



Air Quality Impact Assessment for the Africa Oil South Africa Corp Block 3B/4B Offshore Exploration

Project done for Environmental Impact Management Services (EIMS)

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Rev 0	October 2023	Draft for client review
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Rev 1	March 2024	Added upset scenario of impact of potential oil spill

Abbreviations

AEL	Atmospheric Emissions Licence
Airshed	Airshed Planning Professionals (Pty) Ltd
AOI	Area of interest
AQIA	Air Quality Impact Assessment
AQSR	Air Quality Sensitive Receptor
BRE	Building Research Establishment
CO	Carbon monoxide
DTU	Technical University of Denmark
ECMWF	European Centre for Medium-Range Weather Forecasts
ECSA	Engineering Council of South African
EIA	Environmental Impact Assessment
EIMS	Environmental Impact Management Services
EMEP/EEA	European Monitoring and Evaluation Programme/European Environment Agency
DFFE	Department of Forestry, Fisheries and the Environment (
IFC	International Finance Corporation
ISC	Industrial Source Complex
GHG	Greenhouse gas
GN	Government Notice
GWA	Global Wind Atlas
HAZID	Hazard identification study
HAZOP	Hazard and operability study
MES	Minimum Emission Standards
NAAQS	National Ambient Air Quality Standards (South Africa)
NACA	National Association for Clean Air
NEMA	National Environmental Management Act
NEM:AQA	National Environmental Management: Air Quality Act
NO₂	Nitrogen dioxide
O₃	Ozone
OSRP	Oil Spill Response Plan
Pb	Lead
PM	Particulate matter
PM₁₀	Thoracic particulate matter with an aerodynamic diameter of less than 10 µm
PM_{2.5}	Inhalable particulate matter with an aerodynamic diameter of less than 2.5 µm
SA	South Africa(n)
SCR	Selective catalytic reduction
SO₂	Sulphur dioxide
TVOC	Total volatile organic compounds
US EPA	United States Environmental Protection Agency

Executive Summary

Airshed Planning Professionals (Pty) Ltd (Airshed) was appointed by Environmental Impact Management Services (EIMS) to conduct an air quality impact assessment (AQIA) for the Africa Oil South Africa Corp Block3B/4B Offshore Exploration.

With the exploration being offshore, the nearest identified air quality sensitive receptors (AQSRs) include coastal towns along the west coast, with the nearest town being Paternoster and Saldanha Bay (120 km from the closest point of the licence block).

The total routine pollutant emissions were estimated using the European Monitoring and Evaluation Programme/European Environment Agency (EMEP/EEA) emission factors. Emissions of nitrogen dioxide (NO₂) range between 211 and 216 Tonne per annum (tpa) with fuel combustion being the dominant source. Emissions of carbon monoxide (CO) range between 54 and 76 tpa, with waste gas disposal being the dominant source. Emissions of non-methane volatile organic compounds (NMVOC) range between 17 and 25 tpa, with waste gas disposal being the dominant source. Emissions of particulate matter (PM) and sulfur dioxide (SO₂) are low. Criteria pollutant upset emissions due to an oil spill are summarised in Table 9-2 and Table 9-3 using the EMEP/EEA emission factors. Combustion emissions from the upset scenario are fairly similar to the routine emissions. Emissions of NMVOC due to evaporation and fugitive gas release are elevated for NMVOC. It should be kept in mind that this is only potential emissions and may not happen. NMVOC emissions range between 3 568 and 43 308 tpa, with evaporation emissions and gas released during the blowout being the dominant source. Greenhouse gases (GHG) were also estimated, and these can be found in the climate change assessment report.

Meteorological scenarios that reflect worst-case atmospheric conditions were selected to perform dispersion simulations. These include calm stable night-time conditions (wind speed of 1.5 m/s) and neutral daytime conditions with a relatively low wind speed of 3 m/s. These atmospheric conditions are more likely to occur during winter winds and in order to impact on the coastline, has to be from westerly sector. Based on the wind field for the study area, the wind could blow from this direction approximately 7% of the year.

Screening dispersion modelling using the US EPA SCREEN3 model was used to calculate the maximum concentrations at the closest coastal area, approximately 100 km downwind from the nearest seismic survey location. This model was used with the emission rates calculated using the EMEP/EEA emission factors.

Conservatively all oxides of nitrogen (NO_x) was assumed to be NO₂. The highest hourly average NO₂ concentrations expected at Saldanha Bay (closest receptor at 120 km from a location on the eastern boundary of the Area of Interest) is 12% of the National Ambient Air Quality Standards (NAAQS) limit value. This represents the maximum ground level concentration that would occur under conditions of weak atmospheric dispersion, i.e., low vertical turbulence and calm wind speeds that would otherwise assist with the dilution of air pollutants. Similarly, the highest hourly average SO₂ concentration is predicted to be 0.16% of the NAAQS limit value. The extrapolated highest PM_{2.5} daily average concentration is 0.32% of the NAAQS. The predicted highest CO hourly average concentration is only 0.002% of the NAAQS. There are no NAAQS for NMVOCs; however, the highest predicted hourly average NMVOC concentration at the nearest AQSR is still lower than the annual average NAAQS limit value for benzene. **Since the calculated maximum predicted ground level concentrations (under worst-case atmospheric conditions) are considerably lower than the NAAQS limit values, it is expected that the exposure to any significant concentration levels would be infrequent and insignificant when compared with the NAAQS. Such emissions are therefore unlikely to have a direct effect on any receptor or other activity, other than the project vessels themselves.**

The impact from upset emissions is higher than for routine emissions for NMVOC. The impact at the nearest AQSR is still however below the guideline value of 200 µg/m³.

The impact of the estimated operational emissions from the proposed project is considered to be **local**, and of **short-term duration** and **low intensity**. The potential impact on the air quality emissions is of **low significance** without further mitigation.

The means to minimise emissions from the Project would be achieved by

- Implement a maintenance plan to ensure all ship engines and boilers receive adequate maintenance to minimise soot and unburnt fuel released to the atmosphere and maximize energy efficiency.
- Ensure no incineration (subject to obtaining an atmospheric emissions license) of waste occurs within the port limits.

However, if incineration of waste material is to be undertaken (within port limits), and the vessel is considered an 'installation' (as per the National Environmental Management: Air Quality Act Minimum Emissions Standards (NEM:AQA MES)) and more than 10 kg waste is incinerated per day, this will require an AEL. The relevant listed activity would be *Category 8.1 - Thermal Treatment of Hazardous and General Waste*.

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1 INTRODUCTION

Airshed Planning Professionals (Pty) Ltd (Airshed) was appointed by Environmental Impact Management Services (EIMS) to conduct an air quality impact assessment (AQIA) for the Africa Oil South Africa Corp Block3B/4B Offshore Exploration.

