2025

Atmospheric Impact Report for the proposed TNPA 22MW Generator Project at the Port of Richards Bay

Transnet National Ports Authority

uMOYA-NILU

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EXECUTIVE SUMMARY

The Port of Richards Bay is one of the largest commercial ports in South Africa that is managed by the Transnet National Ports Authority (TNPA). The Eskom power utility is currently challenged to supply the country's contracted electricity demand. This has resulted in rolling power cuts that have severely affected business and port operations. Due to the electricity challenges faced by the port, TNPA proposes to procure and install a duel-fuel 22 MW generator at the Port of Richards Bay to support port operations. The proposed project will generate backup electricity which will ensure continuous operations at the port during power outages and prevent revenue and operational time loss during these events.

The generator is capable of producing electricity using diesel or liquefied natural gas (LNG (in natural gas form)). Liquid Fuel Combustion Installations used primarily for steam raising or electricity generation is a Listed Activity under Category 1: Combustion Installations, and sub-category 1.2: Liquid Fuel Combustion Installations. Gas combustion (including gas turbines burning natural gas) used primarily for steam raising or electricity generation is a Listed Activity under Category 1: Combustion Installations, and sub-category 1.4: Gas combustion. The Minimum Emission Standards for these two Category 1 Listed Activities are presented in Table E-1.

It must be noted that the combustion of liquid fuel for steam production or electricity generation; and the combustion of gaseous fuel for steam production or electricity generation in a turbine is applied to units with a capacity of more than 50 MW heat input per unit. According to the estimated engine performance data provided by TNPA, the heat input for the generator is more than 50 MW at a GTC load of 91.6% (heat input required is 60.5 MW) and 100% (heat input required is 66.3 MW) when running on gas (with NO_X control). In addition, the heat input for the generator varies from 74.4 - 64.8 MW between ambient temperatures of 3 - 36 degrees Celsius at a GTC load of 100% when running on diesel (with NO_X control). An AEL is therefore required for the proposed project.

Table E-1: 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**	
1.2: Liquid fuel combustion installation		
Particulate matter	N/A	50
Sulphur dioxide	SO_2	500
Oxides of nitrogen[a]	NO_X	250
1.4: Gas combustion installation		
Particulate matter	N/A	10
Sulphur dioxide	SO_2	400
Oxides of nitrogen[a]	NO_X	50

a: expressed as NO_2

In this assessment only stack emissions are considered for the dispersion modelling. Emissions from supporting infrastructure (such as storage tanks) and trucks are regarded as fugitive emissions which are negligible. Fugitive emissions are therefore not included in the modelling. Stack emissions resulting from the proposed TNPA 22MW Generator Project are listed in Table E-2 for the diesel-fired and gas-fired option. As a worst-case emission scenario, emission rates for the proposed TNPA 22MW Generator is based on Minimum Emission Standards.

Table E-2: Stack emission concentrations (mg/Nm^3) and emission rates (tonnes/annum) for the diesel-fired and gas-fired option

Substance	Emission concentration (mg/Nm^3)	Emission rate (tonnes/annum)	Listed Activity sub-category
SO_2	500	865.40	1.2: Liquid Fuel Combustion Installations (diesel-fired option)
	400	705.96	1.4: Gas combustion (gas-fired option)
NO_X	250	432.70	1.2: Liquid Fuel Combustion Installations (diesel-fired option)
	50	88.24	1.4: Gas combustion (gas-fired option)
PM_{10}	50	86.54	1.2: Liquid Fuel Combustion Installations (diesel-fired option)
	10	17.65	1.4: Gas combustion (gas-fired option)
CO*	65.9	114.06	diesel-fired option (Not stipulated in MES)
	132.2	233.32	gas-fired option (Not stipulated in MES)

* CO emission data provided by General Electric via TNPA

The CALPUFF dispersion model is used to predict ambient concentrations of SO_2, NO_2, PM_{10} and CO resulting from the proposed TNPA 22MW Generator Project emissions for the diesel-fired and gas-fired option. Modelling is done according to the modelling regulations and 3-years of hourly surface and upper air meteorological data are used.

The maximum predicted annual SO_2, NO_2, PM_{10} and CO concentrations and the 99th percentile concentration of the 24-hour, 8-hour and 1-hour predicted concentrations are very low relative to the NAAQS (Table E-3). 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 Port of Richards Bay and naturally vegetated areas.

Table E-3: Maximum predicted ambient annual SO_2, NO_2, PM_{10} and CO concentrations in µg/m³ 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 – Diesel Fuel	0.38	3.07		7.38
	Scenario 2 – LNG (in natural gas form) Fuel	0.31	2.53		6.07
NAAQS		50	125		350
		NO_2			
Predicted maximum NO_2	Scenario 1 – Diesel Fuel	0.15			2.95
	Scenario 2 – LNG (in natural gas form) Fuel	0.03			0.61
NAAQS		40			200
		PM_{10}			
Predicted maximum PM_{10}	Scenario 1 – Diesel Fuel	0.04	0.31		
	Scenario 2 – LNG (in natural gas form) Fuel	0.01	0.06		
NAAQS		40	75		
		CO			
Predicted maximum CO	Scenario 1 – Diesel Fuel			0.81	0.97
	Scenario 2 – LNG (in natural gas form) Fuel			1.66	2.01
NAAQS				10 000	30 000

The impact assessment was assessed for cumulative impacts of the proposed TNPA 22MW Generator Project with existing sources. The following points are noteworthy:

- Monitoring data for 2021-2023 has shown that ambient SO_2 concentrations are relatively high in Richards Bay, with many exceedances of the 1-hour and 24-hour NAAQS. The additive effect of the contribution of SO_2 from the proposed TNPA 22MW Generator Project 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 2021-2023 is not available for NO_2 in Richards Bay. Despite this, the additive effect of the contribution of NO_2 from the proposed TNPA 22MW Generator Project 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 2021-2023 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 TNPA 22MW Generator Project 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 for 2021-2023 is not available for CO in Richards Bay. Despite this, the additive effect of the contribution of CO from the proposed TNPA 22MW Generator Project 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 TNPA 22MW Generator Project, it is reasonable to expect that other electricity 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 TNPA 22MW Generator Project. Six potential projects have been identified for the assessment of these cumulative impacts:
- RBGP2 400 MW Gas-to-Power Project
- Richards Bay Combined Cycle Power Plant (CCPP)
- Phinda 320 MW Emergency Risk Mitigation Power Plant (RMPP)
- Nseleni Independent Floating Power Plant (NIFPP)
- Phakwe RBGP3 2000 MW Gas-to-Power Project (RBGP3)
- Karpowership 450 MW Gas-to-Power Powership Project at the Port of Richards Bay

The following points are noteworthy:
- Emissions of SO_2, NO_X, PM_{10} and CO from sources associated with the proposed TNPA 22MW Generator Project with other gas-to-power projects will result in an increase in ambient concentrations of SO_2, NO_2, PM_{10} and CO.
- The significance of impact relating to emissions from sources associated with the proposed TNPA 22MW Generator Project with other gas-to-power projects is predicted to be medium (negative) for SO_2 because of predicted exceedances of ambient SO_2 concentrations when diesel is used as an emergency back-up fuel on the Richards Bay CCPP Project and low (negative) for NO_2, PM_{10} and CO.

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.

Table E-4: Air quality impact scores

Description	Pollutants	Consequence	Likelihood	Significance
Construction Phase	Dust	5	13	Low (-65)
Operational Phase: TNPA 22MW Generator Project in isolation	SO_2	7	13	Low (-91)
	NO_2	7	13	Low (-91)
	PM_{10}	7	13	Low (-91)
	CO	7	13	Low (-91)
Operational Phase: TNPA 22MW Generator Project with existing sources (cumulative)	SO_2	7	13	Low (-91)
	NO_2	7	13	Low (-91)
	PM_{10}	7	13	Low (-91)
	CO	7	13	Low (-91)
Operational Phase: TNPA 22MW Generator Project with other gas-to-power projects (cumulative)	SO_2	14	16	Medium (-224)
	NO_2	7	13	Low (-91)
	PM_{10}	7	13	Low (-91)
	CO	7	13	Low (-91)
Decommissioning Phase	Dust	5	13	Low – 65

Air quality management interventions in the form of the control of emission have been considered in all aspects of design and operation. 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 TNPA 22MW Generator Project should be authorised considering the findings of this AIR.

GLOSSARY OF TERMS AND ACRONYMS

AEL	Atmospheric Emission Licence
AIR	Atmospheric Impact Report
DEA	Department of Environmental Affairs
DFFE	Department of Forestry, Fisheries and the Environment
EIA	Environmental Impact Assessment
g/s	Grams per second
kPa	Kilo Pascal
LNG	Liquefied Natural Gas (in natural gas form)
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)
NAAQS	National Ambient Air Quality Standards
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)
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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1. INTRODUCTION

Background

The Transnet National Ports Authority (TNPA) is a division of Transnet SOC Ltd and manages all eight of the Transnet commercial Ports on the South African coastline. The Port of Richards Bay is one of the country's largest ports, with a total land and water surface of 2 174 hectares and 1 443 hectares, respectively. TNPA is responsible for ensuring that the ports are economic hubs for the country while ensuring that they also comply with the South African Laws and Regulations which is governed by the National Ports Act (Act No. 12 of 2005) (NPA) which directs the TNPA to facilitate the provision of water, lighting, power, sewerage, and telecommunications within the ports. The Port of Richards Bay is still developing and constantly upgrading to ensure that the port provides the best possible service and attracts business activities for importing and exporting. Approximately half of the Port of Richards Bay has been developed. Mining activities and commodities are currently the largest contributor to the imports and exports at the port, with coal being the largest exported commodity.

Need and desirability of project

Eskom has a nominal generation capacity of over 45 000 Megawatt (MW); however, the power utility is challenged to supply the country's contracted demand of 22 500 MW. The ever-growing electricity demand with the lower generation capabilities has resulted in rolling power cuts that have severely affected business and port operations. It has become imperative for TNPA to provide reliable utility services such as electricity in a cost-effective and consistent manner.

The current electricity crisis could result in TNPA not fulfilling its responsibility of ensuring that the regulated services are provided and the shortage of electricity supply in the port can affect other basic services such as water supply and sewer. The Port of Richards Bay shows a significant future electricity demand requirement and in alignment with the Port Regulator's assertion that TNPA shall build capacity before demand, this would be necessary for guaranteed business continuity. Thus, it is appropriate that an interim solution be implemented to reduce the impact caused by load shedding and power shortages.

The current electricity demand for the Port of Richards Bay is 11 MW and in line with short-term port planning, it is anticipated that the future demand will be 17.9 MW. The Port of Richards Bay has approximately 10% of current available back-up and/or standby supply for current electricity demand, which is mainly used for offices and not operations, leaving a shortage of 90% of unsecured power and exposure of operational stand-still during load shedding. The South African power utility's strategy of increased levels of planned maintenance to improve reliability is putting additional strain on the plants availability and this strategy has not yielded visible benefits to date. The loss over a period of load shedding when the port is on a stand still have ripple effects on the chrome, ferro alloys, magnetite, alumina, export coal, woodchips, sulphur, and import coal lines. Thus, this will have an impact on both internal and external stakeholders such as leasing tenants, Transnet Freight Rail (TFR) and Transnet Port Terminal (TPT). TNPA needs to secure electricity supply to its operations and stakeholders in the face of escalating scheduled power outages due to declining supply availability as well as the increasing unreliability from both Eskom and the Municipal electricity supply networks.

TNPA is therefore accelerating the introduction of renewable energy into the port systems, however there is a need for an immediate solution to be deployed within the 2023/24 Financial Year to avert the current Eskom risks and crisis that could cost TNPA billions of income per annum. The crisis does not only affect the business revenue but has a negative reputational impact and poses a safety concern due to lack of visibility as the ports' operations are continuous over a 24-hour period. Due to the electricity challenges faced by the port, the strategic interim solution implemented by TNPA is to procure and install a 22 MW output generator to support port operations. The installation of the generator in the Port of Richards Bay is registered under the Strategic Integrate Projects (SIP) of the Infrastructure Development Act (IDA), Act 23 of 2014.

GCS Environment South Africa (Pty) Ltd (GCS SA) was appointed by Transnet SOC Ltd to facilitate the required environmental authorisation in accordance with the requirements of the National Environmental Management Act (NEMA) (DEA, 2014a) and to undertake the required Environmental Impact Assessment (EIA). uMoya-NILU Consulting (Pty) Ltd was appointed by GCS SA to undertake the air quality specialist study and to prepare an Atmospheric Impact Report (AIR) according to the regulations prescribing the format and content of an AIR (DEA, 2013a).

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.

2. ENTERPRISE DETAILS

2.1 Detailed Project Description

2.1 Key components/infrastructure of the proposed development

The proposed development will entail the construction of the following key components/infrastructure within the existing port area (which are discussed in more detail below):

- A dual fuel generator for the electricity generation of 22 MW output which can be operated with diesel or liquid natural gas;
- The installation of diesel fuel tank(s) with a total storage capacity of 600 m^3;
- The installation of a 200 m^3 tank for storage of demineralised water;

- Evacuation lines to the substations;
- Fencing for the proposed site;
- An auxiliary pit;
- A drain facility for used diesel and sludge;
- Installation of a transmission line from the generator to the Harbour West Substation, Sorting Yard substation, Liquid Pitch Substation, Arrivals Yard Substation, Eastern Intake Substation, Carina Substation and Admin Quay Substation in order to allow for power distribution from the generator to the rest of the port; and
- LNG (in natural gas form) pipeline from the gas hub to the proposed generator site.

22 MW Generator

The generator is designed by General Electric (GE Gas Power) who are the Original Equipment Manufacturer (OEM). The generator is dual fuel and can operate on either diesel fuel or liquified natural gas (LNG (in natural gas form)). The generator model is TM2500+ GEN 4 (Figure 2-1), the latest generation of one of the world's most experienced, reliable gas turbine solutions.

The gas turbine is a General Electric Model TM2500 that is ISO rated for continuous duty and configured for operation on either natural gas or liquid fuel (diesel 50 ppm). Altitude, humidity and inlet and exhaust losses will affect power output, heat rate and fuel efficiency. In addition to the inlet air filter, the engine is equipped with a stainless-steel mesh screen in the inlet air stream for "last chance" protection against foreign object damage.

Figure 2-1: Generator model for TM2500+ GEN 4 (Source: https://www.aprenergy.com)

Diesel storage tanks

Diesel storage tanks(s) with a combined capacity of 600 m^3 will be installed on the proposed site to store diesel used by the generator. The tanks will be housed within a bunded facility and drains will be in place for possible spills.

Demineralised water storage

A water storage tank with a capacity of 200 m^3 will be installed on site to store demineralised water. The water will be used for the generator and therefore has to be demineralised to prevent a build-up of impurities which would decrease the lifetime of the generator.

Substation transmission lines

A transmission line from the generator to the Harbour West Substation, Sorting Yard substation, Liquid Pitch Substation, Arrivals Yard Substation, Eastern Intake Substation, Carina Substation and Admin Quay Substation will be installed to allow for power distribution within the port.

Auxiliary pit

An auxiliary pit will be constructed to manage noise emanating from the generator, and to mitigate noise impacts from the generator.

Fencing

Although access control is in place at the Port of Richards Bay, the generator area will be fenced off. The generator fence is mainly for the protection of the generator infrastructure and diesel; and is a safety requirement when working with high voltage equipment.

Installation of the liquid natural gas (LNG (in natural gas form)) pipeline

Pipelines for liquid natural gas (LNG (in natural gas form)) will be installed as a supporting fuel source for the generator. The generator can be fuelled with diesel or LNG (in natural gas form). The LNG (in natural gas form) pipeline will be installed from the planned future distribution hub and would reduce the need for diesel which is a non-renewable fuel source. The pipelines would be buried where possible to prevent vandalism and theft. The installation of the pipeline will require vegetation removal. The disturbed areas would be revegetated at a later stage post laydown of the pipeline.

The possibility to use LNG (in natural gas form) as well as diesel ensures that there will be available resources to generate power even when there is a delay or problem sourcing one of the materials. There is an existing LNG (in natural gas form) distribution line situated in the Richards Bay Industrial Development Zone (RBIDZ) to which a pipeline will be connected.

2.1 Site location and infrastructure layout of the proposed development

The site location and infrastructure layout of the proposed TNPA 22MW Generator Project at the Port of Richards Bay is presented in Figure 2-2 and Figure 2-3 respectively.

Figure 2-2: Proposed site location of the TNPA 22MW Generator Project at the Port of Richards Bay

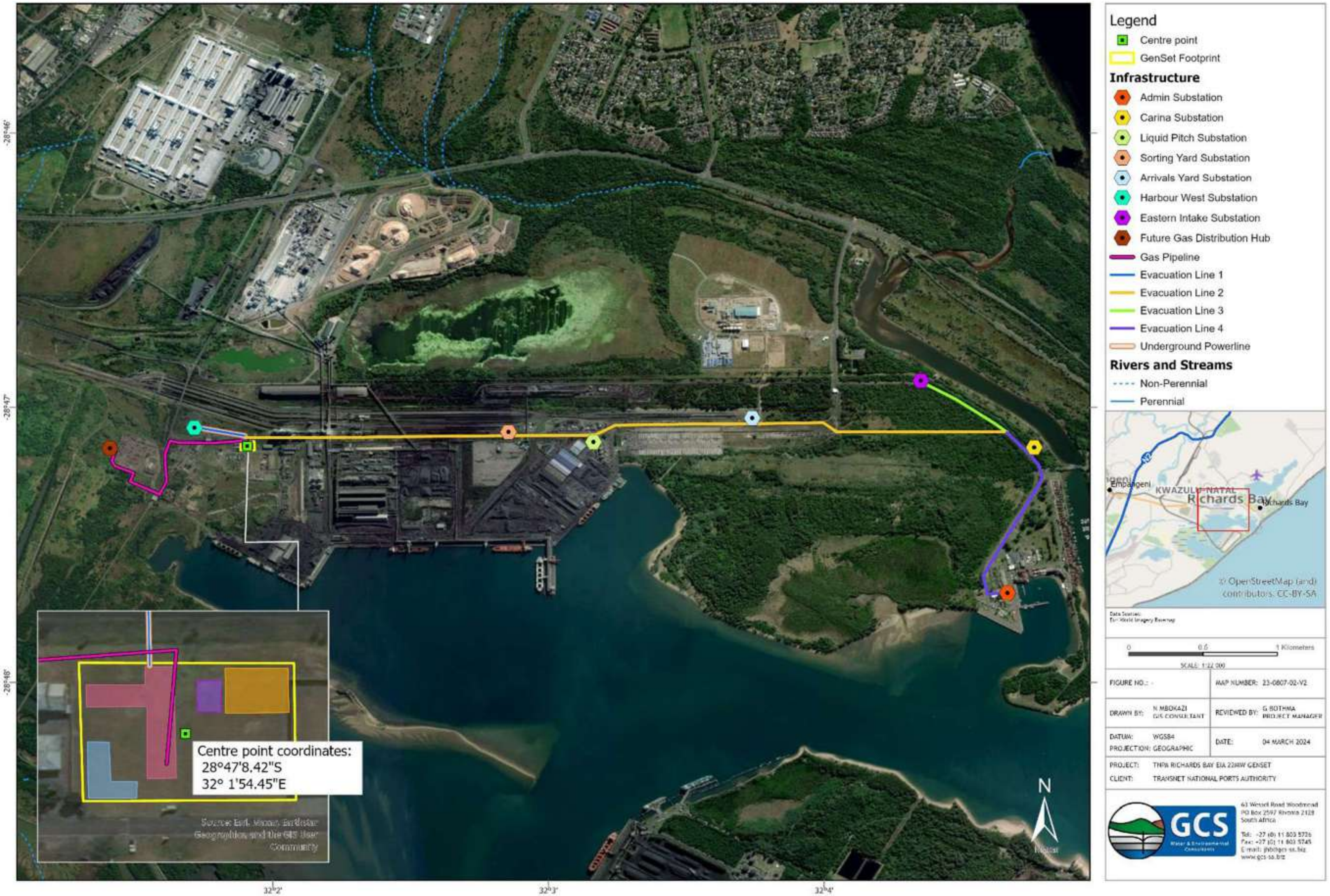

Figure 2-3: Infrastructure layout of the proposed TNPA 22MW Generator Project at the Port of Richards Bay

2.2 Enterprise Details

The enterprise details for the proposed TNPA 22MW Generator Project are listed in Table 2-1.

