ATMOSPHERIC IMPACT REPORT – MATIMBA AND MEDUPI POWER STATIONS

ESKOM HOLDINGS SOC LTD SANDTON, GAUTENG

ATMOSPHERIC IMPACT REPORT

ESKOM HOLDINGS SOC LTD

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EXECUTIVE SUMMARY

BACKGROUND

EScience Associates (Pty) Ltd was appointed by Eskom to undertake an atmospheric impact assessment to determine the impact of SO_2 emissions from the Matimba and Medupi Power Stations on ambient air quality. The purpose of the study is to inform an application for postponement of compliance timeframes, in respect of the Minimum Emissions Standards for SO_2 for existing plants as gazetted in terms of Section 21 of the National Environmental Management: Air Quality Act (Act 39 of 2004). The form of the AIR is prescribed in the 'Regulations Prescribing the Format of the Atmospheric Impact Report' (GN 36904: 2013).

The Matimba Power Station has six units of 665 MW capacity each. The total installed capacity is 3990 MW. Coal is first milled into a powder, increasing its surface area and combustibility, and then fed into boilers. The boilers heat water into steam, which subsequently turns turbines within electromagnets, producing electricity. This electricity is transformed to extremely high voltages for efficient transport via power lines.

The Medupi Power Station comprises of six units, each with a capacity of 800 MW. The total capacity of the station is 4800 MW. Electricity generation at the Medupi Power Station follows a similar process to that of the Matimba Power Station. Supercritical boilers and turbines, which operate at higher temperatures and pressures than conventional boilers, are used at the Medupi Power Station to maximise efficiency. At the time of submitting this application, one unit was in commercial operation and a second was being commissioned.

GN 248:2010 subsequently replaced by GN893:2013 which in turn was subsequently replaced by GN 551:2015 gazetted in terms of Section 21 of the National Environmental Management: Air Quality Act (Act 39 of 2004), represents a list of activities which result in atmospheric emissions which have or may have a significant detrimental effect on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage. Matimba and Medupi Power Stations fall into "Subcategory 1.1: Solid Fuel Combustion Installations" of GN 551:2015. The gazette sets out minimum emission standards which existing stations must comply with by 01 April 2015.

Both the Matimba Power Station and the Medupi Power Station operate under valid Atmospheric Emissions Licences. The Licence numbers are 12/4/12L-W4/A3 and 12/4/12L·W2/A3 respectively. Both licenses have been issued by the Limpopo Department of Economic Development.

STUDY METHODOLOGY

The CALPUFF atmospheric dispersion modelling suite was employed to predict ground level SO_2 concentrations associated with the application for postponement. In this respect, an assessment of the temporal and spatial distributions of ground level SO_2 concentrations was undertaken through the following process:

- A review of National air quality standards and guidelines against which the predicted impact of the process was evaluated.
- Sourcing synoptic data and meteorological data from the surrounding automatic weather stations from South African Weather Service and, Agricultural Research Council, DEA Lephalale and Eskom Medupi and Marapong air quality stations), processing meteorological data into a format suitable for mesoscale modelling inputting and providing a description of the climate and atmospheric conditions impacting on the atmospheric dispersion potential proximal to the site.
- Compilation of an emissions inventory for the existing operations. Point source emissions data was provided by Matimba and Medupi Power Stations.
- Dispersion modelling and compilation of isopleth maps indicating predicted ground level concentrations of sulphur dioxide (SO_2) according to the applicable averaging periods and frequency of exceedance of the ambient air quality limits where relevant. The South African Air Monitoring guidelines approve the use of the California Puff (CALPUFF) dispersion modelling suite, which was employed.
- Air quality impact assessment including a comparison of predicted concentrations with national ambient air quality standards.

CONCLUSIONS AND RECOMMENDATIONS

In terms of the requirements of the Minimum Emissions Standards, Eskom as a listed emitter is required to comply with prescribed emissions limits at its various power stations. Because of variations in the sulphur content of the coal from the Grootegeluk mine, the Matimba and Medupi Power Stations, which both use coal from Grootegeluk, are not able to consistently comply with the 2015 SO_2 MES daily limit of 3500 mg/Nm^3. For this reason, Eskom is seeking a postponement of the compliance timeframes of the existing plant SO_2 MES for the Matimba and Medupi Power Stations, as well as requesting more lenient daily average limits of 4000 mg/Nm^3 for both stations. In making such an application, it is necessary to ascertain the ambient air quality implications of the requested limits and whether the application would result in non-compliance with the NAAQS.

To assess the ambient air quality implications of Eskom's requested emissions limits there have been two primary courses of action. The first of these has been a detailed review of measured ambient air quality data and the second, the modelling of different emissions scenarios using the CALPUFF suite of dispersion models. The modelled concentrations have been compared to the measured concentrations to verify the accuracy of the model predictions. Data from the Marapong and Lephalale AQM stations (on the upwind side of the two power stations) and the Medupi AQM station (on the downwind side of the power stations) have been sourced and analysed for a three and sometimes (in the case of Marapong and Lephalale) for a four-year period. Measured ambient SO_2 concentrations show that there is currently compliance with ambient SO_2 standards at all three monitoring stations. There are several occurrences of exceedances of the NAAQS SO_2 limit values for hourly and 24-hourly averaging periods but the number of exceedances is less than the allowed number of exceedances in the NAAQS. As such, full compliance with the SO_2 NAAQS is evident for all three years for all three stations. Following patterns that have been described elsewhere, there is clear evidence of SO_2 concentrations peaking only in the afternoon, whereas PM_{10} peaks are seen to occur in the morning and in the late afternoon/early evening.

Eight different emissions scenarios were modelled, including the two power stations separately under current emissions and at the requested emission limits (4000 mg/Nm^3), Medupi alone with FGD installed and then three scenarios where the power station emissions were combined. The first combined scenario was at current emissions and the second, the requested emissions limit at Matimba Power Station and FGD installed at Medupi Power Station. Comparisons between the modelled and the measured concentrations indicated good agreement at the Medupi and Lephalale AQM stations but poorer agreement for the Marapong data. Reasons for the poorer agreement at Marapong may derive from an additional, unmodelled source of SO_2 and/or from instrument drift that results in higher concentrations being recorded than exist. The verification exercise confirmed the adequacy of the modelling approach. The dispersion modelling results have been presented as a series of isopleth (lines joining points of equal ambient air pollutant) concentrations. Please refer to the appendix to this AIR entitled 'An Assessment of the Ambient Air Quality Implications of Eskom's Matimba and Medupi's Application for a Postponement of the Compliance Timeframes for the SO_2 Minimum Emission Standards' for a thorough assessment of the impact of Matimba and Matimba's SO_2 emissions on ambient air quality, for various scenarios.

The isopleth maps reveal one main area of elevated predicted SO_2 concentrations. This area is on the downwind (south western) side of the Medupi Power Stations. The risk of adverse health effects is reduced on the downwind side of the power stations by the low population densities that prevail. There is compliance with ambient SO_2 standards in Lephalale and Marapong for all modelled scenarios. The Matimba Power Station alone under current emissions scenario reveals compliance with the NAAQS for all averaging periods for SO_2, but for Matimba and Medupi Power Stations under current emissions (with 6 units operating) there is predicted non-compliance on the downwind side. Again, it should be noted that this scenario will only be applicable for a short period of time, namely for the time between when the last generating unit has been commissioned at Medupi Power Station and the time when the first unit is retrofitted with FGD (June 2019 through to August 2021). The predicted non-compliance area is seen to grow in spatial extent when the requested emission limits are modelled. There is compliance currently (an assertion supported by the measured ambient air quality data) but at some point, as additional units are brought on-line at Medupi Power Station, there is a high likelihood of non-compliance in the downwind area. Based on the modelling done to date, it is not possible to indicate precisely when the non-compliances would start.

GLOSSARY

Glossary of Key Terms adapted from NEMA, NEMAQA, and the US EPA (http://www.epa.gov/ttn/atw/nata/gloss1.html).

Ambient air:

In this assessment, ambient air refers to the air surrounding a person through which pollutants can be carried. This excludes air regulated in terms of the Occupational Health and Safety Act (No. 85 of 1993).

Background concentrations:

Background concentrations means the contributions to pollutant concentrations in ambient air resulting from sources other than the activities of concern.

Dispersion model:

A dispersion model is a computerised set of mathematical equations that uses emissions and meteorological information to simulate the behaviour and movement of air pollutants in the atmosphere. The results of a dispersion model are estimated ambient concentrations of individual air pollutants at specified locations.

Emission:

"Atmospheric emission" or "emission" means any release or entrainment process emanating from a point, non-point or mobile source that results in air pollution;

Frequency of Exceedance (FoE)

"Frequency of exceedance" means a frequency (number/time) related to a limit value representing the tolerated exceedance of that limit value at a specific monitoring station, i.e. if exceedances of limit value are within the tolerances, then there is still compliance with the standard. The exceedances are applicable to a calendar year.

Inhalation:

Breathing. Once inhaled, contaminants can be deposited in the lungs, assimilated into the blood, or both.

Limit Value or Ambient Air Quality Limit

Limit value" means a level fixed on the basis of scientific knowledge, with the aim of reducing harmful effects on human health (or the environment (or both)), to be attained within a given compliance period and not to be exceeded once attained.

ABBREVIATIONS & ACRONYMS

AEL	Atmospheric Emissions Licence
AIR	Atmospheric Impact Report
APPA	Atmospheric Pollution Prevention Act, № 45 of 1965
AQIA	Air Quality Impact Assessment (or Air Pollution Impact Assessment)
AQM	Air Quality Monitoring Station
ARC	Agricultural Research Council
DEA	Department of Environmental Affairs
EIA	Environmental Impact Assessment
FGD	Flue Gas Desulphurisation
FOE	Frequency of Exceedance
GN	Government Notice
MES	Minimum Emissions Standard
NAAQS	National Ambient Air Quality Standards
NEMA	National Environmental Management Act, № 107 OF 1998
NEM: AQA	National Environment Management: Air Quality Act, № 39 Of 2004
NO	Nitric oxide
NO_2	Nitrogen dioxide
NO_x	Oxides of Nitrogen
PM_{10}	Particulate matter with an aerodynamic diameter of less than 10 µm
$PM_{2.5}$	Particulate matter with an aerodynamic diameter of less than 2.5 µm
SO_2	Sulphur Dioxide
SO_3	Sulphur Trioxide
SOC	State Owned Company

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1 INTRODUCTION

Regulations have been published in terms of Section 21 of the National Air Quality Management: Air Quality Act (2004) that detail a 'list of activities which result in atmospheric emissions which have or may have a significant detrimental impact on the environment, including health, social conditions, economic conditions, ecological conditions or cultural heritage' (GN 551:2015 (which amends the first of activities of GN 248:2010 following draft GN 1001:2009)). The regulations also prescribe associated 'minimum emissions standards' (MES) for the various listed activities differentiating between 'existing plant' standards (compliance required in 2015) and stricter 'new plant' standards (compliance required in 2020). Due to increases in sulphur content of coal, Eskom's Matimba and Medupi Power Stations, situated in the Lephalale area of Limpopo Province, cannot consistently comply with the existing plant MES for Sulphur Dioxide (SO_2) emissions. Options to reduce SO_2 emissions include burning lower sulphur coal, or removing the SO_2 from the flue gas stream before it exits to the atmosphere through flue gas desulphurisation (FGD) exist.

