequate residence time. It is the difficulty in controlling all of these parameters that limit the effectiveness of this technology type in reducing PM emissions.

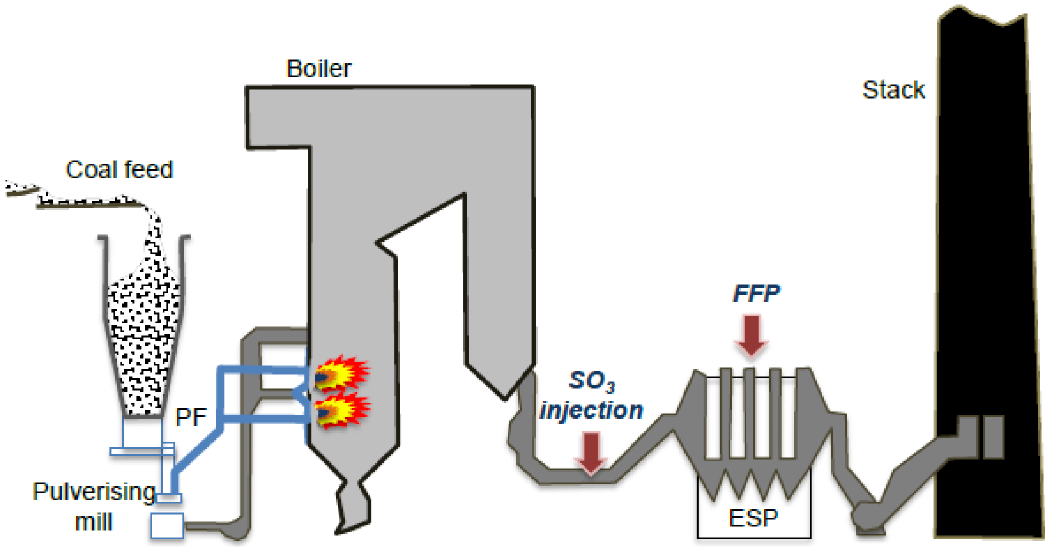

Figure 5. Schematic illustration of the placement of SO_3 injection, electro-static precipitator (ESP) and fabric filter plant (FFP), respectively, on a typical Eskom coal-fired power station. Note that the control options are either ESP and SO_3 injection or FFP, not both

2) An FFP is made up of long, cylindrically shaped bags (tubes) which are made of synthetic fabric, which act as a filter to the dust-laden flue gas that is drawn through each of the bags. FFPs are very efficient particulate emission collectors because of the dust cake that is formed on the surface of the bags.

Unlike an ESP, where particulate matter emission reduction performance may vary significantly depending on process parameters, functioning FFPs, typically, have a particulate collection efficiency of 99% or better, even when particle size is very small. This means that, once Tutuka has installed FFPs on each unit, it will be able to meet the 'new plant' standard of 50mg/Nm^3, which its current ESPs are not able to accomplish. Tutuka is working towards completing a full FFP retrofit to ensure compliance with the 'new plant' emission limit of 50 mg/Nm^3. Eskom is further considering non-FFP solutions to bring the plant into compliance with the new plant standards.

In addition to the above technology solutions it is possible to reduce particulate emissions by reducing the load or output of the station.

8.2.2 NOx emission reduction

NOx formation minimisation is best achieved by reducing flame temperature, reducing excess oxygen in the system and by burning coal with low nitrogen content. For Eskom's power stations specifically, NOx control is about managing the in-furnace process and controlling NOx formation as a function of the burning process and the coal devolatilization process, through the introduction of Low NOx Burners (LNB) and, sometimes, over fire air.

Low NOx burners operate on the principle of staging the amount of air available for combustion thereby reducing the temperature and the amount of oxygen available for conversion of nitrogen (N_2) to nitrogen oxide (NO) (**Figure 6**). The burner is a series of tubes that carry different fuel types required for combustion, with gas in the middle (used to start the combustion process), then fuel oil (also part of the start-up process), pulverized fuel and air (for maintaining the combustion). The tubes carrying air into the burner can be positioned in such a way as to control fuel and air mixing that result in larger, more branched flames with lower peak temperatures (SE Solutions (Pty) Ltd, 2013).

