APPENDIX E2 – Air Quality Impact Assessment

2026

Atmospheric Impact Report for the Proposed Mabasa Energy and Fuels 750 MW Combined Cycle Power Plant in Richards Bay



MABASA ENERGY AND FUELS (PTY) LTD

uMOYA-NILU

16 September 2026

Report Details

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EXECUTIVE SUMMARY

Following the promulgation of the Integrated Resource Plan 2019 (IRP 2019), the Minister of Mineral Resources and Energy determined that the procurement of New Generation Capacity is required to ensure energy security and that approximately 3000 MW of this capacity would be generated from gas. In response, the Department of Mineral Resources and Energy (DMRE) formally invited interested parties in December 2023, to register prospective bids under the first bid window of the Gas Independent Power Producers Procurement Programme (GASIPPPP Bid Window 1). In this respect, Mabasa Energy and Fuels (Pty) Ltd (hereafter referred to as Mabasa) intends to bid for the GASIPPPP and has proposed the development of a 750 MW Combined Cycle Power Plant (CCPP) in Richards Bay.

The combustion of gas for electricity generation is a Listed Activity (Sub-category 1.4) in terms of the National Environmental Management: Air Quality Act (NEM: AQA) (No. 39 of 2004). The minimum emissions standards for Sub-category 1.4 are listed in Table E-1. The air quality assessment supporting the application must therefore adhere to the regulated requirements of an Atmospheric Impact Report (AIR). Stack emissions resulting from the proposed Mabasa CCPP are listed in Table E-2.

Table E-1: Minimum Emission Standards for Category 1.4 Listed Activities according to GN 248 (DEA, 2010) and its revisions (DEA, 2013c, 2019)

Substance or mixture of substances		Minimum Emission Standards (mg/Nm^3) under normal conditions of 15% O_2, 273 Kelvin and 101.3 kPa. (Sub-category 1.4)
Common name	Chemical symbol	
Particulate matter	N/A	10
Sulphur dioxide	SO_2	400
Oxides of nitrogen [a]	NO_X	50

a: expressed as NO_2

Table E-2: Mabasa stack emission concentrations (mg/Nm^3) and emission rates (tonnes/annum)

Source name	MES	Emission rates			
		Gas Turbine 1 Stack	Gas Turbine 2 Stack	HRSG 1 Stack	HRSG 2 Stack
SO_2	400	5 900	5 900	7 195	7 195
NO_X	50	737.5	737.5	899.3	899.3
PM_{10}	10	147.5	147.5	179.9	179.9
CO*	N/A	303	303	303	303

* CO emission data provided by Technical Team

The CALPUFF dispersion model is used to predict ambient concentrations of SO_2, NO_2, PM_{10} and CO resulting from the proposed Mabasa CCPP emissions. Modelling is done according to the modelling regulations and 3-years of hourly surface and upper air meteorological data are used. To assess the potential impacts of the proposed Mabasa CCPP on ambient air quality, four operational scenarios are assessed quantitatively using dispersion modelling, i.e.:

- Scenario 1: Mabasa CCPP in simple cycle mode (using Combustion Turbines to generate 500 MW of electricity) and in isolation of other sources

- Scenario 2: Mabasa CCPP in combined-cycle mode (using Combustion Turbines and HRSGs to generate 750 MW of electricity) and in isolation of other sources
- Scenario 3: Cumulative - Mabasa CCPP in combined-cycle mode with the contribution of existing industrial sources
- Scenario 4: Cumulative - Mabasa CCPP in combined-cycle mode with the contribution of industrial sources and approved future facilities.

Three scenarios are assed qualitatively, i.e.:

- Emergency Shutdown
- Black-start scenario
- Backup diesel operation

For the Mabasa CCPP operating in Simple and Combined Cycle modes the maximum predicted annual SO_2, NO_2, PM_{10} and CO concentrations and the 99th percentile concentrations of the 24-hour, 8-hour and 1-hour predicted concentrations are very low relative to the National Ambient Air Quality Standards (NAAQS) (Table E-3). The predicted ambient concentrations for the Combined Cycle mode are slightly higher than for Simple Cycle mode. For the cumulative assessments, exceedances are predicted for the 99th percentile concentrations of the 24-hour, 8-hour and 1-hour predicted concentrations. Approved projects add slightly to the predicted ambient concentrations resulting from industry.

Table E-3: Maximum predicted ambient annual SO_2, NO_2, PM_{10} and CO concentrations in µg/m^3 and the predicted 99th percentile concentrations for 24-hour, 8-hour and 1-hour averaging periods, with the South African NAAQS

Description	Scenario	Pollutant and averaging period			
		SO_2			
		Annual	24-hour	8-hour	1-hour
Predicted maximum SO_2	Scenario 1	1.12	14.0	-	40.8
	Scenario 2	4.23	37.3	-	110
	Scenario 3	52.5	243	-	682
	Scenario 4	59.2	315	-	695
NAAQS		**50**	**125**	**-**	**350**
		NO_2			
Predicted maximum NO_2	Scenario 1	0.11	-	-	4.08
	Scenario 2	0.42	-	-	11
	Scenario 3	21.2	-	-	273
	Scenario 4	21.9	-	-	273
NAAQS		**40**	**-**	**-**	**200**
		PM_{10}			
Predicted maximum PM_{10}	Scenario 1	0.03	0.35		
	Scenario 2	0.11	0.93		
	Scenario 3	26.8	189		
	Scenario 4	27.2	189		
NAAQS		**40**	**75**		
		CO			
Predicted maximum CO	Scenario 1	-	-	1.51	3.09
	Scenario 2	-	-	4.64	3.26
	Scenario 3	-	-	**-**	**-**
	Scenario 4	-	-	**-**	**-**
NAAQS				**10 000**	**30 000**

The impact assessment was assessed for cumulative impacts of the proposed Mabasa CCPP with existing pollution sources. The following points are noteworthy:

- Monitoring data for 2021-2025 has shown that ambient SO_2 concentrations are low in Richards Bay, with occasional exceedances of the 1-hour NAAQS. The additive effect of the contribution of SO_2 from the proposed Mabasa CCPP is predicted to be very small and the potential increase in ambient SO_2 concentrations is highly unlikely to result in elevated concentrations or further exceedances of the NAAQS.
- Monitoring data for is not available for NO_2 in Richards Bay. Despite this, the additive effect of the contribution of NO_2 from the proposed Mabasa CCPP is predicted to be very small and the potential increase in ambient NO_2 concentrations is highly unlikely to result in elevated concentrations or further exceedances of the NAAQS.
- Monitoring data for 2021-2024 has shown that ambient PM_{10} concentrations are relatively high in Richards Bay because of high regional background concentrations, with one exceedance of the 24-hour NAAQS. The additive effect of the contribution of PM_{10} from the proposed Mabasa CCPP is predicted to be very small and the potential increase in ambient PM_{10} concentrations is highly unlikely to result in elevated concentrations or further exceedances of the NAAQS.
- Monitoring data is not available for CO in Richards Bay. Despite this, the additive effect of the contribution of CO from the proposed Mabasa CCPP is predicted to be very small and the potential increase in ambient CO concentrations is highly unlikely to result in elevated concentrations or further exceedances of the NAAQS.

Besides the proposed Mabasa CCPP Project, it is reasonable to expect that other power generation projects may operate in Richards Bay in the future. It is therefore relevant to assess the potential cumulative effects of such projects on ambient air quality in Richards Bay together with the proposed Mabasa CCPP Project. Six potential power generation projects have been identified for the assessment of these cumulative impacts:

- Elegant Afro Chemicals Chlor-Alkali Plant in the RBIDZ
- Eskom 3000 MW CCPP in the RBIDZ
- Nseleni Power Corporation Limited Floating CCPP in the Port of Richards Bay
- Nyanza Light Metals Titanium Dioxide Pigment Plant in the RBIDZ
- Phakwe Richards Bay Gas 3 CCPP in the RBIDZ
- Phinda Richards Bay 320 MW gas PP in Alton industrial

Dust emissions were not estimated for the construction and decommissioning/closure phase as they require specific information on the nature and duration of the activities as well as the equipment and vehicles. The assessment of air quality impacts during the construction and decommissioning/closure phase is therefore qualitative. The findings for both phases are similar.

- Dust generated in both phases are generally coarse and impacts manifest as a nuisance rather than a health issue.
- The magnitude of the impact is considered to be low.
- Activities are likely to endure for a maximum of 6-12 months and impacts may only occur during this period. The duration is therefore short-term.
- Dust emissions are released close to ground level with little or no buoyancy. This implies that their dispersion is limited, and the extent of potential impacts will be limited to the proposed site.
- There is a low probability of potential impacts occurring as a result of the activities.

- The significance of the impact for the construction and decommissioning/closure phase on air quality is low (negative).

A summary of the air quality impact assessment is presented in Table E-4 in terms of consequence, likelihood or probability and significance. Consequence is a function of the severity, duration, and spatial scale of an impact. The likelihood or probability of occurrence of the activity is based on frequencies of the activity and impact, whether the activity is governed by legislation and how easily it can be detected. The significance is a function of consequence and likelihood.

For Scenarios 1 and 2, emissions from the proposed Mabasa CCPP operating in Simple and Combined cycle modes predicted ambient SO_2, NO_2, PM_{10} and CO concentrations are low. The predicted ambient concentrations for the Combined Cycle mode are somewhat higher than for Simple Cycle mode. The associated impact for both scenarios is low.

For Scenarios 3, emissions from the proposed Mabasa CCPP operating in Combined Cycle mode with the contribution of other industries. This is a hypothetical case for two reasons. One, the suite of industries generally operates below the permitted maximum emissions, and two, it is unlikely, but not impossible, that the suite of industries simultaneously emits at the permitted maximum concentration. Using the permitted maximum emissions rather than actual emissions therefore present a possible worst-case scenario. The predicted ambient SO_2, NO_2 and PM_{10} concentrations exceed the NAAQS, and the cumulative assessments of other industries with the Mabasa CCPP is predicted to be medium. A medium rating is applied considering the hypothetical nature of the emissions used. Note that the relative contribution from the Mabasa CCPP to this scenario is low.

For Scenarios 4, emissions from the proposed Mabasa CCPP operating in Combined Cycle mode with the contribution of other industries and approved projects, the predicted ambient SO_2, NO_2 and PM_{10} concentrations exceed the NAAQS. This is also a hypothetical case for a few reasons. Firstly, the suite of industries generally operates below the permitted maximum emissions. Secondly, the approved projects are natural gas projects and will operate well below the MES for SO_2 and particulates due to the nature of natural gas. Lastly, but not impossible that the suite of industries simultaneously emits at the permitted maximum concentration. Using the permitted maximum emissions rather than actual emissions therefore present a possible worst-case scenario. The predicted ambient concentrations for Scenario 4 are somewhat higher than for Scenario 3. In other words, the collective of the approved projects has a relatively small additive effect to industries assessed. The cumulative assessments of other industries and approved projects with the Mabasa CCPP is predicted to be medium. A medium rating is applied considering the hypothetical nature of the emissions used. Note that the relative contribution from the Mabasa CCPP to this scenario is low.

Three additional operating scenarios were assessed qualitatively, namely emergency shutdown, black-start and backup diesel operation. These scenarios involve the use of ULSD for relatively short and infrequent periods, with backup diesel operation representing a contingency measure in the event of a natural gas supply interruption. While these scenarios would result in temporary atmospheric emissions, their infrequent occurrence and limited duration are expected to constrain their potential impact on ambient air quality. The associated air quality impacts are therefore considered to be of low significance.

Natural gas is clean fuel containing very low sulphur and has a very low particulate content. Air quality management interventions in the form of the control of emission have been considered in all aspects of design and operation for the Mabasa CCPP. Apart from Dry Low-NOx burners to control NO_X emissions, further emission reduction interventions are deemed to be unnecessary considering the low impact of the proposed project on air quality. From an air quality perspective, it is the reasonable opinion of the authors that the proposed Mabasa CCPP should be authorised considering the findings of this AIR.

The cumulative assessment of the Mabasa CCPP with other industrial sources and with future sources raises an important flag for air quality management in Richards Bay. These hypothetical assessments demonstrate that ambient air quality in Richards Bay can be significantly affected if the industrial facilities simultaneously operate at their maximum permitted emissions, or generate electricity with fuel other than Natural Gas.

Table E-4: Air quality impact scores

Description	Pollutants	Consequence	Likelihood	Significance
Construction Phase	Dust	5	13	Low (-65)
Scenario 1: Operation of Mabasa CCPP in Simple cycle mode	SO_2	7	13	Low (-91)
	NO_2	7	13	Low (-91)
	PM_{10}	7	13	Low (-91)
	CO	7	13	Low (-91)
Scenario 2: Operation of Mabasa CCPP in Combined cycle mode	SO_2	9	13	Low (-117)
	NO_2	7	13	Low (-91)
	PM_{10}	7	13	Low (-91)
	CO	7	13	Low (-91)
Scenario 3: Operation of Mabasa CCPP with existing sources (cumulative)	SO_2	15	13	Medium (-195)
	NO_2	15	13	Medium (-195)
	PM_{10}	15	13	Medium (-195)
Scenario 4: Operation of Mabasa CCPP with existing sources and future approved projects (cumulative)	SO_2	15	13	Medium (-195)
	NO_2	15	13	Medium (-195)
	PM_{10}	15	13	Medium (-195)
Emergency Shutdown	SO_2/NOx/PM_{10}/CO	5	10	Low (-50)
Black-start	SO_2/NOx/PM_{10}/CO	5	10	Low (-50)
Backup diesel operation	SO_2/NOx/PM_{10}/CO	7	10	Low (-70)
Decommissioning Phase	Dust	5	13	Low (– 65)

GLOSSARY OF TERMS AND ACRONYMS

AEL	Atmospheric Emission Licence
AIR	Atmospheric Impact Report
AQIA	Air Quality Impact Assessment
AQMP	Air Quality Management Plans
CCPP	Combined Cycle Power Plant
CO & CO_2	Carbon monoxide & Carbon dioxide
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
DMRE	Department of Mineral Resources and Energy
EA	Environmental Authorisation
ECO	Emission Control Officer
EIA	Environmental Impact Assessment
GASIPPPP	Gas Independent Power Producers Procurement Programme
g/s	Grams per second
IRP 2019	Integrated Resource Plan 2019
HRSG	Heat Recovery Steam Generator
KCDM	King Cetshwayo District Municipality
kPa	Kilo Pascal
LNG	Liquefied Natural Gas
MES	Minimum Emission Standards
mg/Nm^3	Milligrams per normal cubic meter refers to emission concentration, i.e. mass per volume at normal temperature and pressure, defined as air at 20°C (293.15 K) and 1 atm (101.325 kPa)
MW	Megawatt (1 MW = 1 million W)
NAAQS	National Ambient Air Quality Standards
NAEIS	National Atmospheric Emission Inventory System
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEM: AQA	National Environment Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NO_2 & NO_X	Nitrogen dioxide & Oxides of Nitrogen
PM	Particulate matter
PM_{10} & $PM_{2.5}$	Particulate matter, with diameter less than 10 µm & less than 2.5 µm
RBIDZ	Richards Bay Industrial Development Zone
SO_2	Sulphur dioxide
SAGERS	South African Greenhouse Gas Emission System
TNPA	Transnet National Ports Authority
ULM	Umhlatuze Local Municipality
USEPA	United States Environmental Protection Agency
µm	1 µm = Micro meter 1 µm = 10^{-6} m
WHO	World Health Organisation

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The Richards Bay Clean Air Association (RBCAA) and particularly Sandy Camminga are thanked for presenting our request emission information for the cumulative assessment to the members, and for providing the Atmospheric Emission Licenses (AEL) to us. The cooperation and contribution of the RBCAA members is acknowledged. These are: Mondi, Foskor, Richards Bay Minerals, Tongaat Hullet Felixton, MPACT, Transnet Port Terminals Richards Bay Coal Terminal and Grinrod.

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1. INTRODUCTION

Following the promulgation of the Integrated Resource Plan 2019 (IRP 2019), the Minister of Mineral Resources and Energy determined that the procurement of New Generation Capacity is required to ensure energy security and that approximately 3 000 MW of this capacity would be generated from gas. In response, in December 2023 the Department of Mineral Resources and Energy (DMRE) formally invited interested parties to register prospective bids under the first bid window of the Gas Independent Power Producers Procurement Programme (GASIPPPP Bid Window 1). In this respect, Mabasa Energy and Fuels (Pty) Ltd (hereafter referred to as Mabasa) intends to bid for the GASIPPPP and has proposed the development a 750 MW Combined Cycle Power Plant (CCPP) in Richards Bay.

The combustion of gas for electricity generation is a Listed Activity (Sub-category 1.4) in terms of the National Environmental Management: Air Quality Act (NEM: AQA) (No. 39 of 2004). Therefore, an Air Quality Impact Assessment (AQIA) is required as a component of the Environmental Authorisation (EA).

Mabasa appointed Nemai Consulting (Pty) Ltd (hereafter referred to as Nemai) to facilitate the EA process and to conduct an Environmental Impact Assessment (EIA) in terms of the National Environmental Management Act (NEMA). In turn, Nemai sub-contracted uMoya-NILU Consulting (Pty) Ltd to undertake the AQIA and to prepare an Atmospheric Impact Report (AIR). The NEMA EIA Regulations of 2014 (as amended) specify the information that must be contained in a specialist study report (Appendix 6 (1) of the Regulations). Table A-1 in Annexure 1 indicates where this information is included in the AIR. Furthermore, regulations prescribe the format and content of an AIR (DEA, 2013a).

2. ENTERPRISE DETAILS

2.1 Enterprise Details

The enterprise details for the proposed CCPP are listed in Table 2-1.

Table 2-1: Enterprise details

Entity Name:	Mabasa Energy and Fuels (Pty) Ltd
Trading as:	Mabasa Energy and Fuels
Type of Enterprise, e.g. Company/Close Corporation/Trust, etc.:	Company
Company/Close Corporation/Trust Registration Number (Registration Numbers if Joint Venture):	2017/049591/07
Registered Address:	ERF 16673 Phase 1F, 125 Alumina Street, Alton, Richards Bay, Kwa-Zulu Natal, 3900
Postal Address:	125 Alumina Allee, Richards Bay Industrial Development Zone, Alton, Richards Bay, KwaZulu Natal, South Africa, 3900
Telephone Number (General):	081 319 4285
Fax Number (General):	N/A
Company Website:	-

Industry Type/Nature of Trade:	Generation of electricity
Land Use Zoning as per Town Planning Scheme:	Industrial
Land Use Rights if outside Town Planning Scheme:	N/A
Responsible Person:	Bavumile Skhosana

2.2 Location and Extent of Development

The intended site for the proposed Mabasa 750 MW CCPP is located on Erf 16673 in Phase 1F of the Richards Bay Industrial Development Zone (RBIDZ), within the City of uMhlathuze Local Municipality and the King Cetshwayo District Municipality (KCDM) in KwaZulu Natal. The coordinates for the proposed site are 28°47'8.42"S and 32°1'54.45"E. Site information is listed in Table 2-2. The proposed location of proposed project site at the Richards Bay is shown in Figure 2-1 and Figure 2-2.

Table 2-2: Site information

Physical Address of the Licensed Premises:	ERF 16673 Phase 1F, 125 Alumina Street, Alton, Richards Bay, Kwa-Zulu Natal, 3900
Description of Site:	Phase 1F of the Richards Bay Industrial Development Zone (RBIDZ)
Property Registration Number (Surveyor-General Code):	Erf 16673 in Phase 1F of the RBIDZ
Coordinates (latitude, longitude) Centre of Operations (Decimal Degrees):	Decimal Degrees: Latitude: -28. 74607° Longitude: 32. 097266° DDMMSS: Latitude: 28°44'45.60" S Longitude: 32° 01'53.32" E
Coordinates (UTM) Centre of Operations (UTM 35S):	X: 405418 m E (Easting) Y: 6819793 m S (Northing)
Extent (km²):	To be confirmed
Elevation Above Mean Sea Level (m):	42 m
Province:	KwaZulu-Natal
District/Metropolitan Municipality:	King Cetshwayo District Municipality
Local Municipality:	City of uMhlathuze Local Municipality
Designated Priority Area (if applicable):	N/A



Figure 2-1: Proposed site for the CCPP in Richards Bay (Nemai Consulting, 2024)

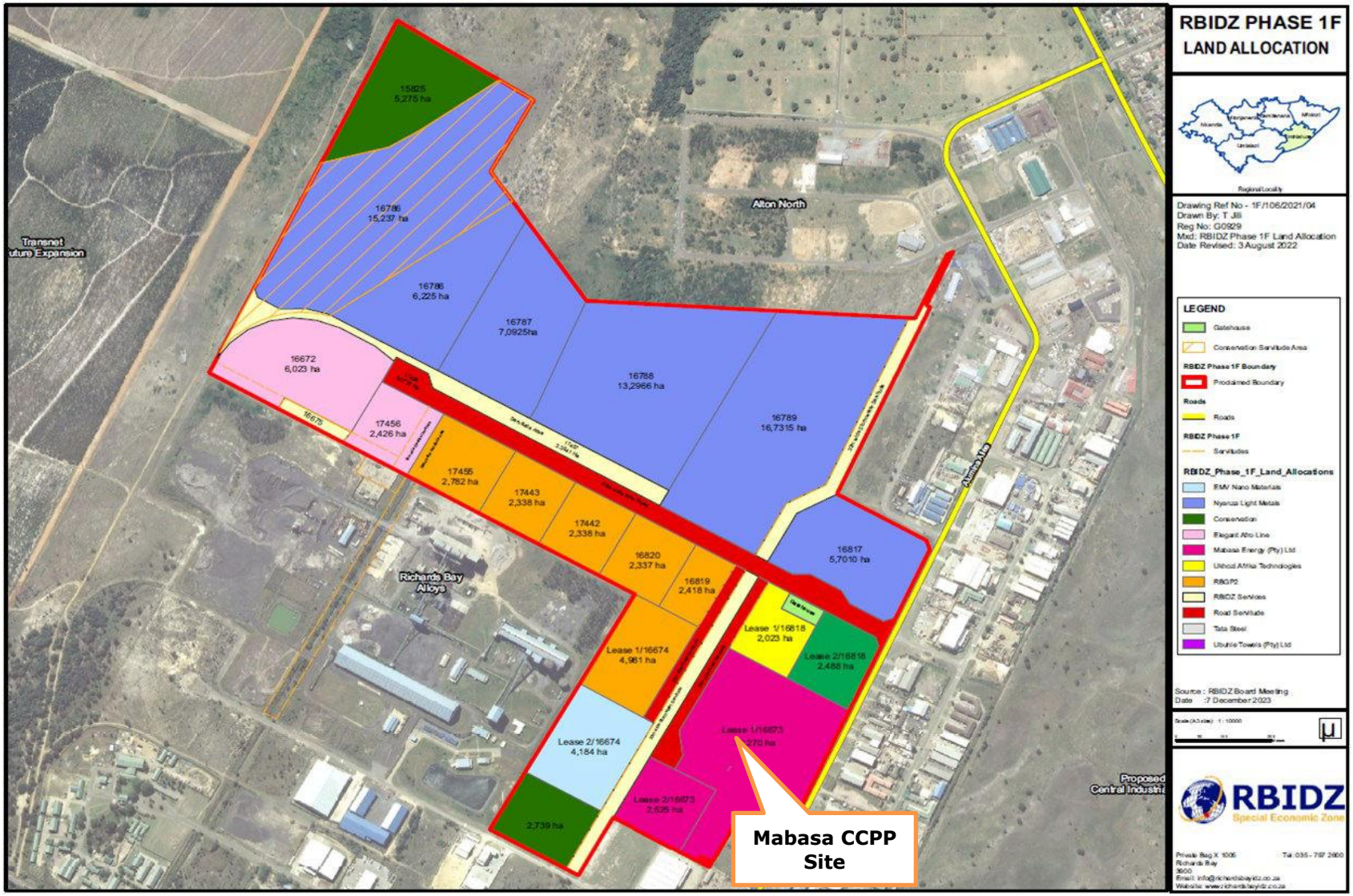


Figure 2-2: Location of the site in relation to the RBIDZ Phase 1 F (Nemai Consulting, 2024)

2.3 Key Components of the CCPP

The proposed site layout of the proposed Mabasa 750 MW CCPP is shown in Figure 2-3. The proposed project will comprise of the key components listed below:

* Two (2) Class F, heavy-duty combustion turbines and generators;
* Two (2) triple pressure, 3 drum, natural circulation Heat Recovery Steam Generators (HRSGs);
* One (1) condensing steam turbine and generator;
* One (1) de-aerating surface condenser;
* One (1) induced draft cooling tower;
* Balance of plant (BOP) equipment consisting of Pumps, Heat Exchangers, Transformers, Power Electrics, etc;
* One (1) integrated plant distribution control system; and
* 400 kV Switchyard comprising of three (3) x 15 kV to 400 kV step-up transformers and
* Two (2) auxiliary transformers (the rating to be defined during detailed design).

2.4 Description of Surrounding Land Use (within 5 km radius)

2.4.1 Description

The proposed Mabasa CCPP is located on Erf 16673 in Phase 1F of the Richards Bay Industrial Development Zone (RBIDZ). The position of the site within a 5 km zone is shown in Figure 2-4. The immediate surroundings up to 1.5 km from the CCPP are within the IDZ and occupied by industrial facilities.

The residential areas of Aquadene, Brakenham, Wind En Weide, Veld En Vlei and Birdswood are beyond the IDZ to the northeast and east of the proposed site and within 5 km. Beyond these residential areas and further east are forests and agricultural land. Arboretum and the Richards Bay CBD are to the southeast and also within 5 km of the proposed site. Alton, industrial facilities and the Port of Richards Bay are to the south of the site. West of the site beyond the RBIDZ includes surface water bodies, vacant land and agricultural areas.

2.4.2 Sensitive receptors

The US Environmental Protection Agency (2024)[1] recognise Sensitive Receptors as areas which include, but are not limited to, hospitals, schools, daycare facilities, elderly housing and convalescent facilities or specialised healthcare facilities. These are areas where the occupants are more susceptible to the adverse effects of exposure to toxic chemicals, pesticides and other pollutants.

The California Air Resources Board[2] identify Sensitive Receptors as children, elderly, asthmatics and others who are at a heightened risk of negative health outcomes due to exposure to air pollution. The locations of these receptors are considered sensitive receptor locations and include hospitals, schools and day care centers, and other such locations.

[1]https://www.epa.gov/newenglandhc/environmental-issues-concern-urban- communities-resources

[2]https://ww2.arb.ca.gov/capp-resource-center/community-assessment/sensitive-receptor-assessment

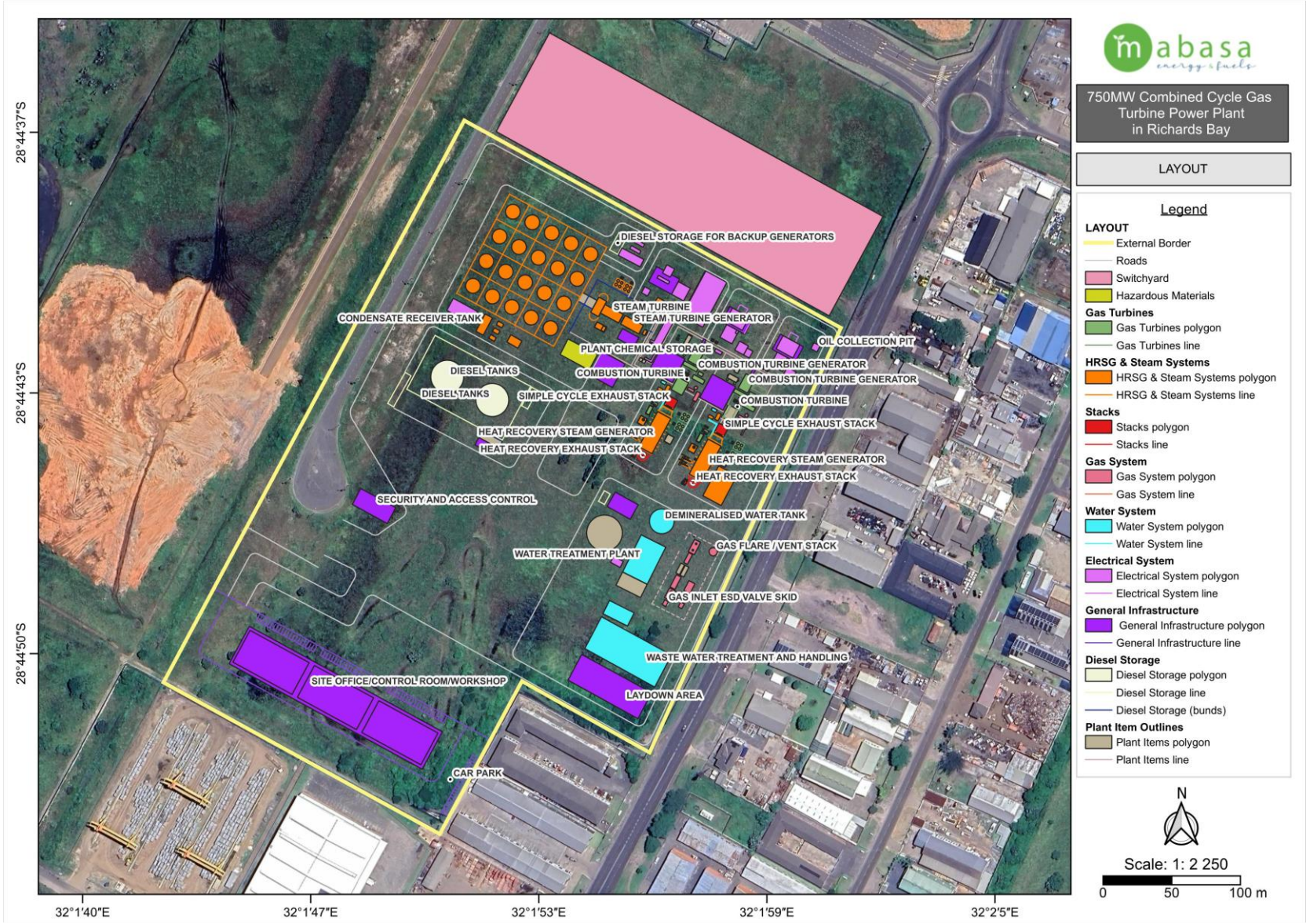


Figure 2-3: Proposed CCPP layout (Nemai Consulting, 2026)

2.4.3 Site sensitivity

The Site Sensitivity regarding air quality considers the existing state of air quality in Richards Bay and is based on the definition and understanding of sensitive receptors. Three sensitivity classes are defined for this Site Sensitivity assessment:

High sensitivity:	Hospitals, clinics, schools, daycare facilities and old age homes
Medium sensitivity:	Residential areas
Low sensitivity:	Commercial and industrial areas

For the Site Sensitivity assessment, receptors are assessed within a 5 km radius of the proposed Mabasa CCPP site, as indicated by the circle in Figure 2-4. Areas of high sensitivity include sensitive receptors as defined above, and up to 200 m around the respective receptors, indicated as red-shaded areas in Figure 2-4. Included are schools in, amongst others, Aquadene, Brakenham, Arboretum and Alton, and hospitals and clinics to the east of the proposed Mabasa CCPP site.

The areas of medium sensitivity are residential areas within the 5 km radius and are indicated in orange-shaded areas. These are generally east of the R619 and include Aquadene, Brakenham, Wild En Weide, Veldenvlei, Birdswood and Arboretum. Generally, people spend the majority of time in these areas.

Low sensitivity areas (blue-shaded areas) which are commercial and industrial areas i.e. non-residential are west of the R619 and include Atton; and south of the R34 including the Port of Richards Bay. Low sensitivity rating is assigned as generally less time is spent by individuals who include economically active adults. Open unoccupied areas such as forests, agricultural areas, water bodies etc. are excluded from the Site Sensitivity.

2.5 Emission Control Officer

The Mabasa Energy and Fuels CCPP Emission Control Officer (ECO) has not yet been appointed. Until then, the Chief Executive Officer (CEO) Bavumile Skhosana, (Tel: 081 319 4285) is the ECO

2.6 Atmospheric Emission License (AEL) and other Authorizations

An Atmospheric Emissions Licence (AEL) nor any other authorisations have been issued for the proposed Mabasa Energy and Fuels CCPP.

2.7 Modelling Contractor

The dispersion modelling for this AIR is conducted by:

Company:	uMoya-NILU Consulting (Pty) Ltd
Modellers:	Dr Mark Zunckel, Atham Raghunandan and Nopasika Xulu
Contact details:	Tel: 031 262 3265
	Cell: 083 690 2728
	email: mark@umoya-nilu.co.za or atham@umoya-nilu.co.za

See Annexure 2 for abridged CV's

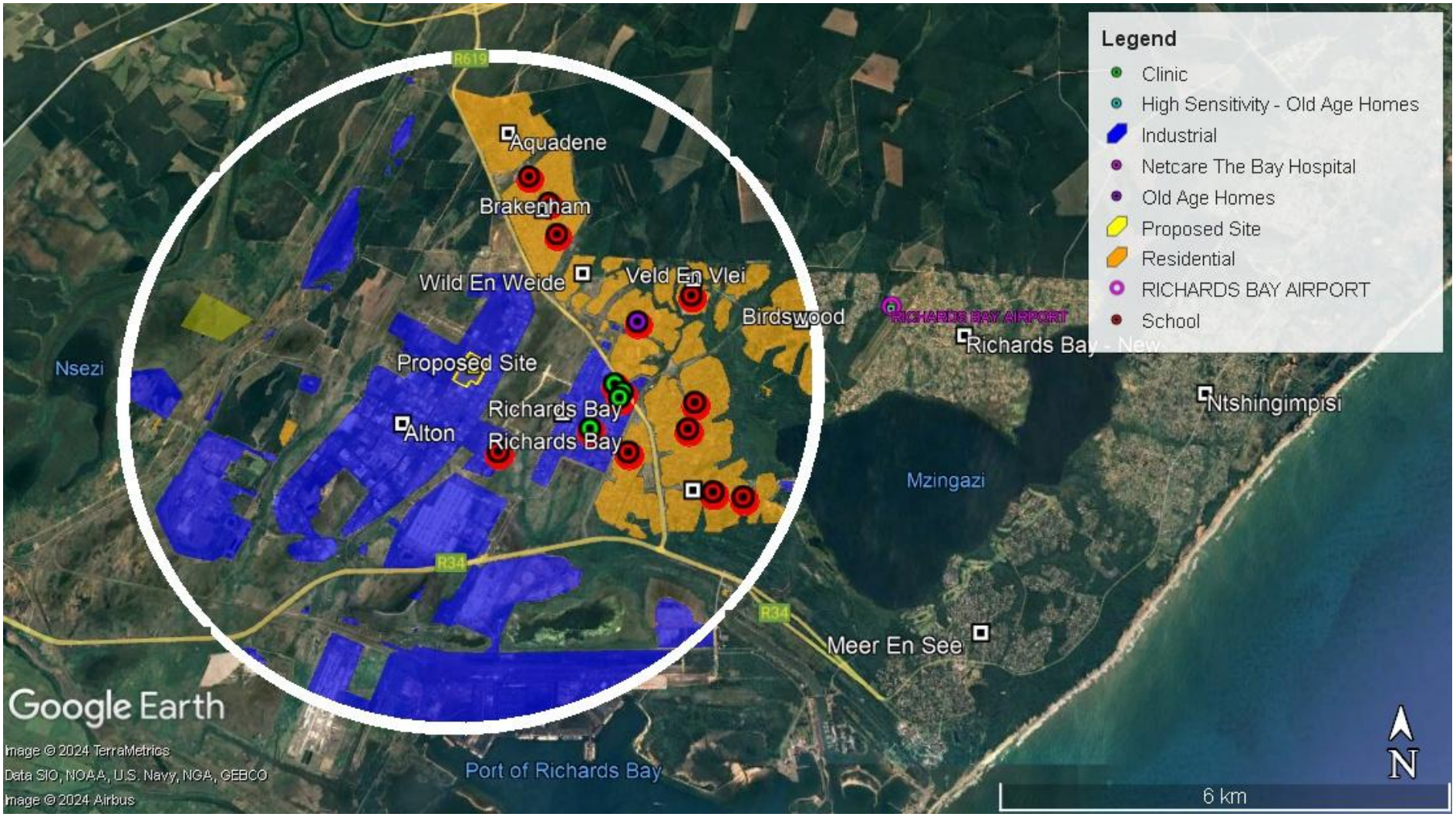


Figure 2-4: Relative location of the proposed Mabasa CCPP site in Richards Bay, sensitivity demarcation and a circle indicate a 5 km radius around the site (Google Earth, 2024)

2.8 Terms of Reference

The application for Environmental Authorisation for the proposed Mabasa CCPP requires the compilation of the AIR. To achieve this objective, the Terms of Reference are to:

i. Prepare a Site Sensitivity Verification report relating to air quality and based on findings of DFFE Screening Tool, to be incorporated into the Scoping Report. A site visit is required. Sensitive receptors will be identified, and available ambient air quality monitoring data will be used. [The proposed Mabasa site is currently undeveloped, and a physical site visit was not undertaken for the Air Quality Impact Assessment. The assessment was based on available project information, spatial data and ambient air quality monitoring data, with sensitive receptors identified within the assessment domain.]
ii. Prepare a Model Plan of Study report providing an overview of the air quality assessment approach, including inputs, modelling methodology and assessment methodology and submit to the Licensing Authority for approval. This is in accordance with to the DEA guideline for dispersion modelling. The Licensing Authority in the case of power generation is the National Air Quality Officer.
iii. Use available data and information to describe the current state of the receiving atmospheric environment in Richards Bay, including ambient air quality and meteorological data.
iv. Work with Mabasa Energy and Fuels and Nemai Consulting to characterise the atmospheric emissions resulting from construction and operations of the power plant, including particulate matter (PM_{10} and $PM_{2.5}$), sulphur dioxide (SO_2), oxides of nitrogen (NO_X), carbon monoxide (CO) and volatile organic compounds (VOC).
v. Predict ambient concentrations of the air pollutants resulting from the construction and operational phases of the power plant using the DEA recommended CALPUFF dispersion model and according to the DEA guideline for dispersion modelling[3].
vi. Assess the potential impact of the emissions of the CCT power plant on ambient air quality using the predicted (modelled) ambient concentrations and the health-based National Ambient Air Quality Standard (NAAQS).
vii. Predicted the cumulative effect of the air pollutants resulting from the operational phase of the power plant with the contribution of existing major industrial sources using the DEA recommended CALPUFF dispersion model and according to the DEA guideline for dispersion modelling[3].
viii. Assess quantitively the cumulative effect of the air pollutants resulting from the operational phase of the CCGT power plant with the contribution of existing major industrial sources and future (approved) gas-to-power projects in Richards Bay.
ix. Prepare and submitted the draft AIR to Nemai Consulting for review with Mabasa Energy and Fuels.
x. Respond to any comments that may be raised on the AIR during the S&EIR Process by authorities or Interested and Affected Parties.
xi. Finalise the AIR following comments received.