Provision is made in the regulations for emitters (such as Eskom's power stations) to apply for postponement of the MES compliance timeframes contained in the regulations. To apply for postponement, emitters must provide *inter alia,* an atmospheric impact assessment compiled in accordance with the regulations providing the format of an Atmospheric Impact Report by a person registered as a professional engineer or as a professional natural scientist in the appropriate category. This document serves as the Atmospheric Impact Report (AIR) that has been compiled as part of Eskom's postponement application for the SO_2 MES for the Matimba and Medupi Power Stations.

EScience Associates (Pty) Ltd, as an independent assessment practitioner and having the required professional registrations, has been appointed by Eskom to undertake the atmospheric impact assessment. The form of the AIR is prescribed in the 'Regulations Prescribing the Format of the Atmospheric Impact Report' (GN 36904: 2013). As such the report contains the following:

- Enterprise details;
- Nature of the process;
- Technical information;
- Atmospheric emissions;
- Impact of enterprise on the receiving environment;
- Complaints;
- Current or planned air quality management interventions;
- Compliance and enforcement actions;
- Additional information; and,
- Formal declarations.

2 ENTERPRISE DETAILS

	Matimba	Medupi
Enterprise Name	Eskom Holdings SOC Ltd	
Trading As	Eskom Holdings SOC Ltd – Matimba Power Station	Eskom Holdings SOC Ltd – Medupi Power Station
Type of Enterprise, e.g. Company/Close Corporation/Trust	State Owned Company	
Company/Close Corporation/Trust Registration Number (Registration Numbers of Joint Venture)	2002/015527/06	
Registered Address	Farm Grootstryd 465, LO District, Lephalale	Farm Naauwontkomen; Farm Eenzaamheid
Postal Address	Eskom Private Bag X215 Lephalale 0555 Limpopo Province	
Telephone Number (General)	+27 14 763 8200	+27 13 656 4061
Fax Number (General)	+27 14 763 3616	+27 13 656 4973
Industry Type/Nature of Trade	Coal-fired power station that generates electricity	
Land Use Zoning as per Town Planning Scheme	Heavy industry	
Land Use Rights if outside Town Planning Scheme	NA	

	Matimba	Medupi
Responsible Person	Mr Rhulani Mathebula	Mr Johan Prinsloo
Emission Control Officer	Mr Rhulani Mathebula	Mr Johan Prinsloo
Telephone Number	+27 14 763 8200	+27 13 656 4061
Cell Phone Number	+27 82 302 1538	+27 83 655 9140
Fax Number	+27 14 763 3616	+27 13 656 4973
E-mail Address	MathebRC@eskom.co.za	CJ.Prinsloo@eskom.co.za
After hours Contact Details	+27 82 302 1538	+27 83 655 9140

2.1 LOCATION AND EXTENT OF THE PLANT

	Matimba	Medupi
Physical Address of the Plant	Farm Grootstryd 465 LO district Lephalale	Farm Naauwontkomen; Farm Eenzaamheid
Description of Site (where No Street Address)	Located approximately 1 km southwest and 13 km west of Marapong and Lephalale, respectively, in the Limpopo Province*	Located approximately 13 km southwest and 18 km west of Marapong and Lephalale, respectively, in the Limpopo Province*
Coordinates of Approximate Centre of Operations:	North-south (Latitude): 23° 40’ 03.44” S	North-south (Latitude): 23° 40’ 03.44” S
	East-west (Longitude): 27° 37’ 00.08” E	East-west (Longitude): 27° 37’ 00.08” E
Extent (km^2)	4.25	6.3
Elevation Above Mean Sea Level (m)	880	900
Province	Limpopo	
Metropolitan/District Municipality	Waterberg District Municipality	
Local Municipality	Lephalale Local Municipality	
Designated Priority Area (if applicable)	Bojanala Waterberg Priority Area	
* See below map with detail in Figure 2-1.		

2.2 DESCRIPTION OF SURROUNDING LAND USE (WITHIN 5 KM RADIUS)

The Medupi Power Station is primarily surrounded by agricultural activity with the Grootegeluk Coal Mine lying some 4 km NNW, and the Matimba ash dam 2.9 km to the east. The town of Lephalale is located 13 km east of the Medupi Power Station and Onverwacht (also a residential area) is located some 4.4 km to the southeast (Figure 2-1 and Figure 2-2).

The Marapong residential area borders the Matimba Power Station, which is approximately 1 km to the west, with agricultural activity surrounding the other boundaries. The Grootegeluk Coal Mine is 4.4 km due west of Matimba Power Station and the ash dam is 4.4 km to the south. The town of Lephalale is located 18 km east of the Matimba Power Station and Onverwacht (also a residential area) is located some 9.4 km to the east (Figure 2-1 and Figure 2-2).