2 DOCUMENT STRUCTURE

This report has been compiled in accordance with the Environmental Impact Assessment (EIA) Regulations, 2017 (Government Notice (GN) 326) as part of the National Environmental Management Act (NEMA) of 1998. A summary of the report structure, and the specific sections that correspond to the applicable regulations, is provided in Table 2-1 below.

Table 2-1: Report structure (NEMA EIA regulations 2017)

Environmental Regulation	Description	Section in Report
Appendix 6 (1) (a)	Details of - (i) the specialist who prepared the report, and (ii) the expertise of that person to compile a specialist report including curriculum vitae.	Report Details Section 3: Specialist Details Appendix B
Appendix 6 (1) (b)	A declaration that the person is independent in a form as may be specified by the competent authority.	Report Details Appendix A
Appendix 6 (1) (c)	An indication of the scope of, and the purpose for which, the report was prepared.	Section 4: Terms of Reference
Appendix 6 (1) (cA)	An indication of quality and age of base data used.	Section 8: Receiving Environment
Appendix 6 (1) (cB)	A description of existing impacts on the site, cumulative impacts of the proposed development and levels of acceptable change.	Section 9: Impact on the Receiving Environment
Appendix 6 (1) (d)	The duration, date and season of the site investigation and the relevance of the season to the outcome of the assessment.	A site investigation was not undertaken. Description of the current land use in the region, simulations undertaken for the current operations and meteorological data used in the study are considered representative of all seasons. Section 9: Impact on the Receiving Environment
Appendix 6 (1) (e)	A description of the methodology adopted in preparing the report or carrying out the specialised process.	Section 7: Methodology
Appendix 6 (1) (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 9: Impact on the Receiving Environment
Appendix 6 (1) (g)	An identification of any areas to be avoided, including buffers.	Section 9: Impact on the Receiving Environment
Appendix 6 (1) (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 9: Impact on the Receiving Environment
Appendix 6 (1) (i)	A description of any assumptions made and any uncertainties or gaps in knowledge.	Section 12: Assumptions, Uncertainties and Gaps in Knowledge
Appendix 6 (1) (j)	A description of the findings and potential implications of such findings on the impact of the proposed activity, including identified alternatives, on the environment.	Section 11: Conclusion

Environmental Regulation	Description	Section in Report
Appendix 6 (1) (k)	Any mitigation measures for inclusion in the EMPr.	Section 11: Conclusion
Appendix 6 (1) (l)	Any conditions for inclusion in the environmental authorisation	Section 11: Conclusion
Appendix 6 (1) (m)	Any monitoring requirements for inclusion in the EMPr or environmental authorisation.	Section 11: Conclusion
Appendix 6 (1) (n)	A reasoned opinion – (i) as to whether the proposed activity, activities or portions thereof should be authorised; regarding the acceptability of the proposed activity or activities; and (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.	Section 11: Conclusion
Appendix 6 (1) (o)	A description of any consultation process that was undertaken during the course of carrying out the study.	Not applicable.
Appendix 6 (1) (p)	A summary and copies of any comments that were received during any consultation process.	Not applicable.
Appendix 6 (1) (q)	Any other information requested by the competent authority.	Not applicable.

3 SPECIALIST DETAILS

Report author: Gillian Petzer (Pr. Eng., BEng Chemical (University of Pretoria))

Gillian Petzer started her professional career in Air Quality in 2000 when she joined the Building Research Establishment (BRE) in the United Kingdom after completing her Bachelor's Degree in Chemical Engineering at the University of Pretoria. She joined Airshed Planning Professionals in 2003 and is now a senior consultant at the company.

She has extensive experience on the various components of air quality management including emissions quantification for a range of source types, simulations using a range of dispersion models, impacts assessment and health risk screening assessments. Her project experience range over various countries in Africa, providing her with an inclusive knowledge base of international legislation and requirements pertaining to air quality.

Gillian is also actively involved in the National Association for Clean Air (NACA) and is a member of the Institution of Chemical Engineers (IChemE) and is a registered Professional Engineer with the Engineering Council of South African (ECSA) (registration no. 20170315).

4 TERMS OF REFERENCE

The following tasks, typical of an air quality impact assessment, were included in the scope of work:

- Study of the receiving environment including the identification of air quality-sensitive receptors (AQSRs) and the collection and analysis of local weather data;
- Establishing the legislative and regulatory context, including the consideration of emission limits and ambient air quality standards;
- Quantification of all sources of atmospheric emissions associated with the proposed Project;
- Dispersion simulations and analyses; and
- An air quality impact assessment report.

5 PROJECT DESCRIPTION

Block 3B/4B is situated between latitudes 31°S and 33°S (see Figure 5-1) on the continental shelf in water depths ranging from 200 m to 2 000 m. Block 3B/4B is located approximately 120 km west of St Helena Bay and approximately 145 km south-west of Hondeklip Bay off the West Coast of South Africa. The area of primary interest is in the north of this block, but this could also cover other areas in future. As part of the process of applying for the Exploration Right, the JV Partners undertook and completed the reprocessing project covering 2 000 km², which is a subset of the 10 000 km² BHP/Shell 3D seismic datasets, focussed primarily on the most northern portion of Block 3B/4B. Block 3B/4B covers an area of approximately 11 100 km², and is adjacent to the Namaqualand and West Coast District Municipalities.

Hydrocarbon deposits occur in reservoirs in sedimentary rock layers. Being lighter than water they accumulate in traps where the sedimentary layers are arched or tilted by folding or faulting of the geological layers. Exploration drilling activities are one of the primary geophysical methods for locating such deposits. The below activities are expected to be undertaken as part of the proposed exploration for oil and gas.

5.1 Pre-Drilling Surveys

Pre-drilling surveys may be undertaken prior to drilling in order to confirm baseline conditions at the drill site and to identify and delineate any seabed and sub-seabed geo-hazards that may impact the proposed exploration drilling operations. Pre-drilling surveys may involve sonar surveys, sediment sampling, water sampling and ROV activities.

5.1.1 Sonar Surveys

Pre-drilling sonar surveys may involve multi- and single beam echo sounding and sub-bottom profiling. These surveys would not be limited to a specific time of the year but would be of short duration (around 15 days or shorter per survey) and focused on selected areas of interest within the block. This survey and other anticipated success-based surveys would take up to four weeks to complete.

5.1.2 Echo Sounders

The majority of hydrographic depth/echo sounders are dual frequency, transmitting a low frequency pulse at the same time as a high frequency pulse. Dual frequency depth/echo sounding has the ability to identify a vegetation layer or a layer of soft mud on top of a layer of rock. The JV Partners are proposing to utilise a single beam echo-sounder with a frequency range of

38 to 200 kHz. In addition, it is proposed to also utilise multibeam echo sounders (70 - 100 kHz range and 200 dB re 1 μ Pa at 1m source level) that are capable of receiving many return “pings”. This system produces a digital terrain model of the seafloor.

5.1.3 Sub-Bottom Profilers

Sub-bottom profilers are powerful low frequency echo-sounders that provide a profile of the upper layers of the ocean floor. Bottom profilers emit an acoustic pulse at frequencies ranging between 2 and 16 kHz, typically producing sound levels in the order of 200-230 db re 1 μ Pa at 1m.