Table 2-1: Enterprise details

Entity Name:	Transnet National Ports Authority (TNPA)
Trading as:	Transnet National Ports Authority (TNPA)
Type of Enterprise, e.g. Company/Close Corporation/Trust, etc.:	Company
Company/Close Corporation/Trust Registration Number (Registration Numbers if Joint Venture):	1990/000900/30
Registered Address:	TNPA Administration Building, Port of Richards Bay, Alton, Richards Bay, South Africa
Postal Address:	P O Box 181, Richards Bay 3900, South Africa
Telephone Number (General):	035 905 3203
Fax Number (General):	No fax
Company Website:	https://www.transnetnationalportsauthority.net
Industry Type/Nature of Trade:	Energy generation
Land Use Zoning as per Town Planning Scheme:	Industrial
Land Use Rights if outside Town Planning Scheme:	N/A
Responsible Person:	Nosicelo Biyana
Emissions Control Officer:	Nosicelo Biyana
Telephone Number:	067 367 0110
Cell Phone Number:	067 367 0110
Fax Number:	No fax
Email Address:	Nosicelo.Biyana@transnet.net
After Hours Contact Details:	Cell phone and email as above

2.3 Location and extent of development

The proposed project is located at the Port of Richards Bay within the City of uMhlathuze Local Municipality and King Cetshwayo District Municipality in KwaZulu Natal, approximately 160 km to the north-east of Durban and 465 km south of Maputo. The proposed project site location falls within the main Port entrance and the Employee Care Centre in the Bayvue Precinct. The GPS coordinates for the proposed site are 28°47'8.42"S and 32° 1'54.45"E. The proposed location of proposed project site at the Port of Richards Bay is shown in Figure 2-2. Site information is listed in Table 2-2.

Table 2-2: Site information

Physical Address of the Licensed Premises:	Erf 397 of Township Richards Bay
Description of Site:	Port of Richards Bay
Property Registration Number (Surveyor-General Code):	Erf 397 of Township Richards Bay
Coordinates (latitude, longitude) Centre of Operations (Decimal Degrees):	TNPA 22MW Generator Project Dec. Deg.: Latitude: -28. 785672° Longitude: 32. 031792° TNPA 22MW Generator Project DDMMSS: Latitude: 28°47'8.42"S Longitude: 32° 1'54.45"E
Coordinates (UTM) Centre of Operations (UTM 35S):	TNPA 22MW Generator Project: X: 405500.27 m E (Easting) Y: 6815375.18 m S (Northing)
Extent (km²):	0.005 km^2 or 5 100 m^2
Elevation Above Mean Sea Level (m):	9.1 m
Province:	KwaZulu-Natal
District/Metropolitan Municipality:	King Cetshwayo District Municipality
Local Municipality:	Umhlatuze Local Municipality
Designated Priority Area (if applicable):	N/A

2.4 Description of surrounding land use (within 5 km radius)

The proposed TNPA 22MW Generator Project site which is located at the Port of Richards Bay is presented in Figure 2-4, showing the surrounding land use.

According to the USEPA, sensitive receptors include, but are not limited to, hospitals, schools, day care facilities, elderly housing and convalescent facilities. These are areas where the occupants are more susceptible to the adverse effects of exposure to toxic chemicals, pesticides, and other pollutants. Extra care must be taken when dealing with contaminants and pollutants in close proximity to areas recognised as sensitive receptors.

Industrial areas may be classified as receptors, but not necessarily sensitive receptors. Higher pollutant concentrations are normally expected in industrial areas and this is reflected in the NAAQS (e.g. dust fallout limit value of 1 200 mg/m^2/day for industrial areas versus 600 mg/m^2/day for residential areas).

There are no residential areas at the Port of Richards Bay. The closest residential area to the proposed project site is Arboretum, which is located approximately 3 km to the northeast of the proposed project site. Arboretum is a moderately populated township. It is identified as a sensitive receptor due to the presence of schools, hospitals, crèches, and other similar facilities. Other residential areas include, Meer En See which is located approximately 6 km to the west, Birdswood which is located 6.3 km to the northeast and Bhiliya which is located 8.5 km to the southwest of the proposed project site. Other residential areas are located much further away from the proposed project site.

2.5 Emission Control Officer

The TNPA 22MW Generator Project Emission Control Officer (ECO) is Lungile Nyembe (Mobile: 066 1696 970 and Email: Lungile.Nyembe@transnet.net).

2.6 Atmospheric Emission License (AEL) and other Authorisations

An Atmospheric Emissions Licence (AEL) nor any other authorisations have been issued for the proposed TNPA 22MW Generator Project (Table 2-3). According to the regulations, an AEL will be required for this project. Further discussion is provided in Section 3.

Table 2-3: Current authorisations related to air quality

Atmospheric Emission License	Date of Registration Certificate	Listed Activity Subcategory	Category of Listed Activity	Listed Activity Process Description
No record				

2.7 Modelling contractor

The dispersion modelling for this AIR is conducted by:

Company: uMoya-NILU Consulting (Pty) Ltd
Modellers: Dr Mark Zunckel and Atham Raghunandan
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 TNPA 22MW Generator Project site (the circle indicates a 5 km radius around the site (Google Earth, 2024)

2.8 Terms of Reference

The application for Environmental Authorisation for the proposed TNPA 22MW Generator Project requires the compilation of an Atmospheric Impact Report (AIR). To achieve this objective, the Terms of Reference are to:

- Prepare a Plan of Study report to provide an overview of the assessment process and submit this to the Licensing Authority for comment and input.
- Use available data and information to describe of current state of the receiving atmospheric environment. This description will consider meteorology, air quality and the surrounding land use. Data will be sourced from relevant authorities via the South African Air Quality Information System (SAAQIS), the Richards Bay Clean Air Association (RBCAA), and the South African Weather Service (SAWS).
- Provide an overview of the legal requirements including regulations under the National Environmental Management: Air Quality Act No. 39 of 2004 (NEM: AQA) and the requirements for an Atmospheric Emission License from the licensing authority.
- Develop an atmospheric emission inventory for the proposed project. Compounds that are regulated will be included in the emission inventory. These include sulphur dioxide (SO_2), oxides of nitrogen (NO_X), PM_{10}, carbon monoxide (CO), total volatile organic compounds, including benzene, toluene, ethylbenzene and xylene (BTEX).
- The emission inventory and the estimation of emissions for the 22 MW Dual Fuel generator will be based on the process and plant design, fuel type, fuel consumption, emission factors and efficiency of the emission control devices. The US-EPA TANKS emission model will be used to estimate emissions from fuel storage.
- Predict ambient concentrations of the pollutants resulting from the emissions using the US-EPA approved and DEA recommended CALPUFF dispersion model and working according to the DEA guideline for dispersion modelling (DEA, 2012).
- Assess potential air quality impacts of emissions resulting from the proposed project and the implications for human health by evaluating model predicted ambient concentrations of the listed air pollutants with National Ambient Air Quality Standard (NAAQS) and/or internationally accepted air quality guidelines and standards. Impact assessment criteria provided by GCS will be used in the assessment.
- Assess cumulative impacts of the proposed project by considering existing ambient concentrations of air pollutants (available measured data) and the predicted concentrations (model results), i.e. the added effect of the proposed project to air quality currently experienced in the area.
- Prepare and submit a draft AIR to GCS for review with TNPA.
- Finalise the AIR.

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.
- 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).

Liquid Fuel Combustion Installations used primarily for steam raising or electricity generation and gas combustion (including gas turbines burning natural gas) used primarily for steam raising or electricity generation are Listed Activities. The storage of liquid fuels over a specified storage capacity of 1 000 m^3 is also a Listed Activity. Details of the Listed Activities are shown in Table 3-1. The MES for Listed Activity sub-categories are listed in Table 3-2 and Table 3-3.

The generation capacity of the gas turbine used for the proposed TNPA 22MW Generator Project is rated at 22 MW. It must be noted that the combustion of liquid fuel for steam production or electricity generation; and the combustion of gaseous fuel for steam production or electricity generation in a turbine is applied to units with a capacity of more than 50 MW heat input per unit. According to the estimated engine performance data provided by TNPA, the heat input for the generator is more than 50 MW at a GTC load of 91.6% (heat input required is 60.5 MW) and 100% (heat input required is 66.3 MW) when running on gas (with NO_X control). In addition, the heat input for the generator varies from 74.4 - 64.8 MW between ambient temperatures of 3 - 36 degrees Celsius at a GTC load of 100% when running on diesel (with NO_X control). The proposed TNPA 22MW Generator is therefore classified as a listed activity and MES will apply for the generator. According to the regulations, an AEL is therefore required for the proposed project.

According to the proposed site layout, a diesel fuel storage tank(s) with a total storage capacity of 600 m^3 will be constructed on site. As an alternate, instead of a fuel storage tank(s), a diesel tanker truck may be brought to site as required. The fuel tank on the truck will be connected directly to the generator fuel line. A large tanker truck carries between 30-40 m^3 of fuel. In both cases, the total fuel storage capacity on site will be well below the threshold of 1 000 m^3. According to the regulations, an AEL is therefore not required for the fuel storage tanks since the combined storage capacity of the petroleum products on site is less than the threshold of 1 000 m^3.

Table 3-1: Details of the Listed Activity for Category 1: Combustion Installations 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	1.2: Liquid Fuel Combustion Installations (Liquid fuels combustion installations 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
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
Category 2: Petroleum industry, the production of gaseous and liquid fuels as well as petrochemicals from crude oil, coal, gas or biomass	Sub-category 2.4: Storage and Handling of Petroleum Products (Petroleum products storage tanks and product transfer facilities)	All permanent immobile liquid storage facilities at a single site with a combined storage capacity greater than 1000 m^3.

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	
1.2: Liquid fuel combustion installation		
Particulate matter	N/A	50
Sulphur dioxide	SO_2	500
Oxides of nitrogen[a]	NO_X	250
1.4: Gas combustion installation		
Particulate matter	N/A	10
Sulphur dioxide	SO_2	400
Oxides of nitrogen[a]	NO_X	50
a: expressed as NO_2		

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

<table>
<tr><th colspan="4">2.4: Storage and Handling of Petroleum Products</th></tr>
<tr><th colspan="2">Application</th><td colspan="2">All permanent immobile liquid Storage facilities at a single site with a combined storage capacity of greater than 1 000 m^3</td></tr>
<tr><th colspan="2">True vapour pressure of contents at product storage temperature</th><th colspan="2">Type of tank or vessel</th></tr>
<tr><td colspan="2">Type 1: Up to 14 kPa</td><td colspan="2">Fixed-roof tank vented to atmosphere, or as per Type 2 and 3</td></tr>
<tr><td colspan="2">Type 2: Above 14 kPa and up to 91 kPa with a throughput of less than 50 000 m^3 per annum</td><td colspan="2">Fixed-roof tank with Pressure Vacuum Vents fitted as a minimum, to prevent "breathing" losses, or as per Type 3</td></tr>
<tr><td colspan="2">Type 3: Above 14 kPa and up to 91 kPa with a throughput greater than 50 000 m^3 per annum</td><td colspan="2">a) External floating-roof tank with primary rim seal and secondary rim seal for tank with a diameter greater than 20 m, or
b) fixed-roof tank with internal floating deck / roof fitted with primary seal, or
c) fixed-roof tank with vapour recovery system.</td></tr>
<tr><td colspan="2">Type 4: Above 91 kPa</td><td colspan="2">Pressure vessel</td></tr>
<tr><th colspan="2">Description:</th><th colspan="2">Vapour Recovery Units</th></tr>
<tr><th colspan="2">Application:</th><th colspan="2">All loading/ offloading facilities with a throughput greater than 50 000 m^3</th></tr>
<tr><th colspan="2">Substance or mixture of substances</th><th rowspan="2">Plant status</th><th rowspan="2">mg/Nm^3 under normal conditions of 273 Kelvin and 101.3 kPa</th></tr>
<tr><th>Common Name</th><th>Chemical Symbol</th></tr>
<tr><td rowspan="2">Total volatile organic compounds from vapour recovery/ destruction units using thermal treatment</td><td rowspan="2">N/A</td><td>New</td><td>150</td></tr>
<tr><td>Existing</td><td>150</td></tr>
<tr><td rowspan="2">Total volatile organic compounds from vapour recovery/ destruction units using non-thermal treatment</td><td rowspan="2">N/A</td><td>New</td><td>40 000</td></tr>
<tr><td>Existing</td><td>40 000</td></tr>
</table>

3.2 Process Description

3.2.1 Diesel

Diesel is distilled from crude oil and is refined until it is 'clean' enough to use in engines. Diesel consist primarily of hydrocarbons with smaller amounts of hydrogen, nitrogen, sulphur, and volatile organic compounds. Diesel has a sulphur content of 500 ppm or less. Combustion of diesel results in emissions of sulphur dioxide (SO_2), oxides of nitrogen (NO and NO_2, referred to as NO_X), particulates and carbon monoxide (CO).

3.2.2 Liquefied natural gas (LNG (in natural gas form))

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 (in natural gas form)) 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.

3.2.3 Power generation

The dual-fuel generator proposed for the TNPA 22MW Generator Project can operate on either diesel fuel or liquified natural gas (LNG (in natural gas form)). A transmission line from the generator to the Harbour West Substation, Sorting Yard substation, Liquid Pitch Substation, Arrivals Yard Substation, Eastern Intake Substation, Carina Substation and Admin Quay Substation will be installed to allow for power distribution within the port.

A flow diagram for power generation with gas turbine power generators is shown in Figure 3-1. A gas turbine mixes compressed air with either natural gas or liquid fuels (diesel or aviation fuel) then ignites it, producing high-speed exhaust gases that rotate turbine blades connected to a shaft that powers a generator or other machinery. Although the operations of a gas turbine are complex, there are three essential parts: the compressor, the combustion system, and the turbine. The compressor, which draws air into the engine, pressurizes it, and feeds it to the combustion chamber at speeds of hundreds of kilometres per hour. The combustion system is typically made up of a ring of fuel injectors that inject a steady stream of fuel into combustion chambers where it mixes with the air. The mixture is burned at temperatures of more than 1 000 degC. The combustion produces a high temperature, high pressure gas stream that enters and expands through the turbine section. The turbine is an intricate array of alternate stationary and rotating aerofoil-section blades. As hot combustion gas expands through the turbine, it spins the rotating blades. The rotating blades perform a dual function: they drive the compressor to draw more pressurized air into the combustion section, and they spin a generator to produce electricity.

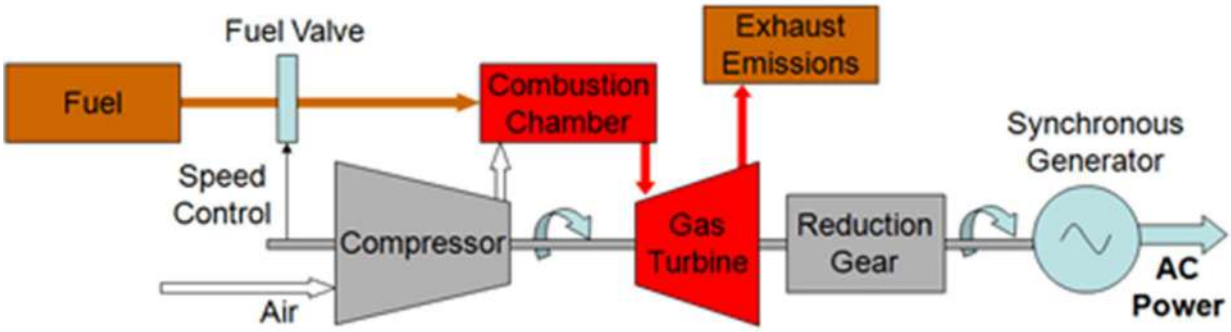

Figure 3-1: A flow diagram for power generation with gas turbine power generators used in simple system configuration consisting of the gas turbine driving an electrical power generator

3.2.4 Air pollutants resulting from the process

3.2.4.1 Overview

The quantity and nature of emissions to the atmosphere from diesel and LNG (in natural gas form) combustion depends on the quality of the fuel, fuel consumption, the combustion device, and the air pollution control devices.

The main pollutants resulting from the combustion of diesel are oxides of nitrogen (NO_X), total organic compounds (TOCs), carbon monoxide (CO), and particulates, which include both visible (smoke) and nonvisible emissions. Nitrogen oxide formation is directly related to high pressures and temperatures during the combustion process and to the nitrogen content, if any, of the fuel. The other pollutants which include hydrocarbons, CO and smoke are primarily the result of incomplete combustion. Ash and metallic additives in the fuel also contribute to the particulate content of the exhaust. Sulphur oxides (SO_X) also appear in the exhaust. The sulphur compounds, mainly sulphur dioxide, are directly related to the sulphur content of the fuel.

The combustion of LNG (in natural gas form) 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 (in natural gas form). NO_X is produced from thermal fixation of atmospheric nitrogen in the combustion flame and from oxidation of nitrogen bound in the LNG (in natural gas form). 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 diesel and LNG (in natural gas form) combustion.

3.2.4.2 National Ambient Air Quality Standards

The effects of air pollutants on human health occur in different ways of 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 99^{th} percentile. 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}, $PM_{2.5}$ and benzene are presented in Table 3-4.

Table 3-4: NAAQS for pollutants relevant to the TNPA 22MW Generator Project

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	0
	Annual	20	0
CO	1-hour	30 000	88
	8-hour running mean	10 000	11
Benzene	Annual	5	0

3.2.4.3 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 TNPA 22MW Generator Project.

Sulphur dioxide (SO_2)

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). There is however, uncertainty about exposure-response effects below concentrations of 200 ppb (520 µg/m^3). For SO_2 exposure short-term peak concentrations are therefore important (US-EPA, 2009). Re-analysis of the effects of SO_2 done post-2005 has found evidence suggesting that the departure point for setting the 10-minute guideline needs an additional uncertainty factor, indicating that the guideline may have to be lowered when it is re-evaluated (WHO, 2013).