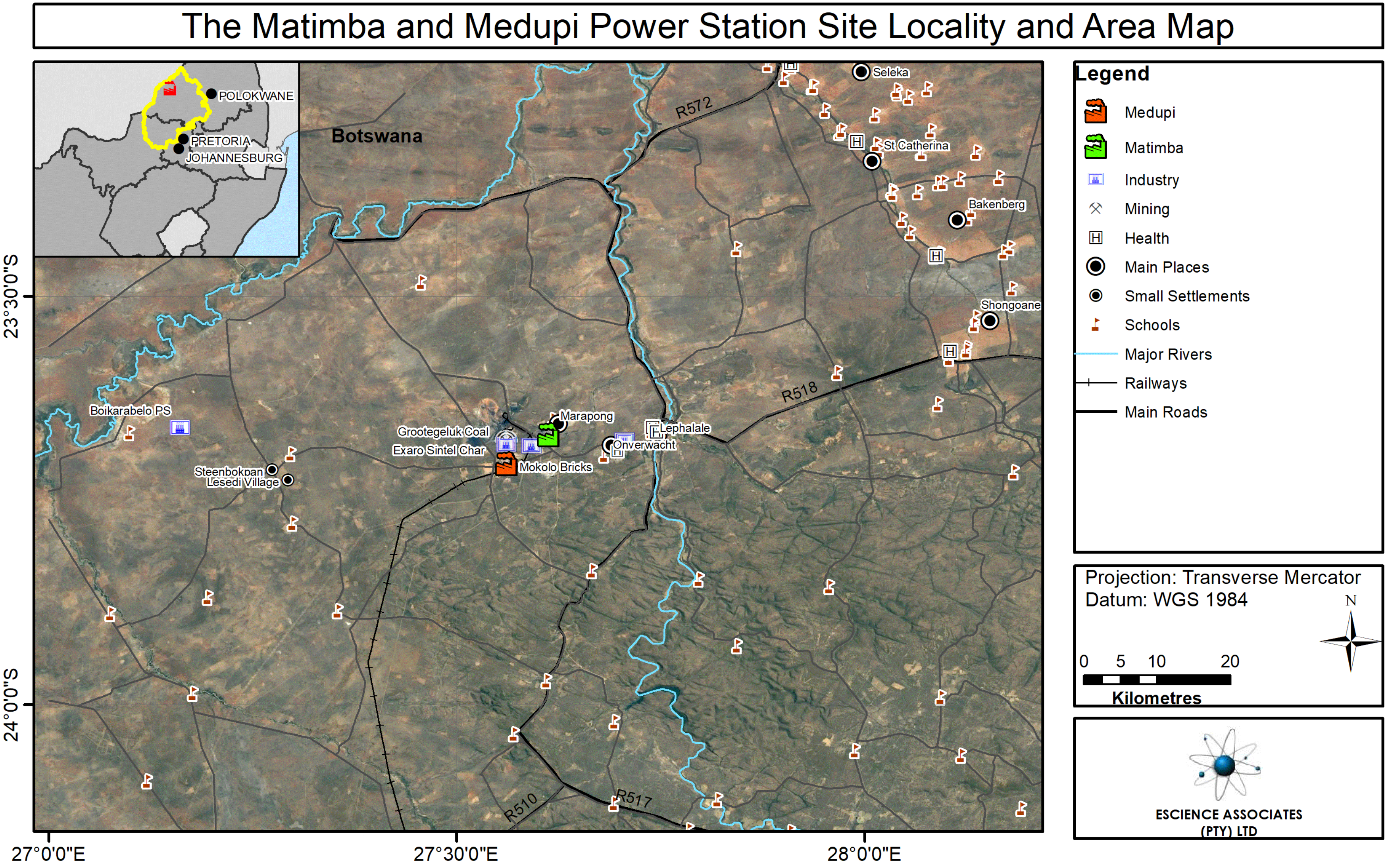

Figure 2-1: The Matimba and Medupi Power Station Site Locality

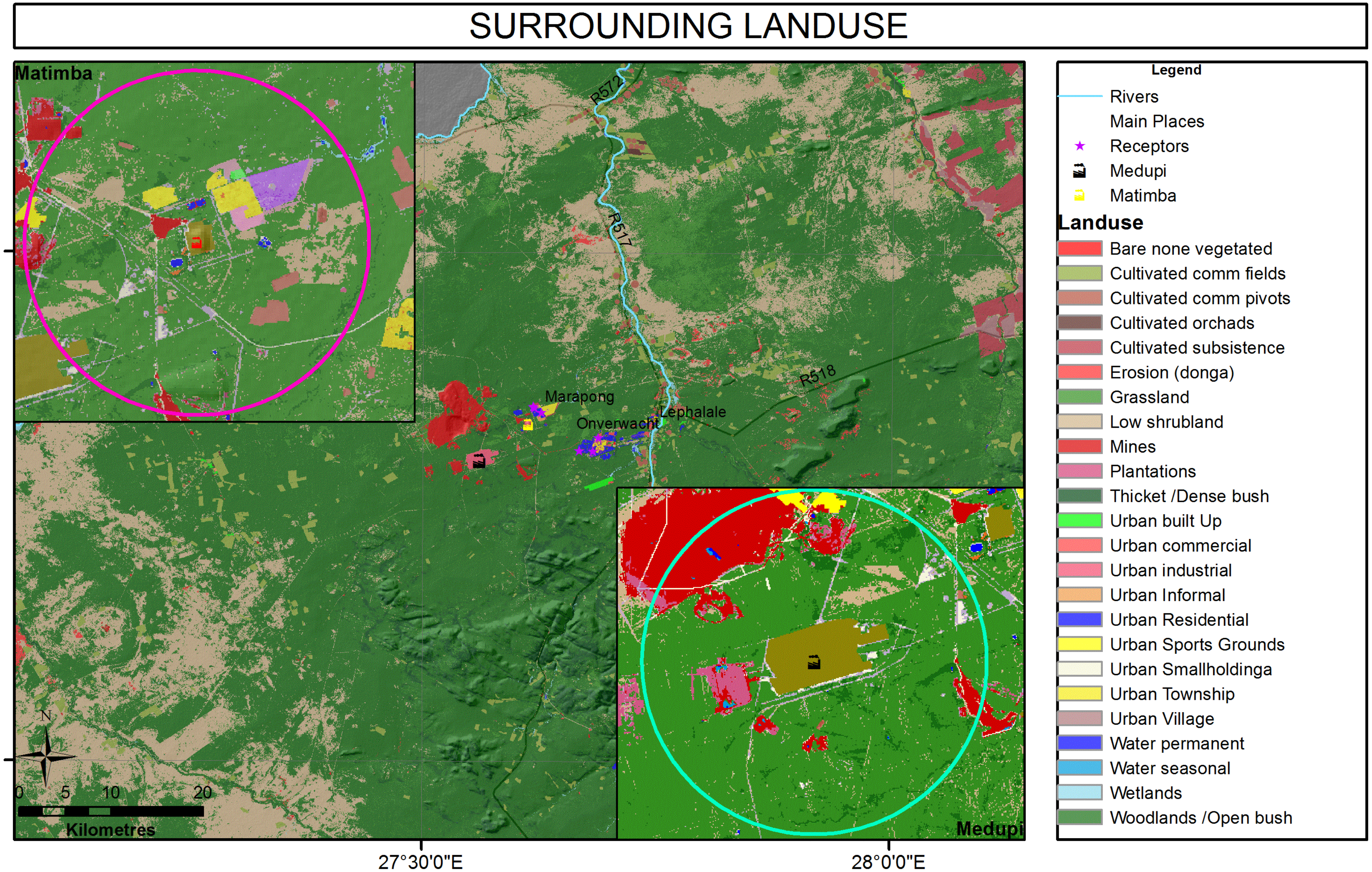

Figure 2-2: Location & Surrounding Land-use of the Matimba and Medupi Power Stations within a 5km radius of the two power stations

2.3 ATMOSPHERIC EMISSION LICENCE AND OTHER AUTHORISATIONS

The Matimba Power Station currently has an AEL with licence number 12/4/12L-W4/A3. The licence is dated 1 April 2015, and is valid until 01 April 2020.

The Medupi Power Station has a provisional AEL with licence number 12/4/12L-W2/A3. The licence is dated 31 March 2015, and is valid until 01April 2020.

3 NATURE OF THE PROCESS

3.1 LISTED ACTIVITY OR ACTIVITIES

<table>
<tr><td colspan="4">Table 3-1: GN551:2015 Subcategory 1.1 Solid Fuel Combustion Installations</td></tr>
<tr><td colspan="4">Subcategory 1.1: Solid Fuel Combustion Installations</td></tr>
<tr><td>Description:</td><td colspan="3">Solid fuels combustion installations used primarily for steam raising or electricity generation</td></tr>
<tr><td>Application:</td><td colspan="3">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.</td></tr>
<tr><td colspan="2">Substance or mixture of substances</td><td>Plant status</td><td>mg /Nm³ of 10% O₂ {273K,101.3 kPa}</td></tr>
<tr><td>Common name</td><td>Chemical symbol</td><td></td><td></td></tr>
<tr><td rowspan="2">Particulate matter</td><td rowspan="2">PM</td><td>New</td><td>50</td></tr>
<tr><td>Existing</td><td>100</td></tr>
<tr><td rowspan="2">Carbon monoxide</td><td rowspan="2">SO_2</td><td>New</td><td>500</td></tr>
<tr><td>Existing</td><td>3500</td></tr>
<tr><td rowspan="2">Oxides of Nitrogen</td><td rowspan="2">NO_x expressed as NO_2</td><td>New</td><td>750</td></tr>
<tr><td>Existing</td><td>1100</td></tr>
</table>

Other authorised listed activities for Matimba and Medupi Power Stations by the licence holder in terms of Section 21 of the NEM: AQA are as follows:

Table 3-2: List of all activities authorised to be conducted at the premises by the Licence holder.

Category of Listed Activity	Sub-category of the Listed Activity	Description of the listed Activity
2-Petroleum Industry	2.4 – Storage and Handling of Petroleum Products	Petroleum product storage tanks and product transfer facilities, except those under liquefied petroleum gas
5-Mineral Processing, Storage and Handling	5.1-Storage and Handling of Ore and Coal	Storage and handling of ore and coal not situated on the premises of a mine or works as defined in the Mines Health and Safety Act 29/1996

3.2 PROCESS DESCRIPTION

Eskom Holdings SOC Ltd is a South African government parastatal that generates, transmits and distributes electricity. Most of the utility's electricity is generated in large coal-fired power stations that are situated close to the sources of coal, with most of the stations occurring on the Mpumalanga Highveld and two stations, Matimba and Medupi (which are the subject of this assessment), in the Waterberg. The process whereby coal is used to generate electricity is detailed below and illustrated in Figure 3-1.

Both the Matimba and the Medupi Power Stations are pulverised fuel (PF) plants whereby the incoming coal is pulverised to the consistency of talcum powder so that it has properties akin to a gas rather than a solid and is accordingly more combustible. Coal is supplied from the Grootegeluk Exxaro mine by means of conveyor belts where it is either temporarily stored as a stockpile or conveyed directly into mill bunkers and from there into mills. Tube ball mills then crush, grind and pulverise the coal. Primary air is used to convey the pulverized coal from the mills to burners with forced draught fans supplying additional air to aid combustion. The coal-air mixture is then blown into the boiler furnace where it is combusted (burnt). The boiler furnace is surrounded by many kilometres of tubing, which contains demineralised water that is heated by the burning coal. Combustion of the coal in the boilers heats water to superheated steam.

The steam is led through a high-pressure turbine to spin the turbine/generator combination at a speed of some 3 000 r/min. After exhausting some of the energy of the steam in the high-pressure turbine, the steam returns to the boiler and is reheated in a re-heater and passed through the intermediate pressure turbine and then directly into two low-pressure turbines. In this manner, the maximum possible energy that can be derived from the steam is derived to generate electricity. The generator rotor is a cylindrical electromagnet enclosed in a gas-tight housing. Electricity passes from the stator windings to a transformer raising the voltage from 20 kV to the transmission voltage of 400 kV.

Bunker Fuel Oil (FO), which is needed to start up the furnaces before switching over to coal, is transported and delivered into the power station by means of road trucks. FO is then offloaded into FO Storage Tanks from where it is passed on to the furnaces as required. With all six units on full load the Matimba Power Station burns more than 1.2 million tonnes of coal per month. On average 450 000 tonnes of ash are generated from the 1.2 million tonnes of coal burned per month. The Medupi Power Station will burn some 1 875 000 tonnes of coal per month and generate around 400 000 tonnes of ash per month. The Matimba Power Station generates 3 990 MW of electricity from 6 generating units with a nominal capacity of approximately 665 MW each. The Medupi Power Station, once it is fully commissioned (only Unit 6 is currently operating), will generate some 4 800 MW of power from 6 generating units of 800 MW each.

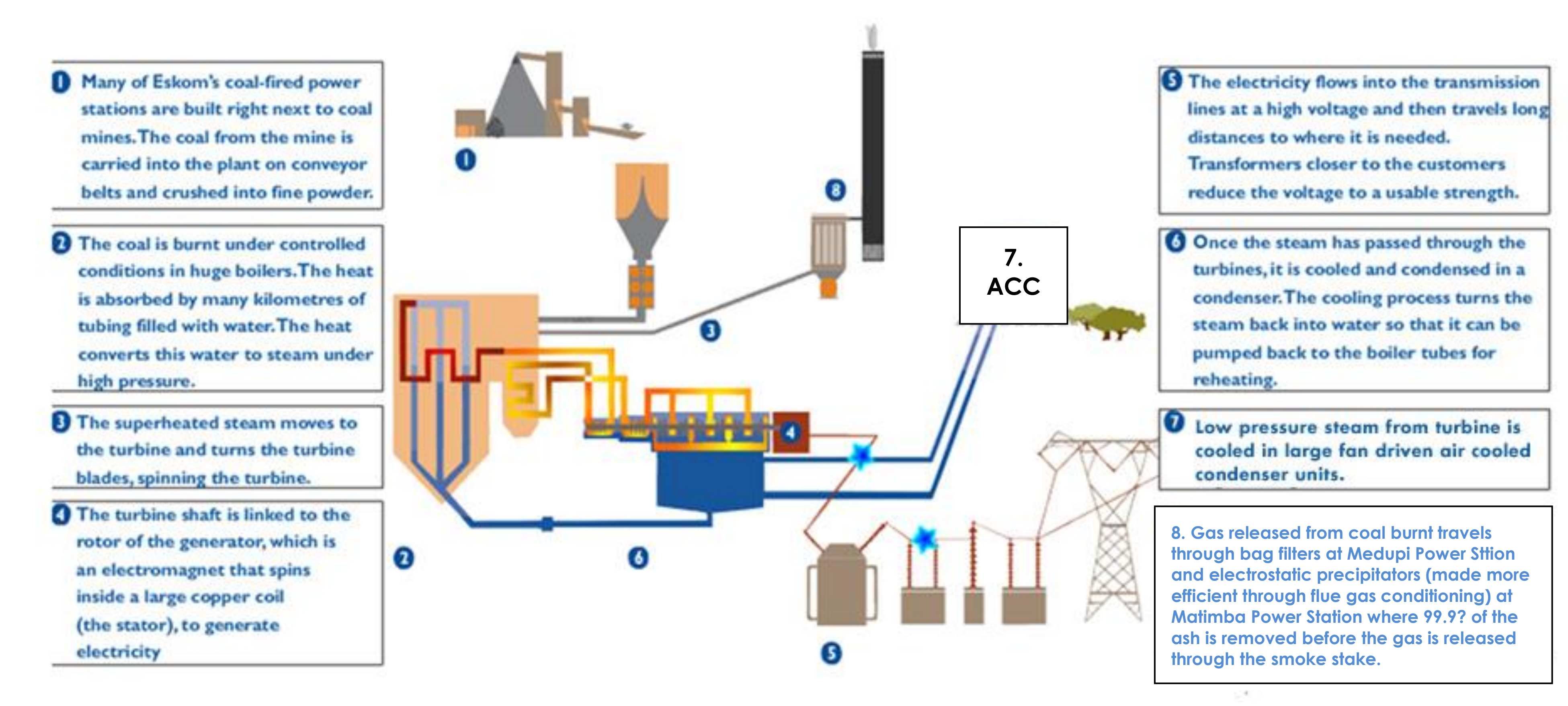

Figure 3-1: Overall process flow diagram of current activities at the Matimba and Medupi Power Stations