5.1.4 Piston coring

Piston coring (or drop coring) is one of the more common methods used to collect seabed geochemical samples. The piston coring rig is comprised of a trigger assembly, the coring weight assembly, core barrels, tip assembly and piston. The core barrels are 6 - 9 m in lengths with a diameter of 10 cm. The recovered cores are visually examined at the surface for indications of hydrocarbons (gas hydrate, gas parting or oil staining) and sub-samples retained for further geochemical analysis in an onshore laboratory.

5.1.5 Box Coring

Box corers are lowered vertically to the seabed from a survey vessel. At the seabed the instrument is triggered to collect a sample of seabed sediment. The recovered sample is completely enclosed thereby reducing the loss of finer materials during recovery. On recovery, the sample can be processed directly through the large access doors or via complete removal of the box and its associated cutting blade. The JV Partners are proposing to take box core samples (50 cm x 50 cm) at a depth of less than 60 cm.

5.2 Well Location and Drilling Programme

The JV Partners are proposing to drill up to five exploration wells within the Area of Interest (AOI) within the Block 3B/4B licence block.

Within Block 3B/4B the AOI for drilling is 9 711.21 km² in extent and is located offshore roughly between Port Nolloth and Hondeklip Bay, approximately 188 km from the coast at its closest point and 340 km at its furthest, in water depths between 1 000 m and 3 000 m. The expected target drilling depth is not confirmed yet and a notional well depth, below mudline, of 3 570 m is assumed at this stage.

The schedule for drilling the wells is not confirmed yet; however, the earliest anticipated date for commencement of drilling is between first quarter of 2024 (Q1 2024) and third quarter of 2024 (Q3 2024). The expected target drilling depth is not confirmed yet and a notional well depth of 3 570 m below sea floor is assumed at this stage. It is expected that it would take approximately three to four months to complete the physical drilling and testing of each well (excluding mobilisation and demobilisation). The Applicant's strategy for future drilling is that drilling could be undertaken throughout the year (i.e., not limited to a specific seasonal window period).

5.3 Drilling Unit Operations

Various types of drilling technology can be used to drill an exploration well (e.g. barges, jack-up rigs, semi-submersible drilling units (rigs) and drill-ships) depending on, inter alia, the water depth and marine operating conditions experienced at the well site. Based on the anticipated sea conditions, the JV Partners are proposing to utilise a semi-submersible drilling unit or a drillship, both with dynamic positioning system suitable for the deep-water harsh marine environment. The final rig selection will be made depending upon availability and final design specifications.

A semi-submersible drilling unit is essentially a drilling rig located on a floating structure of pontoons. When at the well location, the pontoons are partially flooded (or ballasted), with seawater, to submerge the pontoons to a pre-determined depth below the sea level where wave motion is minimised. This gives stability to the drilling vessel thereby facilitating drilling operations. A drillship is a fit for purpose built drilling vessel designed to operate in deep water conditions. The drilling “rig” is normally located towards the centre of the ship with support operations from both sides of the ship using fixed cranes. The advantages of a drillship over the majority of semi-submersible units are that a drill-ship has much greater storage capacity and is independently mobile, not requiring any towing and reduced requirement of supply vessels.

5.4 Support Vessels

The drilling unit would be supported / serviced by up to two support vessels, which would facilitate equipment, material and waste transfer between the drilling unit and onshore logistics base. A supply vessel will always be on standby near the drilling unit to provide support for firefighting, oil containment / recovery, rescue in the unlikely event of an emergency and supply any additional equipment that may be required. Support vessels can also be used for medical evacuations or transfer of crew if needed.

5.5 Helicopters

Transportation of personnel to and from the drilling unit would be provided by helicopter from Cape Town airport. It is estimated that there may be at least two flights per week between the drilling unit and the helicopter support base at Cape Town. The helicopters can also be used for medical evacuations from the drilling unit to shore (at day- or night-time), if required.

5.6 Onshore Logistics Base

The primary onshore logistics base will most likely be located at the Port of Cape Town (preferred option), but alternatively at the Port of Saldanha.

The shore base would provide for the storage of materials and equipment that would be shipped to the drilling unit and back to storage for onward international freight forwarding. The shore base would also be used for offices, waste management services, bunkering vessels, and stevedoring / customs clearance services.

Refer to Figure 5-1 below for an indication as to where the proposed drilling facilities will be located.

5.7 Upset scenario of potential oil spill

In addition to the routine operations, the upset scenario of a potential oil spill from an unplanned well blowout was also assessed. Details of the oil spill were obtained from the Oil Spill Drift Modelling Condensate and Crude Oil Technical Report (Livas, 2024). This study, based on best available information and industry-standard numerical modelling methods, describes possible fates and trajectories of an oil spill from a subsea blowout of a well in Block 3B-4B located off the West Coast of

South Africa. The two Release Points selected for the study scenarios represent the worst-case locations in the block, and two types of products released were simulated: a condensate release, and a crude oil release.

Refer to Figure 5-1 below for an indication as to where the released points were assumed.