Nitrogen dioxide (NO_2)

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 (present in the blood as the nitrite ion) oxidises unsaturated membrane lipids and proteins, which then results in the loss of control of cell permeability. 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). A review study (on 50 publications) published in 2009 by Hesterberg et al. focussed on short-term exposure to NO_2 and adverse health effects on humans. The authors came to the conclusion that a short-term exposure standard of not more than 200 ppb would protect all individuals, including sensitive individuals. People with chronic respiratory problems and people who work or exercise outside will be more at risk to NO_2 exposure.

Chronic exposure to NO_2 increases susceptibility to respiratory infections (WHO, 1997). However, a review study of 50 publications found no consistent evidence that short-term exposure below 200 ppb increased susceptibility to viral infections (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). In addition, some studies have suggested a possible link between PM and diabetes and effects on the central nervous system (WHO, 2013). The increase in daily mortality (between 0.4% and 1%) from exposure to PM_{10} was also confirmed in several studies since 2005 (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 haemoglobin reduces the oxygen-carrying capacity of the blood and impairs the release of oxygen from haemoglobin 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.

Benzene

Benzene (C_6H_6) is a natural component of crude oil, petrol, diesel and other liquid fuels and is emitted when these fuels are combusted. Diesel exhaust emissions therefore contain benzene. After exposure to benzene, several factors determine whether harmful health effects will occur, as well as the type and severity of such health effects. These factors include the amount of benzene to which an individual is exposed and the length of time of the exposure. For example, brief exposure (5–10 minutes) to very high levels of benzene (14000 – 28000 µg/m^3) can result in death (ATSDR, 2007). Lower levels (980 – 4200 µg/m^3) can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion and unconsciousness. In most cases, people will stop feeling these effects when they are no longer exposed and begin to breathe fresh air. Inhalation of benzene for long periods may result in harmful effects in the tissues that form blood cells, especially the bone marrow. These effects can disrupt normal blood production and cause a decrease in important blood components. Excessive exposure to benzene can be harmful to the immune system, increasing the chance for infection. Both the International Agency for Cancer Research and the US-EPA have determined that benzene is carcinogenic to humans as long-term exposure to benzene can cause leukaemia, a cancer of the blood-forming organs.

3.3 Unit Processes

The proposed TNPA 22MW Generator Project at the Port of Richards Bay will comprise the gas turbine, start-up diesel generator, LNG (in natural gas form) regasification unit, the LNG (in natural gas form)/CNG and diesel pipelines, the LNG (in natural gas form)/CNG and diesel tanker trucks, LNG (in natural gas form)/CNG and diesel storage tanks and lubricating oil storage tank. The unit processes that apply to the proposed project are listed in Table 3-5.

Table 3-5: Unit processes for the TNPA 22MW Generator Project

Name of the Unit Process	Unit Process Function	Batch or Continuous
22 MW Gas Turbine 1	Generation of electricity	Continuous
Start-up Diesel Generator	Gas turbine kick-start	Batch
LNG (in natural gas form)/CNG Tanker Truck Receiving	Receiving LNG (in natural gas form)/CNG via road tankers	Batch
LNG (in natural gas form)/CNG Pipeline Receiving	Receiving LNG (in natural gas form)/CNG via pipeline	Batch
LNG (in natural gas form)/CNG Storage Tank 1-4	Storage of LNG (in natural gas form)/CNG	Continuous
Diesel Tanker Truck Receiving	Receiving diesel via road tankers	Batch
Diesel Pipeline Receiving	Receiving diesel via pipeline	Batch
Diesel Storage Tank 1	Storage of diesel	Continuous
Lubricating Oil Storage Tank	Storage of lubricating oil	Continuous

4. TECHNICAL INFORMATION

4.1 Raw Materials Used

The proposed TNPA 22MW Generator Project will use diesel or LNG (in natural gas form) to generate 22 MW of electricity, depending on fuel-type availability. The raw materials consumption rate, production rate and the energy consumption are listed in Table 4-1 to Table 4-3. No by-products are produced.

Table 4-1: Raw material used by the proposed TNPA 22MW Generator Project

Material Type	Maximum consumption rate	Units
Diesel[1]	51 719	tonnes/annum
LNG (in natural gas form)/CNG[2]	45 819	tonnes/annum
Lubricating oil	To be confirmed during operational phase of Project	tonnes/annum

1: Based on diesel-fired option 2: Based on gas-fired option

Table 4-2: Production rate

Product	Maximum production rate	Units
Electricity	22	MW

Table 4-3: Energy sources used

Energy source	Sulphur content of fuel (%)	Ash content of fuel (%)	Maximum consumption rate	Units
Diesel	0.005-0.05[1]	0.01	51 719	tonnes/annum
LNG (in natural gas form)	0.01[2]	0.01	45 819	tonnes/annum
Electricity	-	-	500	kW

1: Low sulphur diesel – 0.005% (50 ppm); normal diesel – 0.05% (500 ppm)

2: Approximate value

4.2 Appliances and Abatement Equipment Control Technology

Most technologies, including diesel technology, goes through iterations of continuous improvement. The refining sector is continuously seeking ways to reduce sulphur content, thereby further lowering the sulphur content. Notably, low sulphur diesel (50 ppm) has greatly reduced sulphur dioxide and particulate matter emissions, both of which play a major role in air pollution. LNG (in natural gas form) is regarded as one of the most clean fuels, with very low SO_2 and particulate emissions. No emission abatement will be installed for the control of SO_2 and particulate emissions on the gas turbine.

The quantity of NO_X produced is directly proportional to the temperature of the process. The generator will be fitted with a water injection metering system to reduce NO_X emissions for gaseous fuel (LNG (in natural gas form) in this case) or liquid fuel (diesel in this case) operation. This is known as Direct Water Injection (DWI) (Table 4-4). Demineralised water is injected into the combustor through ports in the fuel nozzles to produce NO_X suppression. Water is supplied to the nozzles by a special water manifold. Water injection can reduce NO_X emissions to 25 ppm (51 mg/Nm^3) for gaseous fuels and to 42 ppm (86 mg/Nm^3) for liquid fuels.

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

Appliance Name	Appliance Type/Description	Appliance Function/ Purpose
Direct Water Injection	This is a method used for reduction of NO_X emissions by the injection of water directly into the combustion chamber via a separate nozzle. The key element in the design concept is the combined injection valve through which both fuel and water are injected. One needle in the combined nozzle is used for water injection, and the other one for fuel injection. Water injection starts before fuel injection in order to cool down the combustion space to ensure low NO_X formation before fuel ignition.	Control of NO_X emissions

5. ATMOSPHERIC EMISSIONS

5.1 Point Source Parameters

The proposed TNPA 22MW Generator Project will be located at approximately -28.785672°; 32. 031792° at the Port of Richards Bay. The generator will have a single stack which will be located at approximately -28.785529°; 32.031688° and a base elevation of approximately 9.1 m above mean sea level. Stack parameters are shown in Table 5-1.

Table 5-1: Stack parameters

Source name	Stack Height (m)	Stack Diameter (m)	Stack Exit Velocity (m/s)	Stack Temp. (°C)	Stack Flowrate (Am^3/hr)	Stack Flowrate (Nm^3/hr)
Stack 1 (diesel-fired option)	27.43	2.59	30.48	543.50	564 911	197 580
Stack 1 (gas-fired option)	27.43	2.59	30.48	526.49	564 495	201 471

5.2 Point Source Maximum Emission Rates (Normal Operating Conditions)

As a worst-case emission scenario, emission rates for the proposed TNPA 22MW Generator is based on Minimum Emission Standards. Emission rates from the point source (stack) are presented in Table 5-2.

Table 5-2: Stack emission concentrations (mg/Nm³) and emission rates (tonnes/annum) for the diesel-fired and gas-fired option

Substance	Emission concentration (mg/Nm³)	Emission rate (tonnes/annum)	Listed Activity sub-category
SO_2	500	865.40	1.2: Liquid Fuel Combustion Installations (diesel-fired option)
	400	705.96	1.4: Gas combustion (gas-fired option)
NO_X	250	432.70	1.2: Liquid Fuel Combustion Installations (diesel-fired option)
	50	88.24	1.4: Gas combustion (gas-fired option)
PM_{10}	50	86.54	1.2: Liquid Fuel Combustion Installations (diesel-fired option)
	10	17.65	1.4: Gas combustion (gas-fired option)
CO*	65.9	114.06	diesel-fired option (Not stipulated in MES)
	132.2	233.32	gas-fired option (Not stipulated in MES)

* CO emission data provided by General Electric via TNPA

The annual emissions presented above assume that operations are continuous, i.e. 24 hours per day for 365 days. This is a worst-case assumption as operations are likely to be for a few hours per day, during emergency situations, which is mainly during loadshedding or in the event of power failures.

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

It is expected that the generator will only be used during emergency situations, which is mainly during loadshedding or in the event of power failures. It is therefore uncertain how many start-up and shutdown events could be required.

Emission from start-up, shut-down 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. It must be noted that a start-up diesel generator will be used to kick-start the gas turbine into operation, implying that it will not be operated for more than 5 minutes.

The generator that will be used for the proposed TNPA 22MW Generator Project is designed for maximum efficiency during start-up and shutdown. General Electric gas turbines offer ultra-fast, non-spinning grid reserve for any contingency situation or grid black start. They can generate electricity for the TNPA grid speedily from start-up and reach full load in less than 10 minutes. They are designed to start and stop at the push of a button.

The gas turbine, using diesel or LNG (in natural gas form) 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. Only SO_2 has a 10-minute standard. Model predicted SO_2 concentrations resulting from both the diesel-fired and gas-fired model simulations have been shown to be extremely low. Based on the low model predicted results, emissions of SO_2, NO_X, PM_{10} and CO during the 10-minute start-up are not expected to exceed the MES or result in exceedances of the NAAQS. 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

For the purposes of this assessment, emissions from the following components of the proposed project are regarded as fugitive emissions:

- Storage of diesel and lubricating oil at the proposed project site:
    - Fugitive emission will result from the handling and storage of diesel and lubricating oil. Diesel and lubricating oil have a very low Reid vapour pressure (< 1 kPa). According to the special arrangements for the fuel storage (DEA, 2010), products with a vapour pressure up to 14 kPa must be stored in a fixed roof tank which vents to the atmosphere (see Table 3-3).
    - Emissions of VOCs from fixed roof tanks are from standing storage losses and working losses. Standing storage loss is the expulsion of vapour from tanks through vapour expansion and contraction, which is the result of changes in temperature and barometric pressure. This loss occurs without any change in liquid level in the tank. The loss from filling and emptying the tank is called working loss. Evaporation during filling operations is a result of an increase in the liquid level in the tank. As the liquid level increases, the pressure inside the tank exceeds the relief pressure and vapours are expelled from the tank. Evaporative loss during emptying occurs when air drawn into the tank during liquid removal becomes saturated with organic vapour and expands, thus exceeding the capacity of the vapour space.
    - It is expected that VOC emissions from the storage of diesel and lubricating oil at the proposed project site will be negligible, considering that both diesel and lubricating oil will be stored in fixed roof storage tanks and both have a low vapour pressure. Emissions from diesel storage tanks are therefore not considered in this assessment.

- Storage of LNG (in natural gas form) with associated regasification unit at the proposed project site:
    - It is expected that VOC emissions from the storage of LNG (in natural gas form) and the associated regasification unit will be negligible. Emissions from LNG (in natural gas form) storage and transfer are therefore not considered in this assessment.
- Diesel and LNG (in natural gas form) pipeline at the proposed project site:
    - It is expected that VOC emissions from pipelines bringing diesel and LNG (in natural gas form) to the proposed project site will be negligible. Emissions from pipelines are therefore not considered in this assessment.
- Start-up diesel generator:
    - It is expected that exhaust emissions of SO_2, NO_X, PM_{10} and CO from the start-up generator will be negligible, and is therefore not considered in this assessment.
- Transport of diesel and LNG (in natural gas form) by road tanker trucks from the fuel depot to the proposed project site:
    - Truck exhaust emissions from the main road to the proposed project site are presented in Table 5-3. Emissions are based on a worst-case scenario where 4-5 tanker trucks are expected to deliver diesel or LNG (in natural gas form) on a daily basis. It is evident that emissions are very small, and therefore have not been included in the dispersion modelling.

Table 5-3: Fugitive emissions (kg/annum) from truck exhaust

Fugitive Source	SO_2	NO_X	PM_{10}	CO
Truck Exhaust	0.13	9.68	0.20	1.75

- Transfer of diesel from road tanker trucks or from onsite storage tanks to generator fuel line:
    - VOC and BTEX emissions during transfer of diesel into generator fuel line at the proposed project site are presented in Table 5-4. Emissions are based on a worst-case scenario where it is assumed that the generator will be operating continuously. It is evident that emissions are very small, and therefore have not been included in the dispersion modelling.

Table 5-4: Fugitive emissions (kg/annum) during diesel fuel transfer

Fugitive Source	VOC	Benzene	Toluene	Ethyl-benzene	Xylene
Diesel fuel transfer	0.14	0.000001	0.000045	0.000018	0.000408

5.5 Emergency Incidents

The project is being proposed. Therefore no emergency incidents have occurred.

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.

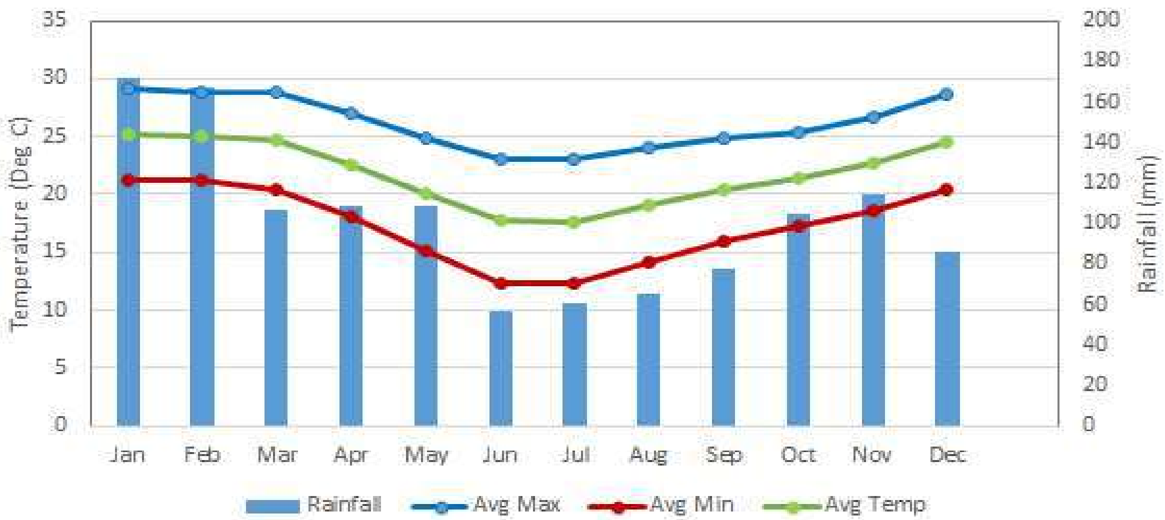

Figure 6-1: Average monthly maximum, minimum and daily temperature at Richards Bay (SAWB, 1992) and the average monthly rainfall (in mm) (SAWB, 1998)

The South African Weather Services (SAWS) station at the Richards Bay Airport provides a good representation of the prevailing wind direction across the region. The windrose at Richards Bay Airport for a 5-year period 1 January 2010 to 31 December 2014 is shown in Figure 6-2. Wind roses 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., southwesterly winds blow from the southwest. Wind speed is given in meters per second (m/s), and each arc represents a percentage frequency of occurrence (5% 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 Richards Bay winds occur predominantly in the sector north to north-northeast and in the sector south to southwest. 32% of all winds occur from the northerly sector. Most of these winds are light to moderate with just 6% exceeding 8.8 m/s. The winds from the south to south-west account for 17% of all winds. While these winds are generally light to moderate, they are strong at times and exceed 11.1 m/s on occasions. These strong winds are usually associated with the passage of deep coastal lows ahead of cold frontal systems.

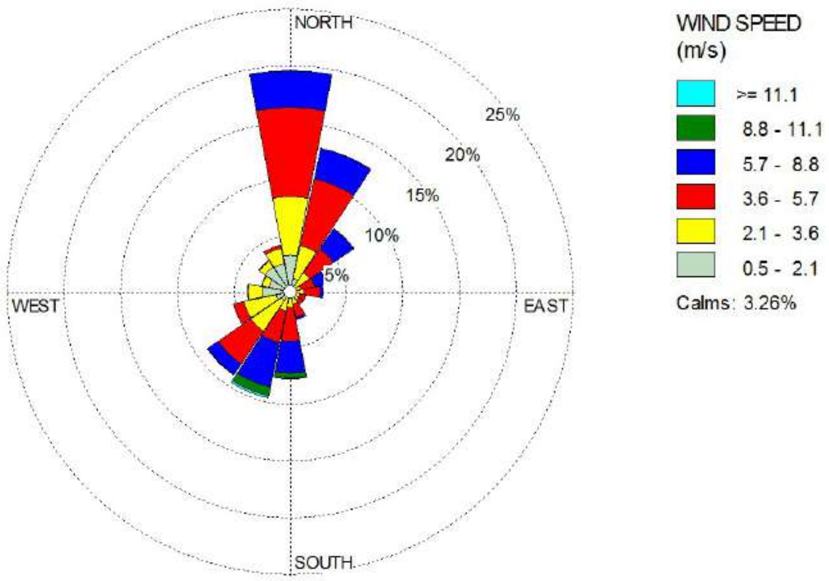

Figure 6-2: Annual wind rose for Richards Bay Airport, for 2010 to 2014 (SAWB, 1998)

The windrose also indicates mesoscale time land and sea breeze circulation. The land breeze is shown by the light off-shore winds from the west and northwest. These occur mostly at night time in the winter. The sea breeze is also a winter time feature and is shown by the onshore easterly to northeasterly winds. The sea breeze is a daytime feature and is somewhat stronger than the land breeze.

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, Mtunzini and Esikhaleni showed low concentrations of SO_2.