2.9 Assumptions

The following assumptions are relevant to this AIR:

* No ambient monitoring is done in this assessment, rather available ambient air quality data is used to describe the baseline conditions.
* The assessment of potential human health impacts is based on model predicted ambient concentrations of SO_2, NO_2, PM_{10} and CO and the health-based National Ambient Air Quality Standards (NAAQS).

3. NATURE OF THE PROCESS

3.1 Listed Activity or Activities

As a measure to reduce emissions from industrial sources and to improve ambient air quality, Listed Activities and associated Minimum Emission Standards (MES) were initially published in 2010 in Government Notice 248 (DEA, 2010) with the most recent revision applicable in 2019 (Government Notice 867, DEA, 2019).

Gaseous fuel combustion installations used primarily for steam raising or electricity generation as well as gas combustion (including gas turbines burning natural gas) used primarily for steam raising or electricity generation are Listed Activities. With a generation capacity exceeding 50 MW the details of the Listed Activities are shown in Table 3-1. The MES for Listed Activity Sub-categories is listed in Table 3-2.

Table 3-1: Details of the Listed Activity for the proposed Mabasa CCPP according to GN 248 (DEA, 2010) and its revisions (DEA, 2013c, 2019)

Category of Listed Activity	Sub-category of the Listed Activity and Description	Application of the Listed Activity
Category 1: Combustion Installations	Sub-category 1.4: Gas combustion (including gas turbines burning natural gas) used primarily for steam raising or electricity generation	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

Table 3-2: Minimum Emission Standards for Category 1 Listed Activities according to GN 248 (DEA, 2010) and its revisions (DEA, 2013c, 2019)

Substance or mixture of substances		Minimum Emission Standards (mg/Nm^3) under normal conditions of 15% O_2, 273 Kelvin and 101.3 kPa.
Common name	Chemical symbol	
1.4: Gas combustion installation		
Particulate matter	N/A	10
Sulphur dioxide	SO_2	400
Oxides of nitrogen	NO_X	50
a: expressed as NO_2		

3.2 Process Description

3.2.1 Liquefied natural gas (LNG)

Natural gas used for energy generation is primarily methane, with low concentrations of other hydrocarbons, water, carbon dioxide, nitrogen, oxygen and some sulphur compounds. Liquefied Natural Gas (LNG) is natural gas which has been cooled below its boiling point of minus 161 °C in a process known as liquefaction. The process of liquefaction involves extracting most of the impurities in raw natural gas. The remaining natural gas is primarily methane with only small amounts of other hydrocarbons and consequently is widely considered a clean fossil fuel.

3.2.2 Power generation

The Mabasa CCPP will be designed for base load operations at 500 MW in Simple Cycle and 750 MW in Combined Cycle on twenty-four hours a day, seven days a week basis. The scope of supply for the CCPP will be based on a combination comprising Two (2) Class F, heavy-duty combustion turbines and generators (the "Combustion Turbine") each with a dedicated HRSG to generate and supply steam to a shared steam turbine (the Combustion Turbine, HRSG and steam turbine together known as the "Power Plant"). Generators attached to each of the Combustion Turbines and steam turbines will supply electrical power to the grid.

The Combustion Turbine has two functions: i) to produce electrical power through the generator and ii) to supply hot gases to the HRSG. Ambient air is drawn into the compressor element of the Combustion Turbine through the air inlet filtration and silencing system. Fuel is fired in the combustion section, and the resulting hot exhaust gases then expand through the turbine element, spinning the rotor and generator connected directly to it via a reduction gearbox. The hot exhaust gases from the Combustion Turbine will pass through the HRSG, where the heat will be used to generate steam. The gases will then exhaust through the rear HRSG stack. A schematic of an operation of CCGT power plant is shown in Figure 3-1.

During maintenance or other shut-down of the proposed HRSG model, exhaust gases from the Combustion Turbine will be diverted through the front HRSG stack, preventing steam generation, but still enabling the Combustion Turbine to continue to generate power to the grid. The HRSG forms the link between the Combustion Turbine and the steam cycle. It is proposed that a horizontal gas flow type waste heat recovery boiler is used for ease of future access and maintenance.

The proposed HRSG model utilizes a two-stage high pressure and low-pressure steam design (subject to final engineering) with exhaust gases flowing through the HRSG. The steam generated in the HRSG is then distributed to the steam turbine. High-pressure steam is supplied directly to the steam turbine inlet. Low-pressure steam enters the steam turbine through a second admission steam pressure controller. The steam expands through the steam turbine sections causing the rotor to spin and generate electrical power through the generator connected directly to it via a gear box. The steam exits the steam turbine through an exhaust system connected to a condenser, where the steam is returned to a condensate / liquid state after being passed through a cooling water system. The Condensate is pumped from the condenser and returned to the HRSG where the steam generating cycle process starts again.

Emergency diesel generators are required in the event of grid failure or fault to safely shutdown the plant, or during maintenance on the electrical transformer equipment. In a typical emergency shutdown the generators will be required for up to 2 hours. Maintenance is likely to happen every three years. (Pers. Comm. Stephen Trickett, PDEX).

In the unlikely event of a complete grid black out, a so-called black-start would be required. Gas turbines have large electrical starting motors which are usually started using power from the grid. In the event of grid failure the black-start generator is required to provide the power to run the gas turbine starting motors and all necessary balance of plant equipment to support the start-up of the first gas turbine. Thereafter this gas turbine would provide the power to start up the rest of the power plant. The expected operation time of the black-start generator is between 30 and 60 minutes as gas turbines usually start in approximately 30 minutes. (Pers. Comm. Stephen Trickett, PDEX).

In the event of a failure or interruption of the natural gas supply, the gas turbines may operate on ultra-low sulphur diesel (ULSD) as a backup fuel. This scenario is distinct from the emergency shutdown and black-start scenarios, which involve the use of diesel generators to provide emergency or starting power. Under the backup diesel scenario, the gas turbines themselves would be operated on diesel fuel instead of the normal natural gas fuel. Provision has been made in the conceptual design for sufficient diesel storage to allow operation of the gas turbines for up to three days in the event of a gas supply failure or interruption, representing a worst-case contingency scenario. The requirement for backup diesel operation is expected to be highly infrequent, with an anticipated frequency of less than once per year. The likelihood of a prolonged gas supply interruption is considered low, particularly given that the Zululand Energy Terminal (ZET) LNG facility incorporates significant gas storage and is connected to the Lily pipeline. The actual risk of gas supply failure will, however, need to be evaluated in accordance with the final power purchase agreement (PPA) and associated gas supply arrangements. Given the available gas supply infrastructure and the low probability of a prolonged gas supply interruption, it is anticipated that backup diesel operation would rarely, if ever, be required.

There are no plans yet for on-site natural gas storage for reserve supply due to the proximity of the planned Transnet natural gas terminal at the Port of Richards Bay. The natural gas is expected to be supplied through a pipeline from the Transnet natural gas terminal to the Plant.

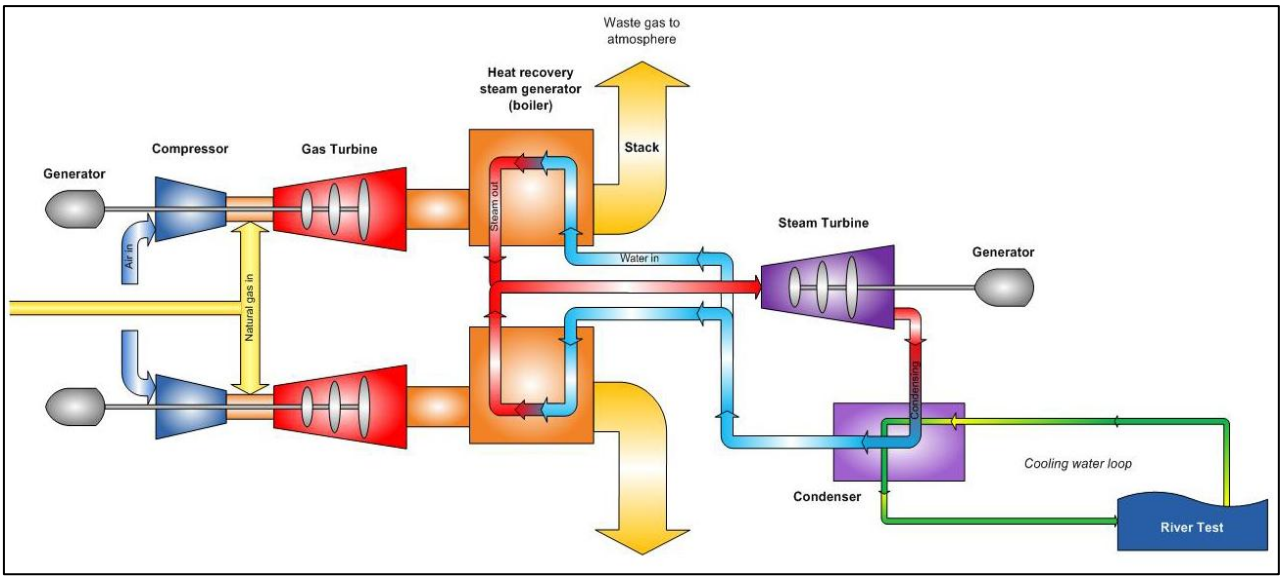


Figure 3-1: Mode of operation of CCGT power plants (https://www.marchwoodpower.com/ccgt/)

3.3 Air Pollutants Resulting from the Process

3.3.1 Overview

The quantity and nature of emissions to the atmosphere from LNG combustion depends on the quality of the fuel, fuel consumption, the combustion device, and the air pollution control devices.

The combustion of LNG results in gaseous emissions of sulphur dioxide (SO_2), oxides of nitrogen (NO + NO_2 = NO_X), carbon monoxide (CO), and some particulate matter (PM). SO_2 is produced from the combustion of sulphur in the LNG. NO_X is produced from thermal fixation of atmospheric nitrogen in the combustion flame and from oxidation of nitrogen bound in the LNG. The quantity of NO_x produced is directly proportional to the temperature of the flame. The non-combustible portion of the fuel remains as solid waste and emitted as PM.

Carbon dioxide (CO_2) is the main greenhouse gas resulting from LNG combustion. It is not considered in this AIR.

3.3.2 National ambient air quality standards

The effects of air pollutants on human health occur in different ways with short-term, or acute effects, and chronic, or long-term, effects. Different groups of people are affected differently, depending on their level of sensitivity, with the elderly and young children being more susceptible. Factors that link the concentration of an air pollutant to an observed health effect are the concentration and the duration of the exposure to that particular air pollutant.

Criteria pollutants occur ubiquitously in urban and industrial environments. Their effects on human health and the environment are well documented by the World Health Organisation

(WHO) (e.g. WHO, 1999; 2003; 2005). South Africa has accordingly established NAAQS for SO_2, NO_2, CO, and respirable particulate matter (PM_{10}), amongst others (DEA, 2009).
The NAAQS consists of a 'limit' value and a permitted frequency of exceedance. The limit value is the fixed concentration level aimed at reducing the harmful effects of a pollutant. The permitted frequency of exceedance represents the acceptable number of exceedances of the limit value expressed as the 99th percentile, referred to as the tolerance. Compliance with the ambient standard implies that the frequency of exceedance of the limit value does not exceed the permitted tolerance.

Being a health-based standard, ambient concentrations below the standard imply that air quality poses an acceptable risk to human health, while exposure to ambient concentrations above the standard implies that there is an unacceptable risk to human health. The NAAQS for SO_2, NO_2, PM_{10} and $PM_{2.5}$ are listed in Table 3-3.

Table 3-3: NAAQS for pollutants relevant to the Mabasa CCPP

Pollutant	Averaging period	Limit value (µg/m^3)	Tolerance
SO_2	1-hour	350	88
	24-hour	125	4
	Annual	50	0
NO_2	1-hour	200	88
	Annual	40	0
PM_{10}	24-hour	75	4
	Annual	40	0
$PM_{2.5}$	24-hour	40	4
	Annual	20	0
CO	1-hour	30 000	88
	8-hour running mean	10 000	11

CO_2 is a Greenhouse Gas and ambient air quality standards do not apply. However, it is a priority pollutant (DEA, 2016). Emissions must be accounted for and reported to the relevant Authorities.

3.3.3 Air pollutants and health implications

The path of exposure to air pollutants is inhalation, although some exposure may occur through dermal contact with surfaces where air pollutants settle. The sections below provide a short literature review of air pollutants from an air quality and human health perspective. Note that the text below is for general background information and is not related directly to the proposed Mabasa CCPP.

Sulphur dioxide

Dominant sources of SO_2 include fossil fuel combustion from industry and power plants. SO_2 is emitted when coal is burnt for energy. The combustion of fuel oil also results in high SO_2 emissions. Domestic coal or kerosene burning can thus also result in the release of SO_2. Motor vehicles also emit SO_2, in particular diesel vehicles due to the higher sulphur content of diesel fuel. Smelting of mineral ores can also result in the production of SO_2, because metals usually exist as sulphides within the ore.

On inhalation, most SO_2 only penetrates as far as the nose and throat, with minimal amounts reaching the lungs, unless the person is breathing heavily, breathing only through the mouth, or if the concentration of SO_2 is high (CCINFO, 1998). The acute response to SO_2 is rapid, within 10 minutes in people suffering from asthma (WHO, 2005). Effects such as a reduction in lung function, an increase in airway resistance, wheezing and shortness of breath, are enhanced by exercise that increases the volume of air inspired, as it allows SO_2 to penetrate further into the respiratory tract (WHO, 1999). SO_2 reacts with cell moisture in the respiratory system to form sulphuric acid. This can lead to impaired cell function and effects such as coughing, broncho-constriction, exacerbation of asthma and reduced lung function. For example, an exposure of 5 to 10 min to 200 to 300 ppb (520 to 780 µg/m^3) may reduce lung function (measured as Forced Expiratory Volume in the first second (FEV_1)) by more than 15% (US EPA, 2009).

Nitrogen dioxide

Nitrogen dioxide (NO_2) and nitric oxide (NO) are formed simultaneously in combustion processes and other high temperature operations such as metallurgical furnaces, blast furnaces, plasma furnaces, and kilns. NO_X is a term commonly used to refer to the combination of NO and NO_2. NO_X can also be released from nitric acid plants and other types of industrial processes involving the generation and/or use of nitric acid. NO_X also forms naturally through de-nitrification by anaerobic bacteria in soils and plants. Lightning is also a source of NO_X.

The route of exposure to NO_2 is inhalation and the seriousness of the effects depend more on the concentration than on the length of exposure. The site of deposition for NO_2 is the distal lung where NO_2 reacts with moisture in the fluids of the respiratory tract to form nitrous and nitric acids. About 80 to 90% of inhaled nitrogen dioxide is absorbed through the lungs (CCINFO, 1998). Nitrogen dioxide causes decrements in lung function, particularly increased airway resistance. Inflammatory reactions were observed at NO_2 concentrations between 200 and 1000 ppb (380 to 1880 µg/m^3) when individuals were exposed under controlled conditions for periods that varied between 15 minutes and six hours (WHO, 2013). However, the results had been inconsistent below 1000 ppb but were much more evident at concentrations higher than 1000 ppb (1880 µg/m^3) (WHO, 2013). Below 1000 ppb healthy individuals did not show inflammatory reactions and for those with respiratory diseases (asthma and chronic obstructive pulmonary disease), inflammation was not induced below 600 ppb, except for one study that reported individuals responded at 260 ppb (500 µg/m^3) (Hesterberg et al., 2009).

The WHO has reviewed studies published between 2004 and 2011 on adverse health effects after short-term and long-term exposure to NO_2 (WHO, 2013). The health effects from short-term exposure are more evident than from long-term (chronic) exposure, because in many studies a high correlation was found between NO_2 and other pollutants (WHO, 2013). However, some epidemiology studies suggested an association between NO_2 and respiratory mortality and an association with respiratory effects in children, including effects on children's lung function (WHO, 2013).

Particulate Matter

Particulate Matter (PM) is a broad term used to describe the fine particles found in the atmosphere, including soil dust, dirt, soot, smoke, pollen, ash, aerosols and liquid droplets. With PM, it is not just the chemical composition that is important but also the particle size.

Particle size has the greatest influence on the behaviour of PM in the atmosphere with smaller particles tending to have longer residence times than larger ones. PM is categorised, according to particle size, into TSP, PM_{10} and $PM_{2.5}$.

Total suspended particulates (TSP) consist of all particles smaller than 100 µm suspended within the air. TSP is useful for understanding nuisance effects of PM, e.g. settling on houses, deposition on and discolouration of buildings, and reduction in visibility.

PM_{10} describes all particulate matter in the atmosphere with a diameter equal to or less than 10 µm. Sometimes referred to simply as coarse particles, they are generally emitted from motor vehicles, factory and utility smokestacks, construction sites, tilled fields, unpaved roads, stone crushing, and burning of wood. Natural sources include sea spray, windblown dust and volcanoes. Coarse particles tend to have relatively short residence times as they settle out rapidly and PM_{10} is generally found relatively close to the source except in strong winds.

$PM_{2.5}$ describes all particulate matter in the atmosphere with a diameter equal to or less than 2.5 µm. They are often called fine particles, and are mostly related to combustion (motor vehicles, smelting, incinerators), rather than mechanical processes as is the case with PM_{10}. $PM_{2.5}$ may be suspended in the atmosphere for long periods and can be transported over large distances. Fine particles can form in the atmosphere in three ways: when particles form from the gas phase, when gas molecules aggregate or cluster together without the aid of an existing surface to form a new particle, or from reactions of gases to form vapours that nucleate to form particles.

Particulate matter may contain both organic and inorganic pollutants. The extent to which particulates are considered harmful depends on their chemical composition and size, e.g. particulates emitted from diesel vehicle exhausts mainly contain unburned fuel oil and hydrocarbons that are known to be carcinogenic. Very fine particulates pose the greatest health risk as they can penetrate deep into the lung, as opposed to larger particles that may be filtered out through the airways' natural mechanisms.

In normal nasal breathing, particles larger than 10 µm are typically removed from the air stream as it passes through the nose and upper respiratory airways, and particles between 3 µm and 10 µm are deposited on the mucociliary escalator in the upper airways. Particles in the range of 1 µm to 2 µm penetrate deeper where deposition in the alveoli of the lung can occur (WHO, 2003). Coarse particles (PM_{10} to $PM_{2.5}$) can accumulate in the respiratory system and aggravate health problems such as asthma. $PM_{2.5}$, which can penetrate deeply into the lungs, are more likely to contribute to the health effects (e.g. premature mortality and hospital admissions (WHO, 2003).

The WHO has reviewed many studies since 2005 to update information on health effects on PM (WHO, 2013). Studies have once again confirmed that PM (not only PM_{10} but fine and ultra-fine PM as well), has short and long-term (both immediate and delayed) adverse health effects such as cardiovascular effects, but new associations with diseases such as atherosclerosis (thickening of artery walls), birth defects and respiratory illness in children have also been found (WHO, 2013).

Carbon monoxide

CO is an odourless, colourless and toxic gas. People with pre-existing heart and respiratory conditions, blood disorders and anaemia are sensitive to the effects of CO. Health effects of CO are mainly experienced in the neurological system and the cardiovascular system (WHO, 1999). The binding of CO with hemoglobin reduces the oxygen-carrying capacity of the blood and impairs the release of oxygen from hemoglobin to extravascular tissues. These are the main causes of tissue hypoxia produced by CO at low exposure levels. The toxic effects of CO become evident in organs and tissues with high oxygen consumption such as the brain, the heart, exercising skeletal muscle and the developing fetus.

4. TECHNICAL INFORMATION

4.1 Raw Materials Used

The Mabasa CCPP will be designed for base load operations at 500 MW in Simple Cycle and 750 MW in Combined Cycle on twenty-four hours a day, seven days a week basis. As described in Section 3.2.2, generators attached to each of the Combustion Turbines and the HRSGs will supply electrical power to the grid.

The raw materials consumption rates, production rates and the energy consumption rates are listed in Table 4-1 to Table 4-3. No by-products will be produced.

Table 4-1: Raw material used by the proposed Mabasa CCPP

Material Type	Maximum consumption rate	Units
LNG	21383 TJ/annum (~410000 tpa) at 50% dispatch; ~42766 TJ/annum (~820000 tpa) at 100% dispatch, depending on the gas specification	tonnes/annum

Table 4-2: Production rate

Product	Maximum production rate	Units
Electricity: Simple cycle	500	MW
Electricity: Combined cycle	750	MW

Table 4-3: Energy sources used

Energy source	Sulphur content of fuel (%)	Ash content of fuel (%)	Maximum consumption rate	Units
LNG	To be confirmed	To be confirmed	21383 TJ/annum (~410000 tpa) at 50% dispatch; ~42766 TJ/annum (~820000 tpa) at 100% dispatch, depending on the gas specification	tonnes/annum
Electricity	N/A	N/A	6.6 GWh/annum at 100% dispatch; ~3.3 GWh/annum at 50% dispatch	GWh/annum

4.2 Appliances and Abatement Equipment Control Technology

LNG is regarded as one of the cleanest fossil fuels, with very low SO_2 and particulate emissions when combusted. These emissions are well below the respective MES (Table 3-2) therefore no emission abatement will be installed for the control or further reduction of SO_2 and particulate emissions. The quantity of NO_X produced is directly proportional to the temperature of the process. Dry Low-NOx burners will be installed on all stacks at the Mabasa Power Plant to control NO_X emissions (Table 4-4).

Table 4-4: Appliances and abatement equipment and control technology

Appliance Name	Appliance Type/Description	Appliance Function/Purpose
To be confirmed	Dry Low-NOx burners will be installed on all stacks at the power plant	Control of NO_X emissions

4.3 Unit Processes

The unit processes included at the proposed Mabasa CCPP will comprise the gas turbines and HRSG to generate electricity and supporting units. The unit processes are listed in Table 4-5.

Table 4-5: Unit processes for the Mabasa CCPP

Name of the Unit Process	Unit Process Function	Batch or Continuous
Two (2) Class F, heavy-duty combustion turbines and generators	Generation of electricity	Continuous
Two (2) triple pressure, 3 drum, natural circulation HRSGs	Generation of steam	Continuous
One (1) condensing steam turbine and generator	Generation of electricity	Continuous
One (1) de-aerating surface condense	Condensation of steam	Continuous
One (1) induced draft cooling tower	Cooling of steam	Continuous
Balance of plant (BOP) equipment consisting of Pumps, Heat Exchangers, Transformers, Power Electrics, etc.	Required to keep the plant running stably and efficiently.	Continuous

5. ATMOSPHERIC EMISSIONS

5.1 Point Source Parameters for the Mabasa CCPP

Stack parameters used in the dispersion modelling assessment

The proposed Mabasa CCPP will be located at approximately 28.746067° S and 32.097266° E in Phase 1F of the RBIDZ, at a base elevation of approximately 42 m. The facility will comprise two gas combustion turbines, each with a single stack, and two heat recovery steam generators (HRSGs), each with a single stack, resulting in a total of four stacks. The stack parameters used in the dispersion modelling assessment are presented in Table 5-1.

The stack height, stack diameter, exit velocity and exit temperature were provided by the Mabasa CCPP technical team and represented the best available information at the time the modelling was undertaken. The stack flow rates presented in Table 5-1 were calculated by the uMoya-NILU dispersion modelling team based on the provided stack parameters. The coordinates shown in Table 5-1 were based on the initial site layout provided by the Mabasa CCPP technical team and were therefore used in the dispersion modelling.

Table 5-1: Stack parameters used for the Mabasa CCPP dispersion modelling assessment

Source name	UTM Coordinates		Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Temp. (°C)	Stack Flowrate (Nm^3/hr)
	Lat	Lon					
Gas Turbine 1 Stack	405433.02	6819863.21	40	6.9	40	600	1 683 832
Gas Turbine 2 Stack	405469.65	6819843.53	40	6.9	40	600	1 683 832
HRSG 1 Stack	405453.41	6819901.07	65	6.3	25	100	2 053 370
HRSG 2 Stack	405490.08	6819881.43	65	6.3	25	100	2 053 370

Updated stack design parameters

Subsequent to completion of the dispersion modelling assessment, the stack design was refined and the site layout was finalised. The updated stack design parameters are presented in Table 5-2 (Nemai Consulting, 2026).

Table 5-2: Proposed stack dimensions (extracted from Nemai Consulting, 2026)

Stack parameters	Bypass Stack	Main Stack
Stack height (m) at top of stack	40±5	65±5
Stack diameter (m) approx.	6.9	6.991
Emission Exit Velocity (m/s)	41	17.7
Emission Exit Temperature (°C)	620	102

In Table 5-2, the Main Stack refers to the HRSG stacks, while the Bypass Stack refers to the Gas Turbine stacks.

Comparison with the modelling inputs

The updated stack design parameters were compared with those used in the dispersion modelling assessment. The comparison indicates that the stack heights are essentially unchanged (40 ± 5 m compared with 40 m for the bypass stacks, and 65 ± 5 m compared with 65 m for the main stacks). The bypass stack diameter remains unchanged at approximately 6.9 m, while the main stack diameter increases from 6.3 m to 6.991 m. The bypass stack exit velocity changes only marginally (40 m/s to 41 m/s), while the main stack exit velocity decreases from 25 m/s to 17.7 m/s. The exit temperatures change only slightly, from 600°C to 620°C for the bypass stacks and from 100°C to 102°C for the main stacks.

The final site layout indicates that the two Front Exhaust HRSGs (simple cycle exhaust stacks) are located approximately 85 m east-southeast of their original modelled positions, while the two Rear Exhaust HRSGs (heat recovery exhaust stacks) are located approximately 115 m south-southeast of their original modelled positions.

From an air quality and dispersion modelling perspective, the air quality specialist team considers the revised stack dimensions and the relatively small positional changes unlikely to have a significant influence on the predicted ambient air quality impacts. The changes are also not expected to materially alter the overall dispersion potential of the emissions, as the effective release characteristics remain broadly similar. The stacks remain within the site boundary, and the dispersion characteristics are expected to remain broadly similar.

Accordingly, the overall conclusions of the air quality impact assessment are expected to remain unchanged.

5.2 Point Source Maximum Emission Rates (Normal Operating Conditions)

The Mabasa CCPP will be required to comply with the MES for gas-fired power plants. For the purposes of the air dispersion assessment, emissions from the gas turbine and HRSG stacks (point sources) were modelled at the applicable MES concentration limits under normal operating conditions. The MES are the maximum permitted emissions. While MES for gas combustion apply, natural gas contains little sulphur and particulates. The actual SO_2 and particulate emissions resulting from natural gas combustion are therefore very low relative to the MES.

This assessment is based on the MES. It therefore represents a conservative (worst-case) assessment approach, as it assumes emissions occur at the maximum allowable concentration limits. The stack emission concentrations and the corresponding annual emission rates used in the dispersion modelling assessment are presented in Table 5-3.

Table 5-3: Minimum emission Standards (MES) for Sub-category 1.4, stack emission concentrations (mg/Nm^3) and emission rates (tonnes/annum)

Source name	MES	Emission rates			
		Gas Turbine 1 Stack	Gas Turbine 2 Stack	HRSG 1 Stack	HRSG 2 Stack
SO_2	400	5 900	5 900	7 195	7 195
NO_X	50	737.5	737.5	899.3	899.3
PM_{10}	10	147.5	147.5	179.9	179.9
CO	N/A	303	303	303	303

The annual emission rates presented in Table 5-3 were calculated assuming continuous operation (24 hours per day, 365 days per year). This represents a conservative assumption for dispersion modelling purposes. Actual operating hours are expected to vary depending on plant dispatch and operational requirements.

The SO_2 emission assessment is based on compliance with the applicable MES concentration limit. Because natural gas contains very little sulphur, gas-fired power plants typically emit low concentrations of SO_2, which are expected to be well below the applicable MES limit of 400 mg/Nm^3. Gas-fired combustion also produces very low particulate matter emissions, which are expected to remain well below the applicable PM MES limit under normal operating conditions.

NO_X emissions from the gas turbines were modelled at the applicable MES concentration limit of 50 mg/Nm^3. As NO_X is the principal combustion-related pollutant from gas-fired power

plants, modelling at the MES concentration represents a conservative assessment of the potential ambient air quality impacts under the prescribed regulatory compliance limit.

There is no applicable MES for CO under Sub-category 1.4; accordingly, N/A is indicated in Table 5-3. Although no MES has been established for CO, it was included in the dispersion modelling assessment because a NAAQS has been established for this pollutant. The maximum predicted CO concentrations for Scenario 1 and Scenario 2 are 3.09 µg/m^3 and 3.26 µg/m^3, respectively (see Table 6-9 in Section 6.3, Dispersion Modelling Results). Compared with the applicable CO NAAQS of 30 000 µg/m^3, these predicted ambient concentrations are substantially below the standard. Even if the modelled CO emissions were increased by a factor of four, the predicted ambient CO concentrations would still remain well below the NAAQS.

From a combustion turbine emissions perspective, the pollutant mass generated at a given load is expected to be essentially the same irrespective of whether the exhaust is discharged through the main stack or the bypass stack. However, for the purposes of the air dispersion assessment, emissions were modelled at the applicable MES concentrations in accordance with the regulatory assessment methodology. This approach is intended to assess the potential ambient air quality impacts associated with emissions at the prescribed compliance limits rather than the expected turbine emissions under normal operating conditions. The mass emission rates used in the model were calculated from the applicable MES concentration and the calculated normalised stack flow rate. Because the normalised flow rates differ between the Simple Cycle and Combined Cycle configurations, the resulting modelled emission rates (tonnes/annum) also differ, even though the underlying turbine emissions at a given load may be similar. The differences in modelled emission rates therefore reflect the application of the MES to different exhaust flow conditions rather than any change in the turbine combustion process itself.

5.3 Point Source Maximum Emission Rates (Start Up, Shut-Down, Upset and Maintenance Conditions)

Emission from start-up, shutdown and upset conditions depend on a wide variety of factors, including the generation technology, fuel consumption, and the frequency of events. Information is not available at this early stage, so the emission and emission profile have been excluded from this assessment.

During start-up and ramp-up to full power takes a maximum of 10 minutes. It is not possible with the available dispersion models to assess or predict ambient concentrations during the 10-minute start-up. Shutdown is instantaneous, equating to switching off the generator. Emissions to the atmosphere will stop immediately.

Planned maintenance will be done routinely, as per manufacturers specifications.

5.4 Fugitive Emissions

It is planned to bring LNG to the Mabasa CCPP via pipeline from the Transnet National Ports Authority (TNPA) LNG storage facility at the Port of Richards Bay. LNG will be fed directly into the process. There will be no handling and transfer of LNG. Fugitive emissions from natural gas equipment are not expected to be a significant source of emissions under normal operation.

5.5 Emergency Incidents

Emergency diesel generators are required in the event of grid failure or fault to safely shutdown the plant. In typical emergency shutdown the generators will be required for up to 2 hours.

6. IMPACT OF ENTERPRISE ON THE RECEIVING ENVIRONMENT

6.1 Baseline Conditions

6.1.1 Climate and meteorology

The Richards Bay climate is best described by the South African Weather Bureau (now South African Weather Service) long-term climate statistics (SAWB, 1992 and 1998). The Richards Bay region has a warm temperate climate, and the temperature range is not extreme, although high temperatures can occur during summer. Averages of daily minimum, maximum and mean temperatures, and average monthly rainfall are presented in Figure 6-1. The average summer maximums exceed 27 °C from December to March, when it is also very humid. Winters are mild with average minimum temperatures of 14 °C in June and July (SAWS, 1998). The average annual rainfall at Richards Bay is 1 212 mm (SAWB, 1992). The majority of rainfall occurs from late September to March and this period is usually associated with convective summer storms. The winter rainfall is not uncommon and associated with the passage of cold fronts.

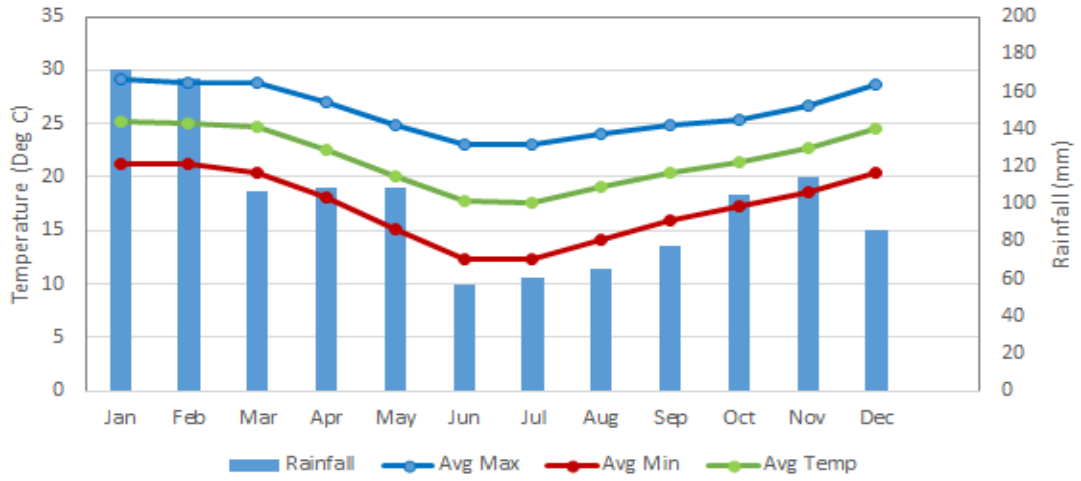


Figure 6-1: Average monthly maximum, minimum and daily temperature at Richards Bay (SAWB, 1992) and the average monthly rainfall (in mm) (SAWB, 1998)

The Richards Bay Clean Air Association (RBCAA) station at the Harbour West AQMS provides a good representation of the prevailing winds across the region. The windrose at the Harbour West for a 5-year period 1 January 2021 to 31 December 2025 is shown in Figure 6-2. Windroses simultaneously depict the frequency of occurrence of wind from the 16 cardinal wind directions and wind speed classes, for a single site. Wind direction is given as the direction from which the wind blows, i.e., south-westerly winds blow from the southwest.

Wind speed is given in meters per second (m/s), and each arc represents a percentage frequency of occurrence (2% in this case).

The predominant winds are associated with the Indian Ocean high pressure system and its seasonal movement relative to Richards Bay, with coastal lows and the passage of frontal systems having some influence. The winds are generally aligned with the coastline, and at the Harbour West AQMS, winds occur predominantly in the sector north-northeast to east-northeast (~36% of all winds) and in the sector west-southwest to southwest (~19% of all winds). While these winds are generally light to moderate, they are strong at times and exceed 8 m/s on occasions. These strong winds are usually associated with the passage of deep coastal lows ahead of cold frontal systems.

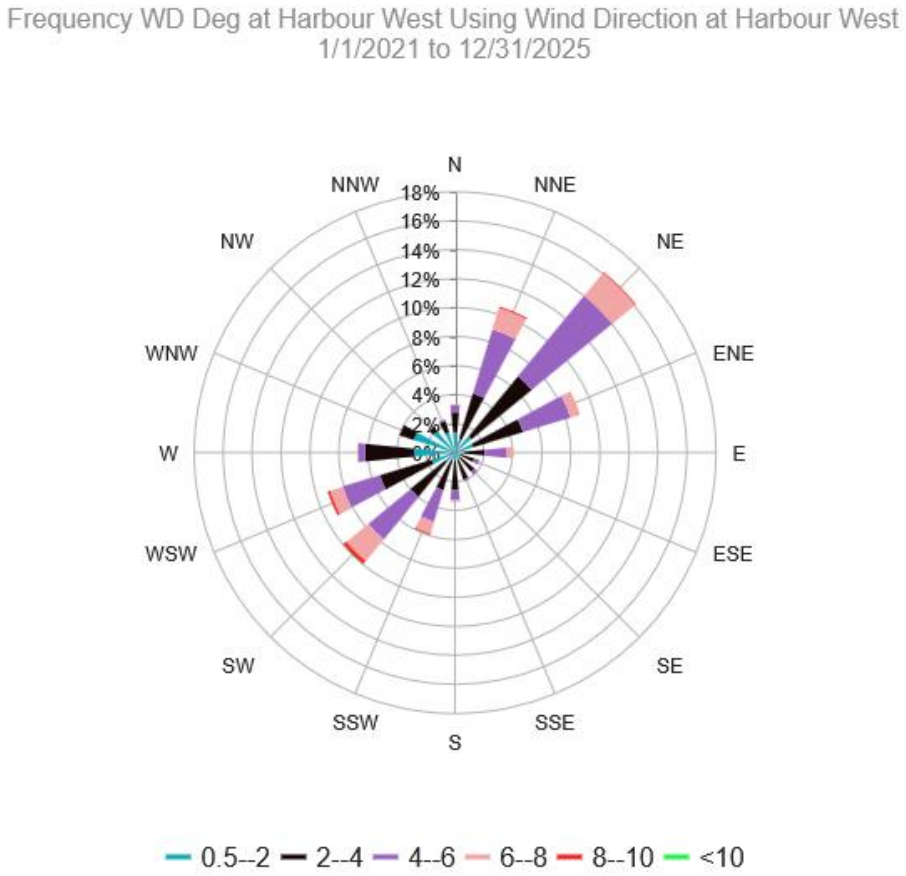


Figure 6-2: Annual wind rose for the Harbour West AQMS for 2021-2025 (RBCAA, 2026)

The poorest atmospheric dispersion conditions occur with inversion conditions and calm or light winds. Greater surface cooling in winter is conducive to the formation of surface temperature inversions and a shallow mixing layer, particularly at night. Pollutants that are released into the inversion layer are typically trapped between the surface and the top of the inversion. Under light wind conditions, pollutants will tend to accumulate. It is under these conditions for May to August when the highest ground level concentrations of pollutants may be expected in the area.

6.1.2 Ambient air quality

6.1.2.1 Long-term trends

The Richards Bay Clean Air Association (RBCAA, http://www.rbcaa.org.za/) has undertaken ambient air quality monitoring in the area since 2004, measuring SO_2 and PM_{10}. Okello et al. (2018) used the RBCAA data to describe air quality in the Richards Bay area over the period 2004 to 2017. Findings from this comprehensive analysis are highlighted here.