3.3 UNIT PROCESSES

Table 3-3: The Matimba and Medupi Power Station Unit Processes			
Unit Process: Matimba	**Unit Process: Medupi**	**Function of Unit Process**	**Batch or Continuous Process**
Boiler Unit 1	Boiler Unit 1	Power generation process	Continuous
Boiler Unit 2	Boiler Unit 2	Power generation process	Continuous
Boiler Unit 3	Boiler Unit 3	Power generation process	Continuous
Boiler Unit 4	Boiler Unit 4	Power generation process	Continuous
Boiler Unit 5	Boiler Unit 5	Power generation process	Continuous
Boiler Unit 6	Boiler Unit 6	Power generation process	Continuous
Coal stockyard	Coal stockyard	Coal storage	Continuous
Fuel Oil Storage Tanks	Fuel Oil Storage Tanks	Fuel Oil Storage	Continuous
Ash Dump	Ash Dump	Ash disposal facility	Continuous

4 TECHNICAL INFORMATION

4.1 RAW MATERIALS USED

Table 4-1: Raw materials used for electricity production at the Matimba and Medupi Power Stations		
Matimba Power Station		
Raw Material Type	**Design Consumption Rate (quantity)**	**Units (quantity/period)**
Coal	1 310 000	tonnes/month
Fuel Oil	1 200	tonnes/month
Medupi Power Station		
Coal	1 875 000	tonnes/month
Fuel Oil	40 000	tonnes/month

4.2 APPLIANCES AND ABATEMENT EQUIPMENT CONTROL TECHNOLOGY

Table 4-2: Point source emission management and mitigation

Appliance Name	Appliance Type/Description	Appliance Function / Purpose
Matimba Power Station		
Electrostatic Precipitators (ESPs)	Electrostatic Precipitators (ESPs)	Removes fly ash particles from the gas stream (i.e. reduces Particulate Matter (PM) emissions)
SO_3 plants (also known as the Flue Gas Conditioning Plants)	SO_3 injection	SO_3 injection increases conductivity of particles, and significantly improves the performance of the ESP
Medupi Power Station - Existing		
Pulse Jet Fabric Filter Plant	Pulse Jet Fabric Filter Plant	Removes fly ash particles from the gas stream (i.e. reduces PM load)
Low NO_x Burner and Overfire Air	Low NO_x Burner and Overfire Air	Reduces NO_x formation and therewith NO_x emissions
Medupi Power Station - Future		
Flue-gas desulphurisation (FGD) – 6 years after commissioning of every unit	Flue gas desulphurisation	Reduce SO_2 emissions

It should be noted that although there is no abatement equipment in place to reduce SO_2 emissions at the Matimba Power Station *per se*, the power station is engaging actively with the coal supplier Exxaro to explore measures that could be used to reduce the net sulphur content in the coal. Blending of different coals that have different sulphur quantities is already occurring at the mine which reduces the variability in the sulphur content (thus decreasing maximum emission concentrations). Eskom has requested that the mine investigate options to reduce the sulphur content of the coal that it provides to Eskom.

5 ATMOSPHERIC EMISSIONS

5.1 POINT SOURCE PARAMETERS

The values in Table 5-1 to Table 5-3 represent the values modelled. Some of these values (namely temperature, flowrate, and velocity) inherently vary with changes in feed compositions and operating conditions.

5.2 POINT SOURCE PARAMETERS - MATIMBA POWER STATION

Table 5-1 Point source parameters at the Matimba Power Station

Point source number	Point source name	Point source coordinates		Height of release above ground (m)	Height above nearby building (m)	Diameter at stack tip/vent exit (m)	Actual Gas Exit Temperature (°C)	Actual gas volumetric flow (m^3 /hr)	Actual Gas Exit Velocity (m/s)	Type of emission (continuous /batch)
		UTM - Latitude	UTM - Longitude							
Stack 1	Boiler Unit 1 Boiler Unit 2 Boiler Unit 3	7382.459	562.158	250	113	14.33	131.85	12 960 000	24	Continuous
Stack 2	Boiler Unit 4 Boiler Unit 5 Boiler Unit 6 Boiler Unit 5 Boiler Unit 6	7382.151	562.465	250	113	15.40	131.85	12 960 000	24	Continuous

5.3 POINT SOURCE PARAMETERS – MEDUPI POWER STATION

Table 5-2 Point source parameters at the Medupi Power Station

Point source number	Point source name	Point source coordinates		Height of release above ground (m)	Height above nearby building (m)	Diameter at stack tip/vent exit (m)	Actual Gas Exit Temperature (°C)	Actual gas volumetric flow (m^3 /hr)	Actual Gas Exit Velocity (m/s)	Type of emission (continuous /batch)
		UTM - Latitude	UTM - Longitude							
Stack 1	Boiler Unit 1 Boiler Unit 2 Boiler Unit 3	7378.553	557.231	220	100	15.40	136.9	12 000 000	21	Continuous
Stack 2	Boiler Unit 4 Boiler Unit 5 Boiler Unit 6	7378.553	557.231	220	100	15.40	136.9	12 000 000	21	Continuous

5.4 POINT SOURCE PARAMETERS – MEDUPI POWER STATION (WITH FGD)

Table 5-3 Point source parameters at the Medupi Power Station with FGD

Point source number	Point source name	Point source coordinates		Height of release above ground (m)	Height above nearby building (m)	Diameter at stack tip/vent exit (m)	Actual Gas Exit Temperature (°C)	Actual gas volumetric flow (m^3 /hr) -	Actual Gas Exit Velocity (m/s)	Type of emission (continuous /batch)
		UTM - Latitude	UTM - Longitude							
Stack 1MEF	Boiler Unit 1 Boiler Unit 2 Boiler Unit 3	7378.553	557.231	220	100	15.40	50.9	12 000 000	15.96	Continuous
Stack 2MEF	Boiler Unit 4 Boiler Unit 5 Boiler Unit 6	7378.553	557.231	220	100	15.40	50.9	12 000 000	15.96	Continuous

5.5 POINT SOURCE MAXIMUM EMISSION RATES (NORMAL OPERATING CONDITIONS)

The maximum emission rates at the Matimba and Medupi Power Stations are the emission limits that the power stations are requesting in the event that the postponement request is granted (4000 mg/Nm^3).

Table 5-4: Point source maximum SO_2 emission rates

Station	Point source number	Point source name	Pollutant name	Average emission rate		Duration of emissions
				(mg/Nm^3)	Averaging period	
Matimba	Stack 1	Boilers 1-3	SO_2	4 000	Daily	Highly episodic but modelled for worst case scenario
	Stack 2	Boilers 4-6				
Medupi before FGD	Stack 1	Boilers 1-3	SO_2	4 000	Daily	Highly episodic but modelled for worst case scenario
	Stack 2	Boilers 4-6				
Medupi with FGD	Stack 1	Boilers 1-3	SO_2	500	Daily	For remaining plant lifetime post FGD
	Stack 2	Boilers 4-6				

5.6 POINT SOURCE MAXIMUM EMISSIONS RATES (START-UP, SHUT-DOWN, UPSET AND MAINTENANCE CONDITIONS)

This Atmospheric Impact Report outlines the atmospheric impact assessment of SO_2 emissions from the Matimba and Medupi Power Stations only, and does not consider other pollutants. Because there is currently no SO_2 emissions abatement technology installed at either the Matimba or Medupi Power Stations, the only conditions that are deemed likely to have anomalous emissions are start-up and shut-down. Point source emissions during upset and maintenance conditions are thus not applicable in this instance. Direct SO_2 emissions measurements during start-up and shut-down (which is typically over a 1-2 day period) reveal highly variable SO_2 emissions but never exceeding 4100 mg/Nm^3. A log of start-ups and shut-downs for the Matimba and Medupi Power Stations is shown in Table 5-5 and Table 5-6 below respectively.

The sections below highlight emissions experienced during the last two start-up/shut-down incidences at the Matimba and Medupi Power Stations respectively to provide information of typical emissions experienced during start-up and shut-down.

5.6.1 START-UP, SHUT-DOWN - MATIMBA POWER STATION

Single start-up and shut-down maximum emission concentrations were recorded for Unit 1 and 3 at the Matimba Power Station and are illustrated in Figure 5-1 to Figure 5-4. As illustrated, the SO_2 emission concentrations vary per unit. When oil support is used, SO_2 emissions are a little higher than usual.