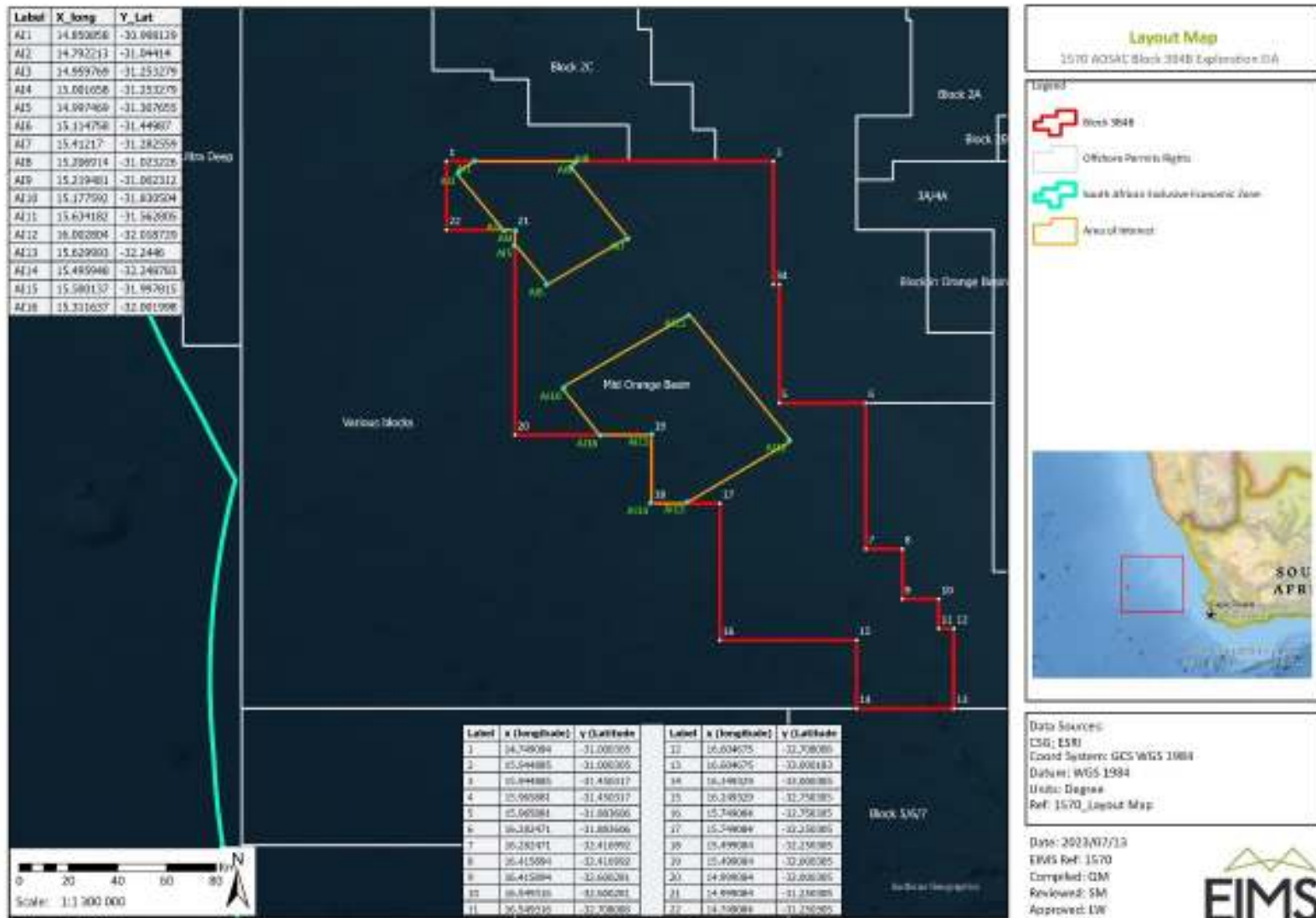


Figure 5-1: Locality map

Air Quality Impact Assessment for the Africa Oil South Africa Corp Block 3B/4B Offshore Exploration



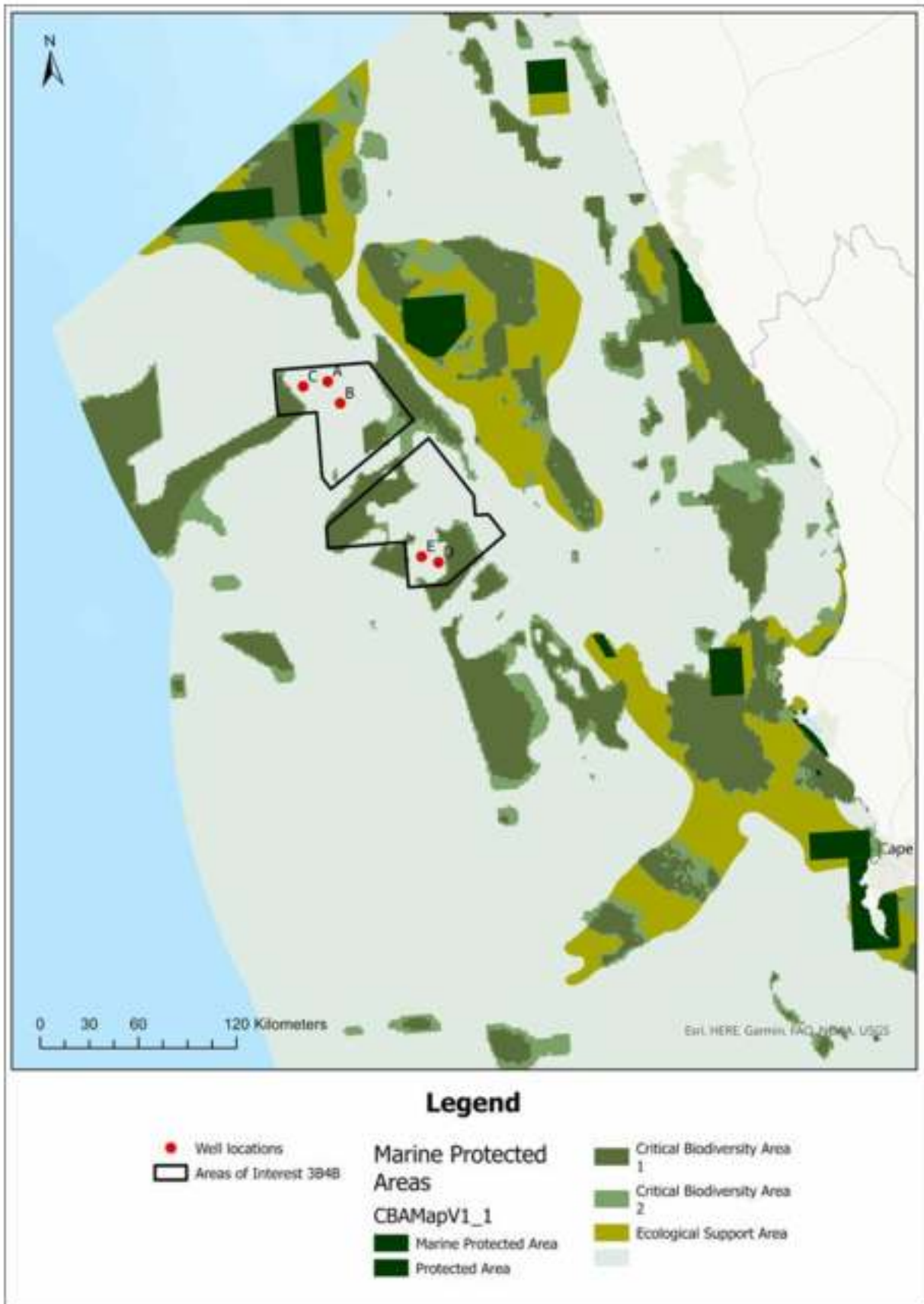


Figure 5-2: Possible release points of oil spill

6 LEGISLATIVE AND POLICY FRAMEWORK

Prior to assessing the impact of activities from the offshore exploration on human health and the environment, reference needs to be made to the environmental regulations governing the impact of such operations i.e., ambient air quality standards and emissions standards. Air quality standards are fundamental to effective air quality management, providing the link between the source of atmospheric emissions and the user of that air at the downstream receptor site. The ambient air quality standards indicate safe daily exposure levels for the majority of the population, including the very young and the elderly, throughout an individual's lifetime. Air standards are given for specific averaging or exposure periods. Emission standards are generally provided for point sources and specify the amount of the pollutant acceptable in an emission stream and are often based on proven efficiencies of air pollution control equipment.