PM_{10} monitoring data indicates a downward trend at 4 stations (Brakenham, CBD, Esikhaleni and Felixton) (Figure 6-3). Mtunzini and St. Lucia, the reference sites, had upward trends. The CBD and Brakenham have higher PM_{10} values compared to the other stations. All measurements were within the stipulated NAAQS annual average limit of 50 µg/m^3.

Esikhaleni is a highly populated area with mostly low-income households and fewer industries compared to areas around the CBD. The source of PM_{10} are different and are likely to be indoor compared to outdoor. St. Lucia and Mtunzini were the reference site with PM_{10} levels averaging at 20.8 µg/m^3 and 22.3 µg/m^3 respectively. This is deemed to be a good indication of the background PM_{10} concentration of the whole study area as both sites are relatively unaffected by local sources. The background in both cases is above the WHO guideline value indicating the potential contribution of other sources such as pollen and sea salts.

SO_2 measurements in all seven monitoring stations where data was available was within the NAAQS of 50 µg/m^3 (Figure 6-4). Downward trends were observed in Arboretum, Brakenham, CBD and Felixton. Harbour West had no observable trend. Esikhaleni showed an upward trend although with ambient concentrations well below the annual limit value. Scorpio had the least favourable SO_2 trends attributable to their close vicinity to industry.

Data taken over the long term (1997 to 2017) for SO_2 indicate a slightly upward trend. From 2013 to 2017 however, a significant downward trend is observed. The Scorpio and Harbour West Stations have consistently been above the 20-year average. This can be attributed mostly to emissions from the surrounding industry. The CBD had SO_2 annual average ambient concentration just below the 20-year regional annual average. Measurement from residential areas such as Arboretum, Mthunzini and Esikhaleni showed low concentrations of SO_2.

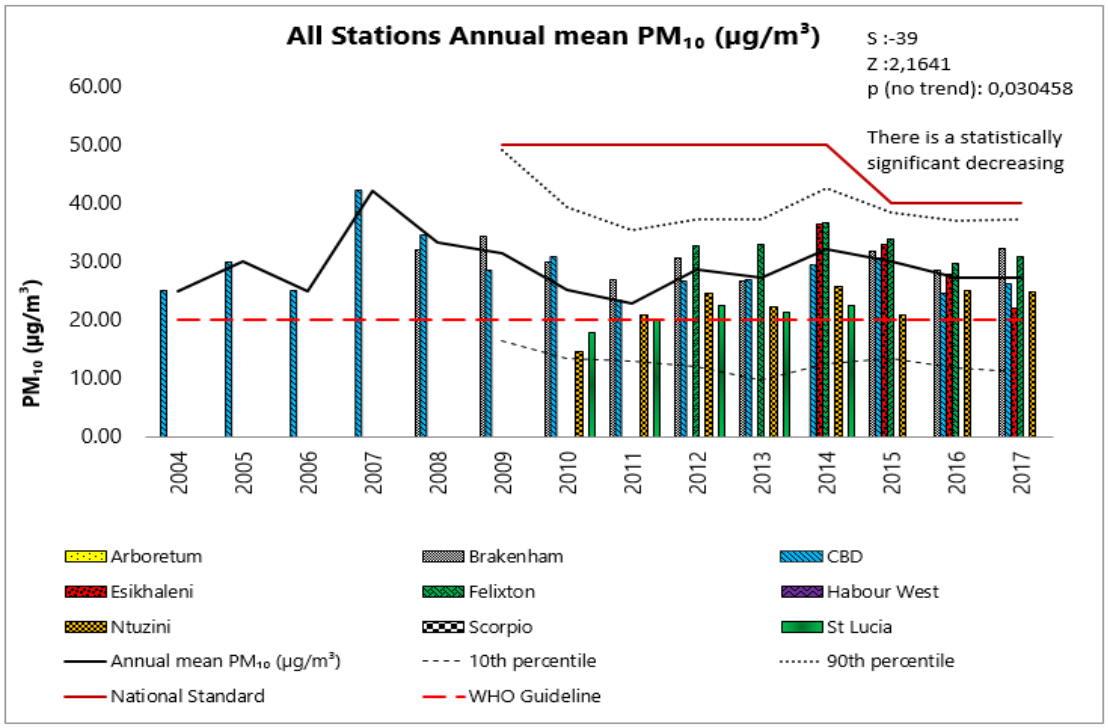


Figure 6-3: Annual average PM_{10} monitored concentrations (Okello et al., 2018)

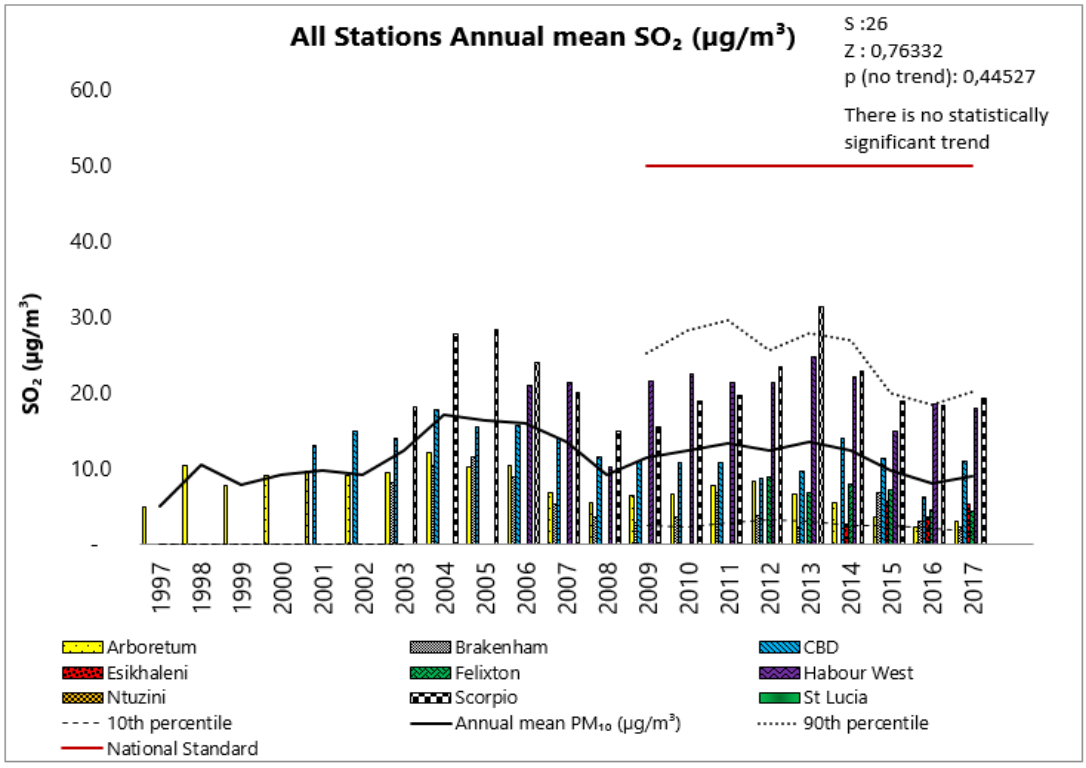


Figure 6-4: Annual average SO_2 monitored concentrations (Okello et al., 2018)

6.1.2.2 Ambient monitoring data from 2021-2025

Ambient air quality monitoring is undertaken in Richards Bay by the City of uMhlathuze and the RBCAA. Ambient air quality is generally influenced by a number of air pollution sources.

Some of the local air pollution sources within the study area include emissions from industrial activities, vehicles exhaust, dust from ore storage and handling, forest burning and coal dust from coal stockpiles. Numerous complaints have been reported between 2021-2023.

The City of uMhlathuze data capture percentages were generally found to not meet SANAS requirements for statistical purposes. This data was not used. Rather the baseline ambient air quality conditions for this assessment were evaluated using available data from selected Richards Bay Clean Air Association (RBCAA) air quality monitoring stations (AQMS) in the area. Ambient SO_2 data was downloaded from the RBCAA website (https://rbcaa.org.za/) for the Harbour West AQMS for 2021 to 2025 and PM_{10} and $PM_{2.5}$ at the Brakenham and CBD AQMS for 2021 to 2024. The Harbour West AQMS is located close to the proposed project site, the CBD AQMS is approximately 5 km north of the proposed project site and the Brackenham AQMS is approximately 6.6 km north of the study site.

Data capture at the respective AQMS for the assessment periods is relatively high (Table 6-1). It is considered representative for the baseline air quality conditions in the study area.

Table 6-1: Data Capture for data obtained from respective RBCAA AQMS

Pollutant	Data Capture (%)	Station
SO_2	97	Harbour
PM_{10}	86	CBD
$PM_{2.5}$	80	Brakenham

Sulphur dioxide (SO_2)

Ambient SO_2 concentrations may be attributed mostly to local industrial sources. The ambient SO_2 concentrations are relatively low and there is general compliance with the NAAQS. Despite this, exceedances of the 1-hour and 24-hour standard have been recorded.

The annual average SO_2 concentrations at the Harbour West AQMS were low and well below the SO_2 annual standard of 19 ppb in all years (Table 6-2).

Table 6-2: Annual average SO_2 concentrations at the Harbour West AQMS in ppb

Year	2021	2022	2023	2024	2025
Concentration	12.0	10.7	7.1	6.1	6.3

During the 5-year period, hourly average SO_2 concentrations at the Harbour West AQMS ranged between 0.003 ppb and 2 357.2 ppb (Figure 6-5), whereas daily average SO_2 concentrations ranged between 0.07 and 805.8 ppb (Figure 6-6). There were 53 exceedances of the hourly standard (134 ppb) in 2021, 66 exceedances in 2022, 3 exceedances in 2023 and 1 exceedance in 2024. There is no WHO ambient air quality guideline for 1-hr SO_2.

There were 4 exceedances of the daily standard (48 ppb) in 2021 and 10 exceedances in 2022 (Table 6-3). In terms of the South African NAAQS, 88 exceedances of the hourly limit are permitted, whereas 4 exceedances of daily limit are permitted within a calendar year. The more stringent WHO 24-hour guideline of 15.3 ppb was exceeded on 242 days in the 5-year period (Table 6-3).

Therefore, SO_2 levels measured at the Harbour West AQMS between 2021-2025 exceeded the daily air quality standard in 2021 and 2022. No exceedances of the SO_2 annual standard (19 ppb) were observed during the monitoring assessment period

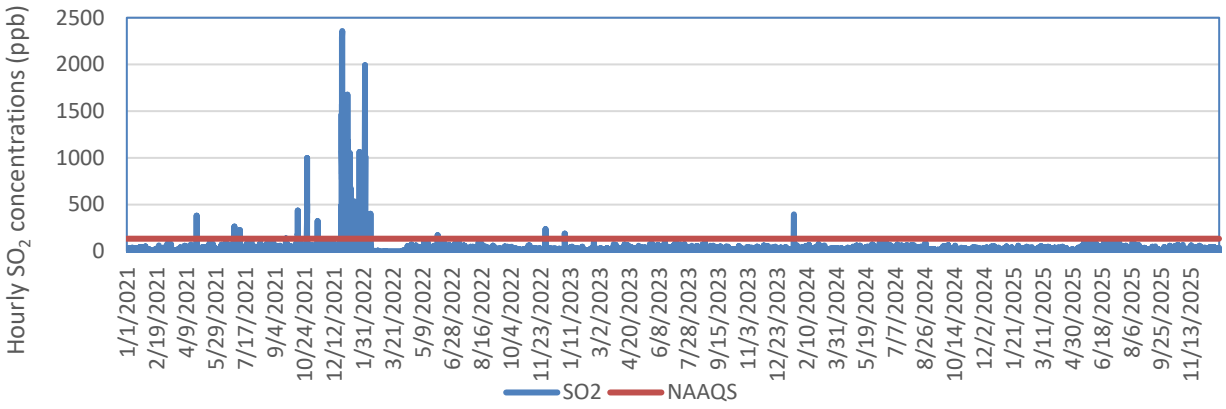


Figure 6-5: Hourly average SO_2 concentrations (ppb) measured at the Harbour West AQMS

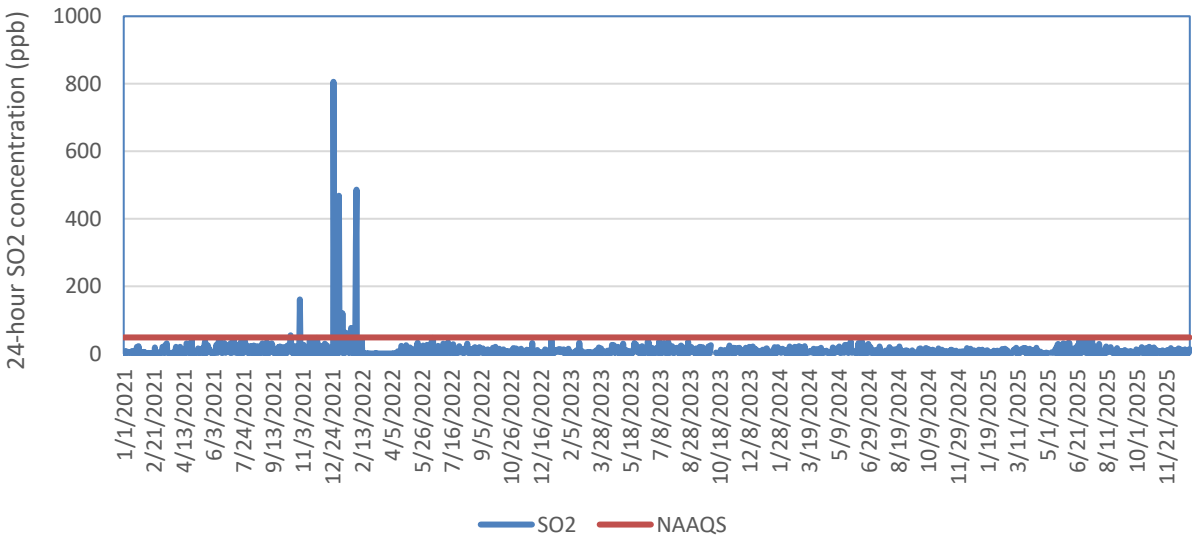


Figure 6-6: Daily average SO_2 concentrations (ppb) measured at the Harbour West AQMS

Table 6-3: Number of exceedances of daily standard/guidelines for SO_2

	2021	2022	2023	2024	2025
NAAQS	4	10	0	0	0
WHO	76	49	47	31	39

Particulate matter (PM_{10})

PM_{10} is a regional pollutant with a regional background concentration in Richards Bay of more than 20 µg/m^3 (Okello et al, 2018). Ambient PM_{10} concentrations may be attributed mostly to the high regional background with some contribution from local sources.

Annual average PM_{10} concentrations were below the annual standard of 40 µg/m³ (Table 6-4). The ambient PM_{10} concentrations are relatively low and there is general compliance with the NAAQS. The increase from 2022 to 2023, and from 2023 to 2024 is noteworthy. A continued increasing trend cannot be assessed without data in 2025. In 2023 and 2024 the annual average PM_{10} concentration was above the WHO annual ambient air quality guideline of 15 µg/m³.

Exceedances of the 24-hour standard have been recorded. Daily average PM_{10} concentrations at the CBD AQMS from January 2021 to October 2024 ranged between 1.99 µg/m³ and 123 µg/m³, with an average of 17 µg/m³. In 2024 five exceedances of the PM_{10} daily standard (75 µg/m³) were recorded (Figure 6-7). In terms of the South African NAAQS, 4 exceedances of the PM_{10} 24-hour standard are permitted within a calendar year. Therefore, PM_{10} concentrations measured in 2024 at the CBD AQMS exceeded the NAAQS, otherwise they complied. The stricter WHO 24-hour ambient air quality guideline of 45 µg/m³ was exceeded on 7 days in 2023 and on 30 days in 2024.

Table 6-4: Annual average PM_{10} concentrations at the CBD AQMS in µg/m³

Year	2021	2022	2023	2024
Concentration	12.5	10.5	18.6	26.4

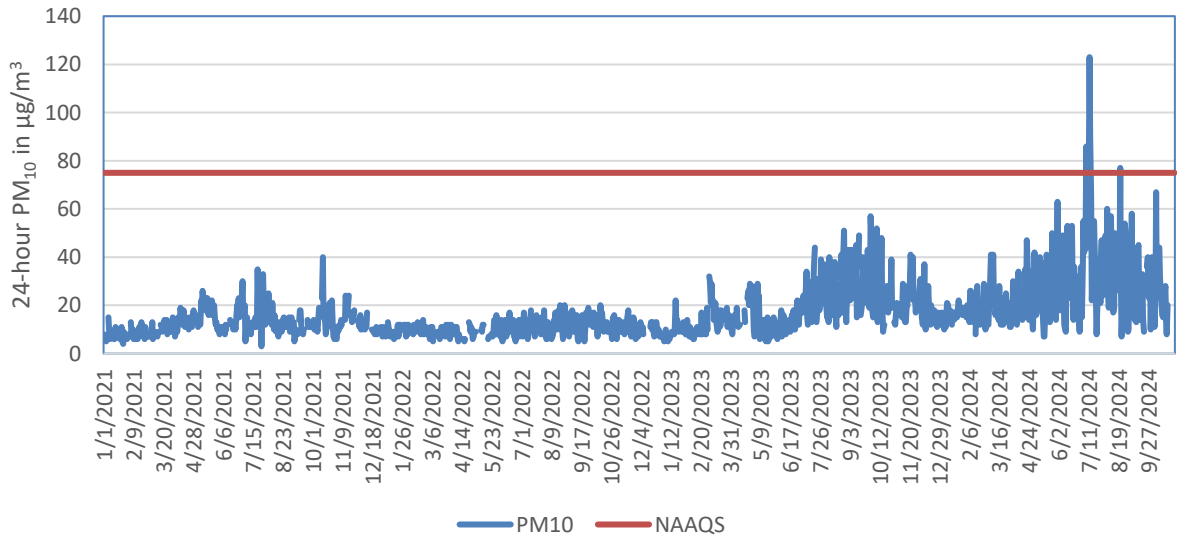


Figure 6-7: Daily average PM_{10} concentrations (µg/m³) measured at the CBD AQMS

Particulate matter ($PM_{2.5}$)

Annual average $PM_{2.5}$ concentrations were below the standard of 20 µg/m³ (Table 6-5). The ambient $PM_{2.5}$ concentrations are relatively low and there is general compliance with the NAAQS. The stricter WHO annual ambient air quality guideline of 5 µg/m³ was exceeded in all years.

Daily average $PM_{2.5}$ concentrations at the Brackenham AQMS range between 2 µg/m³ to 67 µg/m³, with an average of 13.0 µg/m³. A total of 8 exceedances of the $PM_{2.5}$ daily standard (i.e. 40 µg/m³) were observed during the 2021 to 2024 period, one each in 2022 and 2023, and six in 2024 (Figure 6-8). In terms of the South African NAAQS, 4 exceedances of the

$PM_{2.5}$ 24-hour standard are permitted within a calendar year. $PM_{2.5}$ concentrations measured at the Brackenham AQMS did not comply with the NAAQS in 2024. In the assessment period the stricter WHO 24-hour ambient air quality guideline of 15 µg/m^3 was exceeded on 75 days.

Table 6-5: Annual average $PM_{2.5}$ concentrations at Brackenham in µg/m^3

Year	2021	2022	2023	2024
Concentration	13.4	12.3	12.6	13.7

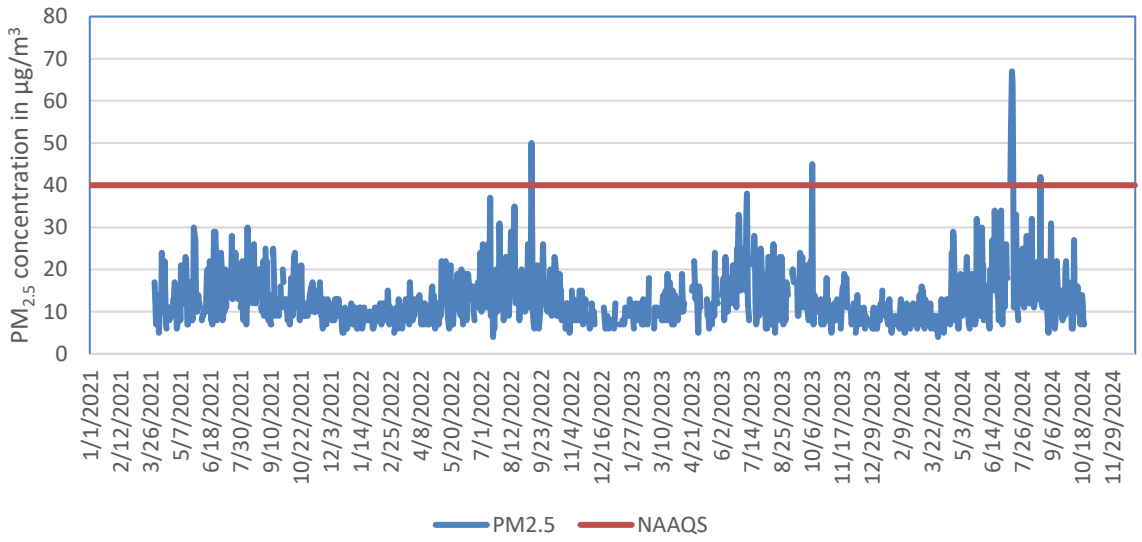


Figure 6-8: Daily average $PM_{2.5}$ concentrations (µg/m^3) measured at the Brackenham AQMS

Coal dust

A review of complaints listed in the RBCAA's monthly report for September 2022 (https://rbcaa.org.za/) highlights the negative impacts of coal dust on health and property in Arboretum, Alton, Birdswood, Veldenvlei, amongst others. There has been a significant demand internationally for coal which resulted in an increase in the amount of coal being brought to Richards Bay. It is stored and handled in open coal yards before being exported through the Port of Richards Bay. Fugitive emissions of coal dust from storage, handling and wind entrainment are sources of coal dust.

6.1.2.3 WSP Environment and Energy modelling study

WSP Environment and Energy conducted a dispersion modelling study in Richards Bay to assess the cumulative effects of industrial operations (WSP, 2015). The report is the most comprehensive modelling assessment for sources in Richards Bay. The study however has a number of notable shortcomings namely:

i) The emissions inventory was compiled in 2015 and includes emissions for 12 industrial sources.
ii) Emissions data was extracted from the various AELs and other reports (e.g. AQIAs) from 2012 to 2015, depending on applicability.
iii) Light industrial sources were excluded. Other notable exclusions were vehicle emissions and sugarcane burning.
iv) Three years of meteorological data was used, 2011 to 2013.
v) The emission profile in Richards Bay has changed since the modelling was done. Some industries have since closed and on 01 April 2020 all Listed Activities had to comply

with Minimum Emission Standards (MES) for new plants. Changes in emission as a result of the MES regulations are there not captured in the WSP modelling.

The results of the WSP study are however indicative of dispersion and ambient concentrations of SO_2, NO_2 and PM_{10} in 2015. Predicted annual SO_2 and NO_2 concentrations were well below the NAAQS of 50 µg/m^3 and 40 µg/m^3 respectively and the highest concentrations were predicted in the CDB, Alton and Brakenham. Predicted ambient PM_{10} concentrations exceeded the annual NAAQS of 40 µg/m^3 over parts of the Port of Richards Bay and adjacent areas and were attribute mainly to coal storage and handling.

6.2 Dispersion Modelling

6.2.1 Models used

A Level 3 air quality assessment must be conducted in situations where the purpose of the assessment requires a detailed understanding of the air quality impacts (time and space variation of concentrations) and when it is important to account for causality effects, calms, non-linear plume trajectories, spatial variations in turbulent mixing, multiple source types and chemical transformations (DEA, 2014b). A Level 3 assessment may be used in situations where there is a need to evaluate air quality consequences under a permitting or environmental assessment process for large industrial developments that have considerable social, economic and potential environmental consequences. Under these circumstances, the proposed Mabasa CCPP clearly demonstrates the need for a Level 3 assessment.

The CALPUFF suite of models are approved by the US EPA (http://www.src.com/calpuff/calpuff1.htm) and by the DEA for Level 3 assessments (DEA, 2014b). It consists of a meteorological pre-processor, CALMET, the dispersion model, CALPUFF, and the post-processor, CALPOST. It is an appropriate air dispersion model for the purpose of this assessment as it is well suited to simulate dispersion from several sources. It also has the capability to simulate dispersion in the atmosphere's complex land-sea interface. More information about the model can be found in the User's Guide for the CALPUFF Dispersion Model (US EPA, 1995).

The Air Pollution Model (TAPM) (Hurley, 2000; Hurley et al., 2001; Hurley et al., 2002) is used to model surface and upper air metrological data for the study domain. TAPM uses global gridded synoptic-scale meteorological data with observed surface data to simulate surface and upper air meteorology at given locations in the domain, taking the underlying topography and land cover into account. The global gridded data sets that are used are developed from surface and upper air data that are submitted routinely by all meteorological observing stations to the Global Telecommunication System of the World Meteorological Organisation. TAPM has been used successfully in Australia where it was developed (Hurley, 2000; Hurley et al., 2001; Hurley et al., 2002). It is an ideal tool for modelling applications where meteorological data does not adequately meet requirements for dispersion modelling. TAPM modelled output data is therefore used to augment the site-specific surface meteorological data for input to CALPUFF.

6.2.2 TAPM and CALPUFF parameterisation

The TAPM diagnostic meteorological model is used to generate a 3-dimensional temporally and spatially continuous meteorological field for 2021, 2022 and 2023 in hourly increments for the modelling domain.

TAPM is set-up in a nested configuration of three domains, centred on the Port of Richards Bay. The outer domain is 480 km by 480 km at a 24 km grid resolution, the middle domain is 240 km by 240 km at a 12 km grid resolution and the inner domain is 60 km by 60 km at a 3 km grid resolution (Figure 6-9). The nesting configuration ensures that topographical effects on meteorology are captured, and that meteorology is well resolved and characterised across the boundaries of the inner domain. Twenty-seven vertical levels are modelled in each nest from 10 m to 5 000 m, with a finer resolution in the lowest 1 000 m. The subset of the entire TAPM model output in the form of pre-processed gridded surface meteorological data fields is input into the dispersion model.

The 3-dimensional TAPM meteorological output on the inner grid includes hourly wind speed and direction, temperature, relative humidity, total solar radiation, net radiation, sensible heat flux, evaporative heat flux, convective velocity scale, precipitation, mixing height, friction velocity and Obukhov length. The spatially and temporally resolved TAPM surface and upper air meteorological data is used as input to the CALPUFF meteorological pre-processor, CALMET.

The CALPUFF modelling domain covers an area of 900 km^2, where the domain extends 30 km (west-east) by 30 km (north-south) (Figure 6-9). It consists of a uniformly spaced receptor grid with 0.25 km spacing, giving 14 400 grid cells (120 x 120 grid cells).

The topographical and land use for the respective modelling domains is obtained from the dataset accompanying the Commonwealth Scientific and Industrial Research Organisation (CSIRO) TAPM modelling package (CSIRO, 2008). This dataset includes global terrain elevation and land use classification data on a longitude/latitude grid at 30-second grid spacing from the US Geological Survey, Earth Resources Observation Systems (EROS) Data Center.

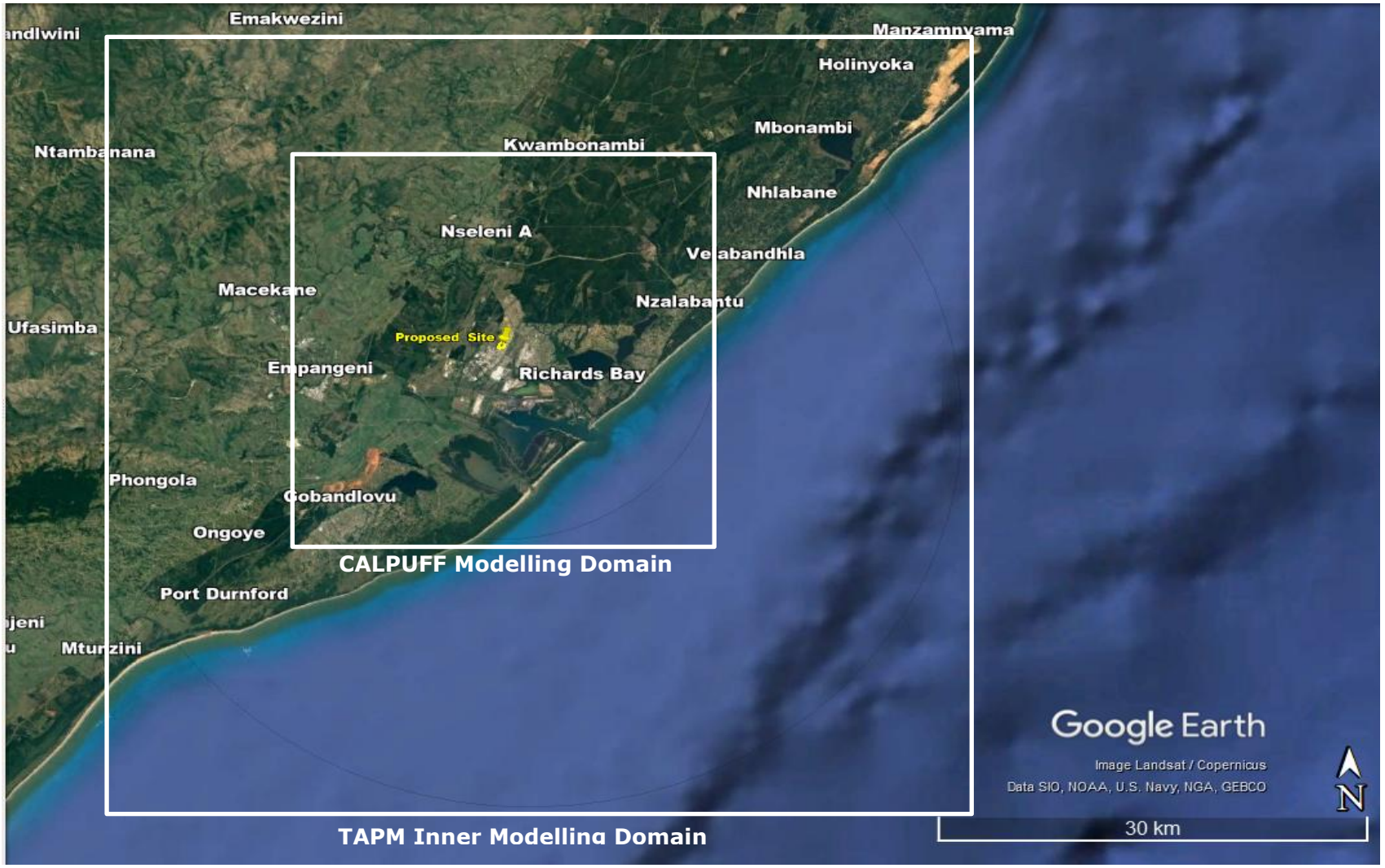


Figure 6-9: TAPM and CALPUFF modelling domains

The parameterisation of key variables that apply in CALMET and CALPUFF are indicated in Table 6-6 and Table 6-7 respectively.

Table 6-6: Parameterisation of key variables for CALMET

Parameter	Model value
12 vertical cell face heights (m)	0, 20, 40, 80, 160, 320, 640, 1000, 1500, 2000, 2500, 3000, 4000
Coriolis parameter (per second)	0.0001
Empirical constants for mixing height equation	Neutral, mechanical: 1.41 Convective: 0.15 Stable: 2400 Overwater, mechanical: 0.12
Minimum potential temperature lapse rate (K/m)	0.001
Depth of layer above convective mixing height through which lapse rate is computed (m)	200
Wind field model	Diagnostic wind module
Surface wind extrapolation	Similarity theory
Restrictions on extrapolation of surface data	No extrapolation as modelled upper air data field is applied
Radius of influence of terrain features (km)	5
Radius of influence of surface stations (km)	Not used as continuous surface data field is applied

Table 6-7: Parameterisation of key variables for CALPUFF

Parameter	Model value
Chemical transformation	Default NO_2 conversion factor is applied
Wind speed profile	Rural
Calm conditions	Wind speed < 0.5 m/s
Plume rise	Transitional plume rise, stack tip downwash, and partial plume penetration is modelled
Dispersion	CALPUFF used in PUFF mode
Dispersion option	Pasquil-Gifford coefficients are used for rural and McElroy-Pooler coefficients are used for urban
Terrain adjustment method	Partial plume path adjustment

6.2.3 *Model accuracy*

Air quality models attempt to predict ambient concentrations based on "known" or measured parameters, such as wind speed, temperature profiles, solar radiation and emissions. There are, however, variations in the parameters that are not measured, the so-called "unknown" parameters as well as unresolved details of atmospheric turbulent flow. Variations in these "unknown" parameters can result in deviations of the predicted concentrations of the same event, even though the "known" parameters are fixed.

There are also "reducible" uncertainties that result from inaccuracies in the model, errors in input values and errors in the measured concentrations. These might include poor quality or

unrepresentative meteorological, geophysical and source emission data, errors in the measured concentrations that are used to compare with model predictions and inadequate model physics and formulation used to predict the concentrations. "Reducible" uncertainties can be controlled or minimised. This is done by using accurate input data, preparing the input files correctly, checking and re-checking for errors, correcting for odd model behaviour, ensuring that the errors in the measured data are minimised and applying appropriate model physics.

Models recommended in the DEA dispersion modelling guideline (DEA, 2014b) have been evaluated using a range of modelling test kits (http://www.epa.gov./scram001). CALPUFF is one of the models that have been evaluated and it is therefore not mandatory to perform any modelling evaluations. Rather the accuracy of the modelling in this assessment is enhanced by every effort to minimise the "reducible" uncertainties in input data and model parameterisation.

6.2.4 Assessment scenarios

To assess the potential impacts of the proposed Mabasa CCPP on ambient air quality, four operational scenarios are assessed quantitatively using dispersion modelling. These are:

- Scenario 1: Mabasa CCPP in simple cycle mode (using Combustion Turbines to generate 500 MW of electricity) and in isolation of other sources
- Scenario 2: Mabasa CCPP in combined-cycle mode (using Combustion Turbines and HRSGs to generate 750 MW of electricity) and in isolation of other sources
- Scenario 3: Cumulative - Mabasa CCPP in combined-cycle mode with the contribution of existing industrial sources
- Scenario 4: Cumulative - Mabasa CCPP in combined-cycle mode with the contribution of industrial sources and approved future facilities.

Three scenarios are assed qualitatively. These are:

- Emergency Shutdown
- Black-start scenario
- Backup diesel operation

6.2.4.1 Scenario 1

Assessment of the ambient concentration resulting from emissions from the Mabasa CCPP operating in simple cycle mode provides an understanding of the potential impact of the CCPP in isolation using only the gas generators to generate 500 MW. The assessment is based on the stack parameters and MES and are presented in Table 5-1 and Table 5-3.

6.2.4.2 Scenario 2

Assessment of the ambient concentration resulting from emissions from the Mabasa CCPP operating in combined-cycle mode provides an understanding of the potential impact of the CCPP in isolation using only the gas generators to generate 750 MW. The assessment is based on the stack parameters and MES and are presented in Table 5-1 and Table 5-3.

6.2.4.3 Scenario 3

Assessment of the ambient concentration resulting from emissions from the Mabasa CCPP operating in combined-cycle mode with stack emissions of SO_2, NO_X and PM from existing major industrial sources in Richards. In this scenario, the maximum permitted emission concentrations are used to provide an understanding of the potential cumulative impact of these sources. It also provides an understanding of the additive effect of the CCPP to ambient concentrations when generating 750 MW to the ambient concentrations.

This is a hypothetical case for two reasons. One, the suite of industries generally operates below the permitted maximum emissions, and two, it is unlikely, but not impossible, that the suite of industries simultaneously emits at the permitted maximum concentration. Using the permitted maximum emissions rather than actual emissions therefore present a possible worst-case scenario.

For this scenario, the maximum permitted emission concentrations for SO_2, NO_X and PM for the point sources (stacks) included in the respective industry AELs are used. The industries are:

- Mondi
- Foskor
- Richards Bay Minerals
- Tongaat Hullet Felixton
- Transnet Port Terminals
- South 32 stack data was extracted from the Cumulative Air Pollution Dispersion Modelling Assessment – Richards Bay (WSP, 2016). For consistency in the methodology MES for Listed Activity 4.3: Primary Aluminium Production were used.
- MPACT is regulated as a Controlled Emitted. Stack parameters were extracted from the 2023 stack emission testing report. For consistency in the methodology the emission standards for solid fuel fired small boilers were used.

For the purpose of confidentiality, the information contained in the AELs for these sources are not presented in this report.

Note that emission rates for the area source at facilities with AELs for the bulk storage and handling of coal and ore are not specified in the AELs. Emissions resulting from these facilities are not estimated in this assessment for the cumulative assessment. These are Transnet Port Terminals, Grinrod (Kusasa and Sea Munya Terminals) and the Richards Bay Coal Terminals.

While this cumulative modelling exercise provides valuable insights, it must be remembered that the emission inventory that is used does not include all possible sources affecting ambient air quality in Richards Bay. Notable omissions are emissions from other industrial sources, from motor vehicles and shipping, from the handling and storage of coal and other ores, and those from agricultural burning.

6.2.4.4 Scenario 4

Scenario 4 concerns the assessment of recently approve applications for the establishment and operation of industrial facilities in Richards Bay. When in operation in the future, emissions from these facilities will add to ambient concentrations. In the light of the Mabasa CCPP application it is pertinent to assess the collective effect that emissions will have on future air quality in Richards Bay.

To this end, proposed stack parameters and emission rates for SO_2, NO_X and PM for the following approved applications are used in the dispersion modelling for Scenario 4, details are included in Table 6-8.

- Elegant Afro Chemicals Chlor-Alkali Plant in the RBIDZ
- Eskom 3000 MW CCPP in the RBIDZ
- Nseleni Power Corporation Limited Floating CCPP in the Port of Richards Bay
- Nyanza Light Metals Titanium Dioxide Pigment Plant in the RBIDZ
- Phakwe Richards Bay Gas 3 CCPP in the RBIDZ
- Phinda Richards Bay 320 MW gas PP in Alton industrial

Again this is a hypothetical case for a few reasons. Firstly, the suite of industries generally operates below the permitted maximum emissions. Secondly, the approved projects are natural gas projects and will operate well below the MES for SO_2 and particulates due to the nature of natural gas. Lastly, but not impossible that the suite of industries simultaneously emits at the permitted maximum concentration. Using the permitted maximum emissions rather than actual emissions therefore present a possible worst-case scenario.