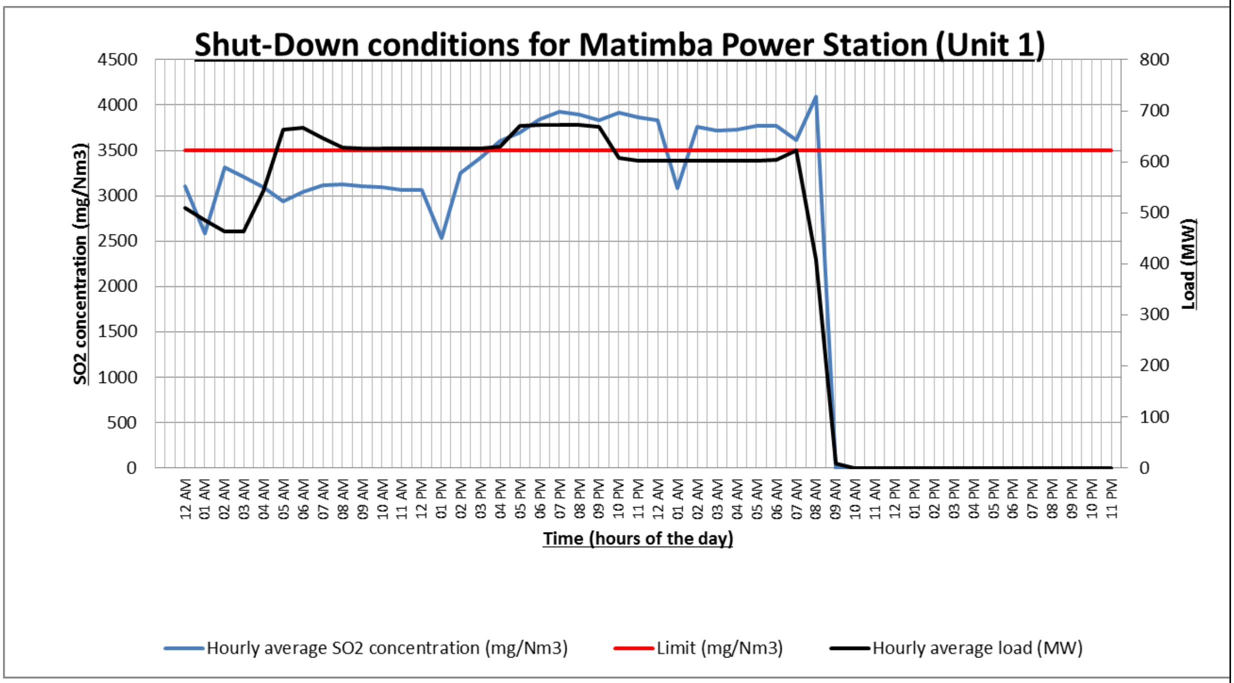

Figure 5-1: Shut-down conditions for Unit 1 at the Matimba Power Station

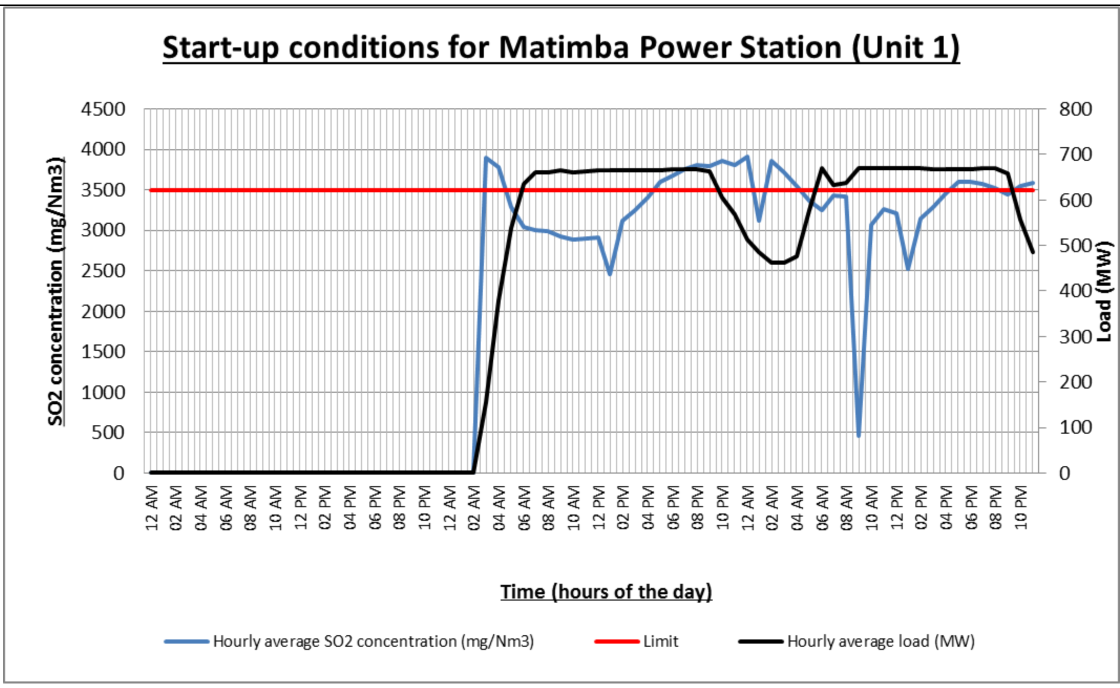

Figure 5-2: Start-up conditions for unit 1 at the Matimba Power Station

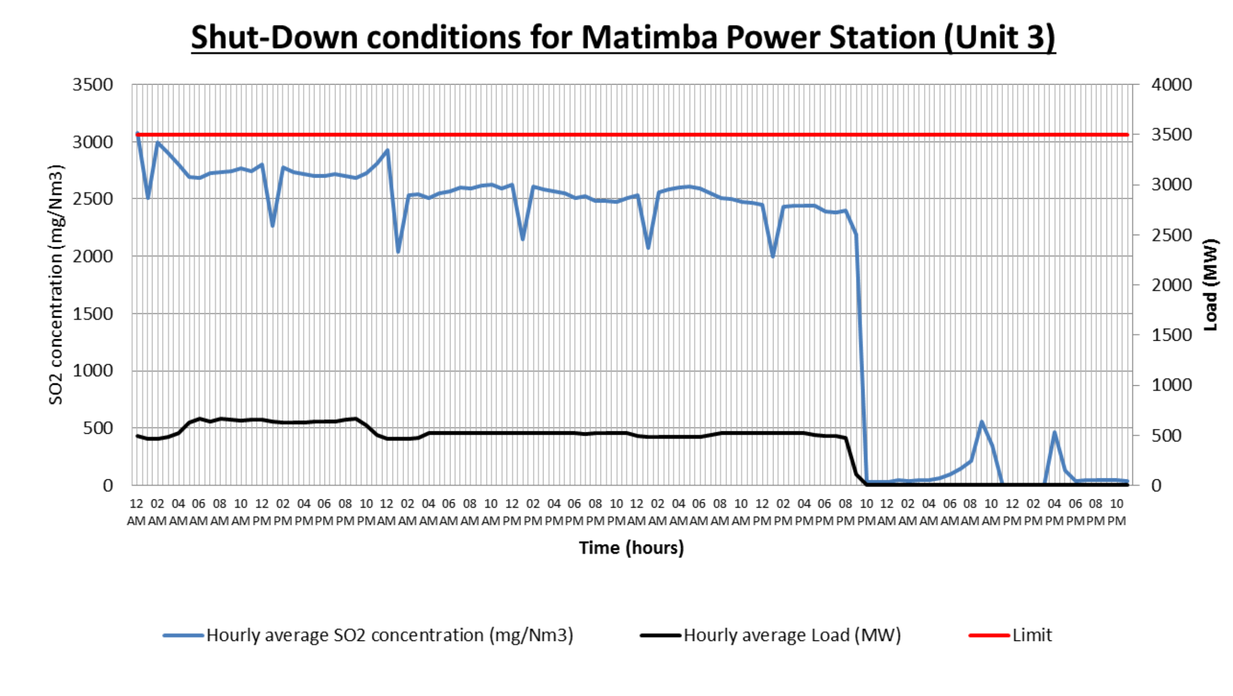

Figure 5-3: Shut-down conditions for Unit 3 at the Matimba Power Station

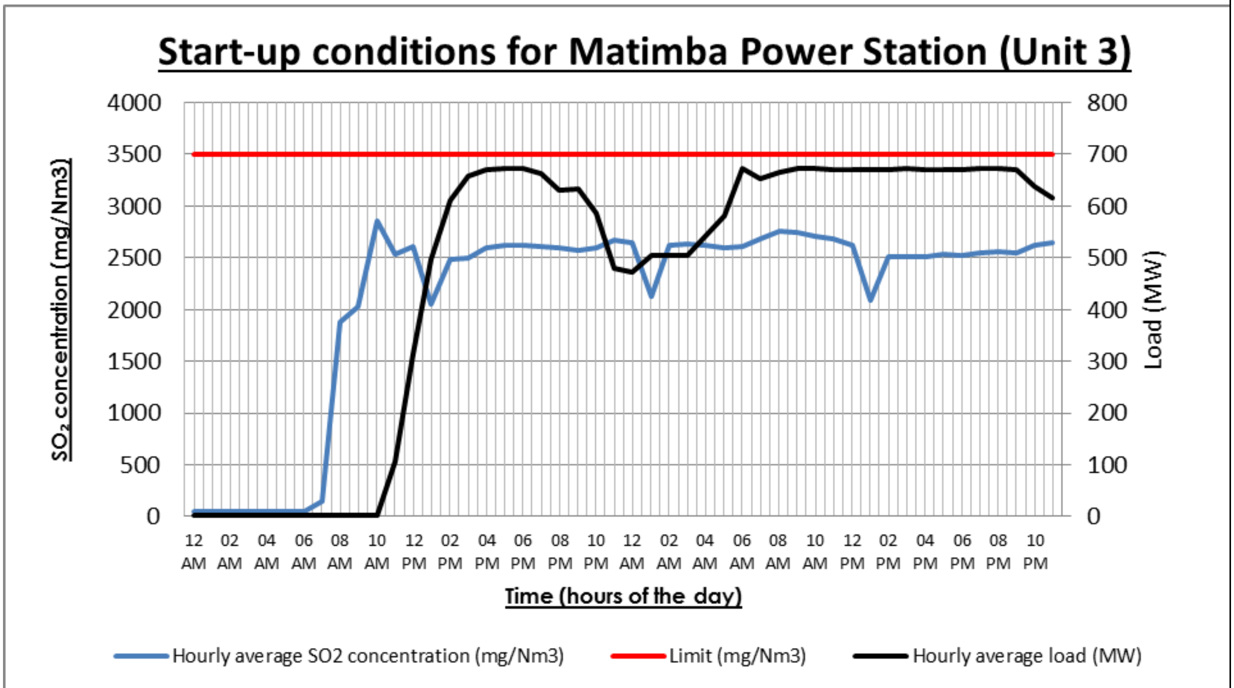

Figure 5-4: Start-up conditions for Unit 3 at the Matimba Power Station

5.6.2 START-UP, SHUT-DOWN - MEDUPI POWER STATION

Twenty-eight start-up and shut-down incidents were recorded for unit 6 for 2016 and 2 start-up and shut-down incidents were recorded for 2017 for unit 6 at the Medupi Power Station and the first 2017 start-up and shut-down is described here. The maximum emission concentrations are illustrated in Figure 5-5. The start-up and shut-down period varies for this unit, for incident 1 took hours for the process to run to completion.