6.1 National Ambient Air Quality Standards for Criteria Pollutants

National Ambient Air Quality Standards (NAAQS) were determined based on international best practice for particulate matter less than 10 and 2.5 μm in aerodynamic diameter (PM_{10} and $\text{PM}_{2.5}$), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone (O_3), carbon monoxide (CO), lead (Pb) and benzene. The NAAQS were published in the Government Gazette (no. 32816) on 24 December 2009 for PM_{10} and other pollutants (South Africa, 2009). The $\text{PM}_{2.5}$ NAAQS were published in 2012 (South Africa, 2012). The relevant NAAQS are listed in Table 6-1.

Table 6-1: South African NAAQS for relevant criteria pollutants

Pollutant	Averaging Period	Limit Value ($\mu\text{g}/\text{m}^3$)	Frequency of Exceedance	Compliance Date
NO_2	1 hour	200	88	Currently enforceable
	1 year	40	0	Currently enforceable
CO	1 hour	30 000	88	Currently enforceable
	8 hour	10 000	11	Currently enforceable
SO_2	1 hour	350	88	Currently enforceable
	24 hour	125	4	Currently enforceable
	1 year	50	0	Currently enforceable
$\text{PM}_{2.5}$	24 hour	40	4	Currently enforceable
	1 year	20	0	Currently enforceable
PM_{10}	24 hour	75	4	Currently enforceable
	1 year	40	0	Currently enforceable

6.2 Inhalation Health Criteria for Non-criteria Pollutants

There is at present no national assessment criterion for total volatile organic compounds (TVOC). Most reported TVOC-concentrations in non-industrial environments are below 100 $\mu\text{g}/\text{m}^3$ and few exceed 250 $\mu\text{g}/\text{m}^3$. At these concentration levels only sensory effects are likely to occur, but other health effects cannot be excluded after long-term exposure. The sensory effects include sensory irritation, dryness, weak inflammatory irritation in eyes, nose, air ways and skin. At TVOC concentrations above 250 $\mu\text{g}/\text{m}^3$, the likelihood of other types of health effects becomes of greater concern (ECA, 1992). For the purpose of this assessment, use is made of the "comfort" limit proposed for use by Mølhav of 200 $\mu\text{g}/\text{m}^3$.

Inhalation criteria for VOCs are summarised in Table 6-2.

Table 6-2: Chronic inhalation screening criteria for VOCs

Pollutant	Averaging Period	Screening criteria ($\mu\text{g}/\text{m}^3$)	Source of Data
VOC	Chronic	200	ECA

6.3 Atmospheric Emission Licence and other Authorisations

The National Environmental Management: Air Quality Act, 2004 (No. 39 of 2004) (NEM:AQA) regulates all aspects of air quality, including prevention of pollution, providing for national norms and standards. The Minister, in terms of *Section 21* of the NEM:AQA, published a list of activities which result in atmospheric emissions, and which are believed to have significant detrimental effects on the environment, human health and social welfare. Minimum Emission Standards (MES) for these listed activities were originally published on 31 March 2010 (Government Gazette No. 33064) with revisions of the schedule on the 22 November 2013 (Government Gazette No. 37054, (South Africa, 2013)) and 31 October 2018 (Government Gazette No. 42013, (South Africa, 2018)). The proposed exploration operations are not included in the listed activities requiring an Atmospheric Emissions Licence (AEL).

7 METHODOLOGY

The approach to, and methodology followed in the completion of tasks as part of the scope of work are discussed.

7.1 Emissions Inventory

The establishment of a comprehensive emission inventory formed the basis for the assessment of the air quality impacts from the Project on the receiving environment. In the quantification of emissions, use was made of emission factors which associate the quantity of a pollutant to the activity associated with the release of that pollutant. Emissions were calculated using comprehensive sets of emission factors and equations as published by the European Monitoring and Evaluation Programme/European Environment Agency (EMEP/EEA).

All air emissions from the Project include criteria and non-criteria pollutants such as SO₂, NO₂, CO, VOC and PM. Greenhouse gases (GHG) were also estimated, and these can be found in the climate change assessment report.

7.2 Dispersion Modelling

Air dispersion modelling provides a cost-effective means for assessing the impact of air emission sources, the major focus of which is to determine compliance with the relevant ambient air quality standards. The Department of Forestry, Fisheries and the Environment (DFFE) Regulations Regarding Air Dispersion Modelling were promulgated on 11 July 2014 in Government Gazette No. 37804 (South Africa, 2014) and recommend a suite of dispersion models to be applied for regulatory practices as well as guidance on modelling input requirements, protocols and procedures to be followed. The Code of Practice contained in the Regulations has been applied to the development of this report. The first step in the dispersion modelling exercise requires a clear objective of the modelling exercise and thereby gives clear direction to the choice of the dispersion model most suited for the purpose. Chapter 2 of the Regulations present the typical levels of assessments, technical summaries of the prescribed models (US EPA SCREEN3, AERSCREEN, AERMOD, SCIPUFF, and CALPUFF) and good practice steps to be taken for modelling applications. According to these Regulations, screening level atmospheric dispersion simulations may be completed using the US EPAs SCREEN3 dispersion model. SCREEN3 is a single source Gaussian plume model which provides maximum ground-level concentrations for point, area, flare, and volume sources. The model, however, is limited in that only single emission sources can be simulated per execution. Therefore, the predicted concentrations from each of the individual simulation runs were added to approximate the downwind concentrations of the combined emission sources from the exploration activities. SCREEN3 calculates 1-hour concentration estimates in simple terrain areas and 24-hour concentration estimates in complex terrain. These modelled estimates must be converted to the averaging period of each applicable national ambient air quality standard. The factor to convert from 1-hour to 1-day is 0.4, and from 1-hour to 1-year is 0.08.

Since the well test operations would be relatively far removed from the public it is anticipated that air pollution concentrations may be low enough to be of any health concern. However, the option of predicting worst-case air concentration levels of the pollutants from the activities, and specifically along the coastline where these plumes could potentially reach the public, is included in the scope of works as an option. The United States of America Environmental Protection Agency's (US EPAs) SCREEN3 is the preferred model for estimating air pollutants. Whilst this model does not have the same model capabilities as the more advanced dispersion models of treating the land/sea air mass interface at the coastline, this requirement may not be particularly relevant due to the relatively long distance that the plume would have travelled from the operation (≥ 45 km), i.e. the vertical dispersion of the elevated plume would've reached ground level at this distance and fumigation effects would be less significant.

SCREEN3 incorporates source related factors and meteorological factors to estimate pollutant concentration from continuous sources. The model assumed that the pollutant does not undergo any chemical reactions, and that no other removal processes (wet or dry deposition) act on the plume during its transportation. SCREEN3 examines a range of stability classes and wind speeds to identify the combination of wind speed and stability that results in the maximum ground level concentrations – the "worst case" meteorological conditions.

Dispersion coefficients are estimated from the Pasquill-Gifford (rural) and McElroy-Pooler (urban) methods based on the Industrial Source Complex (ISC3) formulations. The dispersion coefficients are adjusted to account for the effects of buoyancy induced dispersion. For this assessment, use was made of the rural dispersion coefficients.