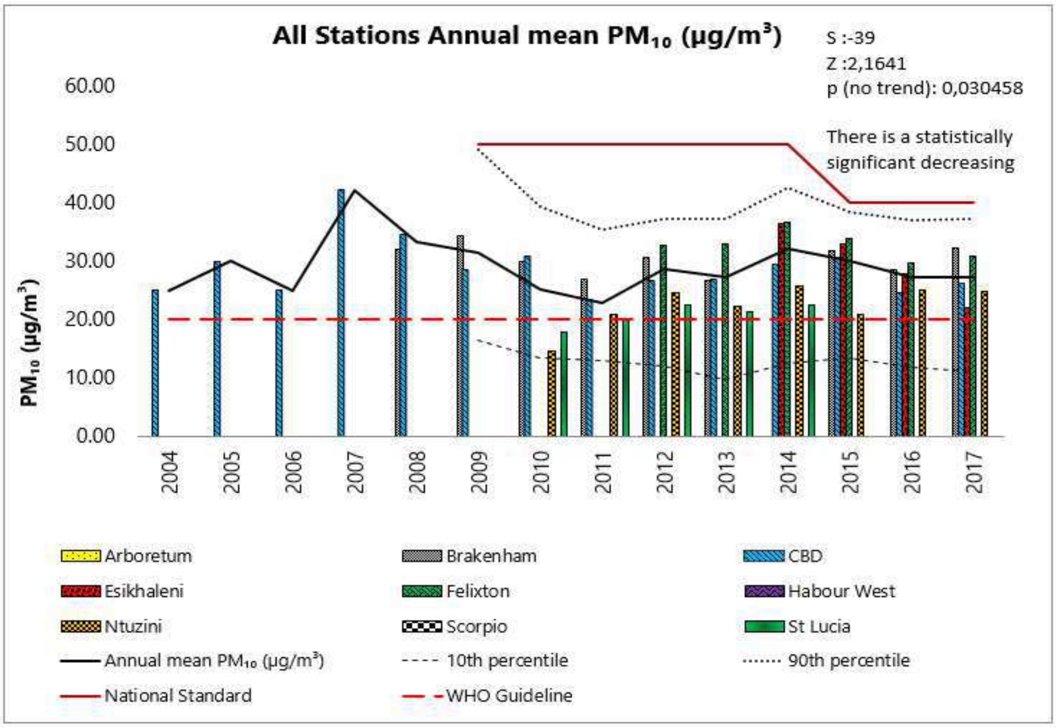

Figure 6-3: Annual average PM_{10} monitored concentrations (Okello et al., 2018)

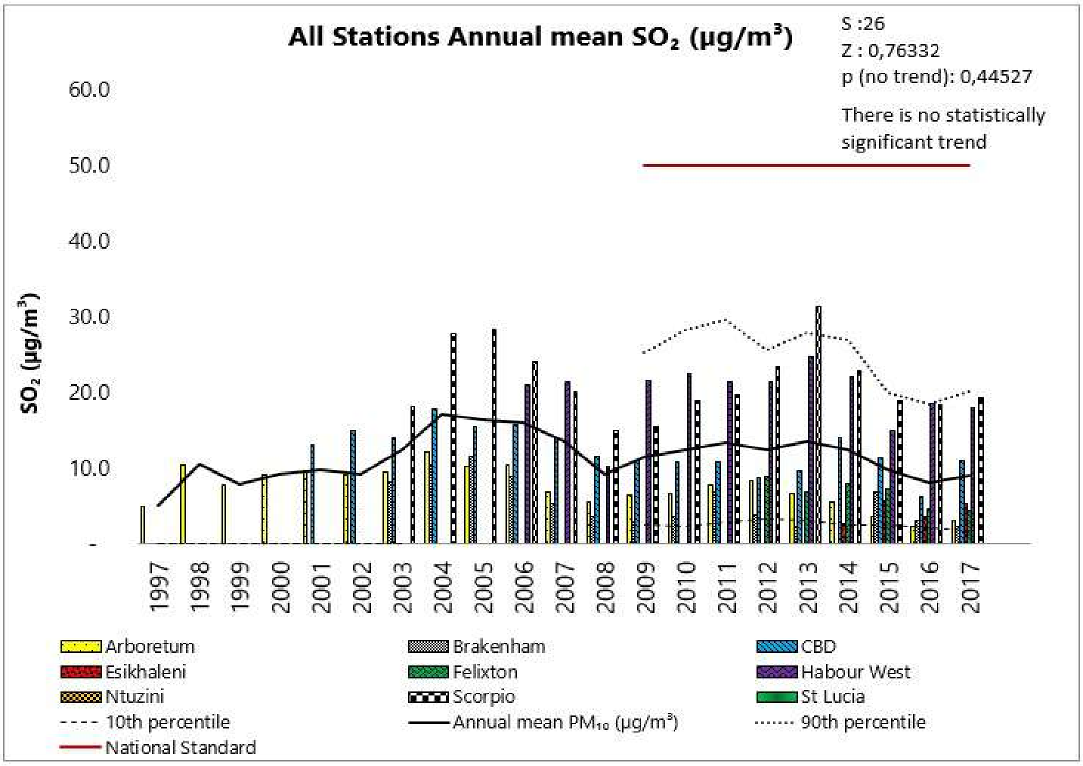

Figure 6-4: Annual average SO_2 monitored concentrations (Okello et al., 2018)

6.1.2.2 Ambient monitoring data from 2021-2023

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 mining activities, forest burning and coal dust from coal stockpiles. Numerous complaints have been reported between 2021-2023.

The current ambient air quality conditions were evaluated using the available air quality monitoring data from air quality monitoring stations (AQMS) in the area. Ambient data was only available for SO_2, PM_{10} and $PM_{2.5}$. Available hourly data was downloaded from the South African Air Quality Information System (SAAQIS) (http://saaqis.environment.co.za). SO_2 data was obtained from the Harbour AQMS, located close to the proposed project site. PM_{10} data was obtained from the CBD AQMS, approximately 5 km north of the proposed project site. $PM_{2.5}$ was obtained from the Brackenham AQMS, approximately 6.6 km north of the study site.

On average, data capture for 2021-2023 is 91% (Table 6-1) and thus may be considered representative for the baseline air quality conditions in the study area.

Table 6-1: Data Capture for data obtained from respective monitoring stations between 2021-2023

Pollutant	Data Capture (%)	Station
SO_2	96	Harbour
PM_{10}	92	CBD
$PM_{2.5}$	84	Brackenham
Average	91	

Sulphur dioxide (SO_2)

Ambient SO_2 concentrations may be attributed mostly to local industrial sources. Hourly average SO_2 concentrations at the Harbour AQMS ranged between 0.003 ppb and 425.2 ppb (Figure 6-5), whereas daily average SO_2 concentrations ranged between 0.07 and 330.47 ppb (Figure 6-6). There were 53 exceedances of the hourly standard (134 ppb) and 37 exceedances of the daily standard (48 ppb). 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. Therefore, SO_2 levels measured at the Harbour AQMS between 2021-2023 exceeded the daily air quality standard. Annual average SO_2 concentrations ranged between 6.78 ppb and 9.59 ppb. No exceedances of the SO_2 annual standard (19 ppb) were observed during the monitoring period.

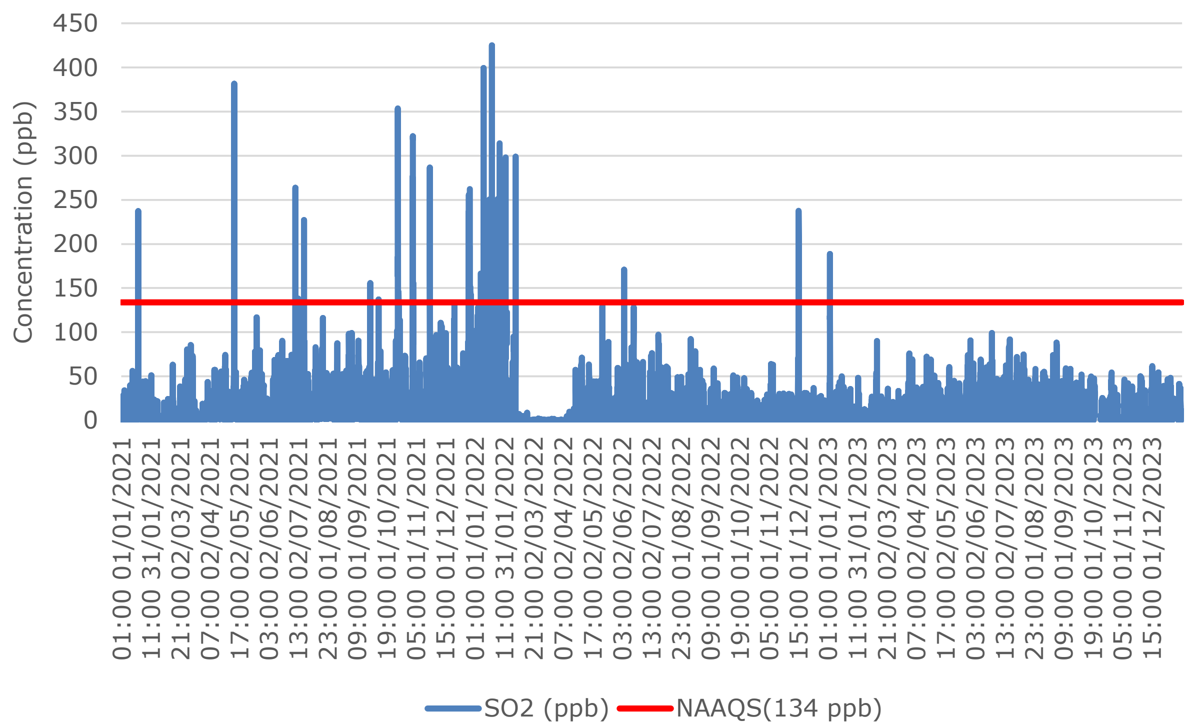

Figure 6-5: Hourly average SO_2 concentrations (ppb) measured at the Harbour AQMS

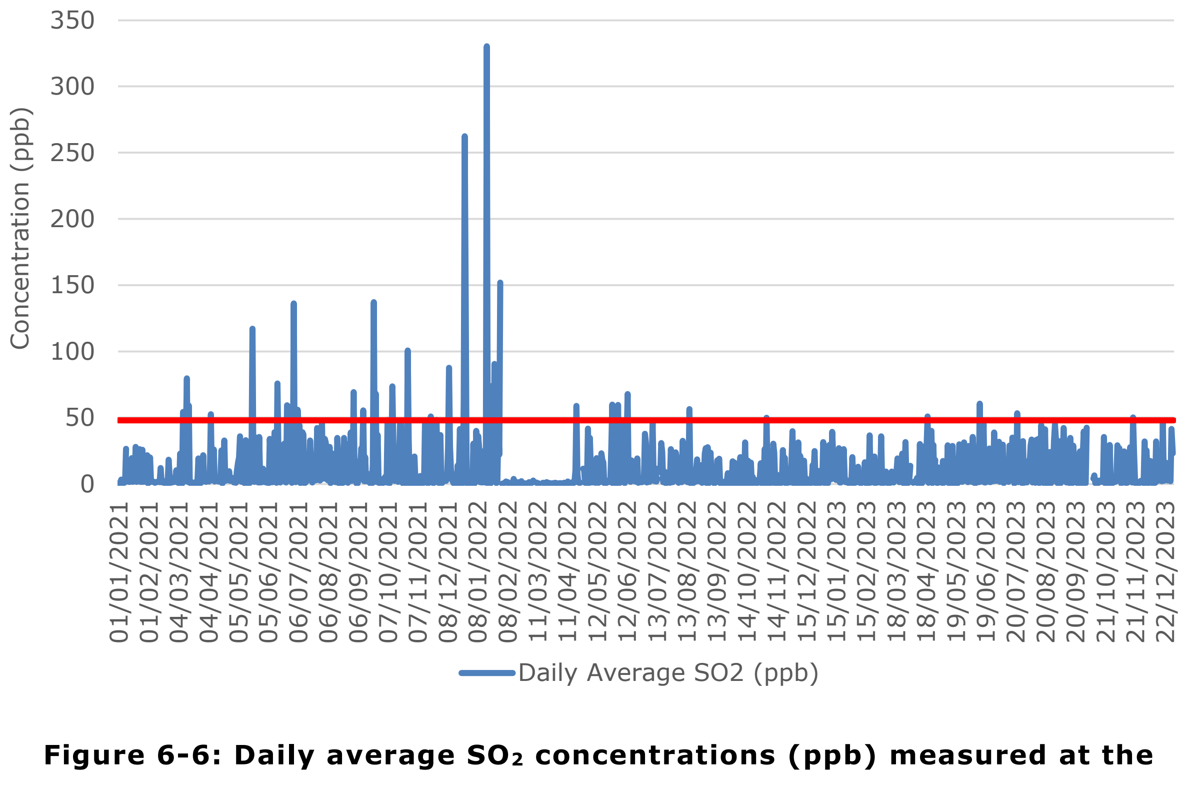

Figure 6-6: Daily average SO_2 concentrations (ppb) measured at the Harbour AQMS

Particulate matter (PM_{10})

PM_{10} is a regional pollutant with a regional background concentration in Richards Bay of more than 20 µg/m³ (Okello et al, 2018). Ambient PM_{10} concentrations may be attributed mostly to the high regional background with some contribution from local sources.

Daily average PM_{10} concentrations at the CBD AQMS ranged between 1.99 µg/m³ and 182.69 µg/m³, with an average of 11.8 µg/m³. Only 1 exceedance of the PM_{10} daily standard (75 µg/m³) was observed during the monitoring period (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 between 2021-2023 at the CBD AQMS are below the standard. Annual average PM_{10} concentrations ranged between 10.48 µg/m³ and 18.21 µg/m³, with an average of 13.32 µg/m³. PM_{10} annual levels were therefore below the annual standard of 40 µg/m³.

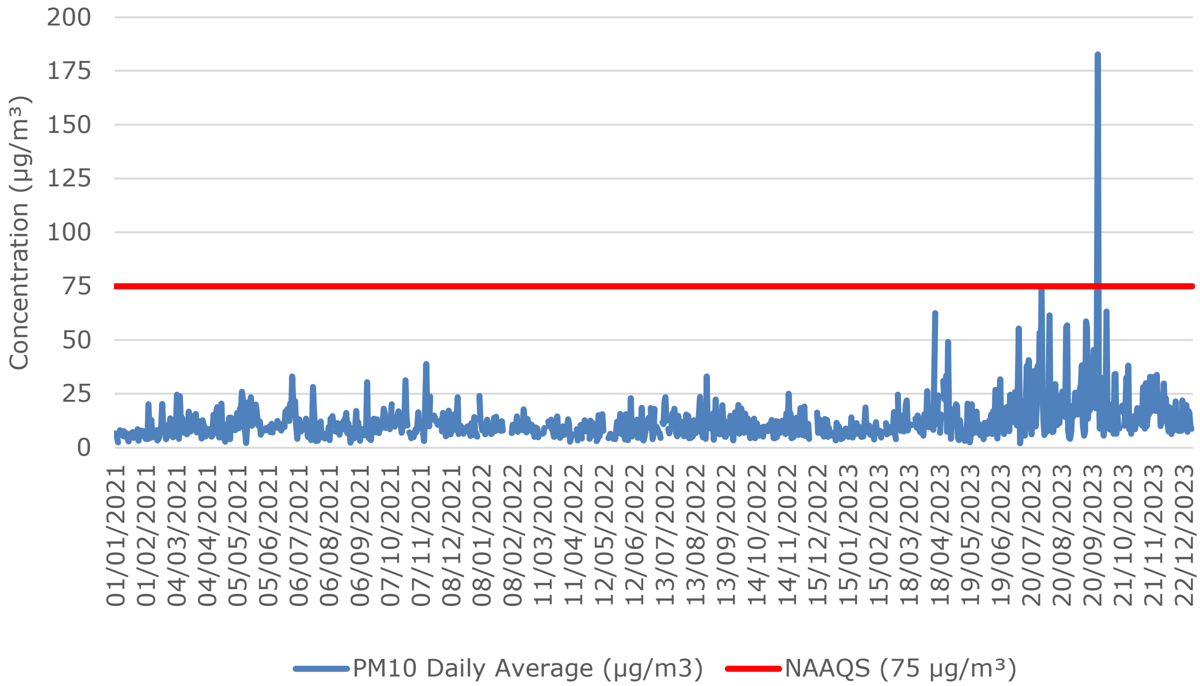

Figure 6-7: Daily average PM_{10} concentrations (µg/m³) measured at the CBD AQMS

Particulate matter ($PM_{2.5}$)

Daily average $PM_{2.5}$ concentrations at the Brackenham AQMS range between 2 µg/m³ to 50 µg/m³, with an average of 11.43 µg/m³. A total of 9 exceedances of the $PM_{2.5}$ daily standard (i.e. 40 µg/m³) were observed during the monitoring period (Figure 6-8). In terms of the South African NAAQS, no exceedances of the $PM_{2.5}$ 24-hour standard are permitted within a calendar year. $PM_{2.5}$ concentrations measured at the Brackenham AQMS are therefore not in compliance with the standard. Annual average $PM_{2.5}$ concentrations ranged between 12.21 µg/m³ to 13.30 µg/m³, with an average of 12.65 µg/m³. $PM_{2.5}$ annual levels were therefore below the annual standard of 20 µg/m³.

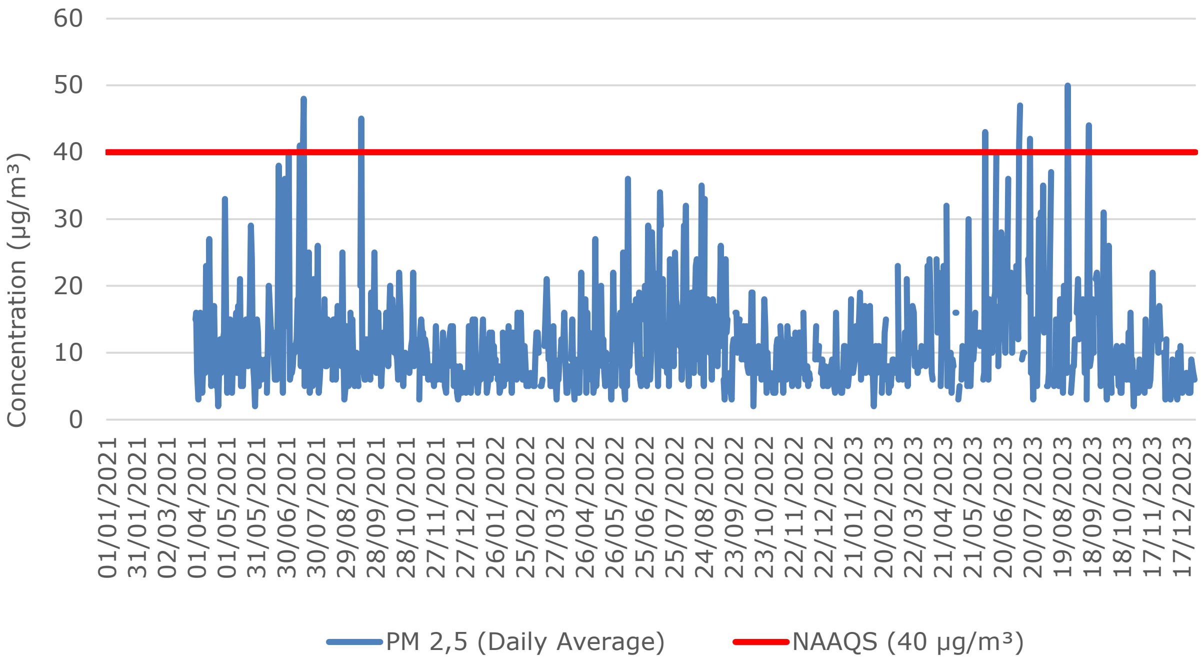

Figure 6-8: Daily average $PM_{2.5}$ concentrations (µg/m³) measured at the Brackenham AQMS

6.1.2.3 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.

6.1.2.4 WSP cumulative dispersion modelling

WSP Environment and Energy conducted a dispersion modelling study in Richards Bay to assess the cumulative effects of industrial operations. The report is considered by the RBCAA to be the most comprehensive modelling assessment for sources in Richards Bay. The modelling however has a number of notable shortcomings (pers. comm., Dr Lisa Ramsay, WSP, 31 March 2021). The shortcomings are:

i) The emissions inventory was compiled in 2015 and includes emissions for various industrial sources (point and area sources).
ii) Emissions data was extracted from the various AELs and other reports (e.g. AQIAs) from 2012 to 2015, depending on applicability.
iii) Some 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 not captured in the WSP modelling.