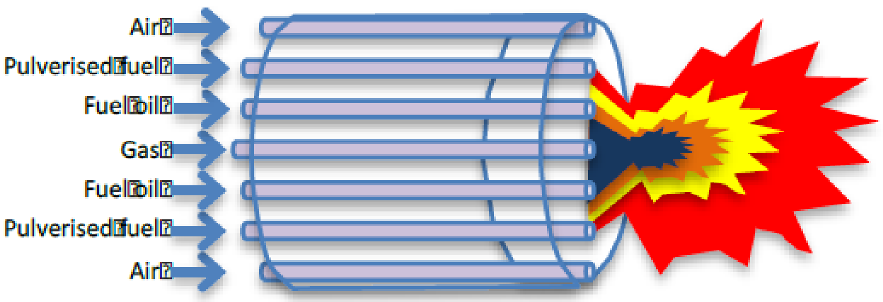

Figure 6 Simplified schematic presentation of a low NOx burner. The incoming air is controlled in such a way that flame temperature is reduced, thereby limiting the formation of NOx formation (SE Solutions (Pty) Ltd, 2013)

Tutuka Power Station currently emits unabated NOx emissions as the station's original design did not include LNB technology. Tutuka is working towards completing a full LNB retrofit to ensure compliance with the 'new plant' emission limit of 750 mg/Nm^3, with which the station is currently not complying with most of the time.

8.2.3 Sulphur dioxide emission reduction

The power stations forming part of the postponement application have no direct form of SO_2 control. SO_2 emissions are released as a result of the sulphur content in the coal. Flue gas desulphurisation (FGD) technology is the only effective control measure to reduce SO_2 emissions. The FGD is a process which passes flue gas through alkaline solution/media. FGD technology is expensive, requires significant quantities of water, creates a new waste stream and increases greenhouse gases. Only the new power stations, namely Kusile and Medupi, are scheduled for being equipped with FGD Plants, while a pilot project is being executed for Kendal power station. Tutuka Power Station currently emits unabated SO_2 emissions as the station's original design did not include FGD technology.

8.3 Abatement technology retrofit schedule

8.3.1 Milestones towards complete abatement technology installation and optimisation

Upgrading a power station's technology to include specific pollutant abatement equipment requires achievement of numerous strategic milestones (**Figure 7**):

Simplistically spoken, an upgrade of this type requires years of planning, which precedes a six month installation process, as well as substantial capital funding and power station down-time. The planning process involves Eskom internal processes that allow for technology concept and -design approval after which significant funds need to be allocated to the project. Being a state owned entity, government approval for projects of such a nature is also required which lead to the additional project development time-lines. Contracts to commence the project are only put in place once carefully regulated tender processes have been completed. Over and above the aforementioned milestones, the actual commencement of the installation of the abatement technology at a unit needs to be carefully scheduled to fit into a six-month unit outage time, which is usually planned alternatingly for each unit (i.e. one unit per year) as part of an official longer term outage schedule.

Once a unit is taken down for maintenance, it is not operational, and thus does not contribute power to the grid. Unit down-time needs to take into account fleet generation capacity and can only take place, if Eskom is sure the country's energy demands can be met. Once the pollutant specific abatement technology has been installed, it takes months for the relevant technology to function optimally (optimisation period), as test-runs and assessments take place to ensure the equipment functions to its design capacity (in this case for NOx and PM to meet 'new plant' emission standards). The optimisation period for FFPs is typically 9 months and the optimisation period for LNBs can typically take up to a year, emphasising that abatement technology installation completion does not automatically signify immediate full compliance.

1.Concept and design approval (2 years)

2. Secured funding (1 year)

3. Tender process (13 months)

4. Contracting phase |6 months)

5. Unit down-time/ outage (7 months)

6. Installation-ready (24 months)

7. Commencement of installation at time of planned unit outage
(one unit at a time at one-year intervals)

8. Completion of installation of abatement (after 6 months)

9. Completion of optimization of technoloy and compliance with pollutant specific 'new plant' standard (3- months after installation completon)

1.Concept and design approval (2 years)

2. Stakeholder approval and Secured funding (2 years)

3. Tender process (13 months)

4. Tender Evaluation and Contracting phase |6 months)

5. Major Component Lead times and Installation-ready (18 - 24 months)

6. Commencement of installation at time of planned unit outage
(one unit at a time at one-year intervals)

7. Completion of installation of abatement (after 6 months)

8. Completion of optimization of technoloy and compliance with pollutant specific 'new plant' standard (3 -6 - months after installation completon)

9.