6.2.4.5 Emergency shutdown

Emergency shutdowns will only happen in the event of a grid failure or fault and are needed to safely shutdown the plant, or during maintenance when the Emergency Generators could be run whilst work is carried out on the electrical transformer equipment. The Emergency Generators use Ultra-Low Sulphur Diesel (ULSD).

The expected duration of a typical emergency shutdown event is up to 2 hours. Maintenance requirements are likely to happen every three years and could take up to a week to complete.

6.2.4.6 Black-start

Gas turbines have large electrical starting motors which are usually started using back-feed power from the grid. In the event of grid failure the Black Start generator would be required to provide the power to run the gas turbine starting motors and all necessary balance of plant equipment to support the start-up of the first gas turbine. Thereafter this gas turbine would provide the power to start up the rest of the power plant. As such a diesel generator of approximately 20 MW is required to provide power to start the first gas turbine.

The frequency of such an event is very unlikely and would require a complete grid blackout.

6.2.4.7 Backup diesel operation

In the event of a failure or interruption of the natural gas supply, the gas turbines may operate on ultra-low sulphur diesel (ULSD) as a backup fuel. This scenario is distinct from the emergency shutdown and black-start scenarios, which involve the use of diesel generators to provide emergency or starting power. Under the backup diesel scenario, the gas turbines themselves would be operated on diesel fuel instead of the normal natural gas fuel. Provision has been made in the conceptual design for sufficient diesel storage to allow operation of the gas turbines for up to three days in the event of a gas supply failure or interruption, representing a worst-case contingency scenario. The requirement for backup diesel operation is expected to be highly infrequent, with an anticipated frequency of less than once per year. The likelihood of a prolonged gas supply interruption is considered low, particularly given that the Zululand Energy Terminal (ZET) LNG facility incorporates significant gas storage and is connected to the Lily pipeline. The actual risk of gas supply failure will, however, need to be evaluated in accordance with the final power purchase agreement (PPA) and associated gas supply arrangements. Given the available gas supply infrastructure and the low probability of a prolonged gas supply interruption, it is anticipated that backup diesel operation would rarely, if ever, be required.

Table 6-8: Stack and emission parameters for the approved future project in Richards Bay, extracted from the respective AIRs

Project name	Source	Lat S	Lon E	Height of release (m)	Diameter (m)	Temp (°C)	Flow (m^3/s)	Vel (m/s)	Emission Rate (g/s)		
									PM	SO_2	NOx
Chlor-alkali	HCl stack	28.738458	32.022492	16.50	0.08	40.00	58.00	3.20	0.00	0.00	0.00
	Cl_2 stack	28.738458	32.022492	6.10	0.15	40.00	860.00	13.50	0.00	0.00	0.00
	H_2 stack	28.738458	32.022492	19.00	0.15	40.00	580.00	9.00	0.00	0.00	0.00
	Boiler stack	28.738458	32.022492	15.00	0.50	193.00	4.43	6.30	0.0123	0.1230	0.0012
Eskom CCPP	Main 1	28.760800	31.987350	60.00	9.00	99.00	4 850 442	20.00	9.34	373.77	46.72
	Main 2	28.768410	31.987180	60.00	9.00	99.00	4 850 442	20.00	9.34	373.77	46.72
	Main 3	28.769060	31.986840	60.00	9.00	99.00	4 850 442	20.00	9.34	373.77	46.72
	Main 4	28.769410	31.986650	60.00	9.00	99.00	4 850 442	20.00	9.34	373.77	46.72
	Main 5	28.770010	31.986210	60.00	9.00	99.00	4 850 442	20.00	9.34	373.77	46.72
	Main 6	28.770040	31.986120	60.00	9.00	99.00	4 850 442	20.00	9.34	373.77	46.72
	Main 7	28.771150	31.985760	60.00	9.00	99.00	4 850 442	20.00	9.34	373.77	46.72
	Main 8	28.771230	31.985210	60.00	9.00	99.00	4 850 442	20.00	9.34	373.77	46.72
Nseleni Floating PP	Turbine 1	28.801730	32.043190	45.00	7.50	260.00	7 952 156	50.00	11.7	469.3	58.7
	Turbine 2	28.801850	32.044210	45.00	7.50	260.00	7 952 156	50.00	11.7	469.3	58.7
	Turbine 3	28.802000	32.043600	45.00	7.50	260.00	7 952 156	50.00	11.7	469.3	58.7
	Turbine 4	28.802040	32.047280	45.00	7.50	260.00	7 952 156	50.00	11.7	469.3	58.7
	Turbine 5	28.802020	32.048050	45.00	7.50	260.00	7 952 156	50.00	11.7	469.3	58.7
	Turbine 6	28.802030	32.049140	45.00	7.50	260.00	7 952 156	50.00	11.7	469.3	58.7
	Turbine 7	28.802040	32.049970	45.00	7.50	260.00	7 952 156	50.00	11.7	469.3	58.7
	Turbine 8	28.802070	32.040980	45.00	7.50	260.00	7 952 156	50.00	11.7	469.3	58.7
	Turbine 9	28.800420	32.049350	45.00	7.50	260.00	7 952 156	50.00	11.7	469.3	58.7
	Turbine 10	28.800810	32.040230	45.00	7.50	260.00	7 952 156	50.00	11.7	469.3	58.7
	Turbine 11	28.801180	32.041200	45.00	7.50	260.00	7 952 156	50.00	11.7	469.3	58.7
	Turbine 12	28.801470	32.042210	45.00	7.50	260.00	7 952 156	50.00	11.7	469.3	58.7

Nyanza Light Metals	Feedstock drier	28.737598	32.027215	14.00	1.20	150.15	33 629	4.20	0.15	0.00	0.00
	Feedstock Mill	28.737770	32.027326	30.50	0.90	80.15	108 000	14.40	0.29	0.00	0.00
	Digester reactor	28.738380	32.026777	23.30	1.60	60.15	720	3.50	0.22	0.20	0.00
	TiCl4 scrubber	28.738050	32.027333	15.00	0.20	30.15	15 000	3.50	0.00	0.00	0.00
	Nuclei scrubber	28.739689	32.029315	25.00	0.20	30.15	427	3.50	0.00	0.00	0.00
	Calciner scrubber	28.738279	32.029134	25.00	2.80	70.15	2 731	4.90	0.00	9.63	0.00
	Spin drier	28.739742	32.030503	23.50	0.60	150.15	1 800	14.70	0.05	1.34	1.34
	Microniser baghouse	28.739906	32.030655	13.00	0.25	100.15	0.76	15.50	0.02	0.00	0.00
	WAN reactor	28.739907	32.030829	15.00	0.40	50.15	0.50	4.00	0.00	0.00	0.00
	Sulphuric acid plant	28.737207	32.025529	40.00	1.40	70.15	80 500	14.50	0.00	0.72	0.72
	Lime kiln	28.737017	32.029278	36.00	0.85	150.15	0.69	1.22	0.14	0.00	0.00
	Lime baghouse	28.737118	32.029482	20.00	0.85	125.15	1.67	2.94	0.07	0.00	0.00
	Boiler stack	28.737231	32.026378	38.00	1.30	180.00	12.57	16.00	0.13	0.44	0.00
Phakwe G2P	GT1 stack	28.741703	32.028852	60.00	9.00	84.00	3 857 551	16.80	8.21	0.01	41.06
	GT2 stack	28.743287	32.029562	60.00	9.00	84.00	3 857 551	16.80	8.21	0.01	41.06
Phinda 320MW	GT1 stack	28.766032	32.010914	20.00	4.00	452.00	1 016 105	22.50	2.33	93.32	11.66
	GT2 stack	28.766035	32.011273	20.00	4.00	452.00	1 016 105	22.50	2.33	93.32	11.66
	GT3 stack	28.766036	32.011990	20.00	4.00	452.00	1 016 105	22.50	2.33	93.32	11.66
	GT3 stack	28.766402	32.011990	20.00	4.00	452.00	1 016 105	22.50	2.33	93.32	11.66
	GT5 stack	28.766429	32.122348	20.00	4.00	452.00	1 016 105	22.50	2.33	93.32	11.66
	Regas boiler 1	28.765450	32.011116	12.00	1.00	220.00	1 016 105	15.00	0.23	0.07	-
	Regas boiler 2	28.765546	32.012400	12.00	1.00	220.00	1 016 105	15.00	0.23	0.07	-
	WWTP boiler 1	28.765681	32.012395	12.00	0.70	140.00	1 016 105	10.00	0.004	0.00035	0.123
	WWTP boiler 2	28.765727	32.012391	12.00	0.70	140.00	1 016 105	10.00	0.004	0.00035	0.123

6.3 Dispersion Modelling Results

The dispersion modelling results are presented in the following sections for the 4 scenarios listed above for SO_2, NO_2, PM_{10} and CO. Firstly, the maximum predicted ambient concentrations are presented in Section 6.3.1. Discussion of the model output is then provided in Section 6.3.2 with the dispersion modelling results presented as isopleth maps. An isopleth is a line on a map of equal concentration.

6.3.1 Maximum predicted ambient concentrations

The maximum predicted annual SO_2, NO_2, PM_{10} and CO concentrations and the 99th percentile of the 24-hour, 8-hour and 1-hour predicted concentrations are listed in Table 6-9. The respective NAAQS are included in Table 6-9.

Table 6-9: Maximum predicted ambient annual SO_2, NO_2, PM_{10} and CO concentrations in µg/m^3 and the predicted 99th percentile concentrations for 24-hour, 8-hour and 1-hour averaging periods, with the South African NAAQS

Description	Scenario	Pollutant and averaging period			
		SO_2			
		Annual	24-hour	8-hour	1-hour
Predicted maximum SO_2	Scenario 1	1.12	14.0	-	40.8
	Scenario 2	4.23	37.3	-	110
	Scenario 3	52.5	243	-	682
	Scenario 4	59.2	315	-	695
NAAQS		**50**	**125**	**-**	**350**
		NO_2			
Predicted maximum NO_2	Scenario 1	0.11	-	-	4.08
	Scenario 2	0.42	-	-	11
	Scenario 3	21.2	-	-	273
	Scenario 4	21.9	-	-	273
NAAQS		**40**	**-**	**-**	**200**
		PM_{10}			
Predicted maximum PM_{10}	Scenario 1	0.03	0.35		
	Scenario 2	0.11	0.93		
	Scenario 3	26.8	189		
	Scenario 4	27.2	189		
NAAQS		**40**	**75**		
		CO			
Predicted maximum CO	Scenario 1	-	-	1.51	3.09
	Scenario 2	-	-	4.64	3.26
	Scenario 3	-	-	**-**	**-**
	Scenario 4	-	-	**-**	**-**
NAAQS				**10 000**	**30 000**

It will have been noted that the MES for Scenario 1 and Scenario 2 are the same (Table 5-3), i.e. no additional fuel is combusted to increase the generation from 500 MW to 750 MW. However, the predicted maximum concentrations are higher for Scenario 2 than for Scenario

1. This is a function of the cooler emission temperature and lower emission exit velocity on the main stack (Table 5-2) resulting in a reduction in the dispersion potential in Scenario 2.

6.3.2 Isopleth maps

Maps of predicted ambient SO_2, NO_2, PM_{10} and CO concentrations are presented in the following sections for the four scenarios.

The predicted concentrations are shown as isopleths (lines of equal concentration) in µg/m^3 for the respective NAAQS averaging periods on a map of the study area. The power plant site is in the centre of each plot and is labelled in yellow. The sensitive receptors are shown on each map. The isopleths are depicted as white lines and where applicable, the NAAQS is presented by a red isopleth.

The prevailing winds over Richards Bay largely dictate the dispersion of pollutants. Dispersion therefore occurs in two predominant directions. This is towards the north as a result of the prevailing south-southwesterly, and to the south and southwest as a result of the prevailing north-northeasterly winds.

6.3.2.1 Sulphur dioxide (SO_2)

The predicted SO_2 concentrations for Scenario 1 (Mabasa Simple Cycle) and Scenario 2 (Mabasa Combined Cycle) are very low relative to the NAAQS throughout the modelling domain which includes Richards Bay and the surrounding areas. No exceedances of the NAAQS are therefore predicted for SO_2 for Scenario 1 and Scenario 2, i.e. Mabasa only. Exceedances are however predicted for Scenario 3 and Scenario 4. The predicted annual, 24 – hour and 1-hour average concentrations for all scenarios are shown in Figure 6-10 to Figure 6-15 and are discussed here.

Scenario 1: The maximum predicted annual, 24-hour and 1-hour ambient concentrations resulting stack emissions from the proposed Mabasa CCPP are 1.12 µg/m^3, 14.0 µg/m^3 and 40.8 µg/m^3, which are all well below the respective NAAQS. This occurs close to the CCPP to the south-southwest.

Scenario 2: The maximum predicted annual, 24-hour and 1-hour ambient concentrations resulting stack emissions from the proposed Mabasa CCPP are of 4.2 µg/m^3, 37.3 µg/m^3 and 110 µg/m^3 which are all well below the respective NAAQS. This occurs close to the CCPP to the south-southwest.. As expected, higher concentrations result from poorer dispersion potential as a result of the lower exit temperature and stack height on the HRSG as discussed earlier.

Scenario 3: The maximum predicted annual, 24-hour and 1-hour ambient concentrations resulting stack emissions from the industry included in this assessment are 52.5 µg/m^3, 243 µg/m^3 and 682 µg/m^3. These concentrations exceed the respective NAAQS for SO_2. Exceedances of 24-hour and 1-hour limit values were observed particularly south-southwest and 12 km northeast of the proposed Mabasa Project site. It must be remembered that Scenario 3 is based on a hypothetical worst-case emission scenario for existing industries.

The maximum contribution of the Mabasa CCPP to the cumulative concentrations is at full capacity (Scenario 2) and occurs close to the plant to the southwest. Here the contribution is 8% of the predicted annual maximum, 15.3% of the predicted 24-hour maximum and 16.1% of the predicted 1-hour maximum. Elsewhere in the modelling domain, the contribution of the Mabasa CCPP will be lower and is unlikely to result in exceedances of the NAAQS for SO_2 throughout the assessment area.

Scenario 4: The maximum predicted annual, 24-hour and 1-hour ambient concentrations resulting stack emissions from the industry included in this assessment and approved projects are 59.2 µg/m^3, 315 µg/m^3 and 695 µg/m^3. Exceedances of annual, 24-hour and 1-hour limits were observed within 4 km and at about 12 km from the proposed project site. High levels of SO_2 also extend to about 4 km offshore. It must be remembered that Scenario 4 is based on a hypothetical worst-case emission scenario for existing industries and approved projects.

The maximum contribution of the Mabasa CCPP is at full capacity (Scenario 2) occurs close to the plant to the southwest. Here the maximum possible contribution of the Mabasa CCPP to the cumulative concentrations is 7.1% of the predicted annual maximum, 11.8% of the predicted 24-hour maximum and 15.3% of the predicted 1 hour maximum. Elsewhere in the modelling domain the contribution of the Mabasa CCPP will be lower and is unlikely to result in exceedances of the NAAQS for SO_2 throughout the assessment area.

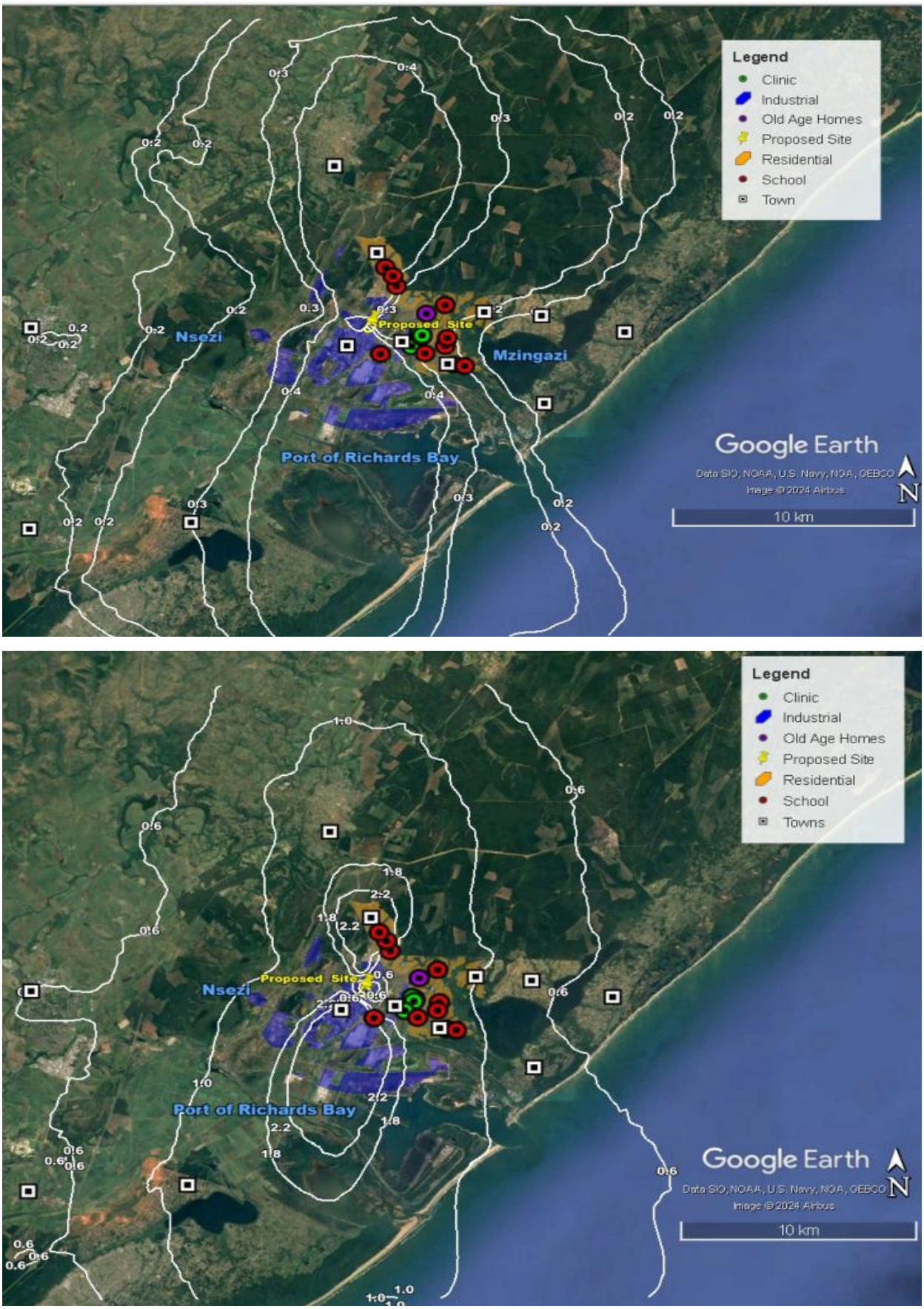


Figure 6-10: Predicted annual average SO_2 concentrations in µg/m³ resulting from emissions from Scenario 1 (top), Scenario 2 (top)

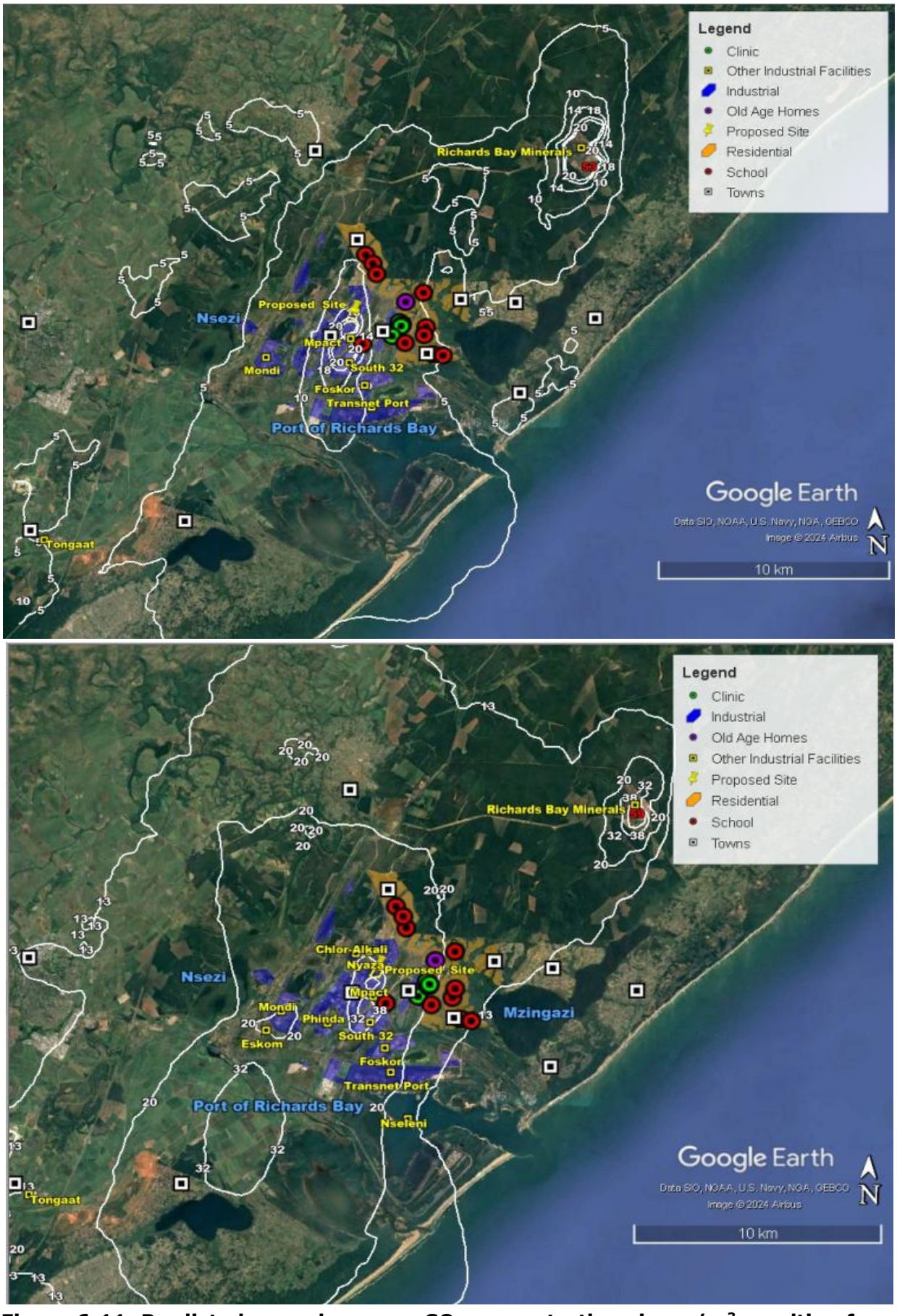


Figure 6-11: Predicted annual average SO_2 concentrations in µg/m³ resulting from emissions from Scenario 3 (top), and Scenario 4 (bottom)

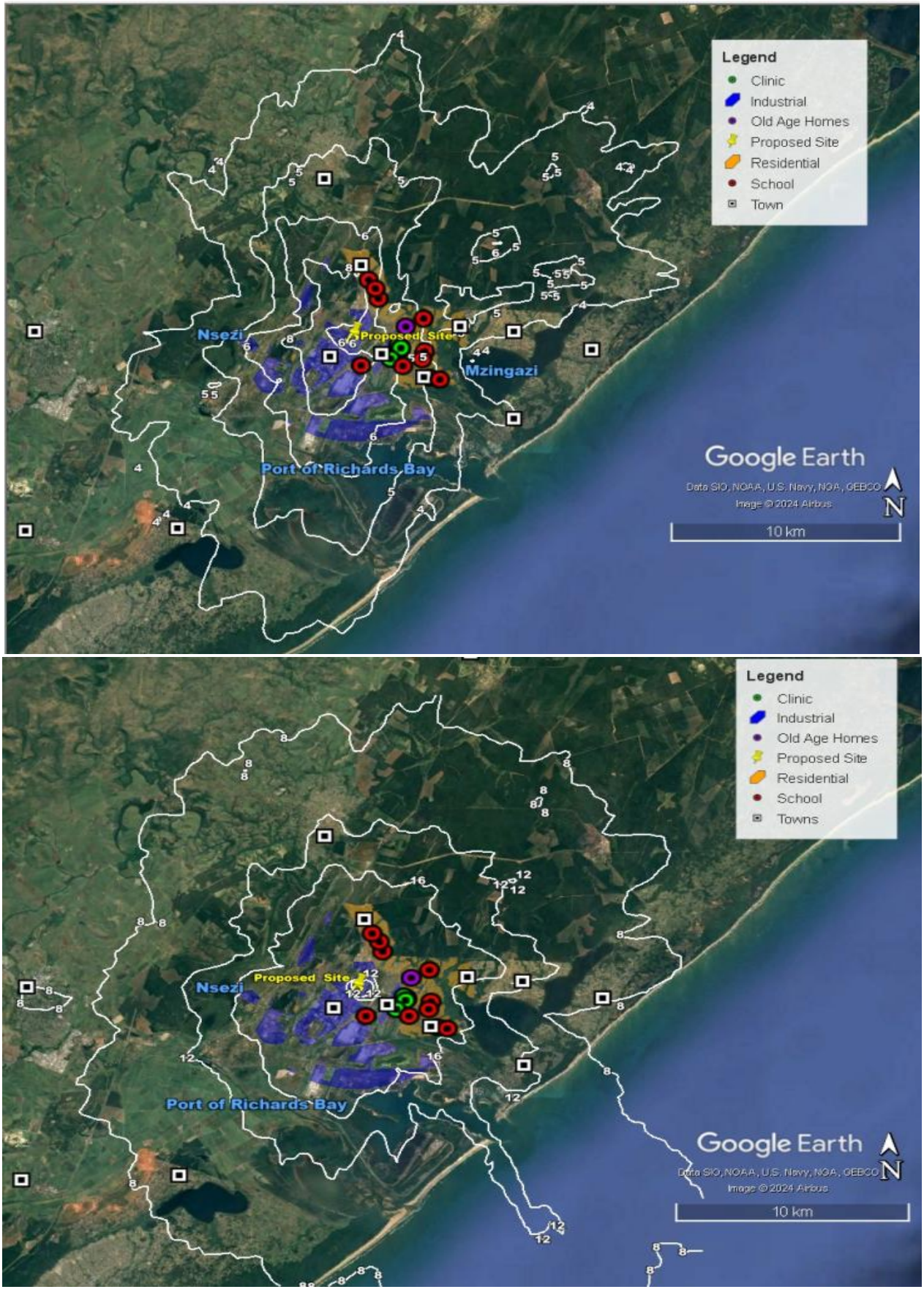


Figure 6-12: Predicted 99th percentile 24-hour SO_2 concentrations in µg/m³ resulting from emissions from Scenario 1 (top), Scenario 2 (bottom)

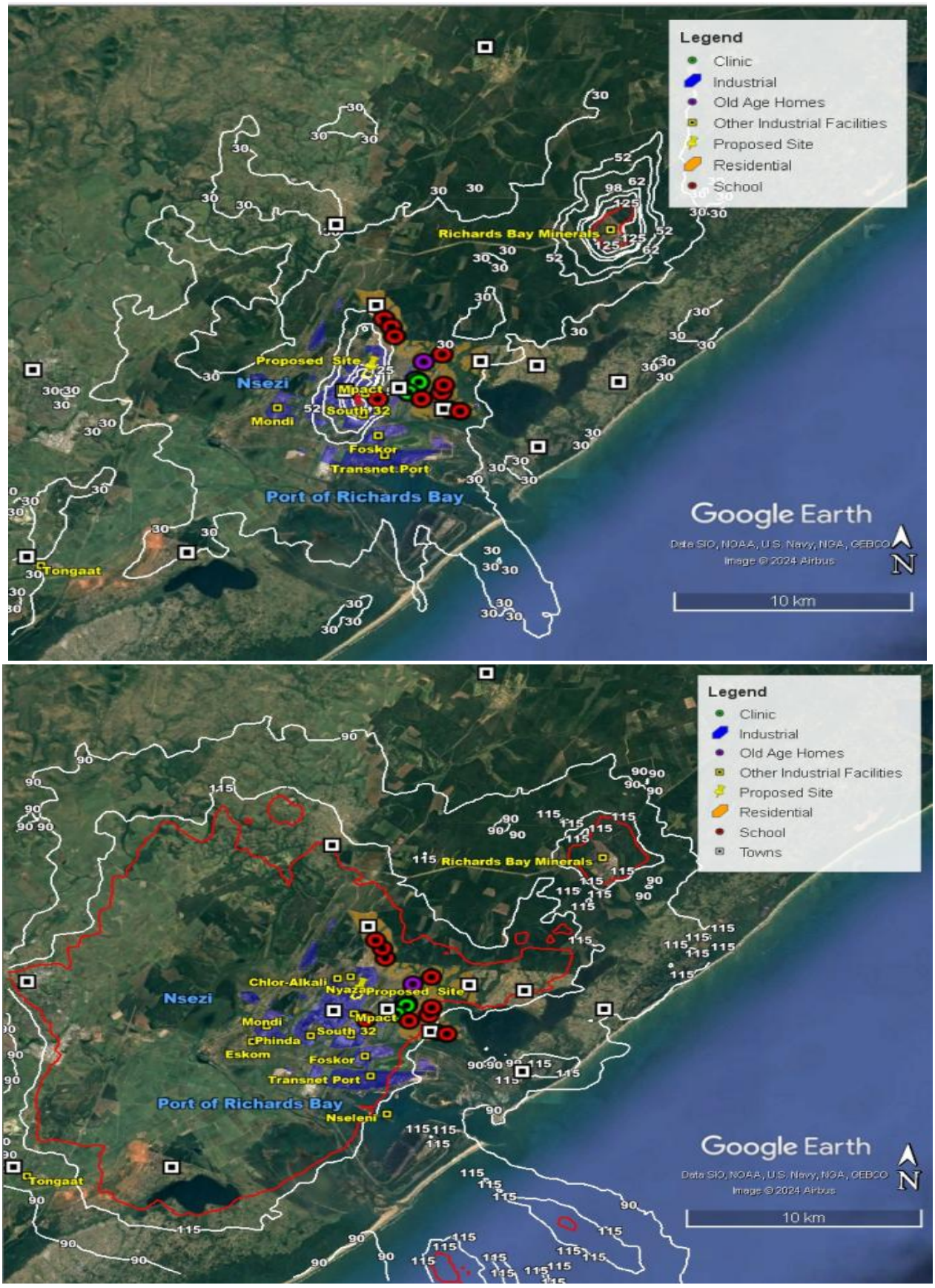


Figure 6-13: Predicted 99th percentile 24-hour SO_2 concentrations in µg/m³ resulting from emissions from Scenario 3 (top), Scenario 4 (bottom)

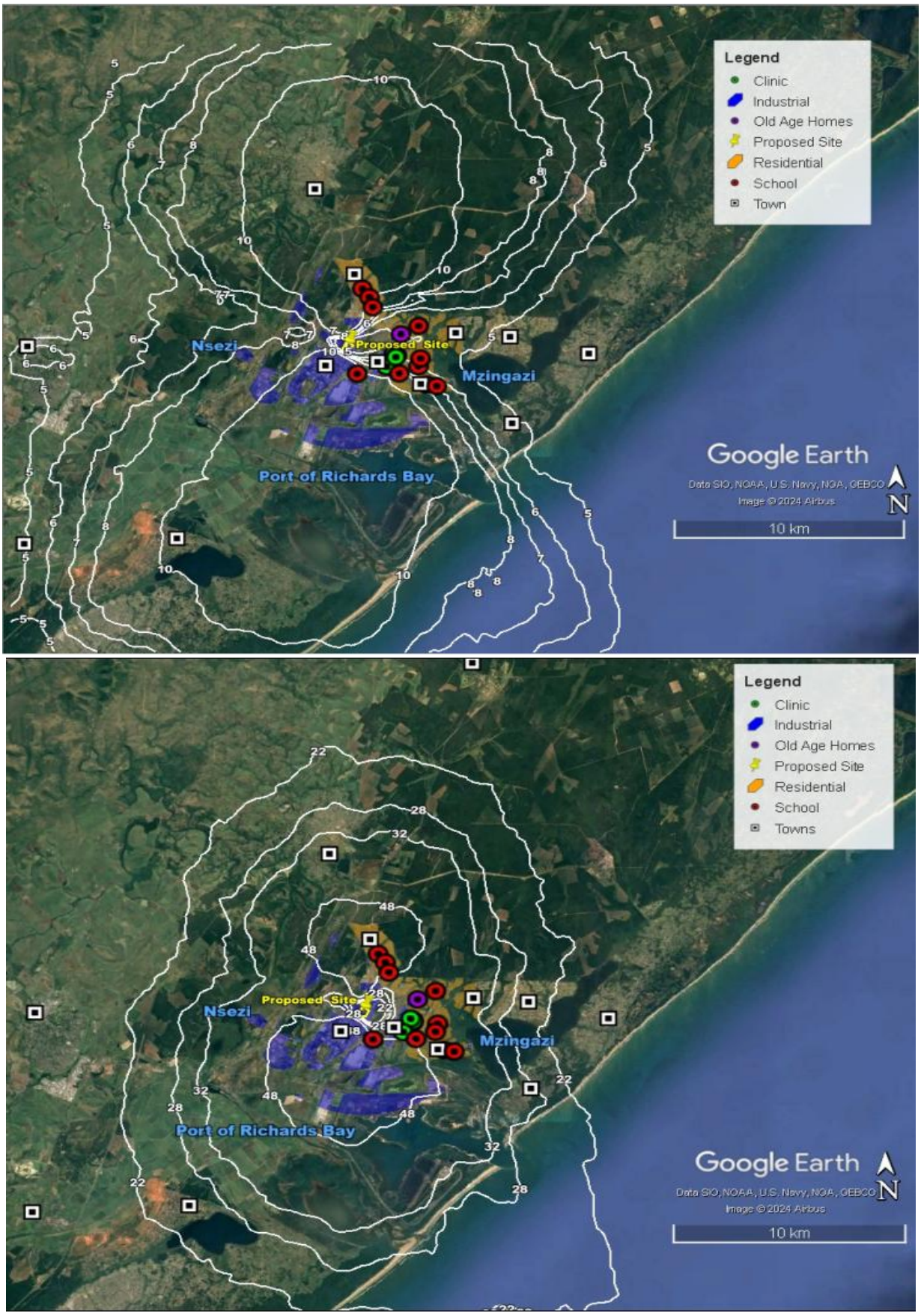


Figure 6-14: Predicted 99th percentile 1-hour SO_2 concentrations in µg/m³ resulting from emissions from Scenario 1 (top), Scenario 2 (bottom)

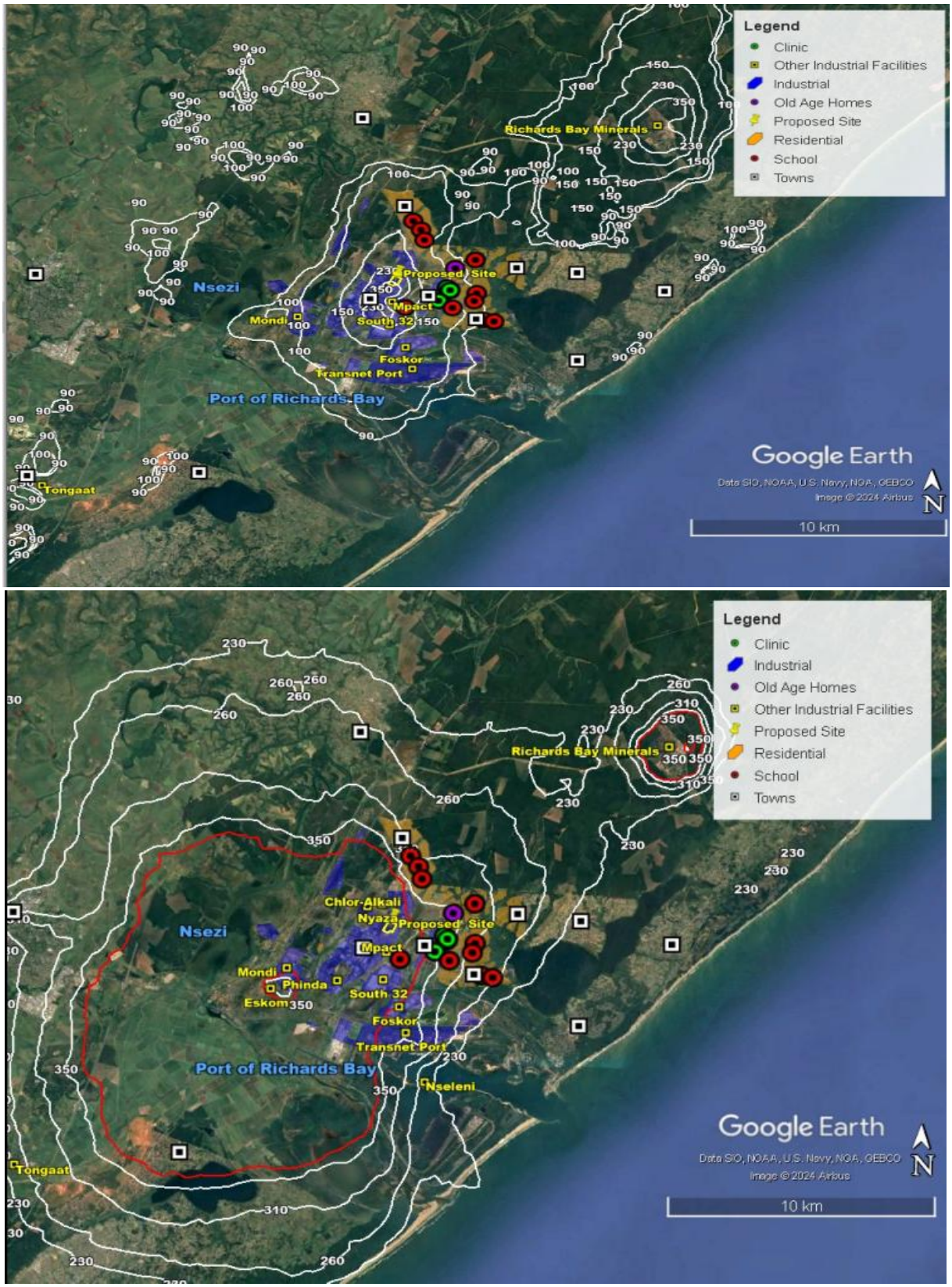


Figure 6-15: Predicted 99th percentile 1-hour SO_2 concentrations in µg/m³ resulting from emissions from Scenario 3 (top), Scenario 4 (bottom)

6.3.2.2 Nitrogen dioxide (NO_2)

The predicted NO_2 concentrations for Scenario 1 (Mabasa Simple Cycle) and Scenario 2 (Mabasa Combined Cycle) are very low relative to the NAAQS throughout the modelling domain which includes Richards Bay and surrounding areas. No exceedances of the NAAQS are predicted for NO_2. The predicted annual and 1-hour average concentrations are shown in Figure 6-16 to Figure 6-19.