The results of the WSP cumulative dispersion modelling are 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 and adjacent areas and were attribute mainly to coal storage and handling.

The short comings of the cumulative dispersion modelling assessment must be noted. As a result of these it must be emphasised that the findings, while indicative, are not representative of the current airshed.

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 TNPA 22MW Generator Project 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.

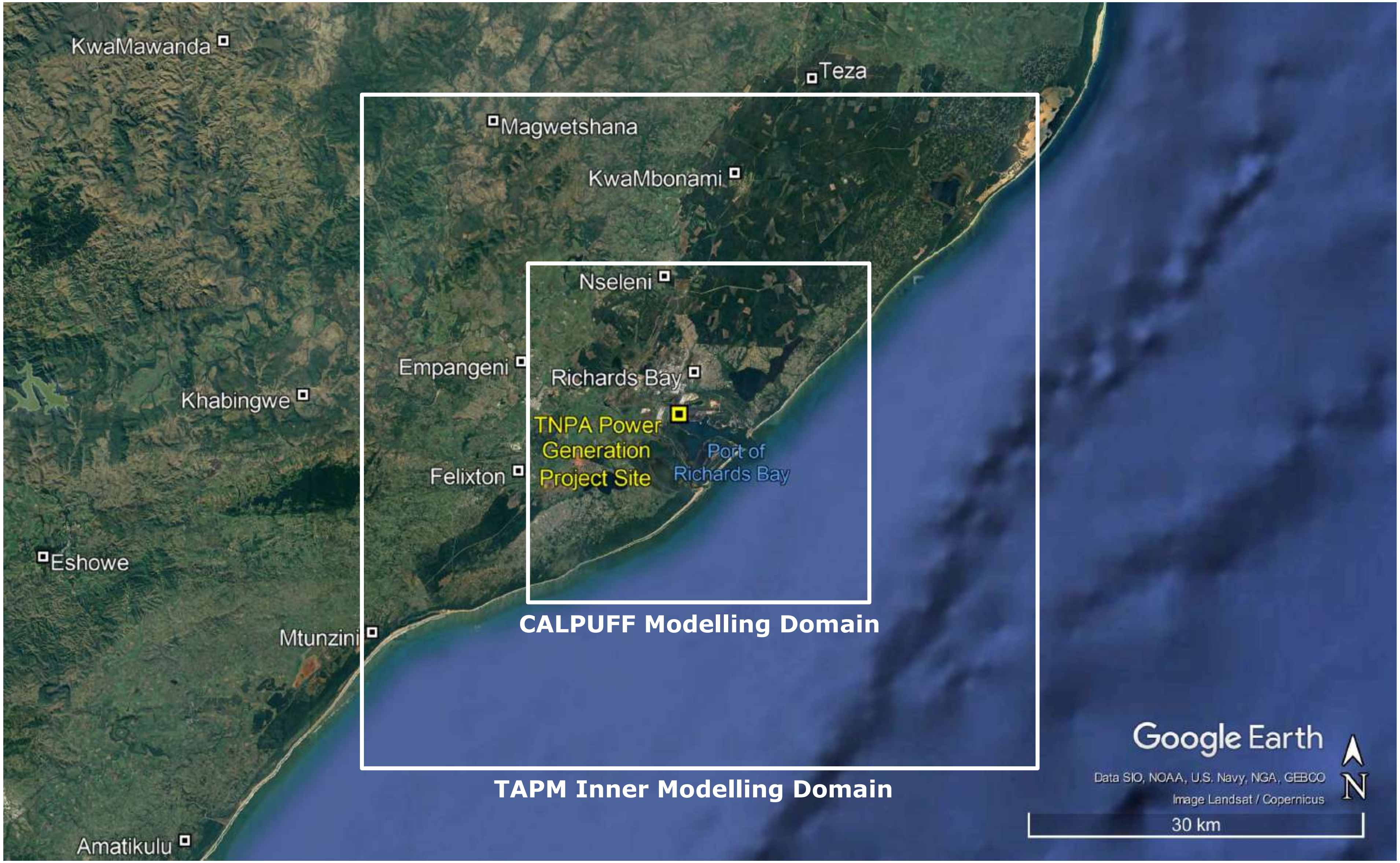

Figure 6-9: TAPM and CALPUFF modelling domains

The parameterisation of key variables that apply in CALMET and CALPUFF are indicated in Table 6-2 and Table 6-3 respectively.

Table 6-2: 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 6-3: 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	Pasquill-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 Background Concentrations and other sources

A background concentration refers to the portion of the ambient concentration of a pollutant due to sources, both natural and anthropogenic, other than the source being assessed.

In the assessment the annual average ambient concentrations of PM_{10} (Figure 6-7) and SO_2 (Figure 6-8) at the RBCAA monitoring stations are used as background concentrations to gauge the potential additive effect of the proposed TNPA 22MW Generator Project emissions in the Richards Bay area.

6.2.5 Assessment scenarios

To assess the potential impacts of the proposed TNPA 22MW Generator Project on ambient air quality, two operational scenarios are assessed:
Scenario 1: Generator using diesel fuel – diesel-fired option
Scenario 2: Generator using LNG (in natural gas form) fuel – gas-fired option

6.3 Dispersion Modelling Results

The dispersion modelling results are presented in the following sections for SO_2, NO_2, PM_{10} and CO. First the maximum predicted ambient concentrations are presented in Section 6.3.1. An explanation of the model output is provided in Section 6.3.2, followed by the dispersion modelling results presented as isopleth maps.

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 6-4. In all cases the predicted maximum concentrations are very low and are well below the respective NAAQS, also shown in Table 3-4.

Table 6-4: 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 – Diesel Fuel	0.38	3.07		7.38
	Scenario 2 – LNG (in natural gas form) Fuel	0.31	2.53		6.07
NAAQS		50	125		350
		NO_2			
Predicted maximum NO_2	Scenario 1 – Diesel Fuel	0.15			2.95
	Scenario 2 – LNG (in natural gas form) Fuel	0.03			0.61
NAAQS		40			200
		PM_{10}			
Predicted maximum PM_{10}	Scenario 1 – Diesel Fuel	0.04	0.31		
	Scenario 2 – LNG (in natural gas form) Fuel	0.01	0.06		
NAAQS		40	75		
		CO			
Predicted maximum CO	Scenario 1 – Diesel Fuel			0.81	0.97
	Scenario 2 – LNG (in natural gas form) Fuel			1.66	2.01
NAAQS				10 000	30 000

6.3.2 Isopleth maps

Maps of predicted ambient SO_2, NO_2, PM_{10} and CO concentrations are presented in the following sections in Figure 6-10 to Figure 6-18. The predicted concentrations are shown as isopleths, lines of equal concentration, in µg/m^3 for the respective NAAQS averaging periods. The isopleths are depicted as white lines on the various maps.

The prevailing winds over the Port of Richards Bay largely dictate the dispersion of pollutants resulting from the proposed TNPA 22MW Generator Project. This is best illustrated by the wind roses at Richards Bay Airport (Figure 6-2). Dispersion occurs in two predominant sectors from the proposed TNPA 22MW Generator Project. The first is to the sector is south to south-southwest because of the prevailing northerly to northeasterly winds. The second is the sector north-northeast to northeast because of the southwesterly winds.

6.3.2.1 Sulphur dioxide (SO_2)

The predicted SO_2 concentrations for Scenario 1 where diesel fuel is used and Scenario 2 where LNG (in natural gas form) fuel is used by the generator are very low relative to the NAAQS throughout the modelling domain which includes the Port of Richards Bay and surrounding areas. No exceedances of the NAAQS are therefore predicted for SO_2. The predicted annual average concentrations are shown in Figure 6-10, with the 99th percentile of the 24-hour concentrations in Figure 6-11 and the 99th percentile of the 1-hour concentrations in Figure 6-12.

For the annual and 1-hour averaging periods, highest predicted concentrations occur within 3 km to the north-northwest of the proposed project site over the industrial area, and to the south-southwest over parts of the Port of Richards Bay and naturally vegetated areas. For the 24-hour averaging period, highest predicted concentrations occur within 1.5 km to the west of the proposed project site over the industrial area.

At the point of maximum predicted ambient concentrations, the proposed TNPA 22MW Generator Project will add a maximum of 0.38 µg/m^3 to the existing annual ambient concentrations, a maximum of 3.07 µg/m^3 to the 24-hour ambient concentrations and a maximum of 7.38 µg/m^3 to the 1-hour ambient concentrations in the assessment area when diesel fuel is used (Scenario 1).

At the point of maximum predicted ambient concentrations, the proposed TNPA 22MW Generator Project will add a maximum of 0.31 µg/m^3 to the existing annual ambient concentrations, a maximum of 2.53 µg/m^3 to the 24-hour ambient concentrations and a maximum of 6.07 µg/m^3 to the 1-hour ambient concentrations in the assessment area when LNG (in natural gas form) fuel is used (Scenario 2).

For both scenarios, the additive effect will be less than this elsewhere in the assessment area where predicted ambient concentrations are lower. The additive effect of emissions from the proposed TNPA 22MW Generator Project on ambient SO_2 concentrations is therefore predicted to be small and is unlikely to result in exceedances of the NAAQS throughout the assessment area.

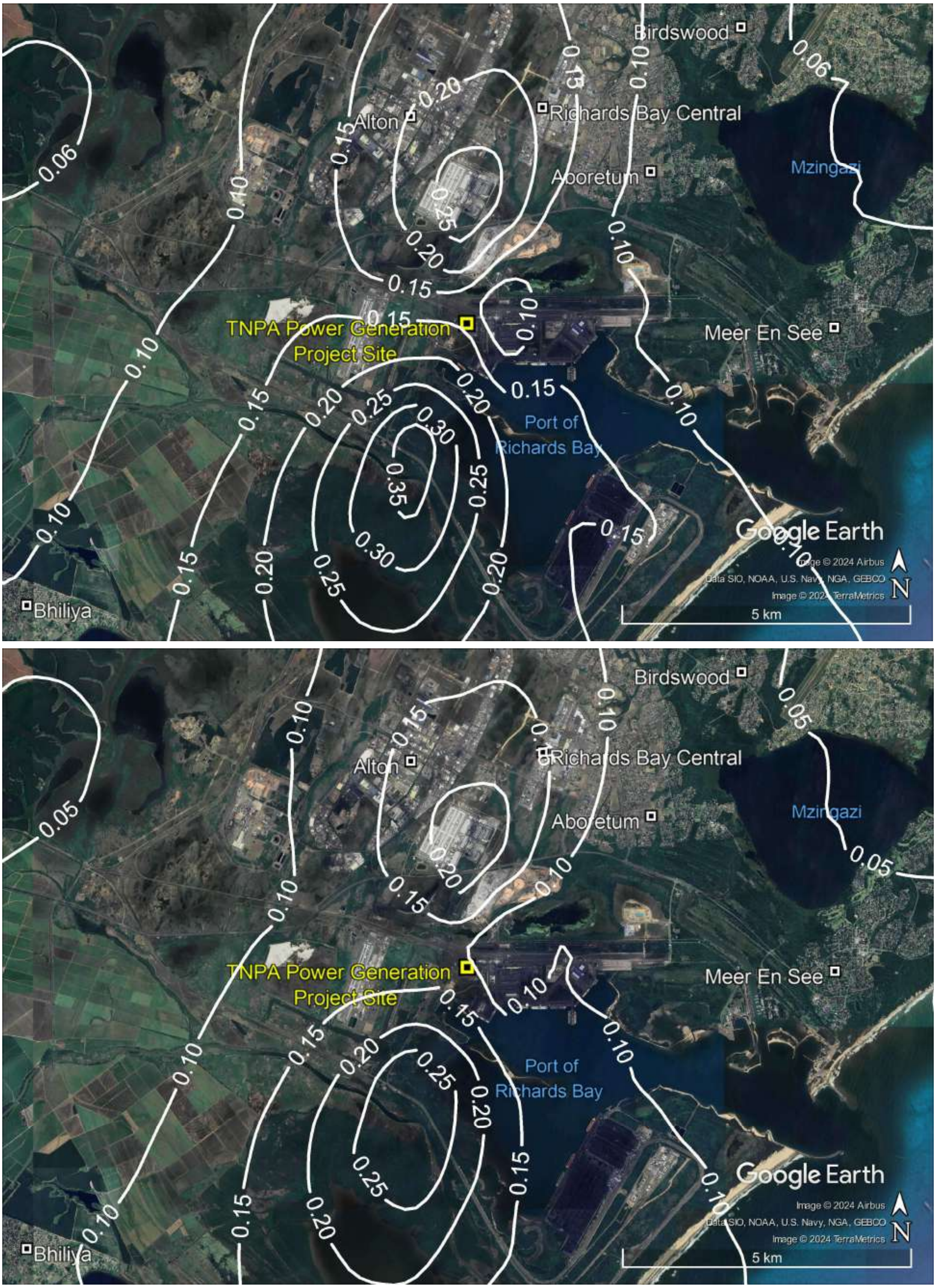

Figure 6-10: Predicted annual average SO_2 concentrations in µg/m³ resulting from emissions from the TNPA 22 MW Duel Fuel Generator for Scenario 1 where diesel fuel is used (top) and for Scenario 2 where LNG (in natural gas form) fuel is used (bottom)

Figure 6-11: Predicted 99th percentile 24-hour SO_2 concentrations in µg/m^3 resulting from emissions from the TNPA 22 MW Duel Fuel Generator for Scenario 1 where diesel fuel is used (top) and for Scenario 2 where LNG (in natural gas form) fuel is used (bottom)

Figure 6-12: Predicted 99th percentile 1-hour SO_2 concentrations in µg/m³ resulting from emissions from the TNPA 22 MW Duel Fuel Generator for Scenario 1 where diesel fuel is used (top) and for Scenario 2 where LNG (in natural gas form) fuel is used (bottom)

6.3.2.2 Nitrogen dioxide (NO_2)

The predicted NO_2 concentrations for Scenario 1 where diesel fuel is used and Scenario 2 where LNG (in natural gas form) fuel is used by the generator are very low relative to the NAAQS throughout the modelling domain which includes the Port of Richards Bay and surrounding areas. No exceedances of the NAAQS are therefore predicted for NO_2. The predicted annual average concentrations are shown in Figure 6-13, with the 99th percentile of the 1-hour concentrations in Figure 6-14.

For the annual and 1-hour averaging periods, highest predicted concentrations occur within 3 km to the north-northwest of the proposed project site over the industrial area, and to the south-southwest over parts of the Port of Richards Bay and naturally vegetated areas.

At the point of maximum predicted ambient concentrations, the proposed TNPA 22MW Generator Project will add a maximum of 0.15 $\mu g/m^3$ to the existing annual ambient concentrations, and a maximum of 2.95 $\mu g/m^3$ to the 1-hour ambient concentrations in the assessment area when diesel fuel is used (Scenario 1).

At the point of maximum predicted ambient concentrations, the proposed TNPA 22MW Generator Project will add a maximum of 0.03 $\mu g/m^3$ to the existing annual ambient concentrations, and a maximum of 0.61 $\mu g/m^3$ to the 1-hour ambient concentrations in the assessment area when LNG (in natural gas form) fuel is used (Scenario 2).

For both scenarios, the additive effect will be less than this elsewhere in the assessment area where predicted ambient concentrations are lower. The additive effect of emissions from the proposed TNPA 22MW Generator Project on ambient NO_2 concentrations is therefore predicted to be small and is unlikely to result in exceedances of the NAAQS throughout the assessment area.

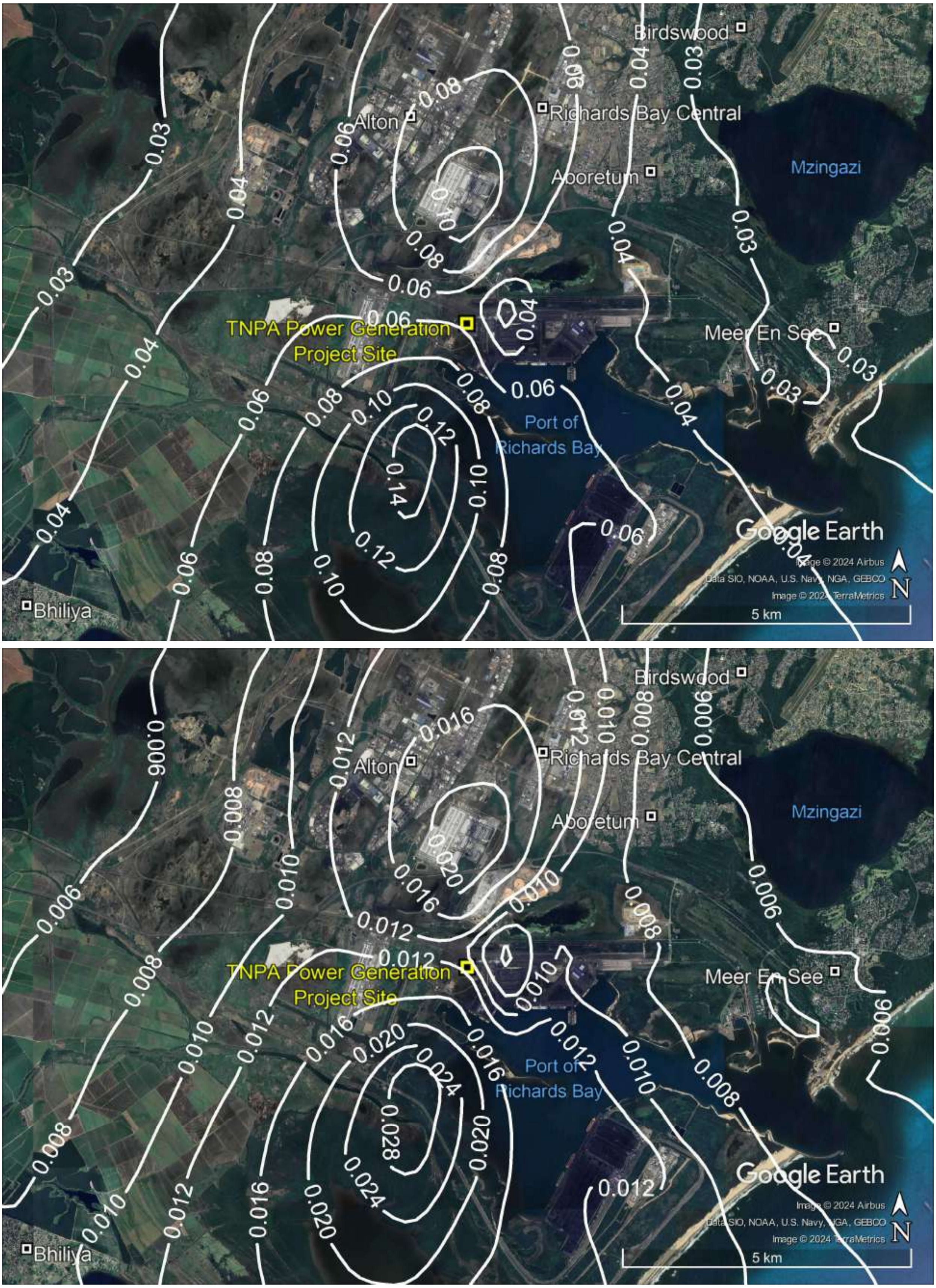

Figure 6-13: Predicted annual average NO_2 concentrations in µg/m³ resulting from emissions from the TNPA 22 MW Duel Fuel Generator for Scenario 1 where diesel fuel is used (top) and for Scenario 2 where LNG (in natural gas form) fuel is used (bottom)

Figure 6-14: Predicted 99th percentile 1-hour NO_2 concentrations in µg/m^3 resulting from emissions from the TNPA 22 MW Duel Fuel Generator for Scenario 1 where diesel fuel is used (top) and for Scenario 2 where LNG (in natural gas form) fuel is used (bottom)

6.3.2.3 Particulates (PM_{10})

The predicted PM_{10} concentrations for Scenario 1 where diesel fuel is used and Scenario 2 where LNG (in natural gas form) fuel is used by the generator are very low relative to the NAAQS throughout the modelling domain which includes the Port of Richards Bay and surrounding areas. No exceedances of the NAAQS are therefore predicted for PM_{10}. The predicted annual average concentrations are shown in Figure 6-15, with the 99th percentile of the 24-hour concentrations in Figure 6-16.