SCREEN View is a user-friendly interface for the U.S. EPA screening model, SCREEN3. SCREEN View can model scenarios with simple or complex terrain, with or without building downwash and give results at discrete or automated distances. SCREEN3 is the screening version of the ISC3 model.

7.3 Air Quality Management Measures

The findings of the above components will inform recommendations on air quality management measures, including mitigation and monitoring.

8 RECEIVING ENVIRONMENT

8.1 Air Quality Sensitive Receptors

With the exploration being offshore, the nearest identified air quality sensitive receptors (AQSRs) include coastal towns along the west coast, with the nearest town being Paternoster and Saldanha Bay (120 km from the closest point). AQSRs generally include places of residence and areas where members of the public may be affected by atmospheric emissions generated by industrial activities.

8.2 Current Air Quality

Saldanha Bay has three monitoring stations, two (Saldanha Bay and Vredenburg) operated by the Saldanha Bay Municipality and one by the Western Cape Province (Saldanha Bay IDZ). Data was obtained from the South African Air Quality Information System (SAAQIS) site. Data availability was generally poor during 2022 and 2023.

It appears that the ambient air quality is in compliance with NAAQS, however due to low data availability this can't be assessed. To properly assess compliance data availability over 80 % is required. Only ambient concentrations of SO₂ and NO₂ are measured. No ambient concentrations of VOCs are available.

8.3 Atmospheric Dispersion Potential

The atmosphere conditions have traditionally been categorised into six stability classes, as summarised in Table 8-1. Whilst the atmospheric condition over land generally exhibits a strong diurnal variation of atmospheric stabilities, with alternating stable night-time and unstable daytime conditions, the atmospheric condition over the ocean is generally more neutral and stable than unstable. The highest concentrations for low level emission sources would occur during weak wind speeds and stable atmospheric conditions. For elevated releases, unstable conditions can result in high concentrations of poorly diluted emissions close to the point of release. Neutral conditions disperse the plume equally in both the vertical and horizontal planes, whereas stable conditions minimise the plume from mixing vertically, although it can still spread horizontally.

Table 8-1: Atmospheric stability classes

Atmospheric Stability	Pasquill-Gifford Stability Classification	Atmospheric Condition
Very unstable	A	calm wind, clear skies, hot daytime conditions
Moderately unstable	B	clear skies, daytime conditions
Unstable	C	moderate wind, slightly overcast daytime conditions
Neutral	D	high winds or cloudy days and nights
Stable	E	moderate wind, slightly overcast night-time conditions
Very stable	F	low winds, clear skies, cold night-time conditions

In the absence of actual wind observational data for the study area, basic wind statistics were obtained from the Global Wind Atlas (GWA), which has been developed to assist with identifying high-wind areas for wind power generation (DTU, 2023). The current version of the (GWA 3.1) is the product of a partnership between the Department of Wind Energy at the Technical University of Denmark (DTU Wind Energy) and the World Bank Group (consisting of The World Bank and the International Finance Corporation, or IFC). The GWA uses a downscaling process, whereby large-scale atmospheric re-analysis data from the European Centre for Medium-Range Weather Forecasts (ECMWF) is used for the simulation period 2008-2017. The

approximately 30-km, coarse gridded ECMWF data is used to feed a smaller spatial scale (mesoscale) model using a grid spacing of 3 km. The result is a set of generalized wind climates that is further applied in a microscale modelling system over the globe. The modelling process is made up of a WASP¹ calculation of local wind climates for every 250 m at five heights: 10 m, 50 m, 100 m; 150 m and 200 m. On a 250 m grid, there is a local wind climate estimate for every node. The wind information is available for an offshore distance of 200 km.

A location approximately 120 km offshore from Paternoster and Saldanha Bay (-32.998°, 16.602°), as shown in Figure 8-1, was selected as a representative area to provide typical wind conditions in the study area. The study area is characterised by strong wind conditions with an annual mean wind speed of 7 m/s. As shown in the annual average wind rose (Figure 8-2) the most prevalent wind direction is from south-southeast (SSE) (35%), followed by winds from the south (S) (20%). Of importance to the current assessment are the conditions leading to impacts of air pollution emissions from the project that may impact on the West coast. The closest shoreline is 120 km from the study area at Paternoster and Saldanha Bay. For a direct impact, the wind must come from a westerly direction. According to the GWA, the probability is about 7% of the year.

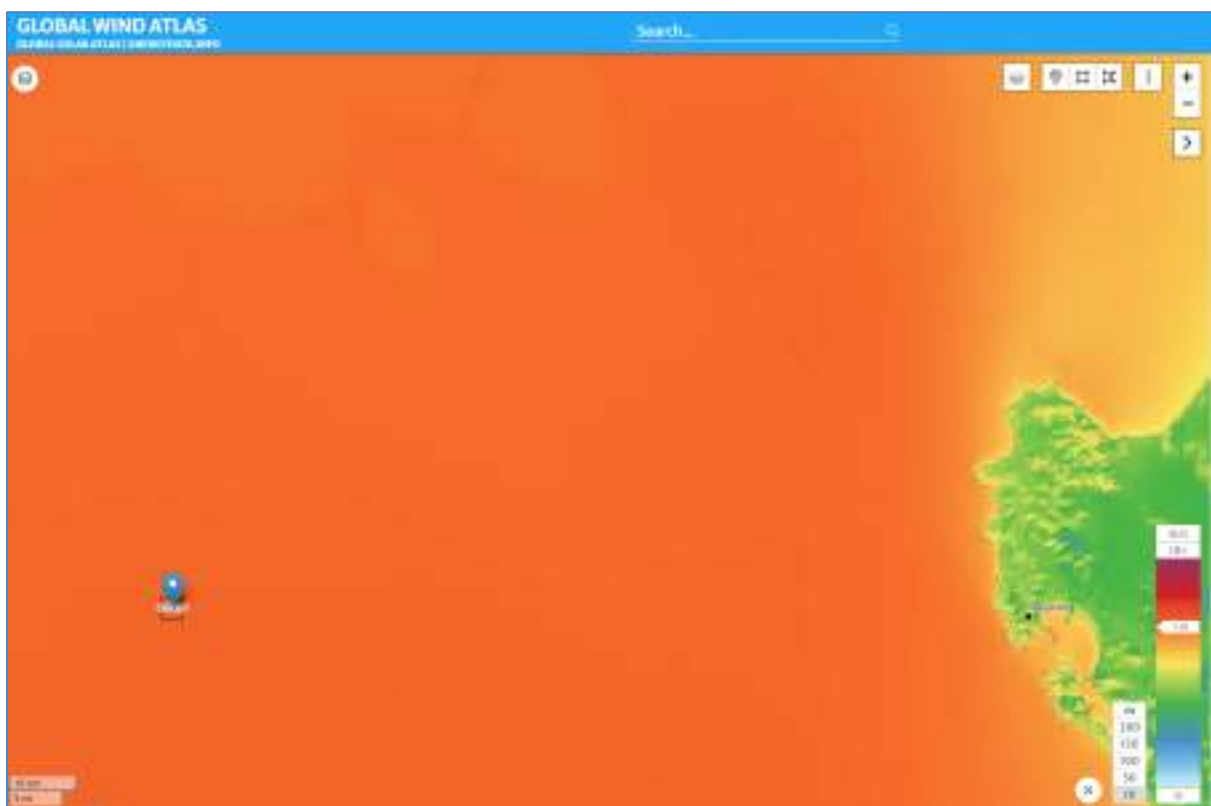


Figure 8-1: Location for selected wind statistics in the Global Wind Atlas (Global Wind Atlas 2022)

¹ The WASP software suite is the industry-standard for wind resource assessment, siting and energy yield calculation for wind turbines and wind farms.