Figure 7 Process-flow diagram outlining the simplified process from abatement technology concept design approval to compliance of unit's emissions with 'new plant' standards

The process outlined above can typically take years to complete from start to finish, and because the successful completion of the entire project requires the conclusion of a myriad of factors it is often difficult to predict, with certainty, the associated execution and completion timelines.

8.3.2 Current schedule to reach compliance with new plant PM standards

Full-scale pilot SO_3 flue gas conditioning tests at a unit at Tutuka showed reduced emissions. While the reduction was significant in itself, Tutuka was still required to reduce emissions to below 50 mg/Nm^3 at full load operating conditions, which the SO_3 injection would not achieve. Such a reduction would have required a major upgrade of the existing ESP together with SO_3 injection. As a function of a life cycle assessment of the upgraded ESP/SO_3 injection option versus an FFP retrofit, the decision was made to retrofit Tutuka with an FFP. This decision was communicated in Tutuka's MES postponement application as submitted in 2014 where FFP installation was scheduled to see completion and optimisation by 1 April 2024. Various delays to the project have shifted the optimisation date of the final unit 1 April 2027.

The current delays set back the original schedule by 2 years and 6 months. The incurred delays have been associated with investment and procurement, budget confirmation and commercial delays. Eskom is currently in the stakeholder approval and funding acquisition phase for this project. Current plans to bring the station into compliance with 'new plant' PM limits, as well as the associated timelines are outlined in **Figure 8.**

8.3.3 Current schedule to reach compliance with new plant NOx standards

Tutuka's previous postponement application included overarching timelines associated with the successful installation of LNBs on all of the site's units. At the time of the application, it was foreseen that Tutuka, in its entirety, would be able to comply with the 'new plant' NOx standard of 750mg/Nm^3 from 1 April 2025. The current schedule sees a slight delay, and aims to bring the station into full compliance with the stringent emission limit from 1 April 2026. It should also be kept in mind that the completion of the installation of the technology does not immediately equate full compliance with the targeted emission limit, as an optimisation period follows the installation. Additional reasons for the delays are associated with approval and procurement timelines. Eskom is currently in the tender process phase for this project. Current plans to bring the station into compliance with 'new plant' NOx limits, as well as the associated timelines are outlined in detail for every unit in **Figure 8**.

Tutuka's compliance to the 2019 commitments in respect of particulates limits was considered possible at that time of the original MES decision based on an expectation that the station would be able to take increased load losses, an assumption which has subsequently been shown to be incorrect, given the national demand.

	Technology already installed	Pollutant to be abated	15/16	16/17	17/18	18/19	19/20	20/21	21/22	22/23	23/24	24/25	25/26	26/27	27/28	28/29	29/30	50-year life
Kusile	FFP,LNB and FGD	N/A																
Medupi	FFP, LNB	SO_2																2064-
Majuba	FFP	NOx																2046-2051
Kendal	ESP + FGC	PM																2038-2043
Kendal	ESP + FGC	SO_2																2038-2043
Matimba	ESP + FGC	SO_2																2037-2041
Matimba	ESP + FGC	PM																2037-2041
Lethabo	ESP + FGC	PM																2035-2040
Tutuka	ESP	PM																2035-2040
Tutuka	ESP	NOx																2035-2040
Duvha (4 & 6)	FFP (Unit 1-3); ESP (Unit 4-6)	PM																2030-2034
Matla	ESP + FGC	PM																2029-2033
Matla	None for NOx	NOx															D	2029-2033
Kriel	ESP + FGC	PM												D	D	D	D	2026-2029
Arnot	FFP	N/A							D	D	D	D	D	D	D	D	D	2021-2029
Hendrina	FFP	N/A						D	D	D	D	D	D	D				2020-2026
Camden	FFP	NOx						D	D	D	D							2020-2023
Grootvlei	FFP (Unit 1,5,6); ESP+FGC (Units 2,3,4)	N/A											D	D	D	D		2025-2028
Komati	ESP + FGC	N/A										D	D	D	D			2024-2028