For the annual averaging period, highest predicted concentrations occur within 3 km to the north-northwest of the proposed project site over the industrial area, and to the south-southwest over parts of the Port of Richards Bay and naturally vegetated areas. For the 24-hour averaging period, highest predicted concentrations occur within 1.5 km to the west of the proposed project site over the industrial area.

At the point of maximum predicted ambient concentrations, the proposed TNPA 22MW Generator Project will add a maximum of 0.04 µg/m^3 to the existing annual ambient concentrations, and a maximum of 0.31 µg/m^3 to the 24-hour ambient concentrations in the assessment area when diesel fuel is used (Scenario 1).

At the point of maximum predicted ambient concentrations, the proposed TNPA 22MW Generator Project will add a maximum of 0.01 µg/m^3 to the existing annual ambient concentrations, and a maximum of 0.06 µg/m^3 to the 24-hour ambient concentrations in the assessment area when LNG (in natural gas form) fuel is used (Scenario 2).

For both scenarios, the additive effect will be less than this elsewhere in the assessment area where predicted ambient concentrations are lower. The additive effect of emissions from the proposed TNPA 22MW Generator Project on ambient PM_{10} concentrations is therefore predicted to be small and is unlikely to result in exceedances of the NAAQS throughout the assessment area.

Figure 6-15: Predicted annual average PM_{10} concentrations in µg/m^3 resulting from emissions from the TNPA 22 MW Duel Fuel Generator for Scenario 1 where diesel fuel is used (top) and for Scenario 2 where LNG (in natural gas form) fuel is used (bottom)

Figure 6-16: Predicted 99th percentile 24-hour PM_{10} concentrations in µg/m^3 resulting from emissions from the TNPA 22 MW Duel Fuel Generator for Scenario 1 where diesel fuel is used (top) and for Scenario 2 where LNG (in natural gas form) fuel is used (bottom)

6.3.2.4 Carbon monoxide (CO)

The predicted CO concentrations for Scenario 1 where diesel fuel is used and Scenario 2 where LNG (in natural gas form) fuel is used by the generator are very low relative to the NAAQS throughout the modelling domain which includes the Port of 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 6-17, with the 99th percentile of the 1-hour concentrations in Figure 6-18.

For the 8-hour and 1-hour averaging periods, highest predicted concentrations occur within 3 km to the north-northwest of the proposed project site over the industrial area, and to the south-southwest over parts of the Port of Richards Bay and naturally vegetated areas.

At the point of maximum predicted ambient concentrations, the proposed TNPA 22MW Generator Project will add a maximum of 0.81 µg/m^3 to the 8-hour ambient concentrations and a maximum of 0.97 µg/m^3 to the 1-hour ambient concentrations in the assessment area when diesel fuel is used (Scenario 1).

At the point of maximum predicted ambient concentrations, the proposed TNPA 22MW Generator Project will add a maximum of 1.66 µg/m^3 to the 8-hour ambient concentrations and a maximum of 2.01 µg/m^3 to the 1-hour ambient concentrations in the assessment area when LNG (in natural gas form) fuel is used (Scenario 2).

For both scenarios, the additive effect will be less than this elsewhere in the assessment area where predicted ambient concentrations are lower. The additive effect of emissions from the proposed TNPA 22MW Generator Project on ambient CO concentrations is therefore predicted to be small and is unlikely to result in exceedances of the NAAQS throughout the assessment area.

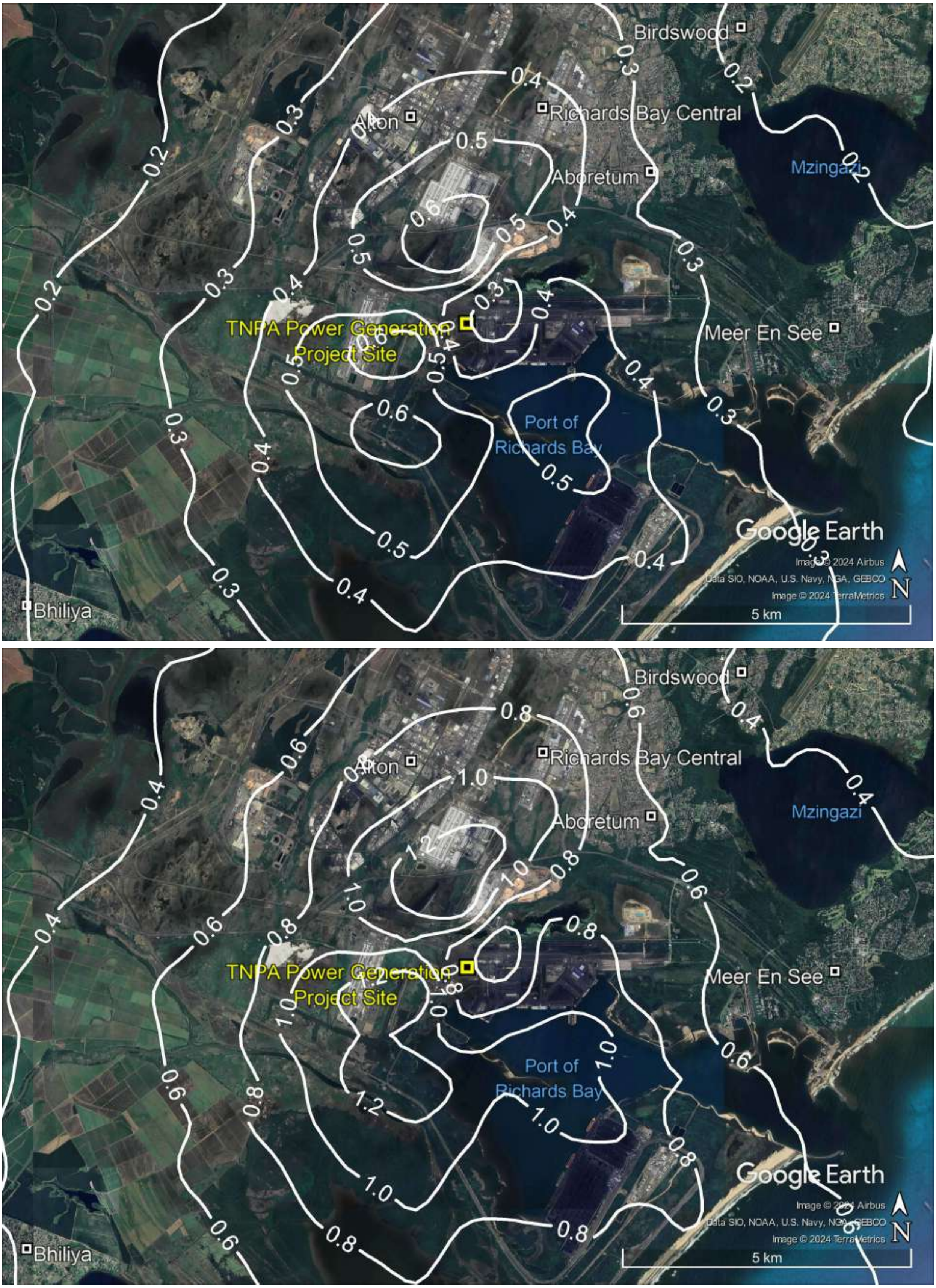

Figure 6-17: Predicted 99th percentile 8-hour CO concentrations in µg/m³ resulting from emissions from the TNPA 22 MW Duel Fuel Generator for Scenario 1 where diesel fuel is used (top) and for Scenario 2 where LNG (in natural gas form) fuel is used (bottom)

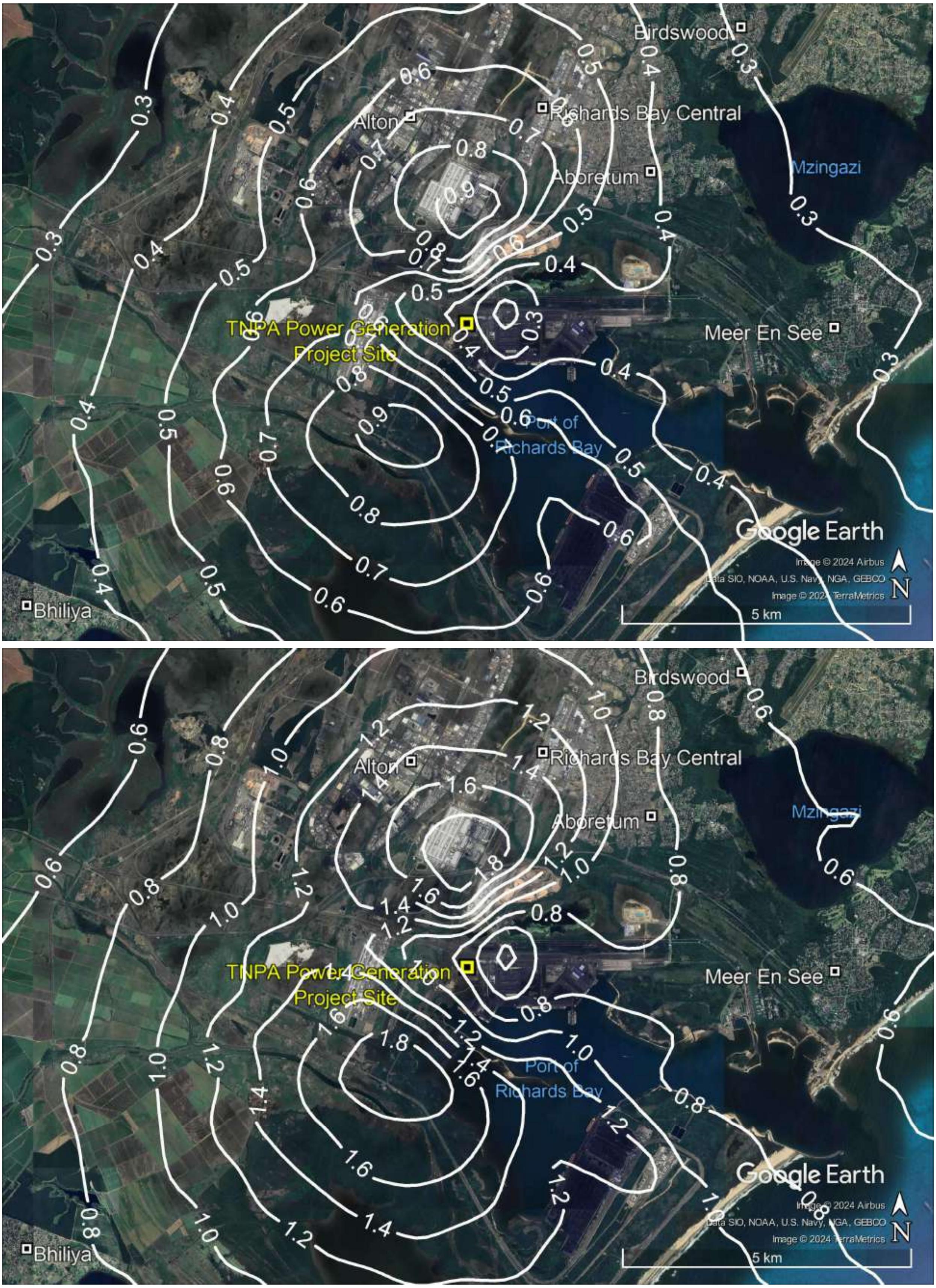

Figure 6-18: Predicted 99th percentile 1-hour CO concentrations in µg/m³ resulting from emissions from the TNPA 22 MW Duel Fuel Generator for Scenario 1 where diesel fuel is used (top) and for Scenario 2 where LNG (in natural gas form) fuel is used (bottom)

6.4 Impact Assessment

6.4.1 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 6-5 - Table 6-14) are used to assess the impacts associated with the proposed TNPA Genset Generator 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 6-5: 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 6-6: Spatial Scale of activity

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

Table 6-7: 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 6-8: 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 6-9: 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 6-10: Legal Issues – governance of activity by legislation

Legal Issues	
No legislation	1
Fully covered by legislation	5

Table 6-11: 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 6-12. Each impact will also be assessed in terms of the level to which there is an irreplaceable loss of resources (Table 6-13) and its degree of reversibility (Table 6-14).

Table 6-12: 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 6-13: 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 6-14: 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 and GCS expertise.

6.4.2 Impact assessment

In this section, the air quality impact assessment is presented for the following phases which are applicable to both Scenario 1 where diesel fuel is used and for Scenario 2 where LNG (in natural gas form) fuel is used:

- Construction Phase
- Operational Phase
  - TNPA 22MW Generator Project in isolation
  - TNPA 22MW Generator Project with existing sources (cumulative)
  - TNPA 22MW Generator Project with other gas-to-power projects (cumulative)
- Decommissioning Phase

The air quality impact assessment for the construction and decommissioning phase of the proposed TNPA 22MW Generator Project 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 6-19.

The air quality impact assessment for the proposed TNPA 22MW Generator Project for the operational phase is based on model predicted ambient SO_2, NO_2, PM_{10} and CO concentrations using the methodology described above, and is therefore quantitative. The proposed TNPA 22MW Generator Project is assessed in isolation, and cumulatively with existing sources and with other gas-to-power projects in Richards Bay. The two operational phases which include the proposed TNPA Power Project in isolation and with existing sources is similar and is therefore assessed together. A summary of the impact scores for the operational phase is presented in Table 6-19.

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.

6.5 Construction phase

The proposed TNPA 22MW Generator Project entails the construction of the following infrastructure within the existing port areas:

- A dual fuel generator for the electricity generation of 22MW output which can be operated with diesel or liquid natural gas – it is assumed that the generator and associated infrastructure will be hauled to site in special trailers and then assembled;
- The installation of diesel fuel tank(s) with a total capacity of 600 m^3;
- The installation of a 200 m^3 tank for the storage of demineralised water;
- Evacuation lines to the substations;
- Fencing for the proposed site;
- An auxiliary pit;
- A drain facility for used diesel and sludge;

- A transmission line from the generator to the Harbour West Substation, Sorting Yard substation, Liquid Pitch Substation, Arrivals Yard Substation, Eastern Intake Substation, Carina Substation and Admin Quay Substation in order to allow for power distribution from the generator to the rest of the port; and
- LNG (in natural gas form) pipeline from the Gas hub to the proposed generator site.

A range of vehicles and equipment are used during construction including heavy duty vehicles and mobile generators. Activities during construction are associated with the movement of a range of vehicles and equipment including bulldozers, excavators and tipper trucks. These activities inherently generate dust that 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 a number of ways. Diligent management of an abatement programme can have a marked effect on reducing dust from all construction activities.

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.

During the construction phase, surface preparation of the proposed project area will 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 is estimated to take approximately 6-12 months to complete. 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 construction dust.

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 6-12 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). It lists 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 from construction sites. 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 considered to be 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 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 or paving of disturbed areas once construction activities are complete.

No further dust control or mitigation is deemed necessary as these measures will be adequate to control dust emissions.

6.6 Operational phase

TNPA 22MW Generator Project in isolation and with existing sources

Severity or magnitude of impact

The severity or magnitude of impact of the proposed TNPA 22MW Generator Project emissions 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 less than 0.03% of the limit value of the NAAQS. The severity or magnitude of the impact associated with SO_2 is therefore predicted to be insignificant (score = 2) for the proposed TNPA 22MW Generator Project in isolation.

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 less than 0.001% of the limit value of the NAAQS. The severity or magnitude of the impact associated with NO_2 is therefore predicted to be insignificant (score = 2) for the proposed TNPA 22MW Generator Project in isolation.

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 less than 0.005% of the limit value of the NAAQS. The severity or magnitude of the impact associated with PM_{10} is therefore predicted to be insignificant (score = 2) for the proposed TNPA 22MW Generator Project in isolation.

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 less than 0.0001% of the limit value of the NAAQS. The severity or magnitude of the impact associated with CO is therefore predicted to be insignificant (score = 2) for the proposed TNPA 22MW Generator Project in isolation.

Monitoring data for 2021-2023 has shown that ambient SO_2 concentrations are relatively high in Richards Bay, with many exceedances of the 1-hour and 24-hour NAAQS. The additive effect of the contribution of SO_2 from the proposed TNPA 22MW Generator Project 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. The severity of the cumulative impact of SO_2 is therefore predicted to be insignificant (score = 2) for the proposed TNPA 22MW Generator Project cumulatively with existing sources.

Monitoring data for 2021-2023 is not available for NO_2 in Richards Bay. Despite this, the additive effect of the contribution of NO_2 from the proposed TNPA 22MW Generator Project 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. The severity of the cumulative impact of NO_2 is therefore predicted to be insignificant (score = 2) for the proposed TNPA 22MW Generator Project cumulatively with existing sources.

Monitoring data for 2021-2023 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 TNPA 22MW Generator Project 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. The severity of the cumulative impact of PM_{10} is therefore predicted to be insignificant (score = 2) for the proposed TNPA 22MW Generator Project cumulatively with existing sources.

Monitoring data for 2021-2023 is not available for CO in Richards Bay. Despite this, the additive effect of the contribution of CO from the proposed TNPA 22MW Generator Project 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. The severity of the cumulative impact of CO is therefore predicted to be insignificant (score = 2) for the proposed TNPA 22MW Generator Project cumulatively with existing sources.

Spatial scale of activity

The spatial scale of impact of the proposed TNPA 22MW Generator Project 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 Port of Richards Bay and naturally vegetated areas. The spatial scale of the impact is therefore local (score = 2) as impacts are limited to the Port of Richards Bay and the immediate surrounding areas for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.

Duration of activity

The duration of impact of the proposed TNPA 22MW Generator Project 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 medium-term of 5-15 years (score = 3) for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.

Frequency of activity

The frequency of impact of the proposed TNPA 22MW Generator Project emissions on ambient air quality is assessed by considering how often the activity is undertaken. It is expected that the generator will only be used during emergency situations, which is mainly during loadshedding or in the event of power failures. As a worst-case scenario, it is expected that the frequency of activity will be definite/always/permanent/daily (score = 5) for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.