Scenario 1: The maximum predicted annual and 1-hour ambient concentrations resulting stack emissions from the proposed Mabasa CCPP are 0.11 µg/m^3 and 4.08 µg/m^3 which are all well below the respective NAAQS. This maximum predicted concentrations occur close to the plant to the southwest.

Scenario 2: The maximum predicted annual and 1-hour ambient concentrations resulting stack emissions from the proposed Mabasa CCPP are 0.42 µg/m^3 and 11 µg/m^3 which are all well below the respective NAAQS. This occurs close to the plant to the southwest. As expected, higher concentrations result from poorer dispersion potential as a result of the lower exit temperature and stack height on the HRSG as discussed earlier.

Scenario 3: The maximum predicted annual and 1-hour ambient concentrations resulting stack emissions from the industry included in this assessment are 21.2 µg/m^3 and 273 µg/m^3. The predicted maximum annual concentration complies with the NAAQS throughout the modelling domain. However, the predicted 1-hour maximum concentration exceeds the limit of the NAAQS for NO_2 at about 12 km northeast of the proposed Mabasa CCPP facility and are relatively high to the south and southwest of the Mabasa CCPP. It must be remembered that Scenario 3 is based on a hypothetical worst-case emission scenario for existing industries.

The maximum contribution of the Mabasa CCPP to the cumulative concentrations is at full capacity (Scenario 2) and occurs close to the plant to the southwest. The contribution from the Mabasa CCPP at the maximum 12 km northeast of the plant is negligible. In the area of relatively high predicted NO_2 concentrations to the south-southwest the contribution of the Mabasa CCPP is 14.6% of the predicted 1-hour concentrations. Elsewhere in the modelling domain, the contribution of the Mabasa CCPP will be less than this and is unlikely to result in exceedances of the NAAQS for NO_2 throughout the assessment area.

Scenario 4: The maximum predicted annual and 1-hour ambient concentrations resulting stack emissions from the industry included in this assessment and approved projects are 21.9 µg/m^3 and 273 µg/m^3. The predicted maximum concentration complies with the annual NAAQS throughout the modelling domain. However, the predicted 1-hour maximum concentration exceeds the respective NAAQS for NO_2 at about 12 km northeast of the proposed Mabasa CCPP facility and are relatively high to the south-southeast of the Mabasa CCPP. It must be remembered that Scenario 4 is based on a hypothetical worst-case emission scenario for existing industries and approved projects.

The maximum contribution of the Mabasa CCPP to the cumulative concentrations is at full capacity (Scenario 2) and occurs close to the plant to the southwest. The contribution from the Mabasa CCPP to the maximum 12 km northeast of the plant is negligible. In the area of relatively high predicted NO_2 concentrations to the south-southwest the contribution of the Mabasa CCPP is 14.6% of the predicted 1-hour concentrations. Elsewhere in the modelling

domain the contribution of the Mabasa CCPP will be less than this and is unlikely to result in exceedances of the NAAQS for NO_2 throughout the assessment area.

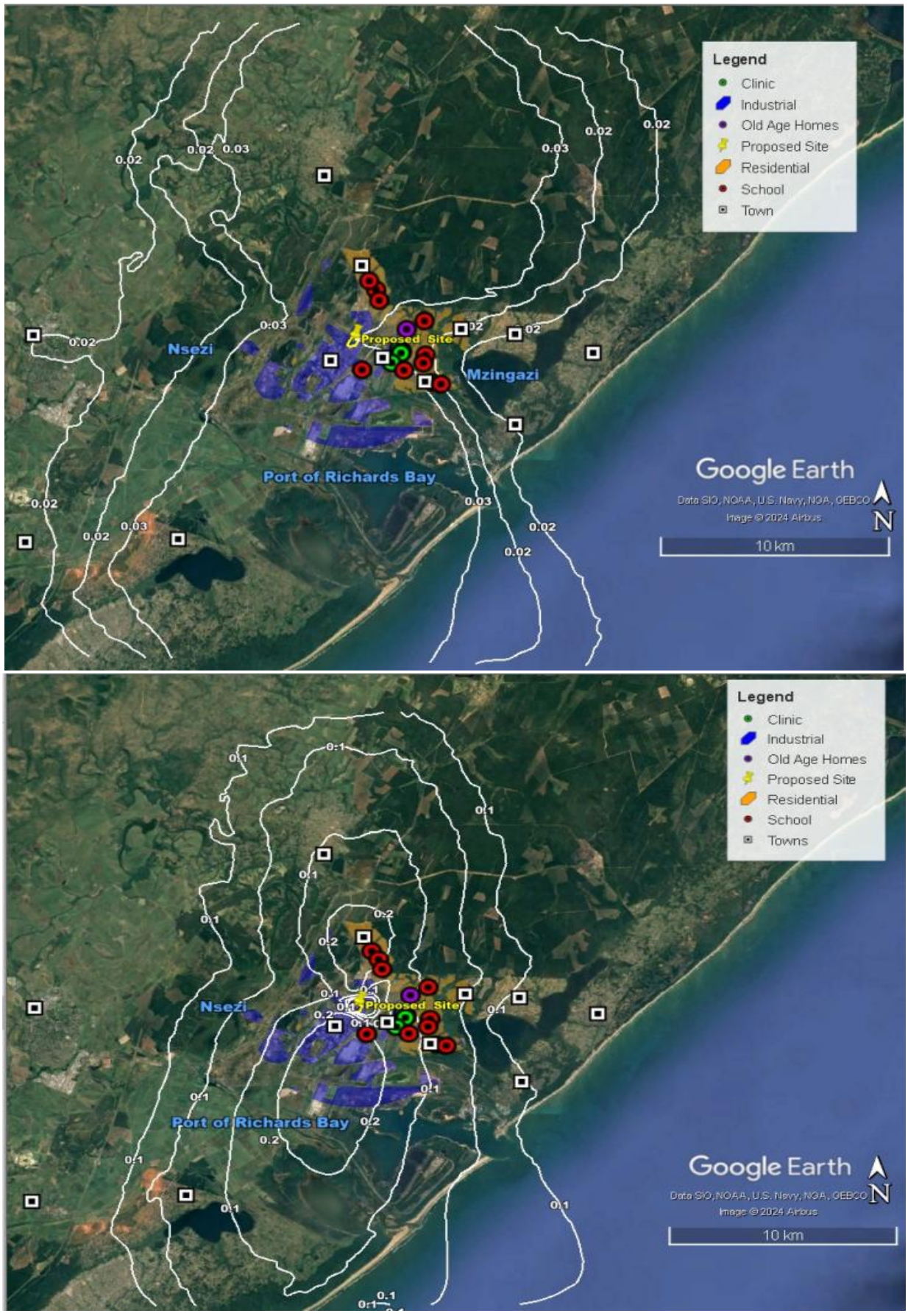


Figure 6-16: Predicted annual average NO_2 concentrations in µg/m³ resulting from emissions from Scenario 1 (top), Scenario 2 (bottom)

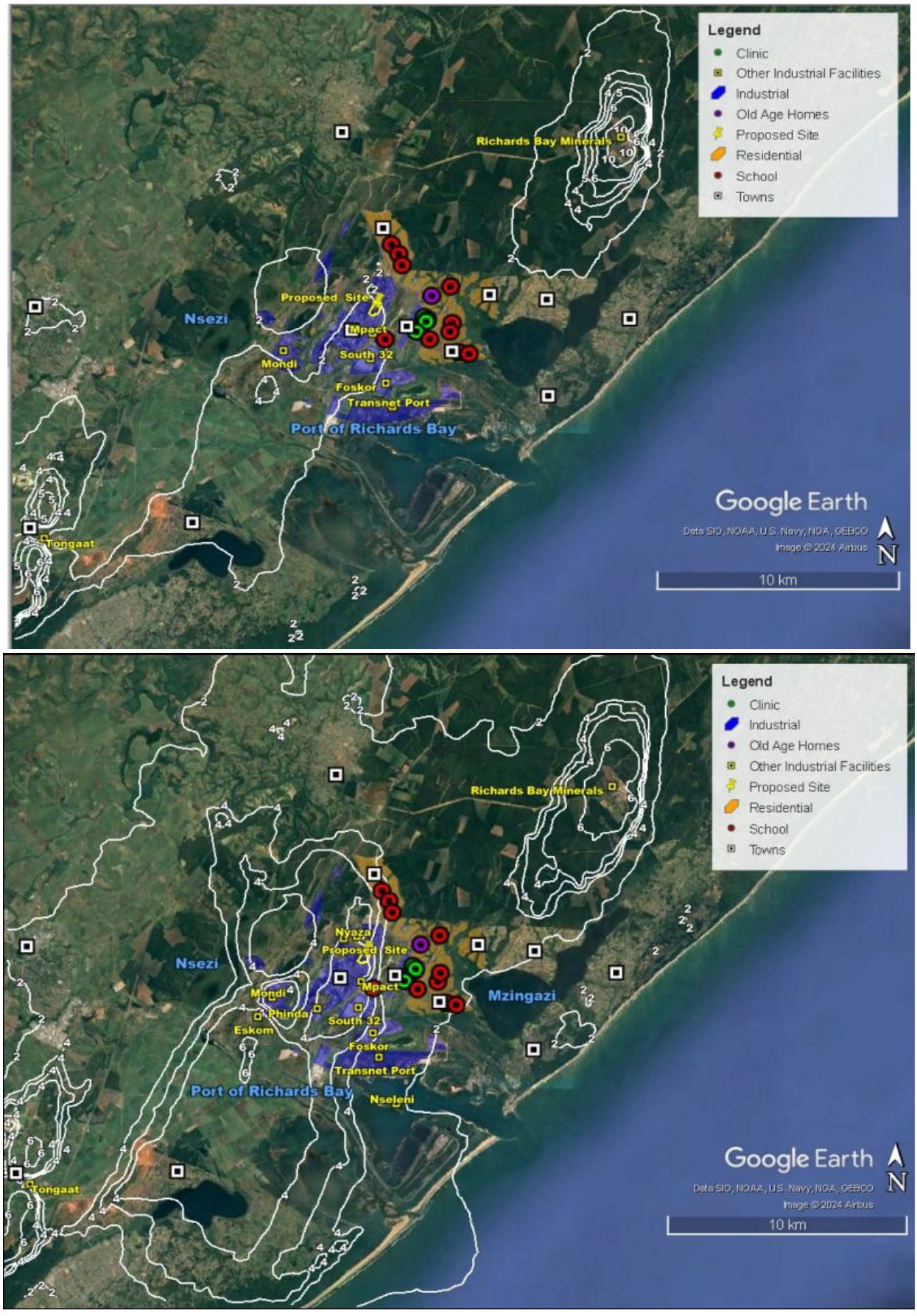


Figure 6-17: Predicted annual average NO_2 concentrations in µg/m³ resulting from emissions from Scenario 3 (top), Scenario 4 (bottom)

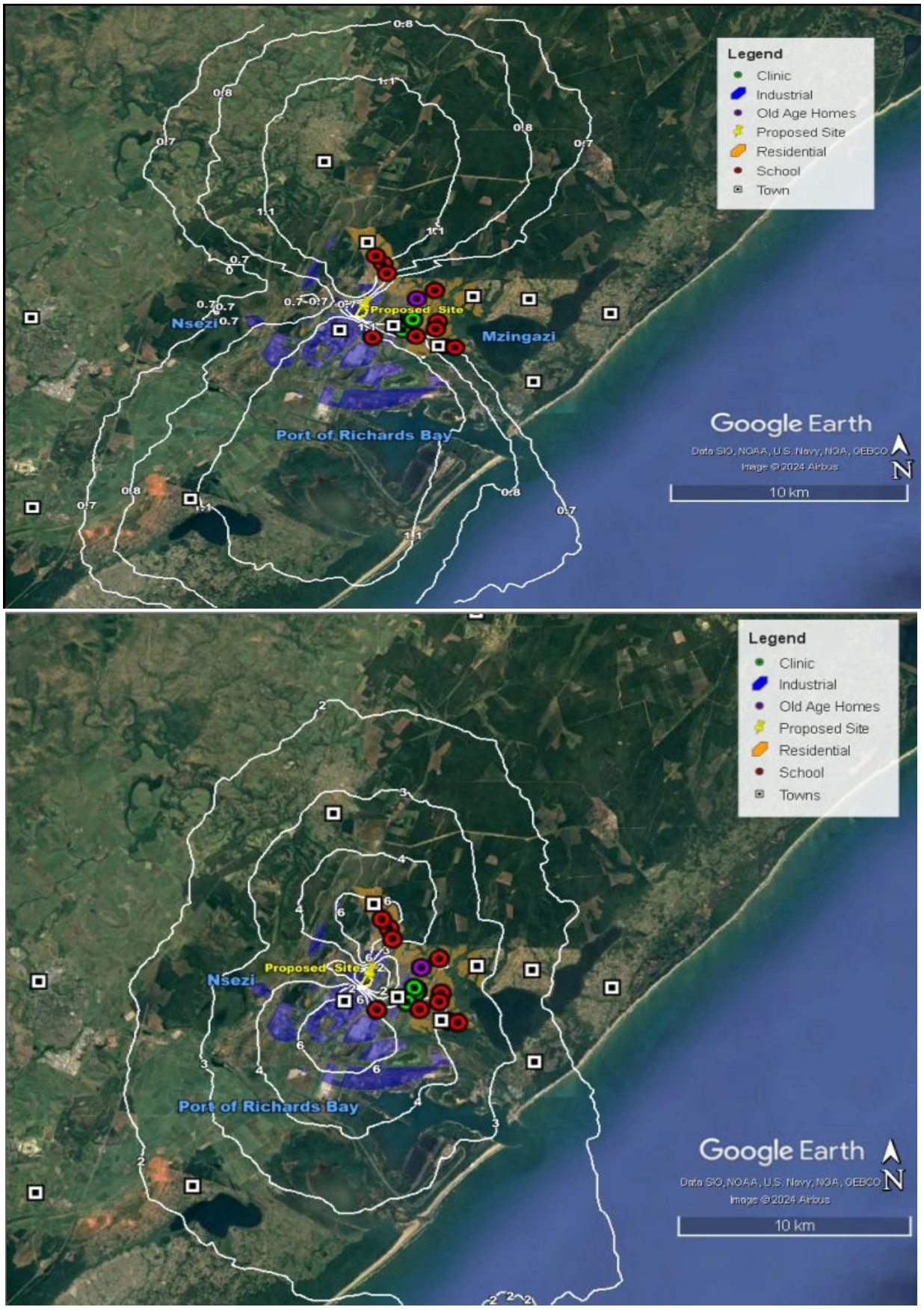


Figure 6-18: Predicted 1-hour average NO_2 concentrations in µg/m³ resulting from emissions from Scenario 1 (top), Scenario 2 (bottom)

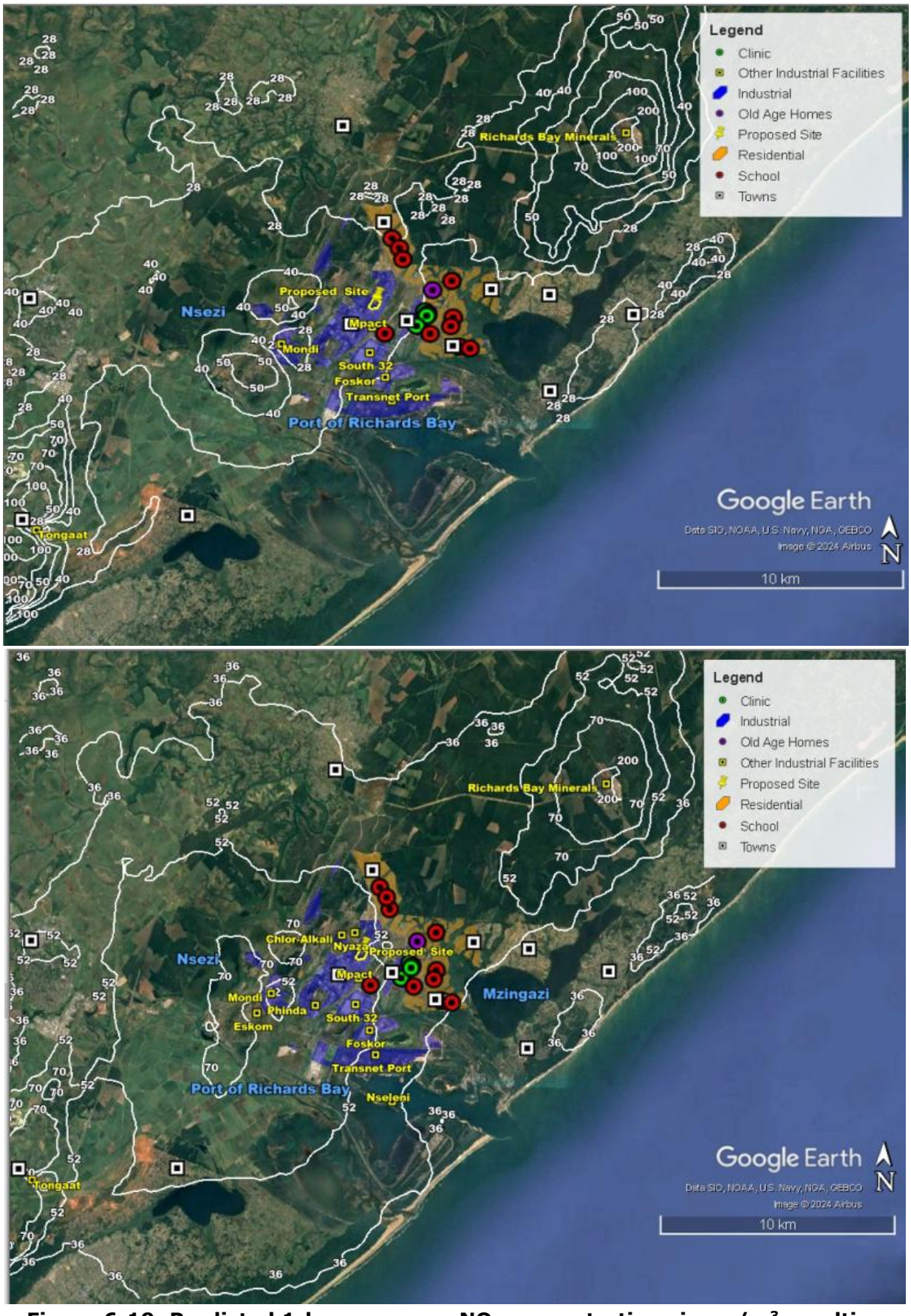


Figure 6-19: Predicted 1-hour average NO_2 concentrations in µg/m³ resulting from emissions from Scenario 3 (top), Scenario 4 (bottom)

6.3.2.3 Particulates (PM_{10})

The predicted PM_{10} concentrations for Scenario 1 (Mabasa Simple Cycle) and Scenario 2 (Mabasa Combined Cycle) are very low relative to the NAAQS throughout the modelling domain which includes the Richards Bay and surrounding areas. No exceedances of the NAAQS are predicted for PM_{10}. The predicted annual and 24-hour average concentrations are shown in Figure 6-20 to Figure 6-23.

Scenario 1: The maximum predicted annual and 24-hour ambient concentrations resulting stack emissions from the proposed Mabasa CCPP are 0.03 µg/m^3 and 0.35 µg/m^3 which are all well below the respective NAAQS. These occurs close to the plant to the southwest.

Scenario 2: The maximum predicted annual and 24-hour ambient concentrations resulting stack emissions from the proposed Mabasa CCPP are 0.11 µg/m^3 and 0.93 µg/m^3 which are all well below the respective NAAQS. This occurs close to the plant to the southwest. As expected, higher concentrations result from poorer dispersion potential as a result of the lower exit temperature and stack height on the HRSG as discussed earlier.

Scenario 3: The maximum predicted annual and 24-hour ambient concentrations resulting stack emissions from the industry included in this assessment are 26.8 µg/m^3 and 189 µg/m^3. The predicted maximum annual concentration complies with the NAAQS throughout the modelling domain. However, but the predicted 1-hour maximum concentration exceeds the limit of the NAAQS for PM_{10} in areas approximately 3 kms south of the proposed Mabasa CCPP. It must be remembered that Scenario 3 is based on a hypothetical worst-case emission scenario for existing industries.

The maximum contribution of the Mabasa CCPP to the cumulative concentrations is at full capacity (Scenario 2) and occurs close to the plant to the southwest. Here the contribution of the Mabasa CCPP is less than 1% of the predicted 24-hour concentrations. In the area of predicted exceedances, the contribution from the Mabasa CCPP is negligible. It is unlikely to result in exceedances of the NAAQS for PM_{10} throughout the assessment area.

Scenario 4: The maximum predicted annual and 24-hour ambient concentrations resulting stack emissions from the industry included in this assessment and from approved projects are 27.2 µg/m^3 and 189 µg/m^3. The predicted maximum annual concentration complies with the NAAQS throughout the modelling domain. However, the predicted 1-hour maximum concentration exceeds the limit of the NAAQS for PM_{10} in areas approximately 3 kms south of the proposed Mabasa CCPP. It must be remembered that Scenario 4 is based on a hypothetical worst-case emission scenario for existing industries and approved projects.

The maximum contribution of the Mabasa CCPP to the cumulative concentrations is at full capacity (Scenario 2) and occurs close to the plant to the southwest. Here the contribution of the Mabasa CCPP is less than 1% of the predicted 24-hour concentrations. In the area of predicted exceedances, the contribution from the Mabasa CCPP is negligible. The Mabasa CCPP is unlikely to result in exceedances of the NAAQS for PM_{10} throughout the assessment area.

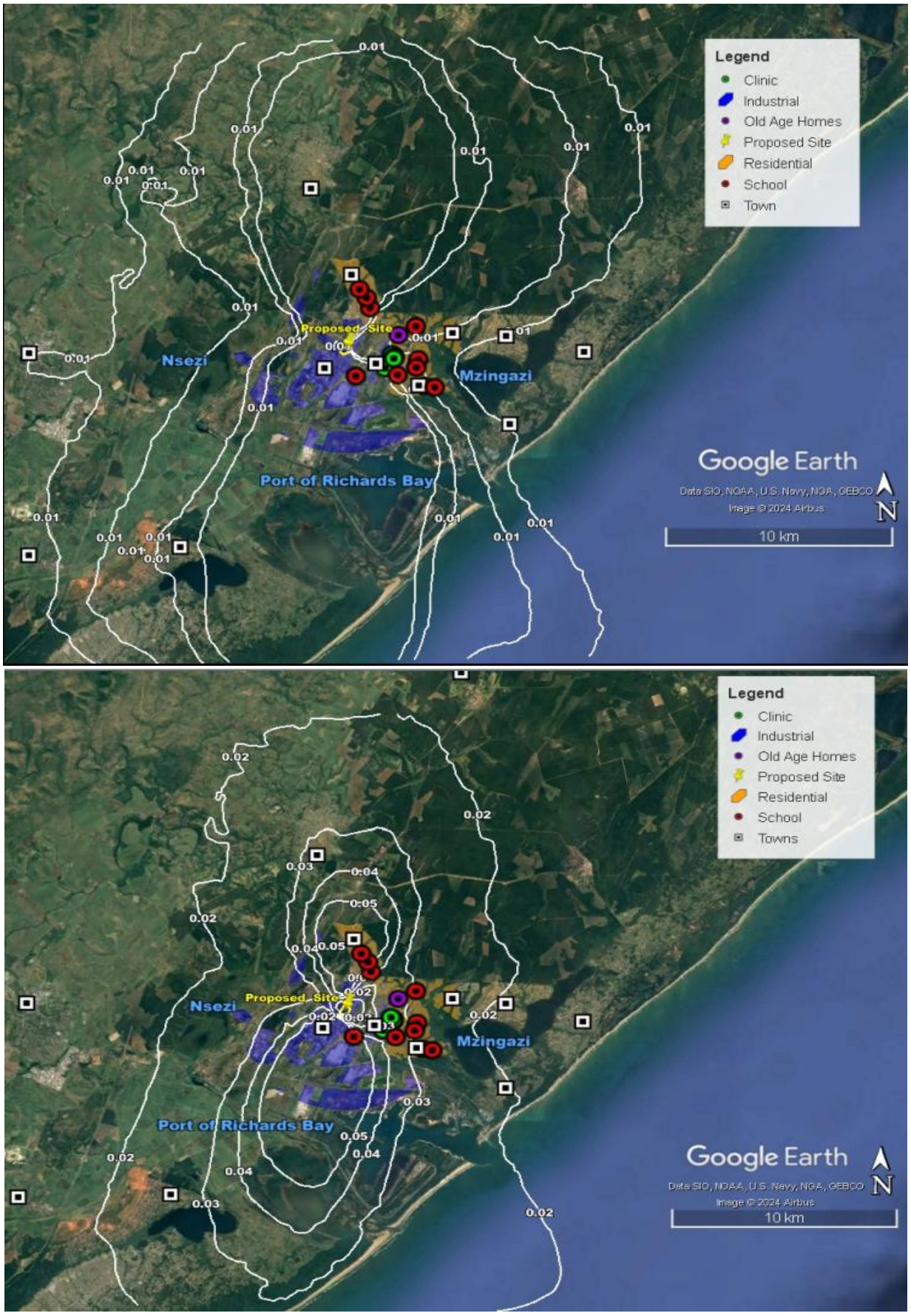


Figure 6-20: Predicted annual average PM_{10} concentrations in µg/m³ resulting from emissions from Scenario 1 (top), Scenario 2 (bottom)

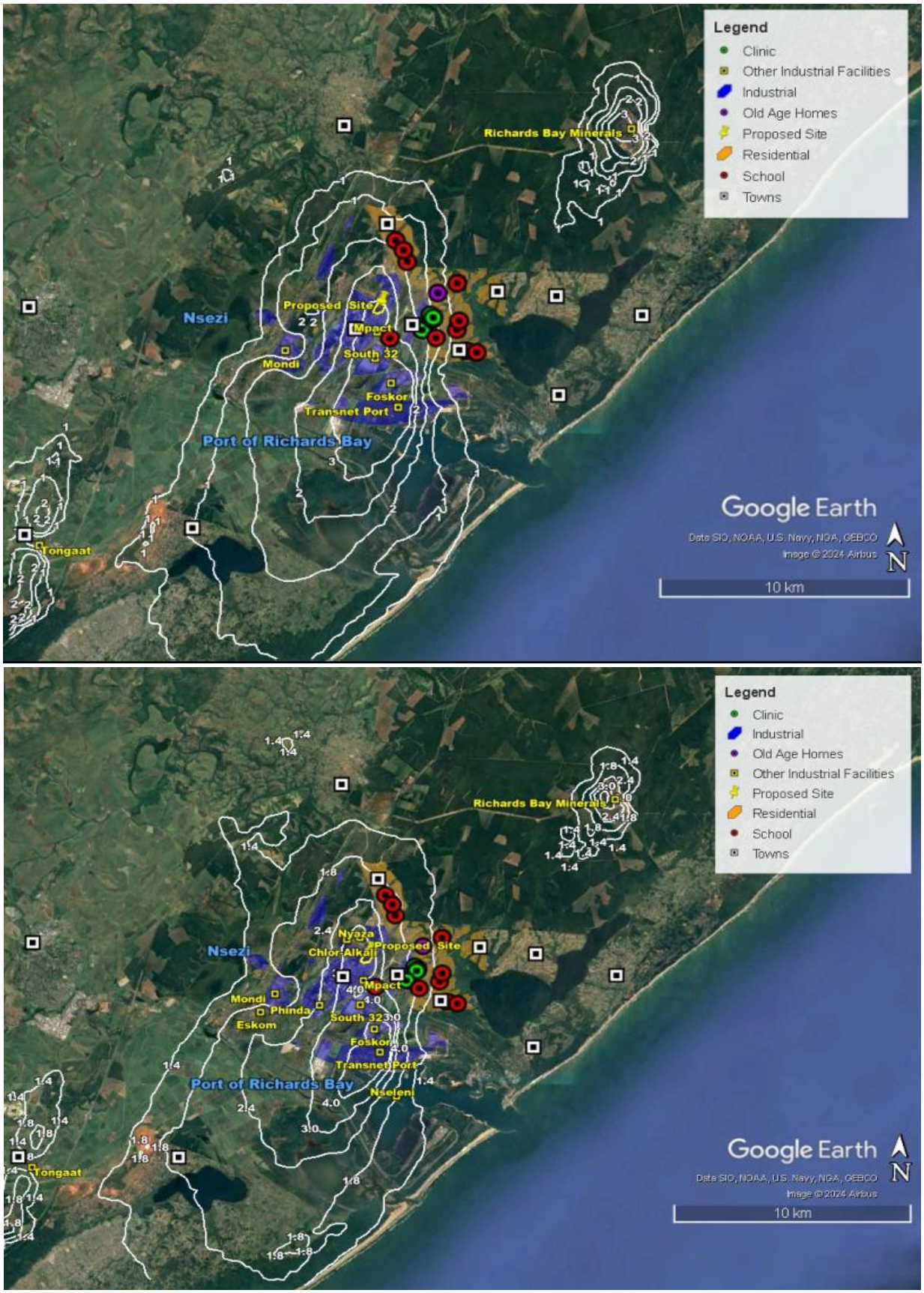


Figure 6-21: Predicted annual average PM_{10} concentrations in µg/m³ resulting from emissions from Scenario 3 (top), Scenario 4 (bottom)

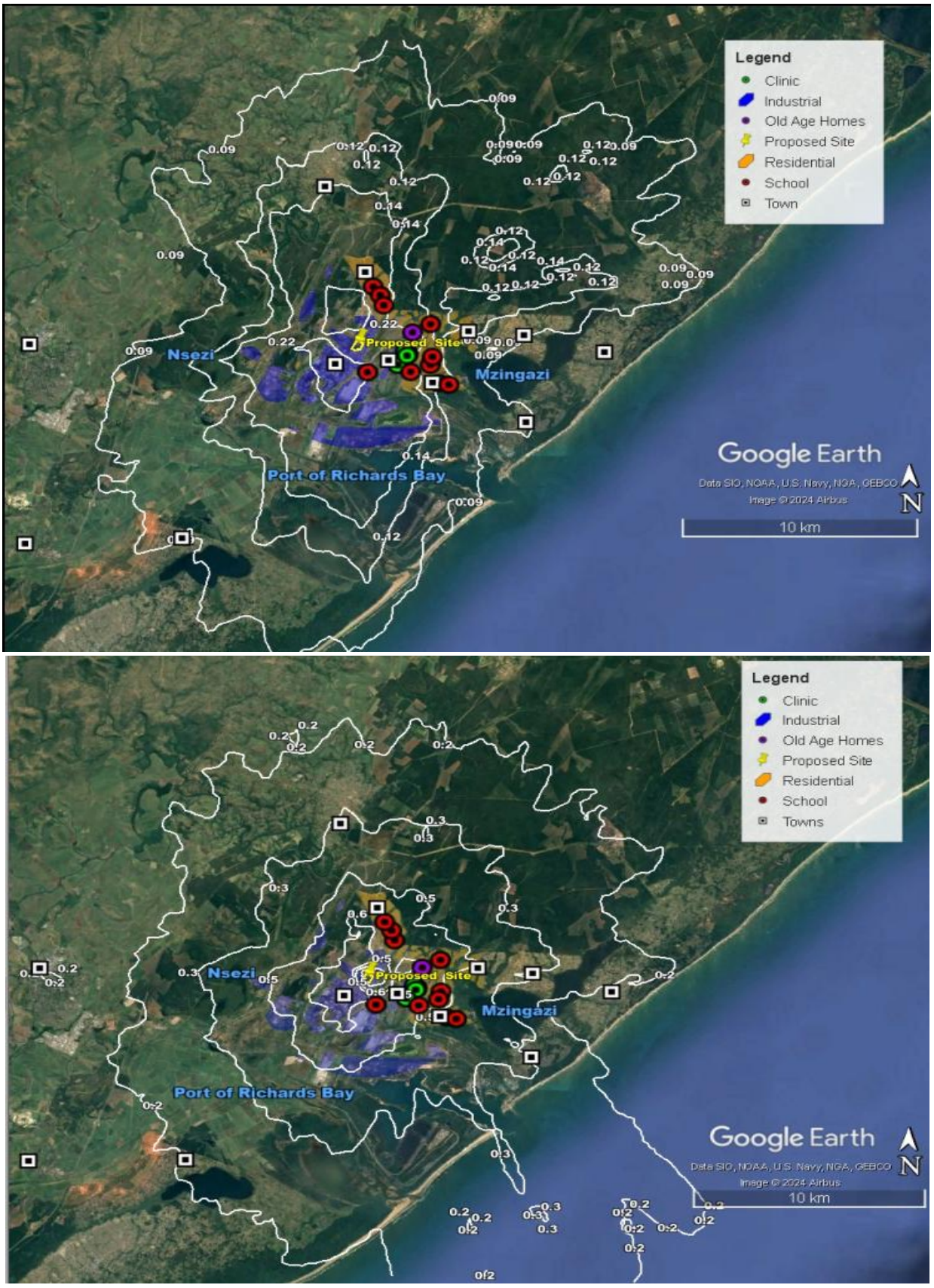


Figure 6-22: Predicted 24-hour average PM_{10} concentrations in µg/m³ resulting from emissions from Scenario 1 (top), Scenario 2 (bottom)

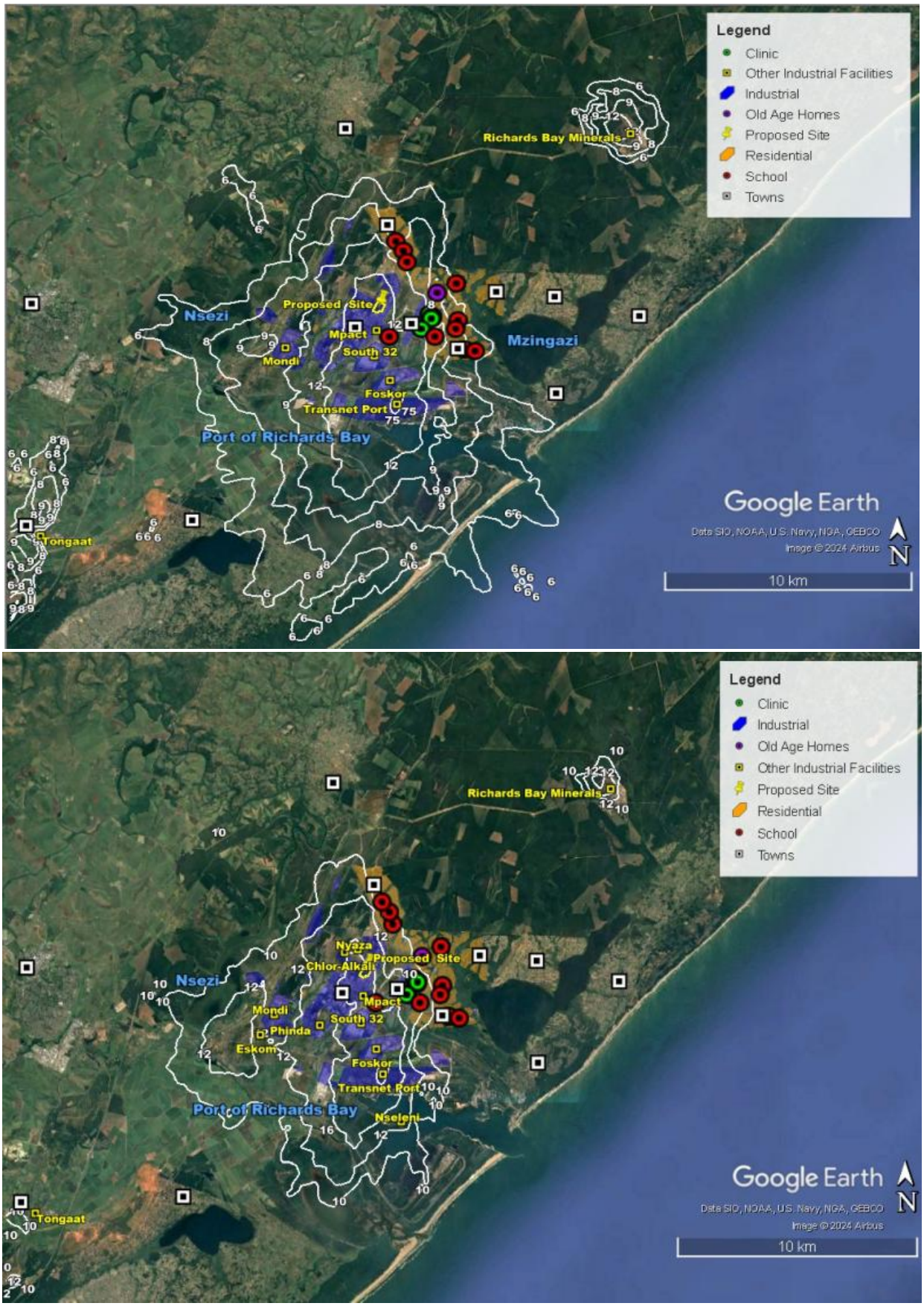


Figure 6-23: Predicted 24-hour average PM_{10} concentrations in µg/m³ resulting from emissions from Scenario 3 (top), Scenario 4 (bottom)

6.3.2.4 Carbon monoxide (CO)

The predicted CO concentrations for Scenario 1 (Mabasa Simple Cycle) and Scenario 2 (Mabasa Combined Cycle) are very low relative to the NAAQS throughout the modelling domain which includes Richards Bay and surrounding areas. No exceedances of the NAAQS are therefore predicted for CO. The predicted 99th percentile of the 8-hour concentrations are shown in Figure 6-24, with the 99th percentile of the 1-hour concentrations in Figure 6-25.

Scenario 1: At the point of maximum predicted ambient concentrations associated with stack emissions from the proposed Mabasa CCPP is 1.51 µg/m^3 and 3.09 µg/m^3 for the 8-hour and 1-hour ambient concentrations.