Legend	
Completed projects	
Future projects	
Decommissioning	D
Investment approval dates	
Previous commitment	

Abbreviations:
CFB-FGD = Circulating Fluidised Bed – Flue Gas Desulphurisation to reduce SO_2
ESP = Electrostatic Precipitator to reduce PM
FFP = Fabric Filter Plant to reduce PM
FGC = Flue Gas Conditioning to reduce SO_2
HFPS = High Frequency Power Supply to reduce PM
LNB = Low NOx Burner to reduce NOx

*These decommissioning dates have been aligned with the 50 year life expectancy of these plants according to the draft 2018 IRP

Figure 8 Committed emission abatement retrofits and power station decommissioning dates to illustrate Eskom's overall atmospheric emissions reduction plan as presented in this current postponement application process

8.4 Interim solutions to reduce emissions

During times when Eskom's coal-fired power stations experience high PM emission levels, reducing load directly assists in decreasing the PM emissions by reducing the air flow through the electrostatic precipitator and thus improving the efficiency, and by reducing the burden on the dust handling plant. Tutuka Power Station regularly takes load losses when a unit's PM emissions reach a threshold level, and so PM emissions are successfully reduced to remain below the emission limit specified in its AEL.

When experiencing high NOx emissions, however, reducing load has proven to have no impact on the NOx concentrations emitted from a unit, as NOx emissions are simply a function of flame temperature and oxygen concentrations and to a lesser degree the coal. When load is dropped, less coal is burnt and volumetric flow rate drops proportionately, hence NOx emission concentrations remain the same. This makes it very difficult to instantaneously manage high NOx emissions. Shutting down a unit with high NOx emissions also does not easily solve the problem as the same combustion conditions will likely prevail when the unit is commissioned again. Tutuka currently does not employ any high NOx emission mitigation methods.

8.5 Impact on ambient air quality

The impact of Tutuka's emissions on ambient air quality has been comprehensively assessed for numerous scenarios in the accompanying, independently compiled Atmospheric Impact Report and its Appendices which have been attached to this report (**Annexure A** to this report).

The dispersion modelling exercise that was conducted to predict ground-level ambient concentrations for various emission scenarios shows that ambient air quality measurements, at the monitoring station, indicate that there is currently compliance with ambient air quality standards for SO_2, NOx and PM on the ground. The modelling reveals predicted ambient SO_2, NO_2 and PM concentrations for three scenarios: Scenario 1, for current emissions, and Scenario 3, for 'new plant' emissions, both predict compliance with all ambient air quality standards on the ground. Scenario 2, for worst case emissions, shows compliance with all ambient air quality standards except for the hourly and daily SO_2 in a small unpopulated area, which is 9 km to the east of the power station. This worst case scenario is however unlikely to ever occur, as it would assume that Tutuka would continuously operate at these high emissions.

8.6 Health implications

The assumption is that the MES are set to ensure that the NAAQS are met and that the NAAQS in turn are set to protect human health. As such, the argument stands that, if the NAAQS can still be met, even if the emissions exceed the MES on occasion, that such emissions should be considered acceptable.

Ambient air quality measurements, as taken at Grootdraai Dam monitoring station, indicate that there is full compliance with the ambient standards on the ground around Tutuka Power Station. Modelling has indicated a few pockets of non-compliance with the daily SO_2 standard modelled to occur to the east of the station during a hypothetical and highly unlikely worst case scenario in which Tutuka would be continuously emitting 3500mg/Nm^3 of SO_2 into the atmosphere. As this scenario is almost certainly not going to materialise (Tutuka's SO_2 emissions are on average below the 3500 mg/Nm^3 mark), it is Eskom's considered view that the emissions from its Tutuka Power Station pose negligible health risks to the people and the environment around the site. Significantly, the pockets of non-compliance that have been modelled to occur to the east of the station are focused to an area that is sparsely populated.