Frequency of incident/impact

The frequency of incident of the proposed TNPA 22MW Generator Project emissions on ambient air quality 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 TNPA 22MW Generator Project is predicted to be very small and the potential increase in ambient concentrations is highly unlikely to result in elevated concentrations or further exceedances of the NAAQS. Impacts will only occur when the generator is in use during emergency situations, which is mainly during loadshedding or in the event of power failures. Impacts are therefore expected to be almost never/almost impossible/>20% (score = 1) for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.

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 NAAQS. In terms of legal issues, the impact of the proposed TNPA 22MW Generator Project 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 TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.

Detection

The detection of impact of the proposed TNPA 22MW Generator Project 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 (if necessary), during the operational phase. Detection of impacts is therefore considered to be undertaken without much effort (score = 2) , for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.

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 is expected to be insignificant (score = 2) for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.
- The spatial scale of the impact is local (score = 2) as impacts are limited to the Port of Richards Bay and the immediate surrounding areas for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.
- The duration of the impact will be for a medium-term of 5-15 years (score = 3) for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.

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 TNPA 22MW Generator Project has a score of 2+2+3=7 for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.

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:

- As a worst-case scenario, it is expected that the frequency of activity will be definite/always/permanent/daily (score = 5) for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.
- Impacts will only occur when the generator is in use during emergency situations, hence, impacts in terms of frequency of impact are therefore expected to be almost never/almost impossible/>20% (score = 1) for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.
- In terms of legal issues, the impact of the proposed TNPA 22MW Generator Project emissions in the ambient environment is fully covered by legislation (score = 5) for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.
- Detection of impacts is considered to be undertaken without much effort (score = 2), for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.

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 TNPA 22MW Generator Project has a score of 5+1+5+2=13 for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing 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, PM_{10} and CO resulting from emissions from the proposed TNPA 22MW Generator Project has a score of 7x13=91 for both the proposed TNPA 22MW Generator Project in isolation, and cumulatively with existing sources.

Emissions of SO_2, NO_X, PM_{10} and CO from sources associated with the proposed TNPA 22MW Generator Project 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 TNPA 22MW Generator Project in isolation and cumulatively with existing sources.

The significance of impact relating to emissions of SO_2, NO_X, PM_{10} and CO from sources associated with the proposed TNPA 22MW Generator Project is therefore predicted to be low (negative) for the proposed TNPA 22MW Generator Project in isolation and cumulatively with existing sources.

Irreplaceability of resource caused by impacts

The predicted ambient concentrations of SO_2, NO_2, PM_{10} and CO are very low and well below the respective NAAQS. Air quality impacts occurring in the ambient environment as a result of the proposed TNPA 22MW Generator Project 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 TNPA 22MW Generator Project in isolation and cumulatively with existing sources.

Reversibility of impacts

The predicted ambient concentrations of SO_2, NO_2, PM_{10} and CO are very low and well below the respective NAAQS. Air quality impacts occurring in the ambient environment as a result of the proposed TNPA 22MW Generator Project are therefore expected to reverse with minimal rehabilitation and negligible residual effects. Since a high reversibility of impacts is possible, the reversibility of impacts caused by the proposed TNPA 22MW Generator Project is rated as high for the proposed TNPA 22MW Generator Project in isolation and cumulatively with existing sources.

Mitigation measures to control stack emissions

The generator will be fitted with a water injection metering system to reduce NO_X emissions for gaseous fuel (LNG (in natural gas form) in this case) or liquid fuel (diesel in this case) operation. Demineralised water is injected into the combustor through ports in the fuel nozzles to produce NO_X suppression. Water is supplied to the nozzles by a special water manifold. Water injection can reduce NO_X emissions to 25 ppm (51 mg/Nm^3) for gaseous fuels and to 42 ppm (86 mg/Nm^3) for liquid fuel.

Air quality management interventions in the form of emission control have been considered in all aspects of design and operation. Further emission reduction interventions are deemed to be unnecessary considering the low impact of the proposed project on air quality. No further control or mitigation is necessary as these measures will be adequate to control exhaust emissions.

TNPA 22MW Generator Project with other gas-to-power projects

The Department of Mineral Resources and Energy launched the Risk Mitigation Independent Power Producer Procurement Programme (RMIPPPP) in August 2020 to procure 2 000 MW of new generation from a range of energy technologies. The objective was to fill the short-term supply gap, alleviate the current electricity supply constraints and reduce the extensive use of diesel-based peaking generators.

Besides the proposed TNPA 22MW Generator Project, it is reasonable to expect that other electricity generation projects may be procured in Richards Bay as part of the RMIPPPP. It is therefore relevant to assess the potential cumulative effects of these projects on ambient air quality in Richards Bay. In this study, six potential projects have been identified for the assessment of cumulative impacts (Table 6-15).

Table 6-15: Potential electricity generation projects in Richards Bay

Project Name and Description	Applicant	Status as at June 2024
RBGP2 400 MW Gas-to-Power Project at RBIDZ 1F (proposed amendments to the existing Environmental Authorisation and EMPr): The Power Plant includes six gas turbines for mid-merit/peaking plant power provision, with two steam turbines using excess heat from the engines in a separate steam cycle, as well as three fuel tanks of 2000 m^3 each for on-site fuel storage.	Richards Bay Gas Power 2 (Pty) Ltd (RBGP2)	Environmental Authorisation was issued in 2016. Amendment was applied for in 2020, and in May 2022 a review application was launched in the Pretoria High Court challenging the reissued authorization.

Project Name and Description	Applicant	Status as at June 2024
Richards Bay Combined Cycle Power Plant (CCPP): The CCPP and associated infrastructure will be located on Portion 2 of Erf 11376 and Portion 4 of Erf 11376 within the Richards Bay IDZ Zone 1D. The facility will operate with natural gas as the main fuel resource and diesel as a back-up resource.	Eskom Holdings SoC Limited	Environmental Authorisation was issued in December 2019, and in August 2022 a review application was launched in the Pretoria High Court challenging the authorization. Judgment was handed down by the Court on 6 October 2022. The Court dismissed the application brought by the NGO's and confirmed that the project's Environmental Authorisation is valid. Leave to appeal was declined on 18 January 2023. NERSA declined to concur with the determination of the Minister. NERSA has since changed its mind and brought an application to the North Gauteng High Court to review its own decision, which was heard on 25 April 2023.
Phinda 320 MW Emergency Risk Mitigation Power Plant (RMPP): The project site is to be located in Alton, near the Richards Bay Industrial Development Zone (IDZ). The facility will have an installed generating capacity of 320 MW, operating with liquified petroleum gas (LPG) or naphtha as an initial source and will convert to using natural gas (NG) once this is available in Richards Bay.	Phinda Power Producers (Pty) Ltd	Environmental Authorisation was granted in July 2021, but the decision was challenged by NGOs by an appeal. The appeal was dismissed by the Minister in November 2021. The NGOs have taken the matter on review to the Pretoria High Court.
Nseleni Independent Floating Power Plant (NIFPP): The project site is to be located at the Port of Richards Bay. The project includes a floating gas-powered power station made up of floating combined cycle gas turbine (CCGT) Power Plants and associated infrastructure for the evacuation of power from the NIFPP to the National Grid. Four floating power	Nseleni Power Corporation (Pty) Ltd and Anchor Energy (Pty) Ltd	The proposed Nseleni Independent Floating Gas Power Plant in Richards Bay was refused for two of its licence applications by different regulatory authorities. Nseleni's application for an Environmental Authorisation was refused by the DFFE on 19 November 2021, and the project's application for a water use license was refused by the DWS on 25

Project Name and Description	Applicant	Status as at June 2024
barges generating a nominal 700 MW per barge will result in 2800 MW generation capacity.		November 2021. Nseleni then apparently appealed the refusals. Anchor and Nseleni have since obtained a positive Environmental Authorisation.
Phakwe RBGP3 2000 MW Gas-to-Power Project (RBGP3) at RBIDZ 1F: The Power Plant includes up to four combined cycle gas turbine (CCGT) Power Plants and associated infrastructure for the generation of electricity using natural gas or a combination of natural gas and hydrogen, and up to four heat recovery steam generators (HRSGs) to generate additional electricity from the capture of excess heat from the turbine exhausts.	Phakwe Richards Bay Gas Power 3 (Pty) Ltd (PRBGP3)	Draft EIAr issued for comments on 4 June 2022 – 22 July 2022. EA was issued on 6 Dec 2022. An appeal was lodged in January 2023.
Karpowership 450 MW Gas-to-Power Powership Project at the Port of Richards Bay: Karpowership SA Proprietary Ltd proposes to locate a Khan Class Powership and a Shark Class Powership in the Port of Richards Bay to supply 450 MW of power to the National Grid using Liquified Natural Gas (LNG (in natural gas form)). A Floating Storage and Regasification Unit (FSRU), also located in the Port, will store the LNG (in natural gas form) and convert it to Natural Gas (NG) to supply the Powership.	Karpowership SA Proprietary Ltd	Environmental Authorisation was granted to Karpowership SA in October 2023. An AEL was issued to Karpowership SA in November 2023. An appeal against the Environmental Authorisation and Environmental Impact Assessment (EIA) was lodged by groundWork and the South Durban Community Environmental Alliance (SDCEA), supported by the Centre for Environmental Rights, Natural Justice and The Green Connection in December 2023.

RBGP2 400 MW Gas-to-Power Project (RBGP2) at RBIDZ 1F

Richards Bay Gas Power 2 (Pty) Ltd proposes the establishment of a gas-to-power plant with a generation capacity of up to 400 MW with associated infrastructure in Zone 1F in the Richards Bay IDZ. The RBGP2 Project will initially require liquid fuel such as diesel or liquefied petroleum gas (LPG) and ultimately liquid natural gas (LNG (in natural gas form)) or natural Gas (NG). Two operational scenarios were therefore assessed in the AIR (uMoya-NILU, 2016). These were Scenario 1: Power generation using diesel, including stack emissions and fugitive emissions from the diesel storage tanks and Scenario 2: Power generation using LNG (in natural gas form) via pipeline, including stack emissions only.

The main findings of the air quality assessment (uMoya-NILU, 2016) are:

- The maximum predicted ambient concentration of SO_2, NO_2, PM_{10} and CO resulting from emission from the two scenarios occur close to the project site and are very low compared to the respective NAAQS (Table 6-16).
- For Scenario 1 (diesel) and Scenario 2 (LNG (in natural gas form)), the significance of the impact of the RBGP2 Project on ambient air quality was rated as low for SO_2, NO_X, PM_{10} and CO, without and with mitigation.

Table 6-16: Maximum predicted annual average concentration and the 99th percentile concentration for the 24-hour and 1-hour predictions at the points of maximum ground-level concentration (uMoya-NILU, 2016a)

	SO_2 (µg/m³)		
	Scenario 1: Diesel	**Scenario 2: LNG (in natural gas form)**	**NAAQS**
1-hour	7.19	3.43	350
24-hour	3.01	1.43	125
Annual	0.25	0.12	50
	NO_2 (µg/m³) controlled in brackets		
	Scenario 1: Diesel	**Scenario 2: LNG (in natural gas form)**	**NAAQS**
1-hour	50.15 (13.68)	18.66 (7.58)	200
Annual	1.71 (0.47)	0.64 (0.26)	40
	PM_{10} (µg/m³)		
	Scenario 1: Diesel	**Scenario 2: LNG (in natural gas form)**	**NAAQS**
24-hour	0.36	0.20	75
Annual	0.03	0.02	40
	CO (µg/m³) uncontrolled		
	Scenario 1: Diesel	**Scenario 2: LNG (in natural gas form)**	**NAAQS**
1-hour	0.24	5.98	30 000
8-hour	0.19	4.77	10 000

Regarding cumulative impacts, the proposed RBGP2 plant is located in an area where there are many notable sources of SO_2, NO_2, PM_{10} and CO. Emissions of SO_2, NO_2, PM_{10} and CO from the combustion of diesel during Phase 1 and LNG (in natural gas form) during Phase 2 will increase the existing ambient concentrations of these pollutants in the immediate vicinity of the plant. The predicted ambient concentrations of SO_2, NO_2, PM_{10} and CO are however very low. The contribution to ambient concentrations beyond the immediate vicinity of the proposed gas-to-power plant is predicted to be small and is highly unlikely to make a significant contribution to the cumulative impacts. It is highly unlikely that they will result in exceedances of the NAAQS. The significance of the cumulative impact is therefore rated as low (Table 6-18).

Richards Bay Combined Cycle Power Plant (CCPP)

The Richards Bay Combined Cycle Power Plant (CCPP) involves the construction of a gas-fired power station which will supply electrical power to the national grid. The proposed site location is 7 km from the CBD and adjacent to Mondi Richards Bay. It will have an installed capacity of 3 000 MW and use natural gas with diesel as back-up fuel. Electricity generation will be via eight gas turbines and four heat recovery steam generators (HRSG) with four steam turbines.

The AIR was compiled by Airshed Planning Professionals (Airshed, 2019). Normal operations (using gas) and three emergency scenarios when the HSRG and steam turbine are offline were assessed. In Emergency 1, gas is used and the emission is via the by-pass stack. Emergency 2 and Emergency 3 use diesel with emissions via the main stack and the by-pass stack respectively. Emergency events are expected to be less than 88 hours in a year, each less than 8 hours.

The main findings of the air quality assessment (Airshed, 2019) are:

- For PM_{10}, for normal operations and emitting at Minimum Emission Standards no exceedances of the NAAQS were simulated and the predicted ambient concentrations were less than 3 µg/m^3 throughout the modelling domain. The predicted concentrations are low for the three emergency scenarios, i.e. less than 2.0 µg/m^3 for Emergency 1, less than 3.6 µg/m^3 for Emergency 2, and less than 2.5 µg/m^3 for Emergency 3. For PM_{10}, the significance of the impact was rated as low.
- For SO_2, for normal operations and using emission factors for gas turbines for LNG (in natural gas form), no exceedances of the NAAQS were simulated. The predicted 1-hour ambient concentrations were less than 0.7 µg/m^3, the predicted 24-hour concentrations were less than 0.21 µg/m^3 and the predicted annual ambient concentrations were less than 0.07 µg/m^3. For Emergency 2, exceedances of the 1-hour NAAQS of 350 µg/m^3 are predicted up to 9 km from the plant. The predicted 1-hour maximum SO_2 concentration for Emergency 1 and 3 of 207.4 µg/m^3 and 259.5 µg/m^3 comply with the NAAQS. For SO_2 the significance of the impact was rated as medium as a result of Emergency 2 using diesel.
- For NO_2, for normal operations no exceedances of the NAAQS were predicted. The annual predicted concentrations were less than 23 µg/m^3 and the hourly concentrations less than 80 µg/m^3. For Emergency 3, exceedances of the 1-hour NAAQS of 200 µg/m^3 are predicted up to 3.5 km from the plant. The predicted 1-hour maximum NO_2 concentrations for Emergency 1 and 2 of 25 µg/m^3 and 179.9 µg/m^3 comply with the NAAQS. For NO_2 the significance of the impact was rated as low.

Regarding cumulative impacts, emissions from the CCPP would elevate ambient concentrations and the significance of the cumulative impact was rated as medium for SO_2 and low for NO_2 and PM_{10} (Table 6-18).

Phinda 320 MW Emergency Risk Mitigation Power Plant (RMPP) at RBIDZ 1F

Phinda Power Producers (Pty) Ltd propose to develop and operate a 320 MW Power Plant and associated infrastructure in Alton, using liquified petroleum gas (LPG) or naphtha as an initial source and will convert to using natural gas once this is available in Richards Bay.

The main findings of the air quality assessment (Airshed, 2021) are:

- The construction (and decommissioning) phase(s) are likely to have a low impact on ambient air quality before and after effective mitigation.
- Compliance with hourly, daily and annual NAAQS under normal operations for SO_2, NO_2, PM_{10}, CO and VOCs.
- A low impact significance is predicted for ambient SO_2, NO_2, PM_{10}, CO, and VOC concentrations for the operational phase based on design mitigation measures with no further need for mitigation.

Regarding cumulative impacts, emissions of SO_2, NO_2, PM, CO and VOCs from the proposed Phinda Power Plant will increase existing ambient concentrations of these pollutants in the immediate vicinity of the plant. The predicted ambient concentrations are however low. The contribution to ambient concentrations beyond the immediate vicinity of the proposed gas-to-power plant is expected to be small and is unlikely to make a significant contribution to the cumulative impacts. The significance of the cumulative impacts on ambient SO_2, NO_2, PM_{10} and CO concentrations is therefore rated as low (Table 6-18).

Nseleni Independent Floating Power Plant (NIFPP)

Nseleni Power Corporation (Pty) Ltd and Anchor Energy (Pty) Ltd is proposing to establish a floating gas-powered power station consisting of floating combined cycle gas turbine (CCGT) Power Plants (known as the Nseleni Independent Floating Power Plant (NIFPP)) and associated infrastructure for the evacuation of power from the NIFPP to the National Grid, in the Port of Richards Bay. The EIA is in process and is being led by SE Solutions (2021).

Initially four floating power barges are proposed (700 MW generated per barge) resulting in a combined generation capacity of 2 800 MW. Thereafter, additional barges would be added to increase the combined power generation potential to as much as 8 400 MW. The fuel proposed is LNG (in natural gas form). The power plants will use CCGT technology, providing high generation efficiencies. The gas turbines have low NO_X burners and selective catalytic reduction (SCR) to control NO_X emissions and three-stage filtration to remove respirable particulate matter (PM). Power will be evacuated to a newly constructed land-based substation and switching yard, and from there into the national grid. Approximately 220 000 tonne of LNG (in natural gas form) will be delivered monthly to the NIFPP and would be offloaded from supply vessels into floating storage units (FSUs) connected to the LNG (in natural gas form) terminal.

The main findings of the air quality impact assessment which are listed in the Draft Environmental Impact Report (SE Solutions, 2021) are:

- Dust is the principal emission during construction but sources of dust are limited; conventional dust suppression would mitigate the impact still further.
- Predicted SO_2 and NO_2 concentrations are within the NAAQS across the modelling domain. The contribution from the NIFPP is small for SO_2 (less than 5% of the hourly, daily and annual SO_2 limit values), while the contribution from the NIFPP is a maximum of 65% of the NO_2 hourly average limit when considering the project within the existing ambient air quality within the modelling domain.
- Cumulative PM_{10} concentrations may exceed the daily NAAQS based on ambient data at Harbour West, Scorpio, and Arboretum monitoring stations due to the elevated baseline concentrations in those areas. However, the contribution from the NIFPP to those elevated concentrations would be small.

Regarding cumulative impacts, emissions from the NIFPP would elevate ambient concentrations and the significance of the cumulative impact was rated as very low for SO_2, and PM_{10} and low for NO_2 (Table 6-18).

Phakwe RBGP3 2000 MW Gas-to-Power Project (RBGP3) at RBIDZ 1F

Phakwe Richards Bay Gas Power 3 (Pty) Ltd proposes to operate a CCGT Power Plant in the Richards Bay IDZ with a generating capacity of up to 2 000 MW using natural gas or a mixture of natural gas and hydrogen.