The hourly average SO_2 concentration for start-up is 2793.57 mg/Nm^3 for incident 1. The hourly average SO_2 concentration for shut-down is 2793.57 mg/Nm^3 for incident 1. Exceedances are only noted in incident 1 after the start-up process had run to completion.

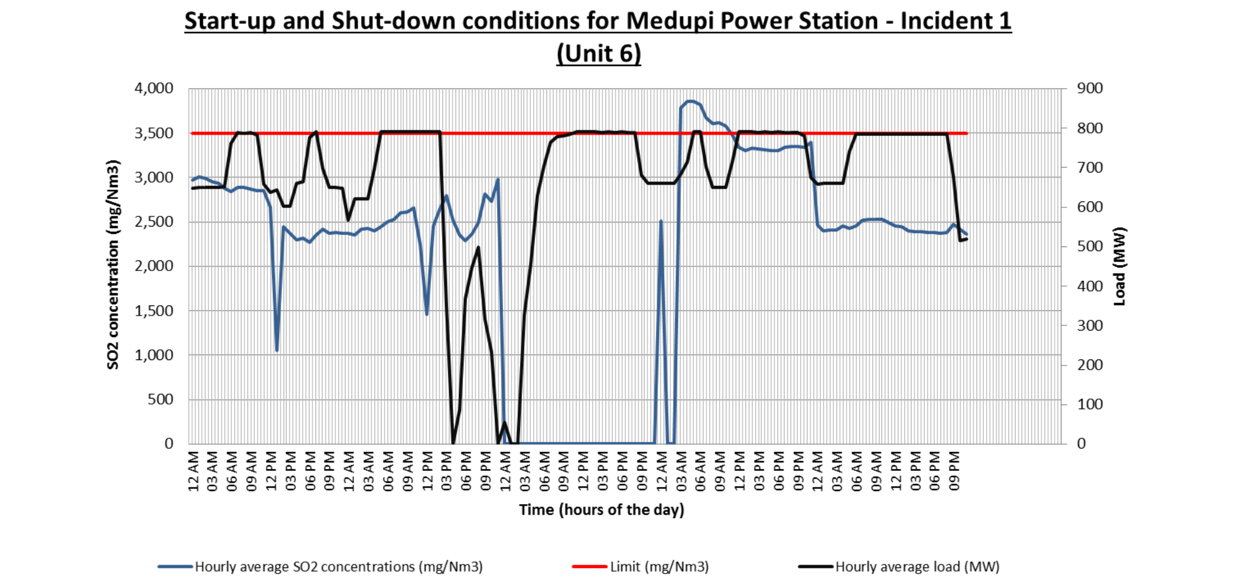

Figure 5-5: Incident 1 start-up and shut-down conditions at the Medupi Power Station (2017)

Table 5-5: Number of start-ups and shut-downs of 6 units at the Matimba Power Station (2014-2017)

	Number of start-ups	Number of shut-downs	Number of start-ups	Number of shut-downs	Number of start-ups	Number of shut-downs	Number of start-ups	Number of shut-downs	Number of start-ups	Number of shut-downs	Number of start-ups	Number of shut-downs
2014	**Unit 1**		**Unit 2**		**Unit 3**		**Unit 4**		**Unit 5**		**Unit 6**	
January	-	-	2	2	-	-	-	-	-	-	-	-
February	-	-	-	-	1	1	-	-	2	2	-	-
March	1	1	-	-	1	1	-	-	2	2	-	-
April	-	-	1	1	-	-	5	5	1	1	-	-
May	-	-	1	1			4	4	-	-	-	-
June	-	-	3	3	-	-	-	-	-	-	-	-
July	-	-	-	-	-	-	-	-	-	-	5	5
August	2	2	-	-	-	-	-	-	2	2	2	2
September	3	3	-	-	-	-	1	1	1	1	1	1
October	-	-	1	1	1	1	-	-	1	1	1	1
November	-	-	-	-	-	-	-	-	1	1	-	-
December	2	2	-	-	-	-	1	1	2	2	2	2
2015	**Unit 1**		**Unit 2**		**Unit 3**		**Unit 4**		**Unit 5**		**Unit 6**	
January	1	1	2	2	1	1	-	-	-	-	1	1
February	-	-	-	-	1	1	1	1	-	-	1	1
March	1	1	1	1	1	1	-	-	2	2	1	1
April												
May	3	3	2	2	-	-	2	2	1	1	-	-
June	1	1	5	5	-	-	3	3	-	-	-	-
July	-	-	-	-	-	-	-	-	1	1	-	-
August	-	-	2	2	-	-	1	1	1	1	1	1
September	1	1	-	-	-	-	-	-	-	-	1	1
October	1	1	-	-	-	-	1	1	2	2	1	1
November	-	-	2	2	-	-	-	-	-	-	-	-
December	-	-	-	-	2	2	2	2	1	1	-	-
2016	**Unit 1**		**Unit 2**		**Unit 3**		**Unit 4**		**Unit 5**		**Unit 6**	
January	-	-	1	1	-	-	1	1	-	-	3	3
February	-	-	-	-	1	1	2	2	-	-	2	2
March	2	2	-	-	-	-	1	1	-	-	-	-
April	-	-	1	1	-	-	-	-	7	7	-	-
May	1	1	1	1	1	1	-	-	-	-	1	1
June	-	-	-	-	-	-	1	1	1	1	1	1
July	-	-	-	-	1	1	-	-	1	1	-	-
August	1	1	-	-	-	-	-	-	2	2	-	-
September	1	1	-	-	-	-	3	3	3	3	-	-
October												
November	Reporting done											
December												
2017	**Unit 1**		**Unit 2**		**Unit 3**		**Unit 4**		**Unit 5**		**Unit 6**	
January												
February					1	1						
March	1	1										

Table 5-6: Number of start-ups and shut-downs of Unit 6 at the Medupi Power Station (2015-2017)

	Number of start-ups	Number of shut-downs
2015	**Unit 6**	
January	-	-
February	-	-
March	-	-
April	-	-
May	-	-
June	-	-
July	-	-
August	-	-
September	6	6
October	4	4
November	5	5
December	-	-
2016	**Unit 6**	
January	2	2
February	3	3
March	5	5
April	3	3
May	4	4
June	2	2
July	2	2
August	1	1
September	3	3
October	1	1
November	Planned outage	
December	2	2
2017	**Unit 6**	
January		
February	1	1
March	1	1

5.7 FUGITIVE EMISSIONS (AREA AND OR LINE SOURCES)

There are no area or line sources of fugitive SO_2 emissions at either the Matimba or Medupi Power Stations.

5.8 EMERGENCY INCIDENTS

Emergency incidents are defined by Section 30 of NEMA: AQA and a requirement of the stations' respective AELs is reporting unexpected and unforeseen emission exceedances of a duration of more than 48 hours to the DEA. The SO_2 emission limit exceedances that have fallen into this category have duly been reported to the DEA. Several exceedances of the 2015 MES for SO_2 of 3500 mg/Nm^3 brought about by high coal sulphur content have been reported to the authorities in terms of NEMA: AQA Section 30. Given the fact that high Sulphur content is not regarded an unforeseen or unpreventable reason for high emissions, the reported incidents are not viewed by the DEA as 'emergency incidents' (Table 5-7 and Table 5-8).

5.8.1 MATIMBA POWER STATION - EMERGENCY INCIDENTS

Table 5-7: Reported emergency incidents at the Matimba Power Station between 2015 and 2016.

Date of incident	Date when 48h grace were exceeded	Date incident was reported	No of days under S30	Cause of incident	Pollutant	Unit
Sunday, November 1, 2015	Tuesday, November 3, 2015	Friday, November 20, 2015	2	High Sulphur content in coal	SO_2	2
Friday, November 6, 2015	Sunday, November 8, 2015	Friday, November 20, 2015	8	High Sulphur content in coal	SO_2	5
Monday, November 9, 2015	Wednesday, November 11, 2015	Friday, November 20, 2015	1	High Sulphur content in coal	SO_2	6
Tuesday, February 16, 2016	Thursday, February 18, 2016	Wednesday, March 2, 2016	3	High Sulphur content in coal	SO_2	2
Saturday, April 23, 2016	Monday, April 25, 2016	Thursday, April 28, 2016	1	High Sulphur content in coal	SO_2	2
Thursday, April 28, 2016	Saturday, April 30, 2016	Thursday, May 5, 2016	2	High Sulphur content in coal	SO_2	1
Wednesday, April 27, 2016	Friday, April 29, 2016	Thursday, May 5, 2016	5	High Sulphur content in coal	SO_2	2
Thursday, April 28, 2016	Saturday, April 30, 2016	Thursday, May 5, 2016	2	High Sulphur content in coal	SO_2	6
Thursday, May 5, 2016	Saturday, May 7, 2016	Tuesday, May 10, 2016	4	High Sulphur content in coal	SO_2	2
Sunday, May 15, 2016	Tuesday, May 17, 2016	Monday, May 23, 2016	3	High Sulphur content in coal	SO_2	1
Tuesday, May 17, 2016	Thursday, May 19, 2016	Monday, May 23, 2016	1	High Sulphur content in coal	SO_2	2
Monday, May 16, 2016	Wednesday, May 18, 2016	Monday, May 23, 2016	1	High Sulphur content in coal	SO_2	6
Thursday, May 26, 2016	Saturday, May 28, 2016	Monday, May 30, 2016	5	High Sulphur content in coal	SO_2	2

5.8.2 MEDUPI POWER STATION - EMERGENCY INCIDENTS

Table 5-8 Reported emergency incidents reported at the Medupi Power station for 2016.

Date of incident	Date when 48h grace were exceeded	Date of incident end	Date incident was reported	No of days under S 30	Cause of incident	Pollutant	Stack Unit
Thursday, September 1, 2016	Saturday, September 3, 2016	Sunday, September 4, 2016	Monday, September 5, 2016	2	High Sulphur content in coal	SO_2	6
Wednesday, September 28, 2016	Friday, September 30, 2016	Friday, September 30, 2016	Friday, September 30, 2016	1	High Sulphur content in coal	SO_2	6

6 IMPACT OF ENTERPRISE ON THE RECEIVING ENVIRONMENT

The impact of the Matimba and Medupi Power Stations on human health and the environment are presented here. Please refer to the appendix to this AIR entitled 'An Assessment of the Ambient Air Quality Implications of Eskom's Matimba and Medupi's Application for a Postponement of the Compliance Timeframes for the SO_2 Minimum Emission Standards' for a thorough assessment of the impact of Matimba and Matimba's SO_2 emissions on ambient air quality, for various scenarios.