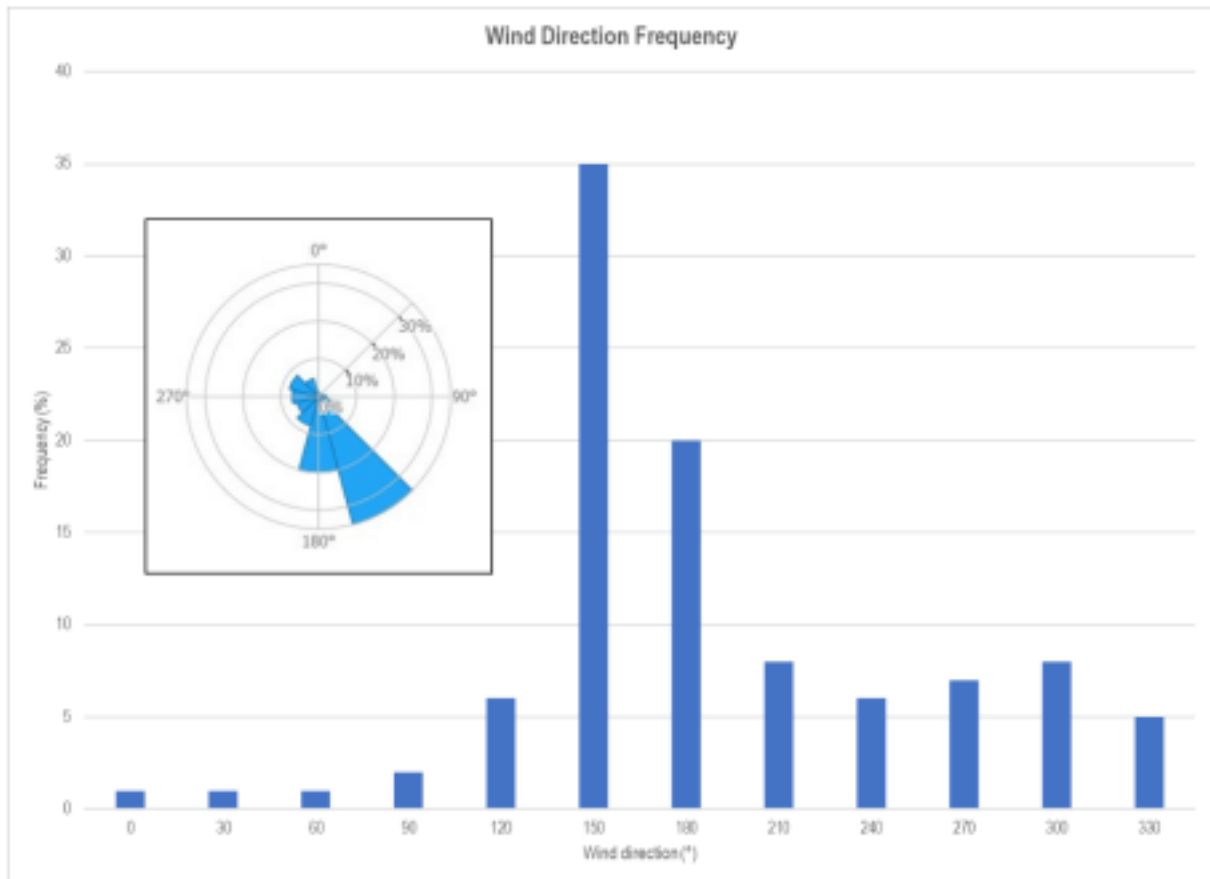


Figure 8-2: Wind rose using 10-year (2008-2017) hindcast data for the study area (Global Wind Atlas 2022)

Two atmospheric conditions were included in the dispersion simulations:

- Worst-case meteorological conditions would be during low wind speed and stable atmospheric periods, typically during the night. This meteorological scenario is represented by "F" Pasquill-Gifford class with a wind speed of 1.5 m/s.
- The second meteorological scenario was "D" Pasquill-Gifford class and a wind speed of 3 m/s, a typical daytime condition represented by neutral atmosphere with a more defined wind speed of 3.0 m/s or greater.

As discussed above, the probability of the wind blowing toward the coastline from the Project is estimated to be a maximum of 7% per year. The annual average wind speed is about 7 m/s. Calm wind conditions (≤ 1.5 m/s) represent the worst case for atmospheric dispersion is expected to occur less than 2% of the year.

9 IMPACT ON THE RECEIVING ENVIRONMENT

9.1 Routine Atmospheric Emissions

Sources of emission and associated pollutants considered in the emissions inventory included:

- Combustion emissions
- Waste gas disposal emissions
- Process emissions

All emissions were determined through the application of emission factors published by the EMEP/EEA (EMEP/EEA, 2019). A summary of sources quantified, emissions estimation techniques applied, emission factors and source input parameters are summarised in Table 9-1. Estimated annual average emissions, per source group, are presented in Table 9-2 (lower range) and Table 9-3 (upper range).