Scenario 2: At the point of maximum predicted ambient concentrations, associated with stack emissions form the proposed Mabasa CCPP is 4.64 µg/m^3 and 3.26 µg/m^3 for the 8-hour and 1 – hour ambient concentrations. As expected, higher concentrations result from the increase from 500 MW to 750 MW generation.

Scenario 3 and Scenario 4: MES for CO is not included in the AELs for the suite of industries assessed. These scenarios are therefore not assessed for CO.

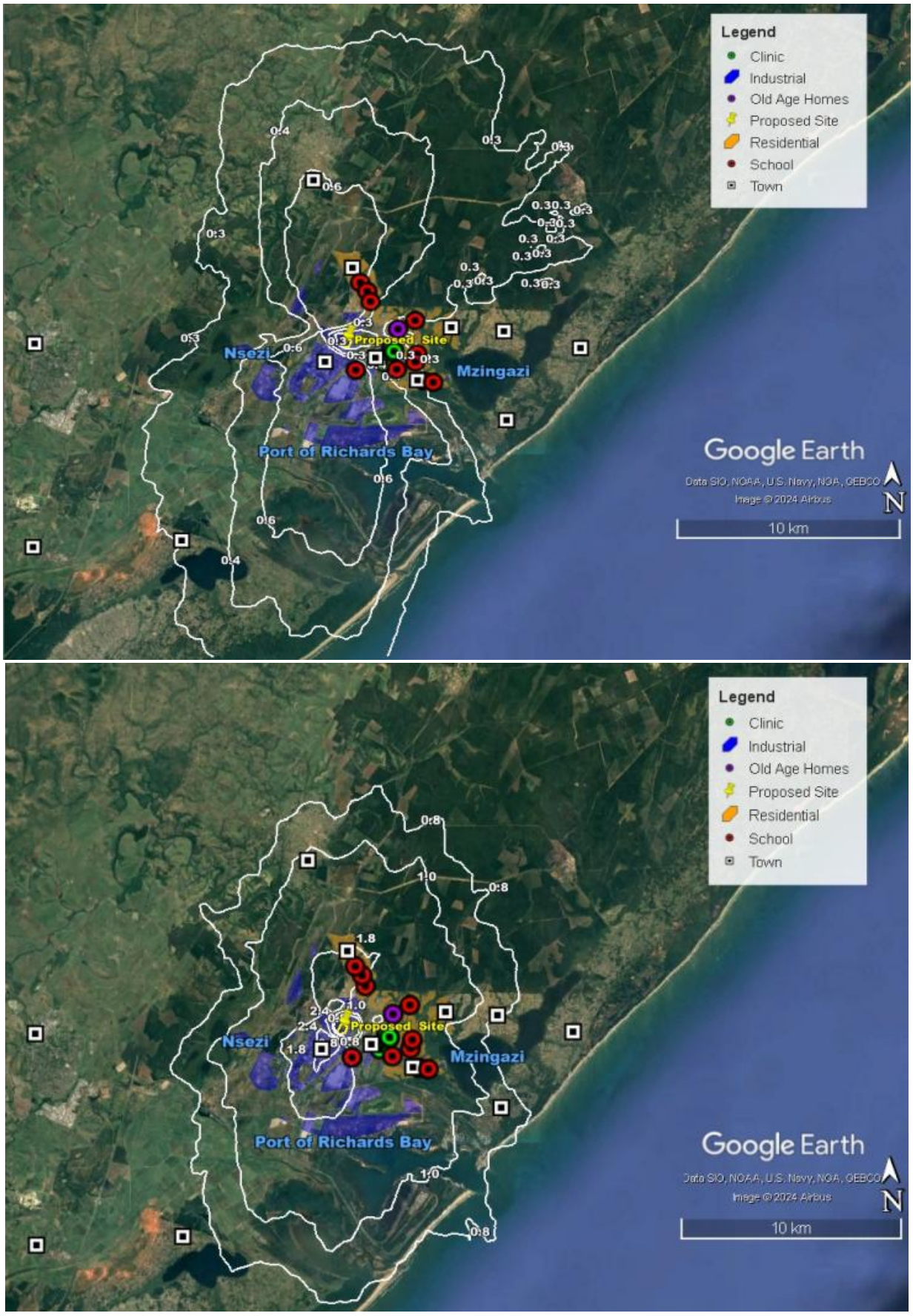


Figure 6-24: Predicted 99th percentile 8-hour CO concentrations in µg/m³ resulting from emissions from Scenario 1 (top), Scenario 2 (bottom)

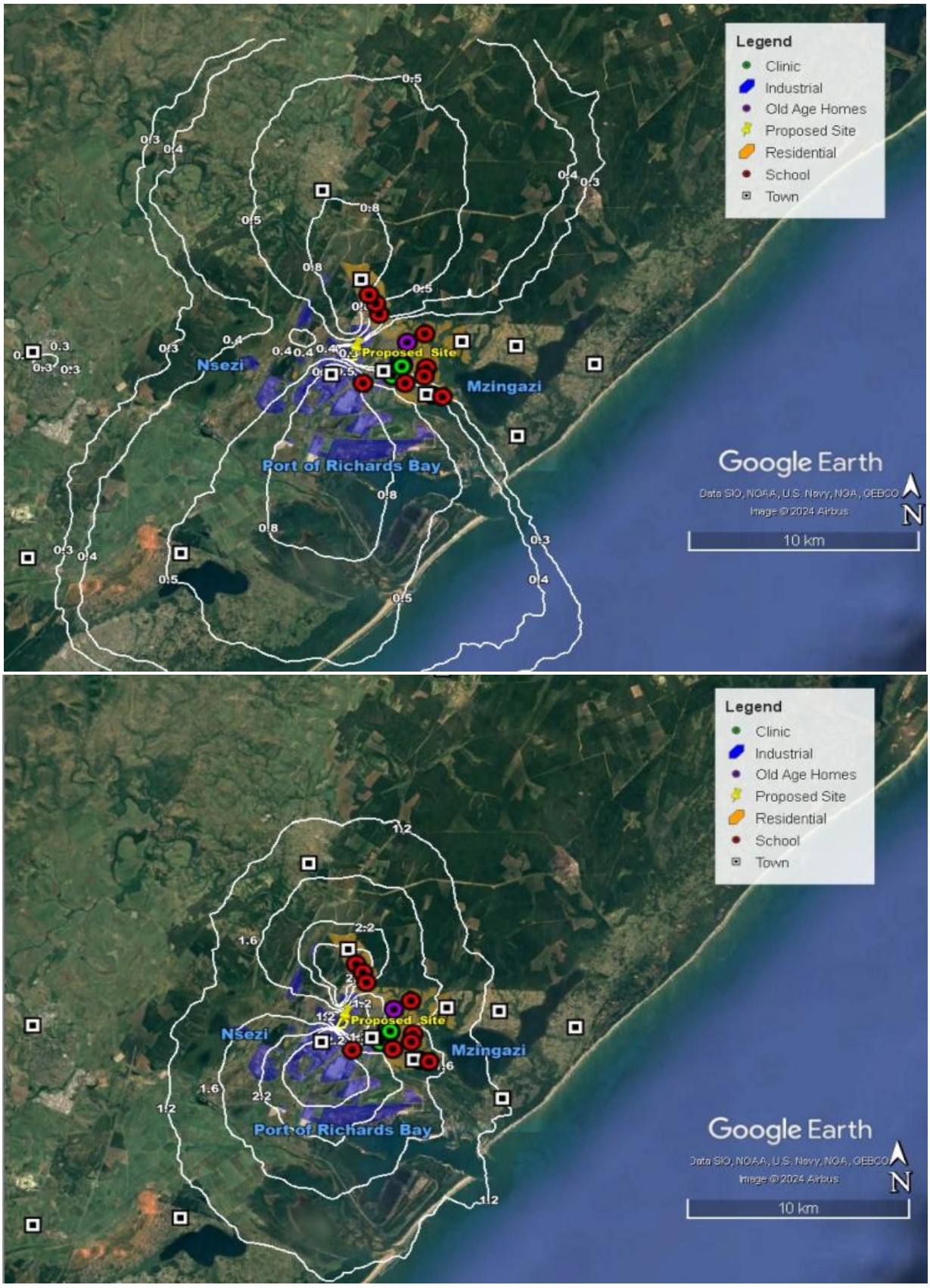


Figure 6-25: Predicted 99th percentile 1-hour CO concentrations in µg/m³ resulting from emissions from Scenario 1 (top), Scenario 2 (bottom)

7. IMPACT ASSESSMENT

7.1 Impact Rating Methodology

The NEMA EIA Regulations (DEA, 2014a) describe the significance of environmental impacts considering the consequence of the impact and the likelihood of the impact occurring.

Clearly defined rating and rankings scales (Table 7-1 to Table 7-7) are used to assess the impacts associated with the proposed Mabasa CCPP project. To enable a scientific approach for the determination of the environmental significance (importance), a numerical value is linked to each rating scale. The rating of these parameters is based on the findings of the assessment and professional judgement of specialists.

Table 7-1: Severity or magnitude of impact

Severity or magnitude of impact	
Not applicable/none/negligible	0
Minor/insignificant/non-harmful (no loss of species/habitat)	2
Low/small/potentially harmful (replaceable loss with minimal effort)	4
Moderate/significant/slightly harmful (replaceable loss of species/habitat with great effort and investment)	6
High/highly significant/harmful (impact to human health or welfare/loss of species/habitat)	8
Very High/extremely significant/extremely harmful/within a regulated sensitive area (loss of human life/irreplaceable loss of Red Data species/conservation habitat)	10

Table 7-2: Spatial Scale of activity

Spatial Scale of activity	
Not applicable/none/negligible	0
Site only	1
Local (within 5 km)	2
Regional/neighbouring areas (5 km to 50 km)	3
National	4
International	5

Table 7-3: Duration of activity

Duration of activity	
Not applicable/none/negligible	0
Immediate (immediately reversible with minimal effort)	1
Short-term (0-5 years - reversible)	2
Medium-term (5 to 15 years – difficult to reverse with effort)	3
Long-term/life of the activity (very difficult to reverse with extensive effort)	4
Permanent/beyond life of the activity (not reversible)	5

Table 7-4: Frequency of activity (how often activity is undertaken)

Frequency of activity	
Not applicable/none/negligible	0
Improbable /almost never/annually or less	1
Low probability/very seldom/6 monthly	2
Medium probability/infrequent/temporary/monthly	3
Highly probable/often/semi-permanent/weekly	4
Definite/always/permanent/daily	5

Table 7-5: Frequency of incident/impact (how often activity impacts environment)

Frequency of incident/impact	
Almost never/almost impossible/>20%	1
Very seldom/highly unlikely/>40%	2
Infrequent/unlikely/seldom/>60%	3
Often/regularly/likely/possible/>80%	4
Daily/highly likely/definitely/>100%	5

Table 7-6: Legal Issues – governance of activity by legislation

Legal Issues	
No legislation	1
Fully covered by legislation	5

Table 7-7: Detection (how quickly/easily impacts/risks of activity on environment, people and property are detected)

Detection	
Immediately (easier to mitigate)	1
Without much effort	2
Need some effort	3
Remote and difficult to observe	4
Covered (more difficult to mitigate)	5

Each impact identified is assessed in terms of probability (likelihood of occurring); the consequence of the impact (spatial scale, severity and duration); and the associated risk (impact significance).

Consequence is determined as follows:

CONSEQUENCE = Severity + Spatial Scale + Duration

The probability or likelihood of occurrence of the activity is calculated based on frequencies of the activity and impact, whether the activity is governed by legislation and how easily it can be detected:

LIKELIHOOD = Frequency of Activity + Frequency of Impact + Legal issues + Detection

The significance or risk of each identified impact is based on the product of consequence and likelihood:

Environmental Significance/Risk = Consequence x Likelihood

Impacts are rated as either of high, medium or low significance on the basis provided in Table 7-8. Each impact will also be assessed in terms of the level to which there is an irreplaceable loss of resources (Table 7-9) and its degree of reversibility (Table 7-10).

Table 7-8: Impact significance ratings

Impact significance ratings		
SIGNIFICANCE	**ENVIRONMENTAL RISK RATING**	**COLOUR CODE**
High (positive)	>240	H
Medium (positive)	120 to 240	M
Low (positive)	<120	L
Neutral	0	N
Low (negative)	>-120	L
Medium negative)	-120 to -240	M
High (negative)	<-240 (max = 400)	H

Table 7-9: Irreplaceability of resource caused by impacts

Irreplaceability of resource caused by impacts	
No irreplaceable resources will be impacted (the affected resource is easy to replace/rehabilitate)	Low
Resources that will be impacted can be replaced, with effort	Medium
Project will destroy unique resources that cannot be replaced	High

Table 7-10: Reversibility of impacts

Reversibility of impacts	
Low reversibility to non-reversible	Low
Moderate reversibility of impacts	Medium
High reversibility of impacts	High

The significance of an impact gives one indication of the level of mitigation measures required to minimise negative impacts and reduce environmental damage during the construction, operational and decommissioning phases. Suitable and appropriate mitigation measures, to ensure avoidance, management and mitigation of impacts, will be identified for each of the potential impacts based on specialist recommendations.

7.2 Impact Assessment

In this section, the air quality impact assessment is presented for the following:

- Construction Phase of the Mabasa CCPP
- Operational Phase of the Mabasa CCPP for
    - Scenario 1: Mabasa CCPP in simple cycle mode (using Combustion Turbines to generate 500 MW of electricity) and in isolation of other sources
    - Scenario 2: Mabasa CCPP in combined-cycle mode (using Combustion Turbines and HRSGs to generate 750 MW of electricity) and in isolation of other sources
    - Scenario 3: Cumulative - Mabasa CCPP in combined-cycle mode with the contribution of existing industrial sources
    - Scenario 4: Cumulative - Mabasa CCPP in combined-cycle mode with the contribution of industrial sources and approved future facilities.
- Decommissioning Phase of the Mabasa CCPP

The air quality impact assessment for the construction and decommissioning phase of the proposed Mabasa CCPP is assessed qualitatively as insufficient emissions data is available for a qualitative assessment. A summary of the impact scores for the construction and decommissioning phase is presented in Table 7-12.

The air quality impact assessment for the proposed Mabasa CCPP for the four operational scenarios are based on model predicted ambient SO_2, NO_2, PM_{10} and CO concentrations using the assessment methodology described above and is therefore quantitative. A summary of the impact scores for the operational phase is presented in Table 7-12.

Model predicted ambient SO_2, NO_2, PM_{10} and CO concentrations for the operational phase is based on accurate emissions data, representative meteorological data and applies the DEA recommended dispersion modelling principles (DEA, 2014b). The assessment team has significant experience and is familiar with the proposed project site and the power generation concept. The confidence in the impact assessment is therefore high.

7.2.1 Construction phase

Construction of the Mabasa CCPP will entail the construction of infrastructure to house and operate the following:

* Two (2) Class F, heavy-duty combustion turbines and generators;
* Two triple pressure, 3 drum, natural circulation HRSGs;
* A condensing steam turbine and generator;
* A de-aerating surface condenser;
* An induced draft cooling tower;
* Balance of plant (BOP) equipment consisting of Pumps, Heat Exchangers, Transformers, Power Electrics, etc.;
* An integrated plant distribution control system;
* 400 kV Switchyard comprising of three (3) x 15 kV to 400 kV step-up transformers and
* Two (2) auxiliary transformers (the rating to be defined during detailed design).

Activities during construction are associated with the movement of vehicles and equipment including bulldozers, excavators and tipper trucks. All aspects of construction inherently generate dust, but the movement of construction vehicles on the unpaved surfaces at the construction site are generally the largest source of dust. Dust is also easily entrained from exposed areas by wind.

Dust generated by construction activities depends on a number of factors, including:

- The nature of the activity: The physical movement of soil through digging, grading, loading and tipping, loosens otherwise bound fine particles allowing entrainment into the atmosphere through mechanical processes and wind.
- Equipment operation and vehicles: Equipment and vehicle movement on unpaved surfaces pulverise particles to a fine dust, which may be entrained into the atmosphere by their movement. Dust entrainment is a function of vehicle size and speed, with heavier vehicles and faster travel generating more dust.
- Silt content of the soil and other materials: Soils and materials with high silt content have a higher percentage of fine material that is easily entrained into the atmosphere when it is disturbed.

- The size of the denuded construction area: Larger exposed areas are naturally greater sources of wind-generated dust.
- The frequency of strong wind and rainfall: Strong winds easily entrain dust from open areas, from storage piles and during operational activities. Rainfall on the other hand suppresses the generation of dust.
- The dust abatement programme: Dust can be suppressed at the point where it is generated in several ways. Diligent management of an abatement programme can have a marked effect on reducing dust from all construction activities.

During the construction phase, surface preparation of the proposed project area will typically be done by vegetation clearing and compaction. A laydown area for the receipt, temporary storage, and assembly of construction equipment and other supplies will be demarcated. Construction for the proposed site infrastructure will typically take up to 12 months to complete.

At this stage there is insufficient information to estimate dust emissions from the construction phase as they require specific information on the nature and duration of the activities as well as the equipment and vehicles. The assessment of air quality impacts during construction is therefore qualitative. The impact assessment below applies to the construction phase of the proposed project, specifically focussing on dust associated with construction activities.

Severity or magnitude of impact

Construction dust is generally coarse in nature and manifests as a nuisance rather than a health issue. The severity or magnitude of the impact associated with the construction activities is therefore considered to be insignificant (score = 2).

Spatial scale of activity

Construction dust is released close to ground level with little or no buoyancy. This implies that their dispersion is limited, and the extent of potential impacts will be limited to the construction site (score = 1).

Duration of activity

Construction activities are likely to endure for a maximum of 12 months and impacts may only occur during this period. The duration of activity is therefore short-term (score = 2).

Frequency of activity

The frequency of impact of construction dust emissions on ambient air quality is assessed by considering how often the activity is undertaken. Construction activities will occur on a daily basis and will last for the entire duration of the construction period (score = 5).

Frequency of incident/impact

Low levels of dust emissions are expected dust during construction activities. The frequency of incident of dust emissions on ambient air quality are therefore expected to be almost never/almost impossible/>20% (score = 1).

Legal issues

The National Dust Control Regulations were published on 1 November 2013 (DEA, 2013b). They provide guidance on the requirements for monitoring dust fallout and provides limit values for acceptable dustfall rates for residential and non-residential areas. Bylaws also prohibit activities that result in high levels of dust. In terms of legal issues, the impact of dust emissions on ambient air quality is therefore fully covered by legislation (score = 5).

Detection

The detection of impact of the dust emissions on ambient air quality during construction is assessed by evaluating how quickly/easily impacts/risks of activity on environment, people and property are detected. High levels of dust emissions are usually visible during dry, windy conditions, particularly from areas of the construction site that are continually disturbed or where natural vegetation has been removed. If dust levels are high, they are easily noticeable when they settle on property, mainly on the surfaces of exterior floors, windows and vehicles. Dust monitors can be used to determine dust levels resulting from the construction site. Detection of impacts is therefore considered to be undertaken without much effort (score = 2).

Consequence (Severity + Spatial Scale + Duration)

Consequence is a function of the severity, duration, and spatial scale of an impact. As discussed above:

- The severity or magnitude of the impact associated with the construction activity is considered to be insignificant (score = 2).
- The spatial scale of the impact is limited to the construction site (score = 1).
- The duration of the impact will be for a short-term of 6-12 months (score = 2).

Based on the equation provided, the consequence of construction dust resulting from construction activities has a score of 2+1+2=5.

Likelihood or Probability (Frequency of Activity + Frequency of Impact + Legal Issues + Detection)

The likelihood or probability of occurrence of the activity is based on frequencies of the activity and impact, whether the activity is governed by legislation and how easily it can be detected. As discussed above:

- Construction activities will occur on a daily basis and will last for the entire duration of the construction period (score = 5).
- The frequency of incident of dust emissions on ambient air quality are expected to be almost never/almost impossible/>20% (score = 1).
- In terms of legal issues, the impact of dust emissions on ambient air quality is fully covered by legislation (score = 5).
- Detection of impacts is undertaken without much effort (score = 2).

Based on the equation provided, the likelihood or probability of construction dust resulting from emissions from construction activities has a score of 5+1+5+2=13.

Environmental Significance/Risk (Consequence x Likelihood)

Significance is a function of consequence and likelihood. Based on the equation provided, the significance of construction dust resulting from emissions from construction activities has a score of 5x13=65.

Emissions of construction dust from sources associated with construction activities will result in an increase in ambient levels of dust. Although exposure to construction dust may not be regarded as a health issue, it does manifest as a nuisance. The status of the impact is therefore negative.

The significance of impact relating to emissions of construction dust from sources associated with construction activities is therefore predicted to be low (negative).

Irreplaceability of resource caused by impacts

Construction dust is generally coarse and manifests as a nuisance rather than a health issue. Emissions are released close to ground level with little or no buoyancy, which implies that their dispersion is limited, and the extent of potential impacts will be limited to the construction site. Construction activities are likely to endure for a relatively short period of time. Air quality impacts occurring in the ambient environment as a result of construction activities are therefore not expected to incur a loss of any resources. Since no irreplaceable resources will be impacted (the affected resource is easy to replace/rehabilitate), the irreplaceability of resources caused by impacts is rated as low.

Reversibility of impacts

Low levels of dust emissions are expected during construction activities. The generation of dust emissions will cease if construction activities stop. Air quality impacts occurring in the ambient environment as a result of construction activities are therefore expected to reverse with minimal rehabilitation and negligible residual effects. Since a high reversibility of impacts is possible, the reversibility of impacts is rated as high.

Mitigation measures to control dust

A few general recommendations to minimise the emission of dust from construction activities are:

- Strict enforcement of speed limits on all site roads
- Routine water spraying of site roads and denuded/disturbed areas (more frequent spraying may be necessary during dry, windy conditions)
- Removal of vegetation only if necessary
- Revegetation or paving of disturbed areas once construction activities are complete.

7.2.2 Operational phase

7.2.2.1 Scenario 1 and 2: Mabasa CCPP in Simple and Combined Modes

Severity or magnitude of impact

The severity or magnitude of impact of the proposed Mabasa CCPP emissions operating in Simple Cycle and Combined Cycle Modes on ambient air quality is assessed by comparing the predicted SO_2, NO_2 PM_{10} and CO concentrations with the health-based NAAQS.

The predicted ambient SO_2 concentrations are very low relative to the NAAQS and there are no predicted exceedances of the NAAQS. The maximum predicted concentrations are 2.2 % and 8.5% of the limit value of the NAAQS operating in Simple Cycle and Combined Cycle Modes. The severity or magnitude of the impact associated with SO_2 is therefore predicted to be minor (score = 2) for the proposed Mabasa CCPP operating in Simple Cycle and low (score = 4) Combined Cycle Modes.

The predicted ambient NO_2 concentrations are very low relative to the NAAQS and there are no predicted exceedances of the NAAQS. The maximum predicted concentrations are 0.3 and 1.1% of the limit value of the NAAQS. The severity or magnitude of the impact associated with NO_2 is therefore predicted to be minor (score = 2) for the proposed Mabasa CCPP operating in Simple Cycle and Combined Cycle Modes.

The predicted ambient PM_{10} concentrations are very low relative to the NAAQS and there are no predicted exceedances of the NAAQS. The maximum predicted concentrations are 0.5 and 1.2% of the limit value of the NAAQS. The severity or magnitude of the impact associated with PM_{10} is therefore predicted to be minor (score = 2) for the proposed Mabasa CCPP operating in Simple Cycle and Combined Cycle Modes.

The predicted ambient CO concentrations are very low relative to the NAAQS and there are no predicted exceedances of the NAAQS. The maximum predicted concentrations are 0.02 and 0.05% of the limit value of the NAAQS. The severity or magnitude of the impact associated with CO is therefore predicted to be minor (score = 2) for the proposed Mabasa CCPP operating in Simple Cycle and Combined Cycle Modes.

Spatial scale of activity

The spatial scale of impact of the proposed Mabasa CCPP operating in Simple Cycle and Combined Cycle Modes emissions on ambient air quality is assessed by evaluating the spatial extent of predicted SO_2, NO_2, PM_{10} and CO concentrations in the ambient environment.

In all cases the predicted ambient concentrations are very low relative to the NAAQS and the highest predicted concentrations occur within a 3 km radius to the west and north-northwest of the proposed project site over the industrial area, and to the south-southwest over parts of the Richards Bay and naturally vegetated areas. The spatial scale of the impact is therefore local (score = 2) for both operational scenarios as impacts are limited to the Richards Bay and the immediate surrounding areas.

Duration of activity

The duration of impact of the proposed Mabasa CCPP emissions on ambient air quality when operating in Simple Cycle and Combined Cycle Modes is assessed by considering the operational lifespan of the proposed project. Impacts on ambient air quality in terms of SO_2, NO_2, PM_{10} and CO will exist for the entire duration of the proposed project. It is assumed that the duration of activity will be for a medium-term of 5-15 years (score = 3).

Frequency of activity

The frequency of impact of the proposed Mabasa CCPP emissions on ambient air quality when operating in Simple Cycle and Combined Cycle Modes is assessed by considering how often the activity is undertaken. As a worst-case scenario, it is expected that the frequency of activity will be definite/always/permanent/daily (score = 5).

Frequency of incident/impact

The frequency of incident of the proposed Mabasa CCPP emissions on ambient air quality when operating in Simple Cycle and Combined Cycle Modes is assessed by considering how often the activity will impact on ambient air quality. The predicted ambient concentrations of SO_2, NO_2, PM_{10} and CO are very low. The highest predicted concentrations are well below the respective NAAQS. The additive effect of the contribution of SO_2, NO_2, PM_{10} and CO from the proposed Mabasa CCPP operating in Simple Cycle and Combined Cycle Modes is predicted to be very small and do not exceed that of the NAAQS. Impacts are therefore expected to be almost never/almost impossible/>20% (score = 1).

Legal issues

Ambient air quality in South Africa is governed by the National Environmental Management: Air Quality Act No. 39 of 2004 (NEM: AQA) and supporting regulations. According to the legislation, the act was promulgated "to reform the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government; for specific air quality measures; and for matters incidental thereto".

Air quality objectives defined in Provincial and Municipal Air Quality Management Plans (AQMP) are achieved to a large extent through the enforcement of regulations supporting the NEM: AQA and through municipal by-laws.

In this study, reference has been made to the MES, NAAQS and AEL. In terms of legal issues, the impact of the proposed Mabasa CCPP emissions on ambient air quality in terms of predicted SO_2, NO_2, PM_{10} and CO concentrations in the ambient environment is fully covered by legislation (score = 5) for both the proposed Mabasa CCPP operating in Simple Cycle and Combined Cycle Modes.

Detection

The detection of impact of the proposed Mabasa CCPP emissions on ambient air quality is assessed by evaluating how quickly/easily impacts/risks of activity on environment, people

and property are detected. Air dispersion modelling is a robust tool that is used to easily predict if ambient concentrations are compliant with the NAAQS, as has been done in this study. Fenceline monitoring can be used to determine ambient concentrations on the fenceline of a facility; and to assess compliance with the NAAQS, during the operational phase of the proposed project. Stack emission testing can be used to measure emissions within a stack and assess compliance with the MES, during the operational phase. Detection of impacts is therefore considered to be undertaken without much effort (score = 2), for both the proposed Mabasa CCPP operating in Simple Cycle and Combined Cycle Modes.

Consequence (Severity + Spatial Scale + Duration)

Consequence is a function of the severity, duration, and spatial scale of an impact for the proposed Mabasa CCPP operating in Simple Cycle and Combined Cycle Modes. As discussed above:

- The severity (or magnitude) of the impact is expected to be minor (score = 2) for the simple cycle case for all pollutants.
- The severity (or magnitude) of the impact is expected to be minor (score = 2) for the combined cycle case for all pollutants, except for SO_2 which is low (score = 4).
- The spatial scale of the impact is local (score = 2) as impacts are limited to the Richards Bay and the immediate surrounding.
- The duration of the impact will be for a medium-term of 5-15 years (score = 3).

Based on the equation provided, the consequence of ambient concentrations of SO_2, NO_2, PM_{10} and CO resulting from emissions from the proposed Mabasa CCPP when operating in Simple Cycle Mode has a score of 2+2+3=7.

The consequence of ambient concentrations of NO_2, PM_{10} and CO resulting from emissions from the proposed Mabasa CCPP when operating in Combined Cycle Mode has a score of 2+2+3=7.

The consequence of ambient concentrations of SO_2 resulting from emissions from the proposed Mabasa CCPP when operating in Combined Cycle Mode has a score of 4+2+3=9.

Likelihood or Probability (Frequency of Activity + Frequency of Impact + Legal Issues + Detection)

The likelihood or probability of occurrence of the activity is based on frequencies of the activity and impact, whether the activity is governed by legislation and how easily it can be detected. As discussed above, for the Mabasa CCPP operating in Simple Cycle and Combined Cycle Modes:

- As a worst-case scenario, it is expected that the frequency of activity will be definite/always/permanent/daily (score = 5).
- Similarly, the frequency of impact is therefore expected to be almost never/almost impossible/>20% (score = 1).
- In terms of legal issues, the impact of the proposed Mabasa CCPP emissions in the ambient environment is fully covered by legislation (score = 5).
- Detection of impacts is considered to be undertaken without much effort (score = 2).

Based on the equation provided, the likelihood or probability of ambient concentrations of SO_2, NO_2, PM_{10} and CO resulting from emissions from the proposed Mabasa CCPP when operating in Simple Cycle and Combined Cycle Mode has a score of 5+1+5+2=13.

Environmental Significance/Risk (Consequence x Likelihood)

Significance is a function of consequence and likelihood. Based on the equation provided, the significance of ambient concentrations of SO_2, NO_2, PM_{10} and CO resulting from emissions from the proposed Mabasa CCPP has a score of 7x13=91 for the proposed Mabasa CCPP operating in Simple Cycle Mode.

The significance of ambient concentrations of NO_2, PM_{10} and CO resulting from emissions from the proposed Mabasa CCPP has a score of 7x13=91 for the proposed Mabasa CCPP operating in Combined Cycle Mode.

The significance of ambient concentrations of SO_2 resulting from emissions from the proposed Mabasa CCPP has a score of 9x13=117 for the proposed Mabasa CCPP operating in Combined Cycle Mode.

Emissions of SO_2, NO_X, PM_{10} and CO from sources associated with the proposed Mabasa CCPP will result in an increase in ambient concentrations of SO_2, NO_2, PM_{10} and CO. Exposure to air pollutants through inhalation poses a health risk, regardless of the concentration. The status of the impact is therefore negative for the proposed Mabasa CCPP operating in Simple Cycle and Combined Cycle Modes.

The significance of impact relating to emissions of SO_2, NO_X, PM_{10} and CO from sources associated with the proposed Mabasa CCPP when operating in Simple Cycle and Combined Cycle Modes is therefore predicted to be low (negative).

Irreplaceability of resource caused by impacts

The predicted ambient concentrations of SO_2, NO_2, PM_{10} and CO resulting from the Mabasa CCPP operating in Simple Cycle and Combined Cycle Modes are very low and well below the respective NAAQS. The direct air quality impacts occurring in the ambient environment as a result of the proposed Mabasa CCPP are therefore not expected to incur a loss of any resources. Since no irreplaceable resources will be impacted (the affected resource is easy to replace/rehabilitate), the irreplaceability of resource caused by impacts is rated as low for the proposed Mabasa CCPP when operating in Simple Cycle Mode.

Reversibility of impacts

The predicted ambient concentrations of SO_2, NO_2, PM_{10} and CO resulting from the Mabasa CCPP operating in Simple Cycle and Combined Cycle Modes are very low and well below the respective NAAQS. Direct air quality impacts occurring in the ambient environment because of the proposed Mabasa CCPP are therefore expected to reverse with minimal rehabilitation and negligible residual effects when the activity ceases to operate. Since a high reversibility of impacts is possible, the reversibility of impacts caused by the proposed Mabasa CCPP is rated as high for the proposed Mabasa CCPP when operating in Simple Cycle and Combined Cycle Modes.

Mitigation measures to control stack emissions

Air quality management interventions in the form of emission control have been considered in all aspects of design and operation. Apart from Dry Low-NOx burners to control NO_X

emissions, further emission reduction interventions are deemed to be unnecessary considering the low impact of the proposed project on air quality.

7.2.2.2 Scenario 3: Cumulative assessment of Mabasa CCPP in Combined Cycle Mode with other industry emissions

In this section, the cumulative impact of the Mabasa CCPP in Combined Cycle Mode with point source emissions from several major industries in Richards Bay is assessed. The industries are Mondi, Foskor, Richards Bay Minerals, Tongaat Hullet Felixton, Transnet Port Terminals, South 32 and MPACT.

For this scenario the maximum permitted emissions of SO_2, NO_X and PM included in the respective industry Atmospheric Emission Licences (AEL) have been used. Using the permitted maximum emissions rather than actual emissions presents a possible worst-case scenario for these sources as mostly the industries operate well within the maximum permitted emissions. A further consideration in this scenario is the exclusion of other sources in Richards Bay i.e. industry, transport (vehicles and shipping), the storage handling of coal and ores, local and regional vegetation burning, and regional scale transport of pollutants into the area.

Severity or magnitude of impact

The severity or magnitude of the cumulative impact of the industries included in this assessment on ambient air quality is assessed by comparing the predicted SO_2, NO_2 and PM_{10} concentrations with the health-based NAAQS.

The predicted ambient SO_2 concentrations are high relative to the NAAQS and there are predicted exceedances of the NAAQS to the south-southwest and northeast of the Mabasa CCPP. The maximum predicted concentrations are more the two times of the limit value of the NAAQS. The severity or magnitude of the impact associated with SO_2 is therefore predicted to be high (score = 8) for the cumulative scenario of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry sources. It must be emphasised that the contribution of the Mabasa CCPP is small (refer to 6.3.2.1).

The predicted ambient NO_2 concentrations are high relative to the NAAQS and there are predicted exceedances of the NAAQS to the south-southwest of the Mabasa CCPP. The maximum predicted concentration is 130% of the limit value of the 1-hour NAAQS. The severity or magnitude of the impact associated with NO_2 is therefore predicted to be high (score = 8) for the cumulative scenario of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry sources. It must be emphasised that the contribution of the Mabasa CCPP is small (refer to 6.3.2.2).

The predicted ambient PM_{10} concentrations are high relative to the NAAQS and there are predicted exceedances of the NAAQS to the south-southwest of the Mabasa CCPP. The maximum predicted concentrations 130% of the limit value of the 24-hour NAAQS. The severity or magnitude of the impact associated with PM_{10} is therefore predicted to be high (score = 8) for the cumulative scenario of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry sources. It must be emphasised that the contribution of the Mabasa CCPP is small (refer to 6.3.2.3).

Spatial scale of activity

The spatial scale of the cumulative impact of the proposed Mabasa CCPP emissions when operating in Combined Cycle Mode with other industry sources on ambient air quality is assessed by evaluating the spatial extent of predicted SO_2, NO_2 and PM_{10} concentrations in the ambient environment.

For all pollutants the predicted ambient concentrations are relatively high compared to the NAAQS. The spatial scale of the impact associated with the cumulative effect of Mabasa CCPP operating in Combined Cycle Mode with other industry sources is therefore regional (score = 3) as impacts extend beyond the Richards Bay.

Duration of activity

The duration of impact of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry source emissions on ambient air quality is assessed by considering the operational lifespan of the proposed project. Impacts on ambient air quality in terms of SO_2, NO_2 and PM_{10} will exist for the entire duration of the proposed project. It is assumed that the duration of activity will be for a long-term (score = 4).

Frequency of activity

The frequency of impact of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry source emissions on ambient air quality is assessed by considering how often the activity is undertaken. As a worst-case scenario, it is expected that the frequency of activity will be definite/always/permanent/daily (score = 5).

Frequency of incident/impact

The frequency of incident of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry source emissions on ambient air quality is assessed by considering how often the activity will impact on ambient air quality. Based on the assumption that the facilities assessed operate simultaneously at the MES the predicted ambient concentrations of SO_2, NO_2 and PM_{10} are relatively high. This is a general assumption, and it is highly unlikely that all industries will simultaneously operate in this mode. Impacts are therefore expected to be almost never/almost impossible/>20% (score = 1).

Legal issues

Ambient air quality in South Africa is governed by the National Environmental Management: Air Quality Act No. 39 of 2004 (NEM: AQA) and supporting regulations. According to the legislation, the act was promulgated "to reform the law regulating air quality in order to protect the environment by providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide for national norms and standards regulating air quality monitoring, management and control by all spheres of government; for specific air quality measures; and for matters incidental thereto".

Air quality objectives defined in Provincial and Municipal Air Quality Management Plans (AQMP) are achieved to a large extent through the enforcement of regulations supporting the NEM: AQA and through municipal by-laws.

In this study, reference has been made to the MES, NAAQS and AEL. In terms of legal issues, the impact of the proposed Mabasa CCPP emissions and those of other industries on ambient air quality in terms of predicted SO_2, NO_2 and PM_{10} concentrations in the ambient environment is fully covered by legislation (score = 5).

Detection

The detection of impact of the proposed Mabasa CCPP emissions and those of other industries on ambient air quality is assessed by evaluating how quickly/easily impacts/risks of activity on environment, people and property are detected. Air dispersion modelling is a robust tool that is used to easily predict if ambient concentrations are compliant with the NAAQS, as has been done in this study. Fenceline monitoring can be used to determine ambient concentrations on the boundary of a facility and to assess compliance with the NAAQS, during the operations of a facility. Stack emission testing can be used to measure emissions within a stack and assess compliance with the MES. Detection of impacts is therefore considered to be undertaken without much effort (score = 2).

Consequence (Severity + Spatial Scale + Duration)

Consequence is a function of the severity, duration, and spatial scale of the cumulative impact for the Mabasa CCPP in Combined Cycle Mode with other industry source emissions. As discussed above:

- The severity (or magnitude) of the cumulative impact is expected to be high (score = 8).
- The spatial scale of the cumulative impact is regional (score = 3) as impacts are limited to the Richards Bay and the immediate surrounding areas.
- The duration of the cumulative impact will be for a long-term (score = 4).