6.1 ANALYSIS OF EMISSIONS' IMPACT ON HUMAN HEALTH

The US EPA Integrated Science Assessment for Sulphur Oxides – Health Criteria (US EPA, 2008) provides an evaluation of the literature on the toxicology, controlled human exposure, epidemiology and mode of action/mechanistic of SO_2 published up to 2007, and concludes that the evidence supports a causal relationship between short-term exposure to ambient levels of SO_2 and respiratory morbidity in adults, and in particular for the asthmatic subpopulation. Similarly, the literature is suggestive of a causal relationship between short-term exposure to ambient levels of SO_2 and respiratory morbidity in children.

The basis of the assessment of SO_2 emissions on human health has been one of determining the effect of SO_2 emissions from the Matimba and Medupi Power Stations on ambient air quality, and in particular compliance with the National Ambient Air Quality Standards (NAAQS). This approach was premised on the assumption that the NAAQS are 'adequately protective of human health and the environment' and that they define 'permissible amounts or concentrations' in respect of the criteria pollutants at a tolerable level of risk and as providing acceptable levels of protection to human health. Such standards cannot be viewed as absolute statements on whether there will be health or environmental consequences, and are simply an expression of what can be considered a tolerable level of risk. In order to determine the likely ambient SO_2 concentrations that will occur as a result of Eskom's requested emissions limit of 4000 mg/Nm^3, the ambient concentrations have been predicted using a dispersion model with the results of that modelling having been presented in the previous section. In addition, measured ambient SO_2 concentrations from three AQM stations have also been analysed to determine the current air quality with a focus on SO_2.

The hourly and daily modelled 99th percentile values were extracted for all scenarios to provide further insight into compliance of NAAQS at the Lephalale, Marapong and Medupi AQM stations for 2013, 2014 and 2015, as well as all three years combined (Table 6-1 and Table 6-2). These tables show that at Lephalale AQM station for all scenarios, for all years, there is full compliance of the hourly and daily NAAQS standards. At the Marapong AQM station there is full compliance of the hourly and daily NAAQS standards for all scenarios and all years, except for the Matimba and Medupi Power Stations at requested postponement emission rates (4000 mg/Nm^3) in 2013, both hourly and daily. However, these exceedances are within close range of the standards, the hourly is exceeding at 354.63 and the daily at 147.27 µg/m^3. At the Medupi AQM station there is only full compliance of both the hourly and daily NAAQS standards for the Matimba Power Station at current emissions and for the Medupi Power Station with FGD emission rates (500 mg/Nm^3), and full compliance of the daily NAAQS standards for the Matimba Power Station at requested postponement emission rates (4000 mg/Nm^3) for all years. The key characteristics of the isopleth maps, which depict the predicted ambient concentrations, are shown in Table 6-3 below.

Table 6-1: Modelled hourly 99th percentile value for Lephalale, Marapong and Medupi AQM stations

Scenarios	Lephalale				Marapong				Medupi			
	2013	2014	2015	Three Years	2013	2014	2015	Three Years	2013	2014	2015	Three Years
Scenario 1 - Matimba Baseline	112	69	66	78	69	50	59	54	273	265	257	260
Scenario 2 - Matimba Postponement	153	94	90	113	93	68	81	81	372	360	350	362
Scenario 3 - Medupi Baseline	125	70	72	96	176	68	103	116	422	372	385	398
Scenario 4 - Medupi FGD	27	18	32	26	67	21	69	52	187	187	194	189
Scenario 5 - Medupi Postponement	143	80	90	109	201	77	128	132	481	424	478	454
Scenario 6 - Matimba + Medupi Baseline	225	146	164	186	287	156	187	202	520	465	524	502
Scenario 7 - Matimba Postponement + Medupi FGD	163	105	114	129	146	112	130	132	426	446	429	433
Scenario 8 - Matimba + Medupi Postponement	279	146	207	229	355	156	227	251	621	465	650	600

Table 6-2: Modelled daily 99th percentile value for Lephalale, Marapong and Medupi AQM stations

Scenarios	Lephalale				Marapong				Medupi			
	2013	2014	2015	Three Years	2013	2014	2015	Three Years	2013	2014	2015	Three Years
Scenario 1 - Matimba Baseline	38	32	33	38	59	47	41	51	78	75	77	78
Scenario 2 - Matimba Postponement	51	37	45	51	67	55	53	67	102	101	102	105
Scenario 3 - Medupi Baseline	59	39	34	48	78	41	62	68	137	97	126	134
Scenario 4 - Medupi FGD	11	10	15	13	24	14	27	23	57	50	61	58
Scenario 5 - Medupi Postponement	68	44	42	54	89	47	77	77	156	111	157	153
Scenario 6 - Matimba + Medupi Baseline	81	63	63	75	120	79	79	87	177	152	195	183
Scenario 7 - Matimba Postponement + Medupi FGD	55	49	53	55	90	72	69	76	132	150	154	144
Scenario 8 - Matimba + Medupi Postponement	103	63	80	94	147	79	99	110	210	152	234	217

Table 6-3: Compliance with ambient SO_2 standards under different emissions scenarios.

Scenario		**Predicted compliance status**		
Averaging period		**1hr**	**24 hr**	**1 yr**
Standard		(350 µg/m³)	(125 µg/m³)	(50 µg/m³)
Allowed number of exceedances		88	4	0
1.	Matimba only at actual emission rates	Exceedances of limit, but in full compliance of 1 hour NAAQS	Exceedances of limit, but in full compliance of 24 hour NAAQS	Compliance in full for annual NAAQS
2.	Matimba only at requested SO_2 limit (4000 mg/Nm³) *	Non-compliacne with 1 hr SO_2 standard downwind to the southwest in areas sparsely populated.	Very localised exceedance of 24 hr SO_2 limit downwind to the southwest in areas sparsely populated. Number of exceedances does not exceed the allowed number of exceedances (so in compliance).	Compliance in full for annual NAAQS
3.	Medupi only at expected emission rates (all 6 Units)	Non-compliance with 1 hr SO_2 standard downwind to the southwest in areas sparsely populated in exceed of the FOE.	Non-compliance with 24 hr SO_2 standard downwind to the southwest in areas sparsely populated in exceed of the FOE.	Compliance in full of annual NAAQS
4.	Medupi only at requested SO_2 limit (4000 mg/Nm³) *	Non-compliance with 1 hr SO_2 standard downwind to the southwest in areas sparsely populated in exceed of the FOE.	Non-compliance with 24 hr SO_2 standard downwind to the southwest in areas sparsely populated in exceed of the FOE.	Full compliance with annual NAAQS
5.	Medupi with FGD (at 500 mg/Nm³) *	Compliance in full with 1 hour NAAQS	Compliance in full with 24 hour NAAQS	Compliance in full with annual NAAQS
6.	Matimba Actual + Medupi Expected	Non-compliance with 1 hr SO_2 standard downwind to the southwest in areas	Non-compliance with 24 hr SO_2 standard downwind to the southwest in significant	Full compliance with annual NAAQS

Table 6-3: Compliance with ambient SO_2 standards under different emissions scenarios.				
Scenario		**Predicted compliance status**		
Averaging period		**1hr**	**24 hr**	**1 yr**
		sparsely populated over significant area.	areas sparsely populated	
7.	Matimba Postponement + Medupi FDG*	Non-compliance with 1 hour SO_2 standard downwind to the southwest in localised areas sparsely populated	Non-compliance with 24 hour SO_2 standard downwind to the southwest in localised areas sparsely populated i	Full compliance with annual NAAQS
8.	Matimba Postponement + Medupi Postponement*	Non-compliance with the 1hr SO_2 standard downwind to the southwest in areas sparsely populated	Non-compliance with the 24hr SO_2 standard downwind to the southwest in areas sparsely populated	Full compliance with annual NAAQS
Green – full compliance to limit Orange – exceedance of limit, but still within allowable number of exceedances Red - number of exceedances above allowed number of exceedances for limit and thus a non-compliance with the standard				

*requested postponement scenarios
Predominant wind direction: North-east Upwind direction: Southwest Downwind direction: North East

It is considered highly likely that with the two power stations operating at the requested emissions limits, there will be non-compliance with the NAAQS for SO_2 for hourly and daily averaging periods to the southwest of the Medupi Power Station over areas of sparse populated land. Much of the area over which these non-compliances are predicted, is sparsely inhabited so an argument could be made that the risk of human exposure is less likely even if there is likely to be non-compliance with the NAAQS. This argument refers, of course, only to the downwind areas to the southwest of the power stations, which are characterised by very low population densities. As has been described earlier the use of the requested emission limits certainly exaggerates the extent of the non-compliance and the real effect is likely to be somewhere between what is modelled at the requested emission limits and the current emissions scenario.

With current emission levels from Matimba and Medupi Power Stations (one unit in operation), there is compliance with the NAAQS (and indeed the ambient air quality data indicates that there is currently full compliance with the NAAQS for SO_2), but with the addition of the remaining five generating units at Medupi and the higher SO_2 emissions rates at Matimba (due to the increasing trend of Sulphur in the coal content from the Grootegeluk Mine), non-compliance on the downwind side of the power stations will likely be progressively realised. In keeping with the definitions provided earlier, this would then imply that the higher emissions requested by Eskom for the two power stations, would ultimately lead to an exceedance of ambient air quality in respect of SO_2 downwind of the power stations.

6.2 ANALYSIS OF EMISSIONS' IMPACT ON THE ENVIRONMENT

The long-term emissions of acid gas species associated with coal combustion such as SO_2 and NO_2 pose a risk of acidification, but principally in areas of sensitive soils. The Waterberg has been highlighted as an area sensitive to acid deposition and continued emissions of acid forming gases will impact this area which hosts various protected areas and have been declared a biosphere reserve. There are also concerns around potential impacts on vegetation and fauna. The predominant land use in this area is game farming and mining. Limited data on effects of acid deposition on soils and surface waters indicate that although sensitive soils are limited in extent, acid sensitive waters are fairly widespread (Austnes *et al.*, 2015).

Monitoring data indicates that freshwater monitoring sites have a higher pH (~6.5) in the highly industrialised Highveld region than in what is assumed more sensitive Waterberg region (~5.5). Thus, the freshwater bodies in the Waterberg are more acidic than those of the Highveld region. Preliminary critical loads estimated for the Waterberg streams are frequently low (~75% <25 mq/m^2/yr, depending on input parameters) which, given present knowledge of deposition, indicates that they are exceeded or nearly exceeded in many of the streams (Austnes, et al 2015). Although not extensive in spatial distribution, with one area only showing the highest exceedance level, these results indicate that areas in the vicinity of the central industrial zone that have susceptible soils are at risk of exceeding critical loads.' Although birds and mammals are not directly affected by water acidification, they are indirectly affected by change in the quantity and quality of their food resources (Air Pollution 2011).