SO_2 from the power station, even at concentrations above the MES, poses far less of a health risk to people than PM from localised sources such as domestic fuel use, unpaved roads, waste burning and so forth, with a resultant non-compliance with the NAAQS for PM. Furthermore, it is Eskom's view that, if the overarching requirement of the MES is to reduce the number of premature deaths and disability-adjusted life years (DALYs), then a much greater reduction in risk can be achieved by addressing local (ground level) emissions of PM. One of the most significant ways in which such risk reductions can be bought about is by supplying affordable electricity that negates the need for at least domestic fuel use for cooking. Eskom is currently in the process of rolling out air quality offset interventions in qualifying low income communities around some of its coal fired power stations to reduce the ground level emissions from the use of domestic fuels (Section 11 of this report). If the cost of electricity is increased as a result of the cost of complying with the MES, then the net effect will be that people who are poor will be forced to continue to use domestic fuels for energy, and in such circumstances would be generally worse off than if they could afford electricity. The provision of affordable electricity to many who are then able to forgo the requirement of burning domestic fuels, more than offsets the health risks brought about by occasional non-compliance with the MES.

Air quality is influenced by a myriad of factors, and the severity of the effect this air quality has on human health is also a function of the general health status of the people affected. Eskom acknowledges that power stations do contribute negatively to ambient air quality, however, so do local activities. Nonetheless, Eskom takes full accountability for its contribution to emissions and is working with the identified local communities towards gradual reduction in ambient air pollution levels by targeting its highest polluting stations with technology interventions and by addressing air pollution on the ground, through air quality offsets, where the people breathe dirty air.

9 Requested limits

As requested in its previous postponement application, Eskom formally requests that leniency be granted to Tutuka Power Station from complying with the more stringent PM and NOx emission limits that come into effect on 1 January 2018 (PM) and 1 April 2020 (NOx), respectively, until LNBs and FFPs have been successfully installed and optimised on all units. Additionally, Eskom requests that leniency be granted from complying with a more stringent SO_2 emission limit from 1 April 2020. The picture painted above, of the status of the site's current emissions tangibly illustrates that the site is currently unable to meet more stringent limits, even if due diligence and load losses are prioritised.

Tutuka requests that the following daily average emission limits strictly apply to its operations (**Table 5**):

Table 5 Requested emission limits for Tutuka Power Station

Pollutant Name	Maximum release rate		
	Limit value (mg/Nm^3)	Date to be achieved by	Average period
PM	300 OR 200	1 January 2019 – 31 March 2027	Daily OR Monthly
	50	From 1 April 2027 onwards	Daily
SO_2	3500	1 April 2020 – 31 March 2025	Daily
	3500	From 1 April 2025 – onwards	Daily
NOx	1200	1 April 2020-31 March 2026	Daily
	750	From 1 April 2026 onwards	Daily

10 Public Participation

A detailed public participation process, as stipulated within the NEMA EIA Regulations, was conducted for the purposes of this postponement application. For details pertaining to the public participation process, the reader is referred to **Annexure B** of this Application.

11 Air Quality Offsets

As a condition of the approved 2014 fleet postponement, Eskom has to implement air quality offsets in populated areas where power stations impact significantly on ambient air quality, and where there is non-compliance with ambient air quality standards. Eskom is of the view that in many cases, household or community emission offsets are a more effective way of reducing human exposure to harmful levels of air pollution, than is retrofitting power stations with emission abatement technology at exorbitant costs. Emission retrofits at power stations also increase the cost of electricity, which may make electricity unaffordable for more people, resulting in an increase in the domestic use of fuels and deterioration in air quality in low income areas.

Eskom is planning to roll out interventions in qualifying households around Tutuka Power Station aimed at improving ambient air quality in low income communities. The plans for Eskom's offsets have been made available to the public on Eskom's website.

12 Concluding comments

Eskom is committed to ensuring that it manages and operates its coal-fired power stations in such a manner that risks to the environment and human health are minimised.

As required in terms of section 5.4.3.3 of the National Framework for Air Quality Management Eskom has:

(i) Provided an air pollution impact assessment compiled in accordance with the prescribed regulations.

(ii) Through this impact assessment it has demonstrated that Tutuka's current and proposed air emission are and will have negligible measured and modelled health and environmental impacts on the on the surrounding environment.

(iii) Concluded an independently run public participation process as prescribed in the NEMA EIA regulations for the Tutuka MES.

Eskom has further apologised for the late submission of this postponement and asked that the authorities condone the late submission of this MES application given the history and issues described.

Eskom believes that it has met the administrative and substantive requirements for the granting of a postponement application and as such request that the NAQO approve the request as submitted.