Based on the equation provided, the consequence of ambient concentrations of SO_2, NO_2, PM_{10} and CO resulting from emissions from the proposed Mabasa CCPP when operation in Combined Cycle Mode with other industry source emissions has a score of 8+3+4=15

Likelihood or Probability (Frequency of Activity + Frequency of Impact + Legal Issues + Detection)

The likelihood or probability of occurrence of the activity is based on frequencies of the activity and impact, whether the activity is governed by legislation and how easily it can be detected. As discussed above for the proposed Mabasa CCPP when operation in Combined Cycle Mode with other industrial sources:

- As a worst-case scenario, it is expected that the frequency of activity will be definite/always/permanent/daily (score = 5).
- Impacts will only occur if the suite of industries assessed operate simultaneously at the MES and therefore expected to be almost never/almost impossible/>20% (score = 1).
- In terms of legal issues, the impact of the proposed Mabasa CCPP emissions and those of other industries in the ambient environment is fully covered by legislation (score = 5).
- Detection of impacts is considered to be undertaken without much effort (score = 2).

Based on the equation provided, the likelihood or probability of ambient concentrations of SO_2, NO_2, PM_{10} and CO resulting from emissions from the proposed Mabasa CCPP has a score of 5+1+5+2=13 for the proposed Mabasa CCPP in Combined Cycle Mode with other industry sources.

Environmental Significance/Risk (Consequence x Likelihood)

Significance is a function of consequence and likelihood. Based on the equation provided, the significance of ambient concentrations of SO_2, NO_2 and PM_{10} resulting from emissions from the proposed Mabasa CCPP in Combined Cycle Mode with other industry sources has a score of 15x13=195.

Emissions of SO_2, NO_X and PM_{10} from sources associated with the proposed Mabasa CCPP and other industries will result in ambient concentrations of SO_2, NO_2 and PM_{10}. Exposure to air pollutants through inhalation poses a health risk, regardless of the concentration. The status of the cumulative impact is therefore negative.

The significance of the cumulative impact relating to emissions of SO_2, NO_X and PM_{10} from sources associated with the proposed Mabasa CCPP in Combined Cycle Mode with other industry sources is therefore predicted to be medium (negative).

7.2.2.3 Scenario 4: Cumulative assessment Mabasa CCPP in Combined Cycle Mode with other industry emissions and emissions from approved applications

In this section, the cumulative impact of the Mabasa CCPP in Combined Cycle Mode with point source emissions from existing major industry facilities and with six approved applications (Table 7-11) is assessed. The cumulative impacts on air quality assumes that all facilities operate together and emit at the maximum permitted rates.

Table 7-11: Sources included in the cumulative assessment

Existing industry sources	Approved applications
i) Mondi ii) Foskor iii) Richards Bay Minerals iv) Tongaat Hullet Felixton v) Transnet Port Terminals vi) South 32 vii) MPACT	i) Elegant Afro Chemicals Chlor-Alkali Plant in the RBIDZ ii) Eskom 3000 MW CCPP in the RBIDZ iii) Nseleni Power Corporation Limited Floating CCPP in the Port of Richards Bay iv) Nyanza Light Metals Titanium Dioxide Pigment Plant in the RBIDZ v) Phakwe Richards Bay Gas 3 CCPP in the RBIDZ vi) Phinda Richards Bay 320 MW gas PP in Alton industrial

Severity or magnitude of impact

The severity or magnitude of the cumulative impact of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry sources and with approved applications on ambient air quality is assessed by comparing the predicted SO_2, NO_2 and PM_{10} concentrations with the health-based NAAQS.

The predicted ambient SO_2 concentrations are high relative to the NAAQS and there are predicted exceedances of the NAAQS to the south-southwest and northeast of the Mabasa CCPP. The maximum predicted concentrations are more than two times the limit value of the NAAQS. The severity or magnitude of the impact associated with SO_2 is therefore predicted to be high (score = 8) for the cumulative scenario of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry sources. It must be emphasised that the contribution of the Mabasa CCPP is small (refer to 6.3.2.1).

The predicted ambient NO_2 concentrations are high relative to the NAAQS and there are predicted exceedances of the NAAQS to the south-southwest of the Mabasa CCPP. The maximum predicted concentrations 130% of the limit value of the 1-hour NAAQS. The severity or magnitude of the impact associated with SO_2 is therefore predicted to be high (score = 8) for the cumulative scenario of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry sources. It must be emphasised that the contribution of the Mabasa CCPP is small (refer to 6.3.2.2).

The predicted ambient PM_{10} concentrations are high relative to the NAAQS and there are predicted exceedances of the NAAQS to the south-southwest of the Mabasa CCPP. The maximum predicted concentrations 130% of the limit value of the 1-hour NAAQS. The severity or magnitude of the impact associated with SO_2 is therefore predicted to be high (score = 8) for the cumulative scenario of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry sources. It must be emphasised that the contribution of the Mabasa CCPP is small (refer to 6.3.2.3).

Spatial scale of activity

The spatial scale of the cumulative impact of the proposed Mabasa CCPP emissions when operating in Combined Cycle Mode with other industry sources and with approved applications on ambient air quality is assessed by evaluating the spatial extent of predicted SO_2, NO_2 and PM_{10} concentrations in the ambient environment.

For all pollutants the predicted ambient concentrations are relatively high compared to the NAAQS. The spatial scale of the impact associated with the cumulative effect of Mabasa CCPP operating in Combined Cycle Mode with other industry sources is therefore regional (score = 3) as impacts extend beyond the Richards Bay.

Duration of activity

The duration of impact of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry source emissions on ambient air quality is assessed by considering the operational lifespan of the proposed project. Impacts on ambient air quality in terms of SO_2, NO_2, PM_{10} and CO will exist for the entire duration of the proposed project. It is assumed that the duration of activity will be for a long-term (score = 4).

Frequency of activity

The frequency of impact of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry source emissions and with approved applications on ambient air quality is assessed by considering how often the activity is undertaken. As a worst-case scenario, it is expected that the frequency of activity will be definite/always/permanent/daily (score = 5).

Frequency of incident/impact

The frequency of incident of the proposed Mabasa CCPP operating in Combined Cycle Mode with other industry source emissions on ambient air quality is assessed by considering how often the activity will impact on ambient air quality. Based on the assumption that the facilities assessed operate simultaneously at the MES the predicted ambient concentrations of SO_2, NO_2 and PM_{10} are relatively high. This is a general assumption, and it is highly unlikely that all industries will simultaneously operate in this mode. Impacts are therefore expected to be almost never/almost impossible/>20% (score = 1).

Consequence (Severity + Spatial Scale + Duration)

Consequence is a function of the severity, duration, and spatial scale of the cumulative impact for the Mabasa CCPP in Combined Cycle Mode with other industry source emissions and with approved applications. As discussed above:

- The severity (or magnitude) of the impact is expected to be high (score = 8).
- The spatial scale of the impact is regional (score = 3) as impacts extend beyond Richards Bay.
- The duration of the impact will be for a long-term (score = 4).

Based on the equation provided, the consequence of ambient concentrations of SO_2, NO_2 and PM_{10} resulting from emissions from the proposed Mabasa CCPP when operation in Combined Cycle Mode with other industry source emissions has a score of 8+3+4=15

Likelihood or Probability (Frequency of Activity + Frequency of Impact + Legal Issues + Detection)

The likelihood or probability of occurrence of the activity is based on frequencies of the activity and impact, whether the activity is governed by legislation and how easily it can be detected. As discussed above for the proposed Mabasa CCPP when operation in Combined Cycle Mode with other industrial sources and with approved applications:

- As a worst-case scenario, it is expected that the frequency of activity will be definite/always/permanent/daily (score = 5).
- Impacts will only occur if the suite of industries assessed operate simultaneously at the MES and therefore expected to be almost never/almost impossible/>20% (score = 1).
- In terms of legal issues, the impact of the proposed Mabasa CCPP emissions and those of other industries in the ambient environment is fully covered by legislation (score = 5).
- Detection of impacts is considered to be undertaken without much effort (score = 2).

Based on the equation provided, the likelihood or probability of ambient concentrations of SO_2, NO_2 and PM_{10} resulting from emissions from the proposed Mabasa CCPP in Combined Cycle Mode with other industry sources and with approved applications has a score of 5+1+5+2=13.

Environmental Significance/Risk (Consequence x Likelihood)

Significance is a function of consequence and likelihood. Based on the equation provided, the significance of ambient concentrations of SO_2, NO_2 and PM_{10} resulting from emissions from

the proposed Mabasa CCPP in Combined Cycle Mode with other industry sources and with approved applications has a score of 15x13=195.

Emissions of SO_2, NO_X and PM_{10} from sources associated with the proposed Mabasa CCPP will result in an increase in ambient concentrations of SO_2, NO_2 and PM_{10}. Exposure to air pollutants through inhalation poses a health risk, regardless of the concentration. The status of the impact is therefore negative for the proposed Mabasa CCPP in Combined Cycle Mode with other industry sources and with approved applications.

The significance of the cumulative impact relating to emissions of SO_2, NO_X and PM_{10} from sources associated with the proposed Mabasa CCPP in Combined Cycle Mode with other industry sources and with approved applications is therefore predicted to be medium (negative).

7.2.2.4 Scenario: Emergency shutdown

Emergency shutdowns would only occur in the event of a grid failure or other fault requiring the plant to safely shut down, or during infrequent maintenance of electrical infrastructure (e.g. electrical transformer equipment). During an emergency shutdown, emergency generators operating on ultra-low sulphur diesel (ULSD) may be required to provide power to essential systems. Emergency generator operation is expected to be infrequent, generally less than once per year, and would typically be required for a period of up to two hours. Maintenance requirements are likely to happen every three years and could take up to a week to complete. The emergency diesel generator is assumed to have a rated power output of 1 MW.

The combustion of ULSD would result in temporary emissions of NO_X, PM, CO and SO_2. Although the low sulphur content of ULSD would limit SO_2 emissions, combustion would still result in emissions of NO_X, PM and CO. Given the short duration and infrequent nature of emergency generator operation, the associated impact on ambient air quality is expected to be temporary and localised.

Severity or magnitude of impact

The impact is considered minor as emissions from the emergency generators would occur for a short period and only under emergency conditions. The severity or magnitude of the impact associated with the emergency shutdown is therefore considered to be insignificant (score = 2).

Spatial scale of activity

The potential air quality impacts are expected to be limited to the local area surrounding the facility due to the short duration of emergency generator operation (score = 2).

Duration of activity

The impact would occur only for the duration of emergency generator operation, which is expected to be up to two hours, and would cease once the generators are switched off. Maintenance requirements are likely to happen every three years and could take up to a week to complete. The impact is therefore considered immediately reversible. The duration is therefore immediate (score = 1).

Frequency of activity

Emergency generator operation is expected to be infrequent, generally occurring less than once per year. Operation would be limited to emergency shutdowns following a total grid failure, or periodic electrical infrastructure maintenance, which is anticipated approximately once every three years. Given the low likelihood of a total grid failure and the infrequent nature of scheduled maintenance, a frequency score of 1 is considered appropriate.(score = 1).

Frequency of incident/impact

The associated air quality impact would only occur when the emergency generators are operated. The frequency of incident or impact on ambient air quality are therefore expected to be almost never/almost impossible/>20% (score = 1).

Legal issues

Emissions during operations, including shutdown, are regulated in terms of the NEM: AQA and may be included in the Atmospheric Emission License and associated atmospheric emission requirements.

Detection

The detection of impact of emissions on ambient air quality from an emergency shutdown event may be assessed by evaluating how quickly/easily impacts/risks of activity on environment, people and property are detected. Emissions may be monitored or estimated during the event with subsequent assessment. Detection of impacts is therefore considered to be undertaken with some effort (score = 3).

Consequence (Severity + Spatial Scale + Duration)

Consequence is a function of the severity, duration, and spatial scale of an impact. As discussed above:

- The severity or magnitude of the impact associated with an emergency shutdown event is considered to be insignificant (score = 2).
- The spatial scale of the impact is localised (score = 2).
- The duration of the impact will be less than 2 hours per year or up to 1 week every three years (score = 1).

Based on the equation provided, the consequence of emissions from the emergency shutdown has a score of 2+2+1=5.

Likelihood or Probability (Frequency of Activity + Frequency of Impact + Legal Issues + Detection)

The likelihood or probability of occurrence of the activity is based on frequencies of the activity and impact, whether the activity is governed by legislation and how easily it can be detected. As discussed above:

- An emergency shutdown event is improbable (score = 1).
- The frequency of an emergency shutdown event will be approximately once every three years, i.e. almost never/almost impossible/>20% (score = 1).

- In terms of legal issues, the impact of emissions on ambient air quality is fully covered by legislation (score = 5).
- Detection of impacts is considered to be undertaken with some effort (score = 3).

Based on the equation provided, the likelihood or probability of emissions from the emergency shutdown has a score of 1+1+5+3=10.

Environmental Significance/Risk (Consequence x Likelihood)

Significance is a function of consequence and likelihood. Based on the equation provided, the significance resulting from emissions during an emergency shutdown event has a score of 5x10=50.

Emissions associated with an emergency shutdown event will result in an increase in ambient concentrations of NOx, SO_2, PM_{10} and CO. The status of the impact is therefore negative.

The significance of impact relating to emissions associated with an emergency shutdown event is therefore predicted to be low (negative).

7.2.2.5 Scenario: Black-start

A black-start would be required following a complete grid blackout or failure to provide power for the initial starting of the first gas turbine and essential balance-of-plant systems. A diesel generator of approximately 20 MW would be used for this purpose, after which the first gas turbine would provide power to enable the remainder of the plant to start. A black-start event is considered very unlikely and would typically require operation of the generator for approximately 30–60 minutes. The use of ULSD during a black-start would result in temporary emissions of NO_X, PM, CO and SO_2. Given the short duration and very infrequent occurrence of a black-start event, the potential impact on ambient air quality is expected to be temporary and localised.

Severity or magnitude of impact

A black-start is done using ULSD, resulting in emissions of SO_2, NO_X, PM and CO. The expected duration of the start-up event is between 30 to 60 minutes The severity or magnitude of the impact associated with a black-start is therefore considered to be insignificant (score = 2).

Spatial scale of activity

The potential air quality impacts associated with black-start operation are expected to be limited to the local area surrounding the facility, given the short duration of the event and temporary nature of the emissions (score = 2).

Duration of activity

The black-start generator would typically operate for approximately 30–60 minutes, after which the first gas turbine would provide power for the remainder of the plant start-up. The associated air quality impact would therefore be immediately reversible once the generator is no longer required. The duration is therefore immediate (score = 1).

Frequency of activity

A black-start would only be required following a complete grid blackout or failure and is considered very unlikely to occur (score = 1).

Frequency of incident/impact

A black-start is unlikely to be required. The frequency of incident or impact on ambient air quality are therefore expected to be almost never/almost impossible/>20% (score = 1).

Legal issues

Emissions during operations, including black-start, are regulated in terms of the NEM: AQA and may be included in the Atmospheric Emission License and associated atmospheric emission requirements (score = 5).

Detection

The detection of impact of emissions on ambient air quality from a black-start event may assessed by evaluating how quickly/easily impacts/risks of activity on environment, people and property are detected. Emission may be monitored or estimated during the event with subsequent assessment. Detection of impacts is therefore considered to be undertaken with some effort (score = 3).

Consequence (Severity + Spatial Scale + Duration)

Consequence is a function of the severity, duration, and spatial scale of an impact. As discussed above:

- The severity or magnitude of the impact associated with a black-start event is considered to be insignificant (score = 2).
- The spatial scale of the impact is localised (score = 2).
- The duration of the impact will be less than an hour (30-60 minutes) (score = 1).

Based on the equation provided, the consequence of emissions from the black-start event has a score of 2+2+1=5.

Likelihood or Probability (Frequency of Activity + Frequency of Impact + Legal Issues + Detection)

The likelihood or probability of occurrence of the activity is based on frequencies of the activity and impact, whether the activity is governed by legislation and how easily it can be detected. As discussed above:

- A black-start event is improbable (score = 1).
- The frequency of a black-start event is almost never/almost impossible/>20% (score = 1).
- In terms of legal issues, the impact of emissions on ambient air quality is fully covered by legislation (score = 5).
- Detection of impacts is considered to be undertaken with some effort (score = 3).

Based on the equation provided, the likelihood or probability of emissions from the black-start event has a score of 1+1+5+3=10.

Environmental Significance/Risk (Consequence x Likelihood)

Significance is a function of consequence and likelihood. Based on the equation provided, the significance resulting from emissions during a black-start event has a score of 5x10=50.

Emissions associated with a black-start event will result in an increase in ambient concentrations of NOx, SO_2, PM_{10} and CO. The status of the impact is therefore negative.

The significance of impact relating to emissions associated with a black-start event is therefore predicted to be low (negative).

7.2.2.6 Scenario: Backup diesel operation

In the event of a failure or interruption of the natural gas supply, the gas turbines may operate on ultra-low sulphur diesel (ULSD) as a backup fuel. This scenario is distinct from the emergency shutdown and black-start scenarios, which involve the use of diesel generators to provide emergency or starting power. Under the backup diesel scenario, the gas turbines themselves would be operated on diesel fuel instead of the normal natural gas fuel. Provision has been made in the conceptual design for sufficient diesel storage to allow operation of the gas turbines for up to three days in the event of a gas supply failure or interruption, representing a worst-case contingency scenario.

Diesel is not considered a preferred or practical fuel for routine operation of the proposed facility. The cost of diesel fuel is substantially higher than that of natural gas, while operation of the gas turbines on liquid fuel would also increase maintenance requirements. In addition, although ULSD has a low sulphur content, it still contains some sulphur, and operation on liquid fuel therefore requires consideration of the sulphur dew point. Maintaining stack temperatures above the sulphur dew point can result in reduced overall combined-cycle gas turbine (CCGT) efficiency. Natural gas therefore remains the preferred fuel for normal operation of the facility.

The requirement for backup diesel operation is expected to be highly infrequent, with an anticipated frequency of less than once per year. The likelihood of a prolonged gas supply interruption is considered low, particularly given that the ZET LNG facility incorporates significant gas storage and is connected to the Lily pipeline. The actual risk of gas supply failure will, however, need to be evaluated in accordance with the final power purchase agreement (PPA) and associated gas supply arrangements. Given the available gas supply infrastructure and the low probability of a prolonged gas supply interruption, it is anticipated that backup diesel operation would rarely, if ever, be required.

Operation on backup diesel would result in increased atmospheric emissions compared with normal natural gas operation, particularly NO_X and PM. Although ULSD has a low sulphur content, combustion of diesel would still result in emissions of SO_2, NO_X, PM and CO. The potential air quality impact associated with this scenario would therefore be limited to periods during which the gas turbines are operated on backup diesel and would cease once normal natural gas operation is restored.

Severity or magnitude of impact

Operation on backup diesel would result in increased atmospheric emissions compared with normal natural gas operation, particularly NO_X and PM. However, this would represent a contingency operating condition that is expected to occur infrequently and for a limited period. The potential increase in ambient pollutant concentrations is therefore considered to be of low magnitude (score = 4).

Spatial scale of activity

The potential air quality impacts associated with backup diesel operation are expected to be limited to the local area surrounding the facility, given the short duration of the event and temporary nature of the emissions (score = 2).

Duration of activity

The conceptual design provides for approximately three days of diesel storage and operation in the event of a natural gas supply failure. The associated air quality impact would cease once the natural gas supply is restored and the plant returns to normal operation. The duration is therefore immediate (score = 1).

Frequency of activity

Backup diesel operation is expected to occur infrequently, with an anticipated frequency of less than once per year. The risk of a prolonged natural gas supply interruption is considered low, hence the activity is considered very unlikely to occur (score = 1).

Frequency of incident/impact

The associated air quality impact would only occur in the event of a natural gas supply interruption requiring the gas turbines to operate on diesel. The frequency of incident or impact on ambient air quality are therefore expected to be almost never/almost impossible/>20% (score = 1).

Legal issues

Emissions during operations, including backup diesel operation, are regulated in terms of the NEM: AQA and may be included in the Atmospheric Emission License and associated atmospheric emission requirements (score =5).

Detection

The detection of impact of emissions on ambient air quality from backup diesel operation may assessed by evaluating how quickly/easily impacts/risks of activity on environment, people and property are detected. Emission may be monitored or estimated during the event with subsequent assessment. Detection of impacts is therefore considered to be undertaken with some effort (score = 3).

Consequence (Severity + Spatial Scale + Duration)

Consequence is a function of the severity, duration, and spatial scale of an impact. As discussed above:

- The severity or magnitude of the impact associated with a backup diesel operation is considered to be low (score = 4).
- The spatial scale of the impact is localised (score = 2).
- The duration of the impact will be approximately three days (score = 1).

Based on the equation provided, the consequence of emissions from the backup diesel operation has a score of 4+2+1=7.

Likelihood or Probability (Frequency of Activity + Frequency of Impact + Legal Issues + Detection)

The likelihood or probability of occurrence of the activity is based on frequencies of the activity and impact, whether the activity is governed by legislation and how easily it can be detected. As discussed above:

- A backup diesel operation is considered unlikely (score = 1).
- The frequency of a backup diesel operation is almost never/almost impossible/>20% (score = 1).
- In terms of legal issues, the impact of emissions on ambient air quality is fully covered by legislation (score = 5).
- Detection of impacts is considered to be undertaken with some effort (score = 3).

Based on the equation provided, the likelihood or probability of emissions from the backup diesel operation has a score of 1+1+5+3=10.

Environmental Significance/Risk (Consequence x Likelihood)

Significance is a function of consequence and likelihood. Based on the equation provided, the significance resulting from emissions during a backup diesel operation has a score of 7x10=70.

Emissions associated with a backup diesel operation will result in an increase in ambient concentrations of NOx, SO_2, PM_{10} and CO. The status of the impact is therefore negative.

The significance of impact relating to emissions associated with a backup diesel operation is therefore predicted to be low (negative).

7.2.3 Decommissioning and closure phase

The decommissioning and closure phase will mainly entail disassembly of the plant and associated infrastructure, and removal from site. All other infrastructure such as fencing, laydown areas, pipelines and transmission lines which may no longer be needed will be demolished. Most of the site is expected to be paved and in good condition at closure. This area could be cleaned and used by future tenants that would occupy the site.

Most of these decommissioning activities generate dust. As with construction, the dust is generally coarse, but may include some fine respirable particles. Dust emissions were not estimated for the closure phase as they require specific information on the nature and duration of the activities as well as the equipment and vehicles. The assessment of air quality impacts during decommissioning is therefore qualitative.

Activities during decommissioning are associated with the movement of vehicles and equipment including bulldozers, excavators and tipper trucks. All aspects of decommissioning inherently generate dust, but the movement of construction vehicles on the unpaved surfaces at the site are generally the largest source of dust. Dust is also easily entrained from exposed areas by wind.

Decommissioning of the proposed site infrastructure is estimated to take 6 to 12 months to complete. There is insufficient information to estimate dust emissions from the decommissioning phase as they require specific information on the nature and duration of the activities as well as the equipment and vehicles. The assessment of air quality impacts during decommissioning is therefore qualitative. The impact assessment below applies to the decommissioning phase of the proposed project, specifically focussing on dust.

Severity or magnitude of impact

Dust is generally coarse in nature and manifests as a nuisance rather than a health issue. The severity or magnitude of the impact associated with the decommissioning activities is therefore considered to be insignificant (score = 2).

Spatial scale of activity

Dust is released close to ground level with little or no buoyancy. This implies that their dispersion is limited, and the extent of potential impacts will be limited to the decommissioning site (score = 1).

Duration of activity

Decommissioning activities are likely to endure for a maximum of 6 to 12 months and impacts may only occur during this period. The duration of activity is therefore short-term (score = 2).

Frequency of activity

The frequency of impact of dust emissions on ambient air quality is assessed by considering how often the activity is undertaken. Decommissioning activities will occur on a daily basis and will last for the entire duration of the decommissioning period (score = 5).

Frequency of incident/impact

Low levels of dust emissions are expected dust during decommissioning activities. The frequency of incident of dust emissions on ambient air quality are therefore expected to be almost never/almost impossible/>20% (score = 1).

Legal issues

The National Dust Control Regulations were published on 1 November 2013 (DEA, 2013b). It lists guidance on the requirements for monitoring dust fallout and provides limit values for acceptable dustfall rates for residential and non-residential areas. By-laws also prohibit activities that result in high levels of dust. In terms of legal issues, the impact of dust emissions on ambient air quality is therefore fully covered by legislation (score = 5).

Detection

The detection of impact of the dust emissions on ambient air quality during decommissioning is assessed by evaluating how quickly/easily impacts/risks of activity on environment, people and property are detected. High levels of dust emissions are usually visible during dry, windy conditions, particularly from areas of the site that are continually disturbed or where natural vegetation has been removed. If dust levels are high, they are easily noticeable when they settle on property, mainly on the surfaces of exterior floors, windows and vehicles. Dust monitors can be used to determine dust levels from the decommissioning site. Detection of impacts is therefore considered to be undertaken without much effort (score = 2).

Consequence (Severity + Spatial Scale + Duration)

Consequence is a function of the severity, duration, and spatial scale of an impact. As discussed above:

- The severity or magnitude of the impact associated with the decommissioning activity is considered to be insignificant (score = 2).
- The spatial scale of the impact is limited to the decommissioning site (score = 1).
- The duration of the impact will be for a short-term of 6-12 months (score = 2).

Based on the equation provided, the consequence of dust resulting from decommissioning activities has a score of 2+1+2=5.

Likelihood or Probability (Frequency of Activity + Frequency of Impact + Legal Issues + Detection)

The likelihood or probability of occurrence of the activity is based on frequencies of the activity and impact, whether the activity is governed by legislation and how easily it can be detected. As discussed above:

- Decommissioning activities will occur on a daily basis and will last for the entire duration of the decommissioning period (score = 5).
- The frequency of incident of dust emissions on ambient air quality are expected to be almost never/almost impossible/>20% (score = 1).
- In terms of legal issues, the impact of dust emissions on ambient air quality is fully covered by legislation (score = 5).
- Detection of impacts is considered to be undertaken without much effort (score = 2).

Based on the equation provided, the likelihood or probability of dust resulting from emissions from decommissioning activities has a score of 5+1+5+2=13.

Environmental Significance/Risk (Consequence x Likelihood)

Significance is a function of consequence and likelihood. Based on the equation provided, the significance of dust resulting from emissions from decommissioning activities has a score of 5x13=65.

Emissions of dust from sources associated with decommissioning activities will result in an increase in ambient levels of dust. Although exposure to dust may not be regarded as a health issue, it does manifest as a nuisance. The status of the impact is therefore negative.

The significance of impact relating to emissions of dust from sources associated with decommissioning activities is therefore predicted to be low (negative).

Irreplaceability of resource caused by impacts

Dust is generally coarse and manifests as a nuisance rather than a health issue. Emissions are released close to ground level with little or no buoyancy, which implies that their dispersion is limited, and the extent of potential impacts will be limited to the decommissioning site. Decommissioning activities are likely to endure for a relatively short period of time. Air quality impacts occurring in the ambient environment as a result of decommissioning activities are therefore not expected to incur a loss of any resources. Since no irreplaceable resources will be impacted (the affected resource is easy to replace/rehabilitate), the irreplaceability of resources caused by impacts is rated as low.

Reversibility of impacts

Low levels of dust emissions are expected during decommissioning activities. The generation of dust emissions will cease if decommissioning activities stop. Air quality impacts occurring in the ambient environment as a result of decommissioning activities are therefore expected to reverse with minimal rehabilitation and negligible residual effects. Since a high reversibility of impacts is possible, the reversibility of impacts is rated as high.

Mitigation measures to control dust

A few general recommendations to minimise the emission of dust from decommissioning activities are proposed below:

- Strict enforcement of speed limits on all site roads
- Routine water spraying of site roads and denuded/disturbed areas (more frequent spraying may be necessary during dry, windy conditions)
- Removal of vegetation only if necessary
- Revegetation of disturbed areas once decommissioning activities are complete.

Table 7-12: Air quality impact scores

Description	Pollutants	Severity or magnitude	Spatial scale	Duration	Frequency of activity	Frequency of incident/impact	Legal issues	Detection	Consequence	Likelihood	Significance	Irreplaceability	Reversibility
Construction Phase	Dust	2	1	2	5	1	5	2	5	13	Low (-65)	Low	High
Scenario 1: Operation of Mabasa CCPP in Simple cycle mode	SO_2	2	2	3	5	1	5	2	7	13	Low (-91)	Low	High
	NO_2	2	2	3	5	1	5	2	7	13	Low (-91)	Low	High
	PM_{10}	2	2	3	5	1	5	2	7	13	Low (-91)	Low	High
	CO	2	2	3	5	1	5	2	7	13	Low (-91)	Low	High
Scenario 2: Operation of Mabasa CCPP in Combined cycle mode	SO_2	4	2	3	5	1	5	2	9	13	Low (-117)	Low	High
	NO_2	2	2	3	5	1	5	2	7	13	Low (-91)	Low	High
	PM_{10}	2	2	3	5	1	5	2	7	13	Low (-91)	Low	High
	CO	2	2	3	5	1	5	2	7	13	Low (-91)	Low	High
Scenario 3: Operation of Mabasa CCPP with existing sources (cumulative)	SO_2	8	3	4	5	1	5	2	15	13	Medium (-195)	Low	High
	NO_2	8	3	4	5	1	5	2	15	13	Medium (-195)	Low	High
	PM_{10}	8	3	4	5	1	5	2	15	13	Medium (-195)	Low	High
Scenario 4: Operation of Mabasa CCPP with existing sources and future approved projects (cumulative)	SO_2	8	3	4	5	1	5	2	15	13	Medium (-195)	Low	High
	NO_2	8	3	4	5	1	5	2	15	13	Medium (-195)	Low	High
	PM_{10}	8	3	4	5	1	5	2	15	13	Medium (-195)	Low	High
Emergency Shutdown	SO_2/NOx/PM_{10}/CO	2	2	1	1	1	5	3	5	10	Low (-50)	Low	High
Black-start	SO_2/NOx/PM_{10}/CO	2	2	1	1	1	5	3	5	10	Low (-50)	Low	High
Backup diesel operation	SO_2/NOx/PM_{10}/CO	4	2	1	1	1	5	3	7	10	Low (-70)	Low	High
Decommissioning Phase	Dust	2	1	2	5	1	5	2	5	13	Low – 65	Low	High

7.2.4 Analysis of Emissions' Impact on the Environment

This AIR has focused on potential human health impacts. An assessment of the atmospheric impact of the facility on the environment was therefore not undertaken as part of this AIR.

8. COMPLAINTS

Not relevant to this assessment as this is a proposed facility.

9. CURRENT OR PLANNED AIR QUALITY MANAGEMENT INTERVENTIONS

Air quality management interventions in the form of the control of emission will be considered in all aspects of design and operation.

Air quality monitoring and reporting requirements will be specified in the AEL. Typically, these will include, amongst others:

- Routine isokinetic stack emission measurements to demonstrate compliance with the Minimum Emission Standards.
- The annual compilation of an emission inventory report and submission to the National Atmospheric Emission Inventory System (NAEIS).
- The annual compilation of a Greenhouse Gas emission inventory report and submission to the South African Greenhouse Gas Emission System (SAGERS).
- The compilation of an annual AEL performance report.

Continuous Emissions Monitoring Systems (CEMS) will be installed on all stacks at the power plant, consistent with standard industry practice.

Fugitive emissions from natural gas equipment are not expected to be a significant source of emissions under normal operation. Gas sensors/detectors will be installed around the gas-handling equipment to detect small leaks, including potential valve gland leaks. These form part of the plant's safety and leak-detection systems. The potential for fugitive emissions will be managed through the plant's gas detection and leak-detection systems and the associated operational and maintenance procedures.

10. COMPLIANCE AND ENFORCEMENT ACTIONS

Not relevant to this AIR as this is a proposed facility.

11. SUMMARY AND CONCLUSION

Following the promulgation of the Integrated Resource Plan 2019, the Minister of Mineral Resources and Energy determined that the procurement of New Generation Capacity is required to ensure energy security and that approximately 3000 MW of this capacity would be generated from gas. In response, the Department of Mineral Resources and Energy formally invited interested parties in December 2023, to register prospective bids under the

first bid window of the Gas Independent Power Producers Procurement Programme. In this respect, Mabasa intends to bid for the GASIPPPP and has proposed the development of a 750 MW CCPP in Richards Bay.

The combustion of gas for electricity generation is a Listed Activity (Sub-category 1.4) in terms of the NEM: AQA (No. 39 of 2004). Therefore, an AQIA is required as a component of the EA.

Mabasa appointed Nemai to facilitate the EA process and to conduct an EIA in terms of the National Environmental Management Act. In turn, Nemai sub-contracted uMoya-NILU Consulting (Pty) Ltd to undertake the AQIA and to prepare the AIR.

The CALPUFF dispersion model was used to predict ambient concentrations of SO_2, NO_2, PM_{10} and CO resulting from the proposed Mabasa CCPP emissions.

Dust emissions were not estimated for the construction and decommissioning/closure phase of the proposed project as they require specific information. The assessment is therefore qualitative. The significance of the impact for the construction and decommissioning/closure phase on air quality is low.

For Scenarios 1 and 2, emissions from the proposed Mabasa CCPP operating in Simple and Combined cycle modes predicted ambient SO_2, NO_2, PM_{10} and CO concentrations are low. The predicted ambient concentrations for the Combined Cycle mode are somewhat higher than for Simple Cycle mode. The associated impact for both scenarios is low.

For Scenarios 3, emissions from the proposed Mabasa CCPP operating in Combined Cycle mode with the contribution of other industries. This is a hypothetical case for two reasons. One, the suite of industries generally operates below the permitted maximum emissions, and two, it is unlikely, but not impossible, that the suite of industries simultaneously emits at the permitted maximum concentration. Using the permitted maximum emissions rather than actual emissions therefore present a possible worst-case scenario. The predicted ambient SO_2, NO_2 and PM_{10} concentrations exceed the NAAQS, and the cumulative assessments of other industries with the Mabasa CCPP is predicted to be medium. A medium rating is applied considering the hypothetical nature of the emissions used. Note that the relative contribution from the Mabasa CCPP to this scenario is low.

For Scenarios 4, emissions from the proposed Mabasa CCPP operating in Combined Cycle mode with the contribution of other industries and approved project, the predicted ambient SO_2, NO_2 and PM_{10} concentrations exceed the NAAQS. This is also a hypothetical case for a few reasons. Firstly, the suite of industries generally operates below the permitted maximum emissions. Secondly, the approved projects are natural gas projects and will operate well below the MES for SO_2 and particulates due to the nature of natural gas. Lastly, but not impossible that the suite of industries simultaneously emits at the permitted maximum concentration. Using the permitted maximum emissions rather than actual emissions therefore present a possible worst-case scenario. The predicted ambient concentrations for Scenario 4 are somewhat higher than for Scenario 3. In other words, the collective of the approved projects has a relatively small additive effect to industries assessed. The cumulative assessments of other industries and approved projects with the Mabasa CCPP is predicted to

be medium. A medium rating is applied considering the hypothetical nature of the emissions used. Note that the relative contribution from the Mabasa CCPP to this scenario is low.

Three additional operating scenarios were assessed qualitatively, namely emergency shutdown, black-start and backup diesel operation. These scenarios involve the use of ULSD for relatively short and infrequent periods, with backup diesel operation representing a contingency measure in the event of a natural gas supply interruption. While these scenarios would result in temporary atmospheric emissions, their infrequent occurrence and limited duration are expected to constrain their potential impact on ambient air quality. The associated air quality impacts are therefore considered to be of low significance.

Natural gas is clean fuel containing very low sulphur and has a very low particulate content. Air quality management interventions in the form of the control of emission have been considered in all aspects of design and operation for the Mabasa CCPP. Apart from Dry Low-NOx burners to control NO_X emissions, further emission reduction interventions are deemed to be unnecessary considering the low impact of the proposed project on air quality. From an air quality perspective, it is the reasonable opinion of the authors that the proposed Mabasa CCPP should be authorised considering the findings of this AIR.

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13. FORMAL DECLARATIONS

A declaration of the accuracy of the information contained in this Atmospheric Impact Report is included here. A declaration of the independence of the practitioners in the uMoya-NILU consultancy team that compiled this AIR is also included.

DECLARATION OF ACCURACY OF INFORMATION – APPLICANT

DECLARATION OF ACCURACY OF INFORMATION – APPLICANT

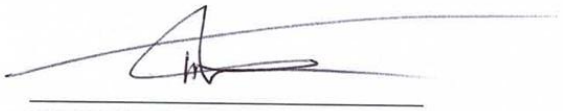
Name of Enterprise: MABASA ENERGY AND FUELS (PTY) LTD

Declaration of accuracy of information provided:

Atmospheric Impact Report in terms of Section 30 of the Act

I, BT SKHOSANA [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 office is a criminal office in terms of section 51(1)(g) of this Act.

Signed at SANDTON on this 16TH day of SEPTEMBER 2026.



SIGNATURE

DIRECTOR

CAPACITY OF SIGNATORY

DECLARATION OF INDEPENDENCE – PRACTITIONER

Name of Practitioner: Mark Zunckel

Name of Registered Body: South African Council for Natural Scientific Professionals

Professional Registration Number: 400449/04

Declaration of independence and accuracy of information provided:

Atmospheric Impact Report in terms of Section 30 of the Act

I, Mark Zunckel declare that I am independent of the applicant. I have the necessary expertise to conduct the assessment required for the report and will perform the work relating to 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 the 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 office is a criminal office in terms of section 51(1)(g) of this Act.

Signed at Durban on this 07th day of September 2026.



SIGNATURE

Managing Director – uMoya-NILU Consulting
CAPACITY OF SIGNATORY

ANNEXURE 1: NEMA REGULATION – APPENDIX 6

Specialist Reports as per the NEMA EIA Regulations, 2014 (as amended), must contain the information outlined in According to Appendix 6 (1) of the Regulations. Table A-1 indicates where this information is included in the AIR.