It is therefore clear that long-term emissions of acidic gases such as SO_2 pose a risk of acidification, but principally in areas of sensitive soils. Given the long-term nature of the effect it must be recognized that there will be an overall reduction in SO_2 emissions in the longer term as FGD is commissioned at the Medupi Power Station. In addition, the significance of the acidification risk has not been presented, so it is not possible to assess the potential consequences (biodiversity loss, reductions in land potential and so forth) in any meaningful way. More importantly perhaps, it is simply not possible to weigh up the benefits of reduced acid gas emissions (that would occur if there was full compliance with the MES) against the financial and non-financial costs of full MES compliance.

6.3 SUMMARY AND CONCLUSIONS

In terms of the requirements of the Minimum Emissions Standards, Eskom as a listed emitter is required to comply with prescribed emissions limits at its various power stations. Because of variations in the sulphur content of the coal from the Grootegeluk mine, the Matimba and Medupi Power Stations, which both use coal from Grootegeluk, are not able to consistently comply with the 2015 SO_2 MES daily limit of 3500 mg/Nm^3. For this reason, Eskom is seeking a postponement of the compliance timeframes of the existing plant SO_2 MES for the Matimba and Medupi Power Stations, as well as requesting more lenient daily average limits of 4000 mg/Nm^3 for both stations. In making such an application, it is necessary to ascertain the ambient air quality implications of the requested limits and whether the application would result in non-compliance with the NAAQS.

To assess the ambient air quality implications of Eskom's requested emissions limits there have been two primary courses of action. The first of these has been a detailed review of measured ambient air quality data and the second, the modelling of different emissions scenarios using the CALPUFF suite of dispersion models. The modelled concentrations have been compared to the measured concentrations to verify the accuracy of the model predictions. Data from the Marapong and Lephalale AQM stations (on the upwind side of the two power stations) and the Medupi AQM station (on the downwind side of the power stations) have been sourced and analysed for a three and sometimes (in the case of Marapong and Lephalale) for a four-year period. Measured ambient SO_2 concentrations show that there is currently compliance with ambient SO_2 standards at all three monitoring stations. There are several occurrences of exceedances of the NAAQS SO_2 limit values for hourly and 24-hourly averaging periods but the number of exceedances is less than the allowed number of exceedances in the NAAQS. As such, full compliance with the SO_2 NAAQS is evident for all three years for all three stations. Following patterns that have been described elsewhere, there is clear evidence of SO_2 concentrations peaking only in the afternoon, whereas PM_{10} peaks are seen to occur in the morning and in the late afternoon/early evening.

Eight different emissions scenarios were modelled, including the two power stations separately under current emissions and at the requested emission limits (4000 mg/Nm^3), Medupi alone with FGD installed and then three scenarios where the power station emissions were combined. The first combined scenario was at current emissions and the second, the requested emissions limit at the Matimba Power Station and FGD installed at the Medupi Power Station. Comparisons between the modelled and the measured concentrations indicated good agreement at the Medupi and Lephalale AQM stations but poorer agreement for the Marapong data. Reasons for the poorer agreement at Marapong may derive from an additional, unmodelled source of SO_2 and/or from instrument drift that results in higher concentrations being recorded than exist. The verification exercise confirmed the adequacy of the modelling approach. The dispersion modelling results have been presented as a series of isopleth (lines joining points of equal ambient air pollutant) concentrations.

The isopleth maps reveal one main area of elevated predicted SO_2 concentrations. This area is on the downwind (southwestern) side of the Medupi Power Station. The risk of adverse health effects is reduced on the downwind side of the power stations by the low population densities that prevail. There is compliance with ambient SO_2 standards in Marapong and Lephalale for all modelled scenarios. There are two scenarios where all averaging periods for SO_2 are in full compliance, these scenarios are; the Matimba Power Station alone under current emissions and the Medupi Power Station with predicted FGD emissions. The Matimba plus Medupi Power Stations under current emissions (with 6 units operating) there is predicted non-compliance on the downwind side. Again, it should be noted that this scenario will only be applicable for a short period of time, namely for the time between when the last generating unit has been commissioned at the Medupi Power Station and the time when the first unit is retrofitted with FGD (June 2019 through to August 2021). The predicted non-compliance area is seen to grow in spatial extent when the requested emission limits are modelled. There is compliance currently (an assertion supported by the measured ambient air quality data) but that at some point, as additional units are brought on-line at the Medupi Power Station, there is a high likelihood of non-compliance in the downwind area. Based on the modelling done to date, it is not possible to indicate precisely when the non-compliances would start.

7 COMPLAINTS

No complaints have been received at either of the two power stations for the last two years. During the public consultation, a number of complaints and or comments were received. Refer to Appendix: Issues and Response Report.

8 CURRENT OR PLANNED AIR QUALITY MANAGEMENT INTERVENTIONS

The key air quality management intervention that is planned for SO_2 emissions control is the installation of flue gas desulphurisation (FGD) at Medupi Power Station. FGD will be installed for each generating unit, 6 years after the commissioning of each unit. The reason for the delay in installation of FGD is because Medupi Power Station was initially planned without FGD at a time when there was no legal requirement for SO_2 emissions control. The Minimum Emission Standards were subsequently published and FGD was subsequently made a World Bank loan condition. FGD will have to be retrofitted to the power station rather than being an integral part of the original design. It will also be necessary to provide an additional supply of water to ensure adequate supply for the FGD process and this is to be effected through the Makolo-Crocodile Water Augmentation Project (MCWAP), which is still to be initiated. Efforts will also be continued to try and manage the coal sulphur content to limit SO_2 emissions from both power stations.

The Grootegeluk Mine 'blends' stockpiles of higher sulphur coal with lower sulphur coal in order to prevent coal batches with particularly high sulphur being dispatched to the power stations. Eskom has also requested that the mine further investigate options to reduce the sulphur content of the coal supplied to the power stations.

9 COMPLIANCE AND ENFORCEMENT HISTORY

Two pre-compliance notices were issued to Eskom and are detailed below:

- The first pre-compliance notice titled "Notice of intention to issue a compliance notice in terms of Section 31L of the National Environmental Management Act, 1998 (Act No. 107 of 1998) ("NEMA") and/or a directive in terms of section 28(4) of NEMA and/or section 31A of the Environment Conservation Act, 1989 (Act No. 73 of 1989) ("ECA"), Eskom Matimba Power Station ("The Facility"), Lephalale, Limpopo Province" was issued to Eskom under the reference Eskom Matimba Power Station, Lephalale, Limpopo Province dated 15 October 2012.

  This letter was issued with regards to water issues and the water use license. Reference is made to Air Quality under the title "Deterioration of Air Quality". The section refers to excessive fugitive dust emissions being emitted from the power station's ash transfer points.

In response to this, Eskom has adopted the fugitive emissions monitoring plan and monthly fugitive emissions sampling and reporting processes at the Matimba Power Station as an adequate fugitive emissions management mechanism.

- The second pre-compliance notice titled "A notice of intention to issue a

compliance notice in terms of Section 31L of the National Environmental Management Act, 1998 (Act no. 107 of 1998) ("NEMA"): Eskom Matimba Power Station ("The Facility"), Lephalale, Limpopo Province" was issued to Eskom under the reference: Eskom Matimba Power Station, Lephalale, Limpopo Province dated 5 December 2016.
This letter was issued with regards to:
- o Non-Compliance in relation to the National Environmental Management: Air Quality Act, 1998 (Act No. 39 of 2004); and,
- o Non-compliance with conditions stipulated in the facility's AEL.

The non-compliance referred to refers to exceedances of SO_2 emission limits. Eskom's Matimba Power Station responded to this pre-compliance notice with written reasons as to why the Department should not exercise its discretion in issuing Eskom's Matimba Power Station with a Compliance Notice. In its reply, Eskom gave details as to Eskom's attempts to address exceedances as well as plan for the 2025 SO_2 emission targets.

This application for postponement is also a direct response to the pre-compliance notices.

10 ADDITIONAL INFORMATION

As the key supplier of electricity in South Africa, Eskom continually faces a balancing act of weighing up the health and environmental risks associated with atmospheric emissions from their power station against the costs of pollution abatement. Any and all costs faced by Eskom are ultimately passed on to the electricity consumer. Eskom sees the provision of affordable electricity as a key intervention in reducing the dependency of especially the poor on domestic fuels and the health risks associated with such fuel use. The implementation of abatement technology is a very costly exercise and runs the risk of increasing the price of electricity thereby excluding access to the same.

11 FORMAL DECLARATIONS

Name of Enterprise: Eskom Holdings SOC Ltd (Matimba and Medupi Power Stations)

Declaration of accuracy of information provided:

Atmospheric Impact Report in terms of section 30 of the Act.

I, ---, [duly authorised], declare that the information provided in this Atmospheric Impact Report is, to the best of my knowledge, in all respects factually true and correct. I am aware that the supply of false or misleading information to an air quality officer is a criminal offence in terms of section 51(1)(g) of this Act.

Signed at: Sandton (Johannesburg) on this ---------------------------- Day of July 2017

SIGNATURE

CAPACITY OF SIGNATORY

Declaration of independence – Practitioner

Name of Practitioner: Theo Fischer
Registered Profession: Professional Natural Scientist
Name of Registration Body: South African Council for Natural Scientific Professions
Professional Registration Number: 400053/17

Declaration of independence and accuracy of information provided:

Atmospheric Impact Report in terms of Section 30 of the Act.

I, ____Theo Fischer___ declare that I am independent of the applicant. I have the necessary expertise to conduct the assessments required for the report and will perform the work relating the application in an objective manner, even if this results in views and findings that are not favourable to the applicant. I will disclose to the applicant and the air quality officer all material information in my possession that reasonably has or may have the potential of influencing any decision to be taken with respect to the application by the air quality officer, the information provided in this Atmospheric Impact Report is, to the best of my knowledge, in all respects factually true and correct. I am aware that the supply of false or misleading information to an air quality officer is a criminal offence in terms of section 51 (1) (g) of this Act.

Signed at: Oaklands (Johannesburg) on this ___19th___ Day of July 2017

SIGNATURE

Director

CAPACITY OF SIGNATORY