The main findings of the air quality assessment (Airshed, 2022) are:

- The construction (and decommissioning) phase(s) are likely to have a low impact on the ambient air quality before and after effective mitigation.
- Compliance with hourly, daily and annual NAAQS under normal operations for SO_2, PM_{10}, $PM_{2.5}$, CO and TVOCs is predicted.
- Predicted exceedances of the limit value concentration of the NAAQS for NO_2 could result from the normal operation, but the frequency of exceedance is likely to be within that allowed by the NAAQS.
- A low impact significance is predicted for ambient SO_2, PM, CO, and VOC concentrations for the operational phase based on design mitigation measures with no further need for mitigation.
- A medium impact significance is predicted for ambient NO_2 concentrations during the operational phase, however, with additional mitigation measures the significance could be reduced to low.
- The predicted ambient NO_2 concentrations exceed the NAAQS during start-up at residential receptors, schools and medical facilities. However, the impacts can be reduced if the turbines reach Minimum Emission Standards in less than 30 minutes, and if the frequency of start-up events is reduced.

Regarding cumulative impacts, the proposed Phakwe RBGP3 project site is located in an area where there are many notable sources of SO_2, NO_2 and PM_{10}. Emissions of SO_2, NO_2, PM, CO and VOCs will increase the existing ambient concentrations of these pollutants in the immediate vicinity of the plant. The predicted ambient concentrations are however low. The contribution to ambient concentrations beyond the immediate vicinity of the proposed gas-to-power plant is expected to be small and is highly unlikely to make a significant contribution to the cumulative impacts. The predicted NO_2 concentrations exceed the limit value of the NAAQS, but comply with the frequency of exceedance. The significance of the cumulative impact on ambient NO_2 concentrations in therefore rated as low (Table 6-18).

Karpowership 450 MW Gas-to-Power Powership Project at the Port of Richards Bay

The Karpowership Project at the Port of Richards Bay comprises the Khan Powership and Shark Powership combination, the FSRU and the LNG (in natural gas form) supply vessel. Each engine has a dedicated stack, or point source. On the Khan Class Powership the 21 stacks are orientated along the vessel from bow to stern. On the Shark Class Powership the 6 stacks are orientated along the deck. LNG (in natural gas form) supply vessels will restock the FSRU approximately once every 20 to 30 days.

The main findings of the air quality assessment (uMoya-NILU, 2023) are:

- The maximum predicted annual SO_2, NO_2 and PM_{10} concentrations and the 99th percentile of the 24-hour and 1-hour predicted concentrations are very low and are well below the respective NAAQS (Table 6-17).
- The highest predicted ambient concentrations occur within 2 km over the industrial area northeast of the Port of Richards Bay and south-southwest of the project area over parts of the Port of Richards Bay and naturally vegetated areas.
- The contribution from the Karpowership Project will add to the existing ambient concentrations in Richards Bay. The greatest addition will be at the point of maximum with lower concentrations elsewhere. The added effect is small and will not result in exceedances of the NAAQS.

Table 6-17: Maximum predicted annual average concentration and the 99th percentile concentration for the 24-hour and 1-hour predictions at the points of maximum ground-level concentration (uMoya-NILU, 2023)

Description	Annual	24-hour	1-hour
	SO_2		
Predicted maximum SO_2	0.07	0.34	0.94
NAAQS	50	125	350
	NO_2		
Predicted maximum NO_2	1.34		18.9
NAAQS	40		200
	PM_{10}		
Predicted maximum PM_{10}	0.33	1.72	
NAAQS	40	75	

Contribution of the Karpowership Project to the existing ambient concentrations is very small. The cumulative effect of the Karpowership Project with existing sources is likely to be very low. Air quality management interventions in the form of the control of emission have been considered in all aspects of design and operation. Further interventions to reduce emissions are deemed to be unnecessary considering the low impact of the project on air quality. With low predicted ambient concentrations for SO_2 and PM_{10} the consequence of impacts is very low. The predicted ambient NO_2 are somewhat higher, but the consequence of the impact is low. The likelihood of occurrence of impacts associated with SO_2, NO_2 and PM_{10} is very low. Therefore, the significance of impacts resulting from the Karpowership Project is predicted to be very low (Table 6-18).

Summary

The cumulative impacts on air quality of the six potential gas-to-power projects and the proposed TNPA 22MW Generator Project may be assessed if it is assumed that all seven projects operate together. The significance of the impacts resulting from operations of the individual projects are presented in Table 6-18. The highest rating for an individual project is used to assess the potential cumulative impact of all seven gas-to-power projects (Table 6-18).

For NO_2 and PM_{10} the significance of the cumulative impact of the proposed TNPA 22MW Generator Project with other gas-to-power projects is rated as low. For SO_2 the significance of the impact is rated as medium because of the predicted exceedances of ambient SO_2 concentrations during the Richards Bay CCPP – Emergency 2 simulation using diesel and emitting via the main stack.

King Cetshwayo District Municipality (KCDM) is responsible for the Atmospheric Emission Licensing (AEL) function in the District, including the issue of AELs and the enforcement of conditions of the AELs. The KCDM developed its first Air Quality Management Plan (AQMP) in 2014 to guide air quality management in the District. With the assistance of GreenApple Sustainability Solutions, the KCDM is currently reviewing the AQMP. The vision of the AQMP is to fulfil the requirement of Section 24 of the Constitution, i.e. to ensure clean and healthy air for all (GreenApple Sustainability Solutions, 2022). To achieve this, the AQMP sets goals including, amongst others, cooperative governance for air quality management, the strengthening of the systems and tools to implement the AQMP, and the capacity and skills to implement the AQMP. The KCDM is also developing Air Quality Management Bylaws to assist with the enforcement of the AQMP, see:
http://www.kingcetshwayo.gov.za/images/Policies/Draft%20KCDM%20AQMP%202022.pdf

Considering the air quality mandate of the KCDM and the demonstrated regulatory intent, cumulative impacts of the proposed TNPA 22MW Generator Project together with existing and new proposed energy projects are considered to be medium for SO_2 and low for NO_2, PM_{10}, CO.

Table 6-18: Significance of project and cumulative impacts

Project	SO_2	NO_2	PM_{10}	CO	Reference
RBGP2 400 MW Gas-to-Power Project (RBGP2) at RBIDZ 1F	Low	Low	Low	Low	uMoya-NILU (2016a)
Richards Bay Combined Cycle Power Plant (CCPP)	Medium	Low	Low	Not assessed	Airshed (2019)
Phinda 320 MW Emergency Risk Mitigation Power Plant (RMPP) at RBIDZ 1F	Low	Low	Low	Low	Airshed (2021)
Nseleni Independent Floating Power Plant (NIFPP)	Very low	Low	Very low	Not assessed	Professional opinion; SE Solutions (2021)
Phakwe RBGP3 2000 MW Gas-to-Power Project (RBGP3) at RBIDZ 1F	Low	Low	Low	Low	Airshed (2022)
Karpowership 450 MW Gas-to-Power Powership Project at the Port of Richards Bay	Very low	Very low	Very low	Not assessed	uMoya-NILU (2023)
TNPA 22MW Generator Project at the Port of Richards Bay	Very low	Very low	Very low	Very low	uMoya-NILU (2024)
Cumulative impact	**Medium**	**Low**	**Low**	**Low**	**Highest rating across different projects**

Severity or magnitude of impact

The severity or magnitude of impact of the proposed TNPA 22MW Generator Project emissions with other gas-to-power projects 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 high relative to the NAAQS and there are predicted exceedances of the NAAQS. The severity or magnitude of the impact associated with SO_2 is therefore predicted to be high (score = 8) for the proposed TNPA 22MW Generator Project with other gas-to-power projects.

The predicted ambient NO_2, PM_{10} and CO concentrations are very low relative to the NAAQS and there are no predicted exceedances of the NAAQS. The severity or magnitude of the impact associated with NO_2, PM_{10} and CO is therefore predicted to be insignificant (score = 2) for the proposed TNPA 22MW Generator Project with other gas-to-power projects.

Spatial scale of activity

The spatial scale of impact of the proposed TNPA 22MW Generator Project emissions with other gas-to-power projects 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.

For SO_2, the highest predicted concentrations are expected to occur within a 15 km radius. The spatial scale of the impact is therefore regional (score = 3) for the proposed TNPA 22MW Generator Project with other gas-to-power projects.

For NO_2, PM_{10} and CO, the predicted ambient concentrations are very low relative to the NAAQS and the highest predicted concentrations are expected to occur within a 5 km radius. The spatial scale of the impact is therefore local (score = 2) as impacts are limited to the Port of Richards Bay and the immediate surrounding areas for the proposed TNPA 22MW Generator Project with other gas-to-power projects.

Duration of activity

The duration of impact of the proposed TNPA 22MW Generator Project emissions with other gas-to-power projects on ambient air quality is assessed by considering the operational lifespan of the projects. Impacts on ambient air quality in terms of SO_2, NO_2, PM_{10} and CO will exist for the entire duration of the projects. It is assumed that the duration of activity will be for a medium-term of 5-15 years (score = 3) for the proposed TNPA 22MW Generator Project with other gas-to-power projects.

Frequency of activity

The frequency of impact of the proposed TNPA 22MW Generator Project emissions with other gas-to-power projects 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) for the proposed TNPA 22MW Generator Project with other gas-to-power projects.

Frequency of incident/impact

The frequency of incident of the proposed TNPA 22MW Generator Project emissions with other gas-to-power projects on ambient air quality is assessed by considering how often the activity will impact on ambient air quality.

For SO_2, the predicted concentrations are high with many exceedances of the NAAQS. Impacts are therefore expected to be often/regularly/likely/possible/>80% (score = 4) for the proposed TNPA 22MW Generator Project with other gas-to-power projects.

For NO_2, PM_{10} and CO, predicted ambient concentrations are very low. The highest predicted concentrations are well below the respective NAAQS. The additive effect of the contribution of NO_2, PM_{10} and CO from the proposed TNPA 22MW Generator Project with other gas-to-power projects is predicted to be very small and the potential increase in ambient concentrations is highly unlikely to result in elevated concentrations or further exceedances of the NAAQS. Impacts are therefore expected to be almost never/almost impossible/>20% (score = 1) for the proposed TNPA 22MW Generator Project with other gas-to-power projects.

Legal issues

As discussed previously, 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. 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 terms of legal issues, the impact of the proposed TNPA 22MW Generator Project emissions with other gas-to-power projects 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).

Detection

The detection of impact of the proposed TNPA 22MW Generator Project emissions with other gas-to-power projects on ambient air quality is assessed by evaluating how quickly/easily impacts/risks of activity on environment, people and property are detected. As discussed previously, 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 all projects. Stack emission testing can be used to measure emissions within a stack and assess compliance with the MES (if necessary), during the operational phase. Detection of impacts is therefore considered to be undertaken without much effort (score = 2), for the proposed TNPA 22MW Generator Project with other gas-to-power projects.

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 is expected to be high (score = 8) for SO_2 and insignificant (score = 2) for NO_2, PM_{10} and CO.
- The spatial scale of the impact is regional (score = 3) for SO_2 and local (score = 2) for NO_2, PM_{10} and CO.
- The duration of the impact will be for a medium-term of 5-15 years (score = 3) for SO_2, NO_2, PM_{10} and CO.

Based on the equation provided:

- The consequence of ambient concentrations of SO2 resulting from emissions from the proposed TNPA 22MW Generator Project with other gas-to-power projects has a score of 8+3+3=14.
- The consequence of ambient concentrations of NO2, PM10 and CO resulting from emissions from the proposed TNPA 22MW Generator Project with other gas-to-power projects has a score of 2+2+3=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:

- As a worst-case scenario, it is expected that the frequency of activity will be definite/always/permanent/daily (score = 5) for SO_2, NO_2, PM_{10} and CO.
- Impacts are expected to be often/regularly/likely/possible/>80% (score = 4) for SO_2, and almost never/almost impossible/>20% (score = 1) for NO_2, PM_{10} and CO.
- In terms of legal issues, the impact of the proposed TNPA 22MW Generator Project with other gas-to-power project emissions in the ambient environment is fully covered by legislation (score = 5) for SO_2, NO_2, PM_{10} and CO.
- Detection of impacts is considered to be undertaken without much effort (score = 2) for SO_2, NO_2, PM_{10} and CO.

Based on the equation provided:

- The likelihood or probability of ambient concentrations of SO_2, resulting from emissions from the proposed TNPA 22MW Generator Project with other gas-to-power projects has a score of 5+4+5+2=16.

- The likelihood or probability of ambient concentrations of NO_2, PM_{10} and CO resulting from emissions from the proposed TNPA 22MW Generator Project with other gas-to-power projects 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 resulting from emissions from the proposed TNPA 22MW Generator Project with other gas-to-power projects has a score of 14x16=224.
- The significance of ambient concentrations of NO_2, PM_{10} and CO resulting from emissions from the proposed TNPA 22MW Generator Project with other gas-to-power projects has a score of 7x13=91.

Emissions of SO_2, NO_X, PM_{10} and CO from sources associated with the proposed TNPA 22MW Generator Project with other gas-to-power projects 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.

The significance of impact relating to emissions from sources associated with the proposed TNPA 22MW Generator Project with other gas-to-power projects is therefore predicted to be medium (negative) for SO_2 and low (negative) for NO_2, PM_{10} and CO.

Irreplaceability of resource caused by impacts

The predicted ambient concentrations of SO_2 is high with many exceedances of the NAAQS while NO_2, PM_{10} and CO are very low and well below the respective NAAQS. Despite the high SO_2, air quality impacts occurring in the ambient environment as a result of the proposed TNPA 22MW Generator Project with other gas-to-power projects are 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 TNPA 22MW Generator Project with other gas-to-power projects.

Reversibility of impacts

The predicted ambient concentrations of SO_2 is high with many exceedances of the NAAQS while NO_2, PM_{10} and CO are very low and well below the respective NAAQS. Despite the high SO_2, air quality impacts occurring in the ambient environment as a result of the proposed TNPA 22MW Generator Project with other gas-to-power projects is expected to reverse with minimal rehabilitation and negligible residual effects. Since a high reversibility of impacts is possible, the reversibility of impacts caused by the proposed TNPA 22MW Generator Project with other gas-to-power projects is rated as high.

Mitigation measures to control stack emissions

In general, air quality management interventions in the form of emission control have been considered in all aspects of design and operation for all gas-to-power projects. Further emission reduction interventions are deemed to be necessary, specifically for SO_2 for the Richards Bay CCPP – Emergency 2 simulation using diesel, considering the high impact on air quality. No further control or mitigation is necessary for NO_2, PM_{10} and CO as proposed measures will be adequate to control these emissions.

6.7 Decommissioning and closure phase

The decommissioning and closure phase will mainly entail disassembly of the generator and associated infrastructure, including storage tanks, 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 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.

A range of vehicles and equipment are used during decommissioning including heavy duty vehicles and mobile generators. Activities during decommissioning are associated with the movement of a range 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 approximately 6-12 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 6-12 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. 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 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.

No further dust control or mitigation is deemed necessary as these measures will be adequate to control dust emissions.

Table 6-19: 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
Operational Phase: TNPA 22MW Generator Project in isolation	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
Operational Phase: TNPA 22MW Generator Project with existing sources (cumulative)	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
Operational Phase: TNPA 22MW Generator Project with other gas-to-power projects (cumulative)	SO_2	8	3	3	5	4	5	2	14	16	Medium (-224)	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
Decommissioning Phase	Dust	2	1	2	5	1	5	2	5	13	Low – 65	Low	High

6.8 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.

7. COMPLAINTS

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

8. CURRENT OR PLANNED AIR QUALITY MANAGEMENT INTERVENTIONS

Air quality management interventions in the form of the control of emission have been considered in all aspects of design and operation. Further interventions to reduce emissions are deemed to be unnecessary considering the low impact of the proposed project on air quality.

9. COMPLIANCE AND ENFORCEMENT ACTIONS

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

10. SUMMARY AND CONCLUSION

Due to the electricity challenges faced by the port, TNPA proposes to procure and install a duel-fuel 22 MW generator at the Port of Richards Bay to support port operations. This project will generate backup electricity which will ensure continuous operations at the port during power outages and prevent revenue and operational time loss during these events. The generator is capable of producing electricity using diesel or liquefied natural gas (LNG (in natural gas form)).

The CALPUFF dispersion model is used to predict ambient concentrations of SO_2, NO_2, PM_{10} and CO resulting from the proposed TNPA 22MW Generator Project emissions for the diesel-fired and gas-fired option. Modelling is done according to the modelling regulations and 3-years of hourly surface and upper air meteorological data are used.

The maximum predicted annual SO_2, NO_2, PM_{10} and CO concentrations and the 99th percentile concentration of the 24-hour, 8-hour and 1-hour predicted concentrations are very low relative to the NAAQS. 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 Port of Richards Bay and naturally vegetated areas.

In terms of the cumulative impacts with existing sources, the proposed TNPA 22MW Generator Project will add to the existing ambient concentrations in Richards Bay. The greatest addition will be at the point of maximum with lower concentrations elsewhere. The added effect is small and will not result in exceedances of the NAAQS. Therefore, the significance of impacts resulting from the proposed project is predicted to be low (negative).

In terms of the cumulative impacts with other electricity generation projects that may operate in Richards Bay in the future, emissions from the proposed TNPA 22MW Generator Project will result in an increase in ambient concentrations of SO_2, NO_2, PM_{10} and CO. The significance of impact relating to emissions from sources associated with the proposed TNPA 22MW Generator Project with other gas-to-power projects is predicted to be medium (negative) for SO_2 because of predicted exceedances of ambient SO_2 concentrations when diesel is used as an emergency back-up fuel on the Richards Bay CCPP Project and low (negative) for NO_2, PM_{10} and CO.

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.

Air quality management interventions in the form of the control of emission have been considered in all aspects of design and operation. 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 TNPA 22MW Generator Project should be authorised considering the findings of this AIR.

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12. 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

Name of Enterprise: uMoya-NILU Consulting (Pty) Ltd

Declaration of accuracy of information provided:

Atmospheric Impact Report in terms of Section 30 of the Act

I, Mark Zunckel [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 Durban on this 17th day of February 2025.

____

SIGNATURE

Managing Director – uMoya-NILU Consulting

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 17th day of February 2025.

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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	2.6 & 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 12
(c)	an indication of the scope of, and the purpose for which, the report was prepared;	Section 1 & 2.7
(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
(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 applicable
(e)	a description of the methodology adopted in preparing the report or carrying out the specialised process inclusive of equipment and modelling used;	Section 2.7 & 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 6.3 & 6.4
(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 2.8

Relevant section in GNR. 982	Requirement description	Relevant section in this report
(j)	a description of the findings and potential implications of such findings on the impact of the proposed activity or activities;	Section 6.4
(k)	any mitigation measures for inclusion in the EMPr; Note: We need to include whether these mitigation measures (excluding ongoing monitoring) can be practically implemented prior to commencement or not.	Section 8
(l)	any conditions for inclusion in the environmental authorisation;	No conditions
(m)	any monitoring requirements for inclusion in the EMPr or environmental authorisation;	No conditions
(n) a reasoned opinion—	(i) whether the proposed activity, activities or portions thereof should be authorised;	Section 10
	(iA) regarding the acceptability of the proposed activity or activities; and	Section 10
	(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.	Section 10
(o)	a description of any consultation process that was undertaken during the course of preparing the specialist report;	Section 1
(p)	a summary and copies of any comments received during any consultation process and where applicable all responses thereto; and	Not received
(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 & 6.2.1

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 odourous 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 Longmin 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	:	14 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 Port of 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: Author: 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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