Table A-1: Prescribed contents of the Specialist Reports (Appendix 6 of the EIA Regulations, 2014)

Relevant section in GNR. 982	Requirement description	Relevant section in this report
(a) details of—	(i) the specialist who prepared the report; and	2.7 & Annexure 2
	(ii) the expertise of that specialist to compile a specialist report including a curriculum vitae;	Annexure 2
(b)	a declaration that the specialist is independent in a form as may be specified by the competent authority;	Section 13
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1 & 2.8
(cA)	an indication of the quality and age of base data used for the specialist report;	Section 6.1 & 6.2
(cB)	a description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change;	Section 6 and 7
(d)	the duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment;	Site investigation not undertaken
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 6.2
(f)	details of an assessment of the specific identified sensitivity of the site related to the proposed activity or activities and its associated structures and infrastructure, inclusive of a site plan identifying site alternatives;	Section 2
(g)	an identification of any areas to be avoided, including buffers;	None identified
(h)	a map superimposing the activity including the associated structures and infrastructure on the environmental sensitivities of the site including areas to be avoided, including buffers;	Section 6.3.2
(i)	a description of any assumptions made and any uncertainties or gaps in knowledge; Note: Uncertainties should be qualified within the report – there will always be uncertainties due to gaps in knowledge should also be qualified – a gap is to record that not all knowledge can be obtained for a study.	Section 2.9
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6.3 and 7
(k)	any mitigation measures for inclusion in the EMPr; Note: We need to include whether these mitigation measures (excluding ongoing monitoring) can be	Section 4.2

Relevant section in GNR. 982	Requirement description	Relevant section in this report
	practically implemented prior to commencement or not.	
(l)	any conditions for inclusion in the environmental authorisation;	No conditions
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	Section 9
(n) a reasoned opinion—	(i) whether the proposed activity, activities or portions thereof should be authorised;	Executive Summary and Section 11
	(iA) regarding the acceptability of the proposed activity or activities; and	Executive Summary and Sections 7, 11
	(ii) if the opinion is that the proposed activity, activities or portions thereof should be authorised, any avoidance, management and mitigation measures that should be included in the EMPr, and where applicable, the closure plan; Note: We need to include whether these mitigation measures (excluding ongoing monitoring) can be practically implemented prior to commencement or not.	Executive Summary and Section 11
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	Not included here
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not included here
(q)	any other information requested by the competent authority.	No requests
(2)	Where a government notice gazetted by the Minister provides for any protocol or minimum information requirement to be applied to a specialist report, the requirements as indicated in such notice will apply.	Section 3, 5 & 6.2

ANNEXURE 2: CURRICULUM VITAE

MARK ZUNCKEL



Firm	:	uMoya-NILU (Pty) Ltd
Profession	:	Air quality consultant
Specialization	:	Air quality assessment, air quality management planning, air dispersion modelling, boundary layer meteorology, project management
Position in Firm	:	Managing director and senior consultant
Years with Firm	:	Since 1 August 2007
Nationality	:	South African
Year of Birth	:	1959
Language Proficiency	:	English and Afrikaans

EDUCATION AND PROFESSIONAL STATUS

Qualification	Institution	Year
National Diploma (Meteorology)	Technikon Pretoria	1980
BSc (Meteorology)	Univ. of Pretoria	1984
BSc Hons (Meteorology)	Univ. of Pretoria	1988
MSc	Univ. of Natal	1992
PhD	Univ. Witwatersrand	1999

Registered Natural Scientist: South African Society for Natural Scientific Professionals
Ex-Council Member: National Association for Clean Air
Member: National Association for Clean Air

EMPLOYMENT AND EXPERIENCE RECORD

Period	**Organisation details and responsibilities/roles**
1976 – May 1992	South African Weather Bureau: Observer, junior forecaster, senior forecast, researcher, assistant director
June 1992 – July 2007	CSIR: Consultant and researcher, Research group Leader: Atmospheric Impacts
August 2007 to present	uMoya-NILU Consulting: Managing Director and senior air quality consultant

Key and Recent Project Experience:

1996	Project leader & Principal researcher: Atmospheric impact assessment for the proposed Mozal aluminium smelter in Maputo, Mozambique.

1996	Project leader & Principal researcher: Dry sulphur deposition during the Ben MacDhui High Altitude Trace Gas and Transport Experiment (BATTEX) in the Eastern Cape.
1997	Project leader & Principal researcher: Atmospheric impact assessment of the proposed capacity expansion project for Alusaf in Richards Bay.
1997	Project leader & Principal researcher: The Uruguayan ambient air quality project with LATU.
1997	Principal researcher on the Air quality specialist study for the Strategic Environmental Assessment on the industrial and urban hinterland of Richards Bay.
1997	Project leader & Principal researcher: Feasibility study for the implementation of a fog detection system in the Cape Metropolitan area: Meteorological aspects.
2001	Project leader & Principal researcher: Air quality specialist study for the Environmental Impact Assessment for the proposed expansion of the Hillside Aluminium Smelter, Richards Bay.
2001-03	Researcher: The Cross Border air Pollution Impact (CAPIA) project. A 3-year modelling and impacts study in the SADC region.
2002	Project leader & Principal researcher: Air quality assessment specialist study for the proposed Pechiney Smelter at Coega.
2002	Project leader & Principal researcher: Air quality assessment specialist study for the proposed N2 Wild Coast Toll Road.
2002-05	Project leader on the NRF project – development of a dynamic air pollution prediction system
2004	Project leader on the specialist study for expansion at the Natal Portland Cement plant at Simuma, KwaZulu-Natal.
2004-05	Researcher: National Air Quality Management Plan implementation project for Department Environmental Affairs and Tourism.
2005	Researcher in the assessment of air quality impacts associated with the expansion of the Natal Portland Cement plant at Port Shepstone.
2006-07	Project team leader of a multi-national team to develop the National Framework for Air Quality Management for the Department of Environment Affairs and Tourism
2007	Air quality assessment for Mutla Early Production System in Uganda for ERM Southern Africa on behalf of Tullow Oil.
2007-10	Lead consultant on the development of a dust mitigation strategy for the Bulk Terminal Saldanha and an ambient guideline for Fe_2O_3 dust for Transnet Projects and on-going monitoring.
2008	Lead consultant on the Air quality status quo assessment and scoping for the EIA for the Sonangol Refinery
2008-09	Lead consultant on the development of the air quality management plan for the Western Cape Provincial. Department of Environmental Affairs and Development Planning.
2008-10	Lead consultant on the development of the Highveld Priority Area air quality management plan for the Department of Environmental Affairs and Tourism.
2008	Lead consultant in the development of an odour management and implementation strategy for eThekwini, focussing on Wastewater Treatment Works and odorous industrial sources
2008&10	Lead consultant on the Air Quality Specialist Study for the EIA for the proposed Kalagadi Manganese Smelter at Coega

2008	Lead consultant on the Air Quality Assessment for the Proposed Construction and Operation of a Second Cement Mill at NPC-Cimpor, Simuma near Port Shepstone.
2008	Lead consultant on the Air Quality Specialist Study Report for the New Multi-Purpose Pipeline Project (NMPP) for Transnet Pipelines.
2008	Lead consultant on the Air quality assessment for the proposed UTE Power Plant and RMDZ coal mine at Moatize, Mozambique for Vale.
2008-09	Lead consultant on the Dust source apportionment study for the Coedmore region in Durban for NPC-Cimpor.
2009	Consultant on the Air quality specialist study for the upgrade of the Kwadukuza Landfill, KwaZulu-Natal
2009-10	Lead consultant on the Audit of ambient air quality monitoring programme and air quality training for air quality personnel at PetroSA
2010	Lead consultant on the Qualitative assessment of impact of dust on solar power station at Saldanha Bay
2010	Lead consultant on the Air quality specialist study for the EIA for the Kalagadi Manganese Smelter at Coega
2009-10	Lead consultant on the Air quality specialist study for the Environmental Management Framework for the Port of Richards Bay
2010	Lead consultant on the Air quality status quo assessment and abatement planning at Idwala Carbonates, Port Shepstone
2010	Lead consultant on the Air quality status quo assessment and abatement planning at Sappi Tugela, Mandeni
2010–11	Air quality status quo assessment and revision of the Air Quality Management Plan for City of Johannesburg
2010	Lead consultant on the Air quality status quo assessment and abatement planning at First Quantum Mining's Bwana Mkubwa and Kansanshi mines, Zambia
2010–11	Lead consultant on the Air quality specialist study for the EIA for the Alternative Fuel and Resources Project at Simuma, Port Shepstone
2010–11	Lead consultant on the Air quality specialist study for the EIA for the Coke Oven re-commissioning at ArcelorMittal Newcastle
2010	Qualitative air quality assessment for the EIA for the Mozpel sugar to ethanol project, Mozambique
2011	Development of the South African Air Quality Information System – Phase II The National Emission Inventory
2011	Ambient baseline monitoring for Riversdale's Zambezi Coal Project in Tete, Mozambique
2010-11	Ambient quality baseline assessment for the Ncondeze Coal Project, Tete Mozambique
2011-12	Air quality assessment for the mining and processing facilities at Lonmin Platinum in Marikana
2012	Air quality assessment for the proposed LNG and OLNG plants in Mozambique
2012	Modelling study in Abu Dhabi for the transport and deposition of radio nuclides
2012	Air quality assessment for the proposed manganese ore terminal at the Ngqura Port
2012-13	Air quality management plan development for Stellenbosch Municipality
2012-12	Air quality management plan development for the Eastern Cape Province
2013	Air quality specialist for Tullow Oil Waraga-D and Kinsinsi environmental audit in Uganda

2013	Air quality specialist study for the EIA for the Thabametsi IPP station
2013	Air quality management plan for the Ugu District Municipality
2013-14	Air quality specialist study for the application for postponement of the minimum emission standards for 9 Eskom power stations
2014	Air quality specialist study for the application for postponement applications of the minimum emission standards for the Engen Refinery in Merebank, Durban
2014-15	Baseline assessment and AQMP development for the uThungulu District Municipality
2013-15	Baseline assessment, AQMP and Threat Assessment for the Waterberg-Bojanala Priority Area
2014-15	Review of the 2007 AQMP for eThekwini Municipality, including metropolitan emission inventory development for all sectors, i.e. industrial, transport, waste management, biomass burning, residential fuel burning, dispersion modelling and strategy development
2014-14	Dispersion modelling study for Richards Bay Minerals
2015	Air quality assessment for Rainbow Chickens at Hammersdale
2015	Air quality status quo assessment and planning for TNPA ports in South Africa
2016- 7	Lead author of the National State of Air Report for 2005 to 2015, including national emission inventory development for all sectors, i.e. industrial, transport, waste management, biomass burning, residential fuel burning
2016	Air quality assessment for Kanshansi Mine, Solwesi, Zambia
2016	Assessment of air quality impacts associated with activities at the Venetia Mine, Limpopo Province
2016	Assessment of air quality impacts associated with activities at the Komati Anthracite Mine, Mpumalanga Province
2016	Air quality assessment for the proposed Powership Project at the Port of Nacala, Mozambique
2016	Air quality assessment for the proposed Richards Bay Gas to Power Project
2017	Baseline assessment and review of the 2009 AQMP for Gauteng Province, including emission inventory development for all sectors, i.e. industrial, transport, waste management, biomass burning, residential fuel burning, and dispersion modelling
2017	Baseline assessment and air quality management plan for Northern Cape Province
2017	Air quality assessment for the EIA for the Thabametsi Power Station in Limpopo Province
2017	Air quality assessment for the EIA for the proposed Tshivasho Power Station in Limpopo Province
2018	Air quality assessment for the EIA for the proposed Bellmall Thermal Plant in Ekurhuleni
2018	Air quality assessment for the EIA for the proposed Simba Oil mini Refinery in Tororo, Uganda
2018-19	Air dispersion modelling for input to the Atmospheric Reports for the postponement application for 14 Eskom power stations
2019	Air quality impact assessment for the proposed NamPower expansion project in Walvis Bay
2019	Air quality assessment for the mine expansion project at the Akanani Mine
2019	Air quality impact assessment for the proposed power plant at Nacala, Mozambique

2020	AIR for the KarpowershipSA proposal in the Ports of Ngqura, Richards Bay and Saldanha Bay
2020	AIR for the Coega Development Corporation gas-to-power project at 4 sites in the CDC
2020	AIRs for 10 Eskom coal-fired power plants on the Highveld to support their postponement application
2020	AIR for the proposed Azure Power gas-to-power project in the Western Cape
2021	Air quality assessment for the proposed optimisation project at Beeshoek Iron Ore Mine, Postmasburg, Northern Cape
2021	AIR for the proposed Frontier Power Gas-to-Power project at Saldanha Bay, Western Cape
2021	AIR for the 2021 shutdown and start-up at Engen Refinery in Merebank
2021	AIR for the proposed expansion of the Swartkops Ore handling facility in Port Elizabeth, Eastern Cape
2016-24	AEL compliance monitoring for Joseph Grieveson, Durban, including dust fallout monitoring and reporting
2018-24	Dust fallout and HF monitoring and reporting for Hulamin, Richards Bay
2018-24	Dust fallout and H_2S monitoring and reporting for at KwaDukuza Landfill for Dolphin Coast Landfill Management (DCLM)
2019-24	AEL compliance monitoring for Umgeni Iron and Steel Foundry, including dust fallout monitoring and reporting

PUBLICATIONS

Author and co-author of 34 articles in scientific journals, chapters in books and conference proceedings. Author and co-author of more than 300 technical reports and presented 47 papers at local and international conferences.

ATHAM RAGHUNANDAN



Firm	:	uMoya-NILU Consulting (Pty) Ltd
Profession	:	Air Quality Consultant
Specialization	:	Meteorological and Atmospheric Dispersion Modelling, Air Quality Specialist Studies, Project Management, Data Processing, Emission Inventories
Position in Firm	:	Senior Air Quality Consultant
Years with Firm	:	16 years (appointed in 2008)
Nationality	:	South African
Year of Birth	:	1977
Language Proficiency	:	English (mother tongue), Afrikaans (fair)

EDUCATION AND PROFESSIONAL STATUS

Qualification	Institution	Year
M.A. (Atmospheric Sciences)	University of Natal, Durban	2003
B.A. Hons. (Environmental Sciences)	University of Durban–Westville	2001
B.Paed. (Education)	University of Durban–Westville	2000

Memberships:

- National Association for Clean Air (NACA)
- South African Society for Atmospheric Sciences (SASAS)
- South African Council of Educators (SACE)

EMPLOYMENT AND EXPERIENCE RECORD

Period	Organisation details and responsibilities/roles
Jan 2003 – Oct 2008	CSIR: Consultant/Researcher in Air Quality Group, Research Group Leader – Air Quality Research Group
Nov 2008 – present	uMoya-NILU: Senior Air Quality Consultant

Key and Recent Project Experience:

2003	Baseline air dispersion modelling study for Natal Portland Cement (Pty) Ltd – Simuma Plant, Port Shepstone – Modelling and Reporting
2004	Air Quality Screening Study for MOZAL 3 – Modelling and Reporting
2005	Air Quality Specialist Study for the Proposed Kudu Combined Cycle Gas Turbine Power Station at Oranjemund, Namibia (Site D) – Modelling and Reporting

2005 Air Quality Specialist Study for the Proposed Kudu Combined Cycle Gas Turbine Power Plant at Uubvlei, Namibia – Modelling and Reporting

2005 Air Quality Specialist Study for a Proposed Cement Milling, Storage and Packaging Facility and a Second Clinker Kiln at Natal Portland Cement (Pty) Ltd – Simuma Plant, Port Shepstone – Modelling and Reporting

2005 Technology Review: Air quality specialist study for the Coega Aluminium Smelter at Coega, Port Elizabeth – Modelling and Reporting

2005 Assessment of Development Scenarios for Hillside Aluminium using Sulphur Dioxide (SO_2) as an Ambient Air Quality Indicator – Modelling and Reporting

2005 Air Quality Scoping Study for Eskom's Proposed Open Cycle Gas Turbine Power Station at Atlantis – Modelling and Reporting

2005 Air Quality Specialist Study for Eskom's Proposed Open Cycle Gas Turbine Power Station at Atlantis, Western Cape – Modelling and Reporting

2005 Air Quality Specialist Study for the Proposed Tata Steel Ferrochrome Project at Richards Bay – Alton North Site – Modelling and Reporting

2005 Air Quality Audit for the Amathole District Municipality - Compilation of detailed emissions inventory

2006 A Regional Scale Air Dispersion Modelling Study for Northeastern Uruguay – Modelling and Reporting

2006 Air Dispersion Modelling Study for Natal Portland Cement (Pty) Ltd for the Proposed AFR Programme at the Simuma Plant, Port Shepstone – Modelling and Reporting

2007 Development of an air quality management strategy for particulate matter at the Bulk Terminal Saldanha - Project Leader and Reporting

2007 Air Quality and Human Health Specialist Study for the Proposed Coega Integrated LNG to Power Project (CIP) within the Coega Industrial Zone, Port Elizabeth, South Africa - Project Leader, Modelling and Reporting

2008 Dispersion Modelling for the Proposed Coega Aluminium Smelter (CAL) at Port Elizabeth - Project Leader, Modelling and Reporting

2008 Modelled and Measured Vertical Ozone Profiles over Southern Africa (as part of the Young Researcher Establishment Fund (2005-2008)) - Project Leader

2008 Air Quality Specialist Study for the Proposed N2 Wild Coast Toll Highway - Project Leader, Modelling and Reporting

2008 Initial Air Quality Impact Assessment for the Proposed Illovo Ethanol Plant in Mali, West Africa - Project Leader, Modelling and Reporting

2008 Modelling Mercury Stack Emissions from South African Coal-fired Power Plants – Modelling and Reporting

2009 Air Quality Management Plan for the Western Cape Province – Baseline Assessment – Modelling

2009 Proposed Exxaro AlloyStream™ Manganese Project in the Coega Industrial Development Zone: Air Quality Impact Assessment – Modelling and Reporting

2009 Air Quality Specialist Study for the Kalagadi Manganese Smelter at Coega, Eastern Cape – Modelling and Reporting

2009 Qualitative Air Quality Impact Assessment for the Wearne Platkop Quarry – Modelling and Reporting

2009 Specialist Air Quality Study for the Vopak Terminal Durban Efficiency Project – Modelling

2009 Qualitative Air Quality Impact Assessment for the Proposed ETA STAR Coal Mine at Moatize, Mozambique – Modelling and Reporting

2009	Specialist Air Quality Study for the Kwadukuza Landfill Upgrade Project – Modelling and Reporting
2010	Ambient dust assessment at Saldanha Bay for the period October 2006 to September 2009 for Transnet Bulk Terminal Saldanha – Reporting
2010	Dust Impact Assessment for the Proposed Saldanha Bay Pilot PV plant – Reporting
2010	Modelling Particulate Emission Concentration Scenarios for Eskom's Kriel Power Station – Modelling and Reporting
2010	Air Quality Dispersion Modelling for MOZAL, Mozambique – Modelling and Reporting
2010	Air Quality Management Plan for the Highveld Priority Area – Air Quality Baseline Assessment for the Highveld Priority Area – Modelling
2010	Ambient Air Quality Modelling and Monitoring at Sappi, Mandeni – Modelling and Reporting
2010	Dust Impact Study at Idwala Carbonates – Modelling and Reporting
2010	Air quality specialist study for the EIA for the proposed re-commissioning of an existing coke oven battery at ArcelorMittal South Africa, Newcastle Works – Modelling
2010	Air quality specialist study for the proposed storage and utilisation of alternative fuels and resources at NPC-Cimpor's Simuma facility, Port Shepstone, KwaZulu-Natal – Modelling and Reporting
2010	Air quality status quo assessment and abatement planning at First Quantum Mining's Bwana Mkubwa and Kansanshi mines, Zambia – Modelling
2010	Air quality specialist study for the proposed briquetting plant at the Mafube Colliery – Modelling and Reporting
2011	Air quality modelling study for the Copeland reactor at Sappi Stanger – Modelling and Reporting
2011	Air quality modelling study for the Copeland reactor at Sappi Tugela – Modelling and Reporting
2011	Air quality monitoring and modelling study for the Copeland reactor at Mpact Paper, Piet Retief – Modelling and Reporting
2011	Air Quality Study for the Basic Environmental Assessment for the Proposed Biomass Co-Firing Facility at the Arnot Power Station – Modelling and Reporting
2011	Assessment of Scenarios for Developing and Implementing a Sulphur Dioxide Emissions Licensing Strategy for Hillside Aluminum – Modelling and Reporting
2011-12	Air quality assessment for the mining and processing facilities at Lonmin Platinum in Marikana – Modelling and Reporting
2012	Development of an Air Quality Management Plan for Anglo's Mafube Colliery in Mpumalanga – Modelling and Reporting
2012	Air quality assessment for the proposed manganese ore terminal at the Ngqura Port – Modelling and Reporting
2012	Air Quality Impact Assessment for NPC Cimpor – Modelling and Reporting
2013	Air Quality Impact Assessment for Proposed AfriSam Plant in Coega – Modelling
2013	Air quality assessment for the Orion Engineered Carbons Co-Gen Plant – Modelling
2013	Air quality assessment for the Orion Engineered Carbons - Main Boiler – Modelling

2013	Air quality assessment for the EIA for the Sekoko Coal Mine – Modelling and Reporting
2013	Air quality specialist study for the EIA for the Thabametsi IPP station – Modelling and Reporting
2013	Air quality specialist study for the EIA for the Mamathwane Common User facility – Modelling and Reporting
2013-14	Air quality specialist study for the application for postponement of the minimum emission standards for 16 Eskom power stations: Acacia, Arnot, Camden, Duvha, Grootvlei, Hendrina, Kendal, Komati, Kriel, Lethabo, Majuba, Matimba, Matla, Madupi, Tutuka, Port Rex – Modelling and Reporting
2014	Air quality specialist study for the application for postponement of the minimum emission standards for the Engen Refinery in Merebank, Durban – Modelling and Reporting
2013-14	Baseline assessment and air quality management plan for the Waterberg-Bojanala Priority Area – Modelling
2013	Air Quality Specialist Study for the EIA for the Pandora Platinum Mine Joint Venture – Modelling and Reporting
2013	Air Quality Specialist Study for the EIA for the Proposed New Tailings Storage Facility (TD8) and Associated Infrastructure at Lonmin's Western Platinum Mine and Eastern Platinum Mine – Modelling and Reporting
2015	Waterberg-Bojanala Priority Area Air Quality Management Plan and Threat Assessment – Modelling
2015	Air Quality Management Plan for eThekwini Municipality – Modelling and Reporting
2015	Air Quality Management Plan for the uThungulu District Municipality – Modelling and Reporting
2015	Dispersion Modelling for Richards Bay Minerals – Modelling and Reporting
2015	Atmospheric Impact Report in support of Sancryl Chemicals's application for a verification to the existing AEL as a result of the introduction of Ethyl Acrylate and Vinyl Acetate, Prospecton – Modelling and Reporting
2016	Dispersion Modelling Study for the City of Johannesburg – Modelling and Reporting
2016	Air Quality Specialist Study for the Department of Energy's Emergency Power IPP Project at Richards Bay and Saldanha Bay – Modelling and Reporting
2016	Atmospheric Impact Report in support of the EIA for the Proposed Gas to Power Plant in Zone 1F of the Richards Bay IDZ – Modelling and Reporting
2016	Atmospheric Impact Report for the EIA for the proposed Tshivhaso Coal-fired Power Plant, Lephalale – Modelling and Reporting
2016	TNPA Air Quality Study – Dispersion Modelling for 8 Ports in South Africa: Port of Richards Bay, Durban, East London, Ngqura, Port Elizabeth, Mossel Bay, Cape Town and Saldanha Bay – Modelling and Reporting
2016	Atmospheric Impact Report for Durran's Calcination Plant – Modelling and Reporting
2016	Air Quality Assessment for the EIA for the Floating Power Plant in Nacala, Mozambique – Modelling and Reporting
2016	Ambient Air Quality Assessment for 2016 for Kansanshi Mining Plc – Modelling and Reporting

2016	Air Quality Impact Assessment for the EIA for the Proposed Hilli FLNG Project in Cameroon – Modelling and Reporting
2016	Kansanshi Smelter and TSF1 Modelling Scenarios for Kansanshi Mining Plc – Modelling and Reporting
2016	Air Quality Assessment the Proposed Accommodation Facility at the Venetia Mine in Limpopo – Modelling and Reporting
2016	Atmospheric Impact Report in support of the EIA for the Proposed Optimisation of the Process Plant at Nkomati Anthracite Mine – Modelling and Reporting
2017	Atmospheric Impact Report in support of the DRDAR Atmospheric Emission License (AEL) application for the proposed replacement and use of an incinerator at their State Veterinary Laboratories located in Grahamstown, Middelburg and Queesntown in the Eastern Cape – Modelling and Reporting
2017	Baseline Assessment and Review of the 2009 AQMP for Gauteng Province, including emission inventory development for all sectors, i.e. industrial, transport, waste management, biomass burning, residential fuel burning, and dispersion modelling – Modelling and Reporting
2017	Baseline Assessment and Air Quality Management Plan for Northern Cape Province – Modelling and Reporting
2017	Atmospheric Impact Report in support of Maloka Machaba Surfacing's application for an Atmospheric Emission License (AEL) for a proposed asphalt plant located in Polokwane – Modelling and Reporting
2017	Assessment of modelling scenarios involving an increase in the open area of the cone on the Common Stack for the pretreater, reformer and CHD furnaces at Engen Refinery – Modelling and Reporting
2017	Atmospheric Impact Report in support of the Atmospheric Emission License (AEL) application and stack-height assessment for the proposed Thabametsi Power Plant near Lephalale, Limpopo – Modelling and Reporting
2017	Dispersion Modelling Study for the Beeshoek Mine, near Postmasburg, Northern Cape – Modelling and Reporting
2018	Air quality assessment for the EIA for the proposed Bellmall Thermal Plant in Ekurhuleni – Modelling and Reporting
2018	Air quality assessment for the EIA for the proposed Simba Oil mini Refinery in Tororo, Uganda – Modelling and Reporting
2018-19	Air dispersion modelling for input to the Atmospheric Reports for the postponement application for 14 Eskom power stations – Modelling and Reporting
2019	Air quality impact assessment for the proposed NamPower expansion project in Walvis Bay – Modelling and Reporting
2019	Air quality assessment for the mine expansion project at the Akanani Mine – Modelling and Reporting
2019	Air quality impact assessment for the proposed power plant at Nacala, Mozambique – Modelling and Reporting
2019	Atmospheric Impact Report in Support of the Atmospheric Emission License (AEL) Amendment Application and Basic Assessment for Dow Southern Africa - New Germany – Modelling and Reporting
2019	Atmospheric Impact Report in support of Tau-Pele Construction's application for an Atmospheric Emission License (AEL) for a proposed emulsion and asphalt plant located in Indwe, Eastern Cape – Modelling and Reporting

2019	Atmospheric Impact Report in Support of the EIA for the Proposed Material Source and Processing Sites Along the N3 Between Durban and Hilton, KwaZulu-Natal: RCL1, RCL9 and Harrison's Quarry – Modelling and Reporting
2019	Atmospheric Impact Report in Support of the Atmospheric Emission License (AEL) Amendment Application and Basic Assessment for the Vopak Efficiency (Growth 4) Expansion Project, Durban, South Africa – Modelling and Reporting
2020	AIR for the KarpowershipSA proposal in the Ports of Ngqura, Richards Bay and Saldanha Bay – Modelling and Reporting
2020	AIR for the Coega Development Corporation gas-to-power project at 4 sites in the CDC – Modelling and Reporting
2020	AIRs for 10 Eskom coal-fired power plants on the Highveld to support their postponement application – Modelling and Reporting
2020	AIR for the proposed Azura Power gas-to-power project in the Western Cape – Modelling and Reporting
2020	Atmospheric Impact Report for the proposed 315 MW LPG Power Plant at Saldanha Bay – Modelling and Reporting
2021	Air quality assessment for the proposed optimisation project at Beeshoek Iron Ore Mine, Postmasburg, Northern Cape – Modelling and Reporting
2021	Air quality assessment for the proposed expansion at Akanani Mine in Limpopo – Modelling and Reporting
2021	AIR for the proposed Frontier Power Gas-to-Power project at Saldanha Bay, Western Cape
2021	AIR for the 2021 shutdown and start-up at Engen Refinery in Merebank – Modelling and Reporting
2021	AIR for the proposed expansion of the Swartkops Ore handling facility in Port Elizabeth, Eastern Cape – Modelling and Reporting
2021	Atmospheric Impact Report in support of the Proposed 200 MW Engie CB Hybrid Power Project in the Coega Special Economic Zone (SEZ) – Modelling and Reporting
2021	Air Quality Impact Assessment for the proposed Mining of TSF-1 at the Stibium Mopani Mine near Gravelotte, Limpopo Province – Modelling and Reporting
2021	Addendum to the Atmospheric Impact Report in support of the proposed Mulilo-Total 200 MW Gas-fired Power Station, Coega Special Development Zone, Eastern Cape – Reporting
2021	Air Quality Assessment for the EIA for the Tete 1 400 MW Coal-Fired Power Plant, Tete Province, Mozambique – Modelling and Reporting
2021	Atmospheric Impact Report in support of Tugela Asphalt's application for an Atmospheric Emission License (AEL) for a proposed asphalt plant located in Mandini, KwaZulu-Natal – Modelling
2021	Atmospheric Impact Report for Nkomati Mine – Modelling and Reporting
2022	Emission Inventory for Lanxess for 2021 – Reporting
2022	Emission Inventory for Lanxess for 2021 – Reporting
2022	Annual Report for Puregas: Atmospheric Emission License - Submission to the City of Ekurhuleni in compliance with the Atmospheric Emission Licence of the facility for the Reporting Period Year 2021 – Reporting

2022 Emission Inventory for Puregas for 2021 – Reporting

2022 Emission Inventory for Dow Advanced Materials for 2020 – Reporting

2022 Atmospheric Impact Report for the Engen Cape Town Terminal – Modelling and Reporting

2022 Air Quality Specialist Study for the Basic Assessment for the Expansion of the Nkomati Anthracite Mine in Mpumalanga, with a focus on future mining activities at Block L – Modelling and Reporting

2022 Emission Inventory for Lanxess for 2021 – Reporting

2022 Annual Report for Puregas: Atmospheric Emission License - Submission to the City of Ekurhuleni in compliance with the Atmospheric Emission Licence of the facility for the Reporting Period Year 2021 – Reporting

2022 Emission Inventory for Puregas for 2021 – Reporting

2022 Emission Inventory for Dow Advanced Materials for 2020 – Reporting

2022 Atmospheric Impact Report in Support of the Atmospheric Emission License (AEL) Amendment Application for the Engen Cape Town Terminal – Modelling and Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for May 2022 - Engen Refinery – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for May 2022 - SAPREF Refinery – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for June 2022 - Engen Refinery – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for June 2022 - SAPREF Refinery – Reporting

2022 BTEX Fenceline Monitoring at Engen Island View Depot: June 2022 - First Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Langlaagte Depot: April 2022 - First Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Mokopane Depot: April 2022 - First Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Makhado Depot: April 2022 - First Campaign – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for July 2022 - Engen Refinery – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for July 2022 - SAPREF Refinery – Reporting

2022 BTEX Fenceline Monitoring at Engen Langlaagte Depot: June 2022 - Second Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Makhado Depot: May 2022 - Second Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Mokopane Depot: June 2022 - Second Campaign – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for August 2022 - Engen Refinery – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for August 2022 - SAPREF Refinery – Reporting

2022 Atmospheric Impact Report for the proposed Karpowership Project at Ngqura (Coega) Port – Modelling and Reporting

2022 Atmospheric Impact Report for the proposed Karpowership Project at the Port of Saldanha Bay – Modelling and Reporting

2022 Atmospheric Impact Report for the proposed Karpowership Project at the Richards Bay– Modelling and Reporting

2022 BTEX Fenceline Monitoring at Engen Cape Town Terminal: August 2022 Campaign – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for August 2022 - Engen Refinery – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for August 2022 - SAPREF Refinery – Reporting

2022 Atmospheric Impact Report in support of the EIA for the Proposed Coega 3000 MW Integrated Gas-to-Power Project, Zone 10: Coastal Power Station (South) – Modelling and Reporting

2022 Atmospheric Impact Report in support of the EIA for the Proposed Coega 3000 MW Integrated Gas-to-Power Project, Zone 10: Coastal Power Station (North) – Modelling and Reporting

2022 Glencore Operations South Africa (Pty) Ltd (Glencore) – Modelling and Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for September 2022 - Engen Refinery – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for September 2022 - SAPREF Refinery – Reporting

2022 BTEX Fenceline Monitoring at Engen Langlaagte Depot: September 2022 - Third Campaign

2022 TSF1 scenario modelling for Kanshansi Mine - 2022 – Modelling and Reporting

2022 BTEX Fenceline Monitoring at Engen Makhado Depot: September 2022 - Third Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Bethlehem Depot: June 2022 - First Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Bethlehem Depot: September 2022 - Second Campaign – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for October 2022 - Engen Refinery – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for October 2022 - SAPREF Refinery – Reporting

2022 Dispersion Modelling Study to Optimise Stack Height for Nampower FIRM Power Project in Walvis bay, Namibia – Modelling and Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for November 2022 - Engen Refinery – Reporting

2022 BTEX Fenceline Monitoring: Monthly Report for November 2022 - SAPREF Refinery – Reporting

2022 BTEX Fenceline Monitoring at Engen Langlaagte Depot: November 2022 - Fourth Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Makhado Depot: November 2022 - Fourth Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Mokopane Depot: October 2022 - Third Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Bethlehem Depot: October 2022 - Third Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Bethlehem Depot: November 2022 - Fourth Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Island View Depot: October 2022 - Second Campaign – Reporting

2022 BTEX Fenceline Monitoring at Engen Island View Depot: November 2022 - Third Campaign – Reporting

2023 Air Quality Assessment for the Karpowership Project in the Port of Matola, Maputo, Mozambique – Modelling and Reporting

2023 BTEX Fenceline Monitoring: Monthly Report for December 2022 - Engen Refinery – Reporting

2023 BTEX Fenceline Monitoring: Monthly Report for December 2022 - SAPREF Refinery – Reporting

2023 Dispersion Modelling Study for the Kansanshi Smelter Expansion Project – Modelling and Reporting

2023 BTEX Fenceline Monitoring: Monthly Report for January 2023 - Engen Refinery – Reporting

2023 BTEX Fenceline Monitoring: Monthly Report for January 2023 - SAPREF Refinery – Reporting

2023 Air Quality Assessment to Support the Proposed Future Mining at The Mogalakwena Platinum Mine – Specifically Focusing on the Transition of the Sandsloot Mine from an Open Pit to Underground Mining Method – Modelling and Reporting

2023 BTEX Fenceline Monitoring: Monthly Report for February 2023 - Engen Refinery – Reporting

2023 BTEX Fenceline Monitoring: Monthly Report for February 2023 - SAPREF Refinery – Reporting

2023 SAPREF_ BTEX Fenceline Monitoring: Annual Report for 2022 – Reporting

2023 Emission Inventory for Lanxess for 2022 – Reporting

2023 Emission Inventory for Dow Advanced Materials for 2022 – Reporting

2023 BTEX Fenceline Monitoring: Monthly Report for March 2023 - Engen Refinery – Reporting

2023 BTEX Fenceline Monitoring: Monthly Report for March 2023 - SAPREF Refinery – Reporting

2023 Air Quality Assessment for the Karpowership Project in the Port of Matola, Maputo, Mozambique (Low Sulphur Case) – Modelling and Reporting

2023 Air Quality Assessment for the Karpowership Project in the Port of Matola, Maputo, Mozambique (Natural Gas Case) – Modelling and Reporting

2023 Air Quality Specialist Study for the Proposed Grasdrift Mine, located on the Left Bank of the Orange River, Richtersveld, Namakwa District, Northern Cape Province – Modelling

2023 Air Quality Specialist Study for the Proposed Remining of Tailings Dam 2 at the Sibanye-Stillwater Eastern Platinum Mine – Modelling and Reporting

2023 Air Quality Specialist Study in Support of the Integrated Environmental Authorisation Process for Open Cast Mining Areas and Expansion of the Madadeni Underground Area and EMPr Consolidation and Amendment for the N'Komati Anthracite Mine

PUBLICATIONS

Author and co-author of 5 articles in scientific journals and conference proceedings. Author and co-author of more than 200 technical reports for external contract clients. Presented 4 papers at local conferences. A full list of publications, conference papers and contract reports is available on request.

NOPASIKA XULU



Firm	:	uMoya-NILU (Pty) Ltd
Profession	:	Senior Air Quality Consultant
Specialization	:	Air Quality Assessment, Air Dispersion Modelling; Project Management; Data Analysis; Report Writing and Reviews
Position in Firm	:	Senior Air Quality Consultant
Years with Firm	:	Since 27 March 2023
Nationality	:	South African
Year of Birth	:	1985
Language Proficiency	:	English and IsiZulu (read, write. Speak)

EDUCATION AND PROFESSIONAL STATUS

Qualification	Institution	Year
BSc. Environmental Studies	Univ. of Witwatersrand	2011
BSc Hons (Env. Studies)	Univ. of Witwatersrand	2012
BSc MSc (Env Sciences)	NWU Potchefstroom	2017

EMPLOYMENT AND EXPERIENCE RECORD

Period	Organisation details and responsibilities/roles
Oct 2016 – Dec 2018:	Gondwana Environmental Solutions (Pty) Ltd: Air Quality Management Plans; Report Writing; Business Development and Marketing, Researcher.
July 2019 – March 2023:	Rayten Engineering Solutions (Pty) Ltd: Air Quality Consultant, Project Management; Report Writing and Review; Data Analysis; Dispersion Modelling and Air Quality Impact Assessment; Research; Compiling Atmospheric Emission License (AEL) Applications; Populating National Atmospheric Emissions Inventory System; AEL Compliance Auditing; Dust Emission Reduction Plans; Greenhouse Gas Emissions Inventory Reporting; Facilitating/ Attending meetings; Liaising with Clients and Suppliers.

March 2023 – Present: uMoya – Nilu Consulting (Pty) Ltd Senior Air Quality Consultant, Dispersion Modelling and Air Quality Impact Assessments; Project Management

Key Project Experience:

2019 – 2023: Project Leader: Air Quality Impact Assessment projects (Harmony Moab Khotsong; EzeeTile Bloemfontein, EzeeTile Mokopane; Transvaal Galvanizers; Duho Drying; Lingaro Drying; Nama Copper Pty Ltd) Project Leader: AEL Applications and Reporting (Harmony Kopanang Operations; Harmony Mponeng Operations; Sibanye Gold Mines; Sibanye Platinum

Mines; TotalEnergies Marketing; Matt Cast Supplies CC; Independent Crematorium SA; City of Tshwane Crematorium; Buffalo City Municipality Crematorium; Wahl Industries; Transvaal Galvanizers)

2014 – 2017: Researcher: Air Quality Assessment in low-income residential areas in the Highveld

Publications: Authors: Xulu, N.A., Piketh, S.J. Feig,G.T., Lack, D.A and Garland,R.M., (2020).Characterizing Light Absorbing Aerosols in a Low –Income Settlement in South Africa. Aerosol Air Quality Aerosol Air Quality Research. https://doi.org/10.4209/aaqr.2019.09.004

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