Table 9-1: Emission estimation techniques and parameters

Source Group	Emission Estimation Technique Emissions factors	Input Parameters
Combustion	EMEP/EEA Shipping (1.A.3.d) (Ships using marine gas oil) NOx: 72.2 kg/tonne fuel CO: 3.84 kg/tonne fuel NMVOC: 1.75 kg/tonne fuel SO ₂ : 1.82 kg/tonne fuel PM: 1.07 kg/tonne fuel	<u>Drill rig</u> : 65 days/exploration period, 22 000 litres/day – 1 430 000 litres/exploration period <u>Platform service vessel</u> : 84 days/exploration period, 5 000 litres/day – 420 000 litres/exploration period <u>Anchor handling tug</u> : 74 days/exploration period, 20 000 litres/day – 1 480 000 litres/exploration period Assumed a marine gas oil density of 0.84 kg/l (Table A.1, Life Cycle Assessment of Greenhouse Gas and Criteria Air Pollutant Emissions from Conventional and Biobased Marine Fuels)
Combustion	EMEP/EEA Civil aviation (1.A.3.a) (Helicopter) NOx: 9.6 kg/tonne fuel CO: 66.4 kg/tonne fuel NMVOC: 5.8 kg/tonne fuel SO ₂ : 0.8 kg/tonne fuel	<u>Helicopter</u> : 16 176 nautical miles (NM)/exploration period, 3.75 litres/NM – 82 500 litres/exploration period Assumed average value for the various countries. Assumed a jet kerosene density of 0.794 kg/l (Table D.1, SA Technical guidelines)
Waste gas/oil disposal	EMEP/EEA Venting and flaring (1.B.2.c) (Well testing) NOx: 3.7 kg/tonne oil burned CO: 18 kg/tonne oil burned NMVOC: 3.3 kg/tonne oil burned	Burning of oil: range of between 100 to 1000 bbl per day Assumed 10 days per exploration period Assumed a crude oil density of 873.46 kg/m ³ (Table 3-8, Compendium of GHG Methodologies for the Natural Gas and Oil Industry 2021)
Waste gas/oil disposal	EMEP/EEA Venting and flaring (1.B.2.c) (Flaring in oil and gas extraction) NOx: 1.4 kg/tonne gas burned CO: 6.3 kg/tonne gas burned NMVOC: 1.8 kg/tonne gas burned SO ₂ : 0.013 kg/tonne gas burned	Flaring of gas: 30 MMscfd Assumed 10 days per exploration period Assumed a natural gas density of 0.6728 kg/m ³ (Table 3-8, Compendium of GHG Methodologies for the Natural Gas and Oil Industry 2021)
Process	EMEP/EEA Oil exploration (1.B.2.a.i) (Oil exploration - offshore facilities) NMVOC: 0.4 kg/tonne oil	Oil: range of between 100 to 1000 bbl per day Assumed 84 days per exploration period

Table 9-2: Estimated annual average emission rates (lower range)

Source Group	NO ₂ (tpa)	CO (tpa)	NMVOC (tpa)	SO ₂ (tpa)	PM ₁₀ (tpa)
Combustion	203	15.1	5.3	5.1	3.0
Waste gas/oil disposal	8	38.4	10.7	0.1	-
Process	-	-	0.5	-	-
Total Emissions	211	53.5	16.5	5.2	3.0

Table 9-3: Estimated annual average emission rates (upper range)

Source Group	NO ₂ (tpa)	CO (tpa)	NMVOC (tpa)	SO ₂ (tpa)	PM ₁₀ (tpa)
Combustion	203	15.1	5.3	5.1	3.0
Waste gas/oil disposal	13	60.9	14.8	0.1	-
Process	-	-	4.7	-	-
Total Emissions	216	76	24.8	5.2	3.0

9.2 Upset Atmospheric Emissions

Sources of emission and associated pollutants considered in the emissions inventory included:

- Combustion emissions from oil spill clean up equipment (vessels and helicopters);
- Fugitive emissions (gas emitted from blowout); and
- Fugitive emissions (evaporated from oil spill at the surface).

All emissions were determined through the application of emission factors published by the EMEP/EEA (EMEP/EEA, 2019). A summary of sources quantified, emissions estimation techniques applied, emission factors and source input parameters are summarised in Table 9-1. Estimated annual average emissions, per source group, are presented in Table 9-2 (crude oil spill) and Table 9-3 (condensate spill).

Table 9-4: Emission estimation techniques and parameters

Source Group	Emission Estimation Technique Emissions factors	Input Parameters
Combustion	EMEP/EEA Shipping (1.A.3.d) (Ships using marine gas oil) NOx: 72.2 kg/tonne fuel CO: 3.84 kg/tonne fuel NMVOC: 1.75 kg/tonne fuel SO ₂ : 1.82 kg/tonne fuel PM: 1.07 kg/tonne fuel	<u>Oil spill response period</u> : 20 days, assumed 12 vessels with fuel use of 10.2 tonne/day. 145 714 litres/day – 2 914 286 litres/oil spill Assumed a marine gas oil density of 0.84 kg/l (Table A.1, Life Cycle Assessment of Greenhouse Gas and Criteria Air Pollutant Emissions from Conventional and Biobased Marine Fuels)
Combustion	EMEP/EEA Civil aviation (1.A.3.a) (Helicopter) NOx: 9.6 kg/tonne fuel CO: 66.4 kg/tonne fuel NMVOC: 5.8 kg/tonne fuel SO ₂ : 0.8 kg/tonne fuel	<u>Oil spill response period</u> : 20 days, <u>Helicopter</u> : Assumed 2 helicopters travelling 360 NM per trip, 8 trips per day, 115 200 nautical miles (NM)/oil spill, 1.75 litres/NM – 432 000 litres/oil spill Assumed average value for the various countries.

Source Group	Emission Estimation Technique Emissions factors	Input Parameters
		Assumed a jet kerosene density of 0.794 kg/l (Table D.1, SA Technical guidelines)
Fugitive gas		Provided with 1 155 tonne/day gas emitted with crude oil blowout and 651 tonne/day with condensate oil blowout. Assumed a gas composition of 83.2% CH ₄ , 1.4% CO ₂ , 1.1 % N ₂ and 14.3% NMHC.
Evaporation	Evaporation emissions from the oil spill report were used	Provided with 40 000 tonne evaporated with crude oil blowout and 1 700 tonne with condensate oil blowout.

Table 9-5: Estimated annual average emission rates (crude oil spill)

Source Group	NO ₂ (tpa)	CO (tpa)	NM VOC (tpa)	SO ₂ (tpa)	PM ₁₀ (tpa)
Combustion	180	32.2	6.3	4.7	2.6
Fugitive	-	-	3 302	-	-
Evaporated	-	-	40 000	-	-
Total Emissions	180	32.2	43 308	4.7	2.6

Table 9-6: Estimated annual average emission rates (condensate spill)

Source Group	NO ₂ (tpa)	CO (tpa)	NM VOC (tpa)	SO ₂ (tpa)	PM ₁₀ (tpa)
Combustion	180	32.2	6.3	4.7	2.6
Fugitive	-	-	1 862	-	-
Evaporated	-	-	1 700	-	-
Total Emissions	180	32.2	3 568	4.7	2.6

As can be seen from the routine emissions compared to the upset emissions, combustion emissions for upset would be fairly similar to routine emissions. Fugitive and evaporation emissions of NMVOCs will be elevated should this upset emission occur.

9.3 Dispersion modelling of proposed exploration activities (routine operations)

Simulations were undertaken to determine highest hourly pollutant concentrations. Highest daily and annual average ground level concentrations were extrapolated through the application of factors specified in the Regulations Regarding Air Dispersion Modelling. Averaging periods were selected to facilitate the comparison of predicted pollutant concentrations to relevant NAAQS and screening criteria.

Results are presented in tabular form as maximum ground level pollutant concentrations in comparison with assessment criteria.

Simulations are for the incremental concentrations due to the exploration activities. The stack parameters provided in Table 9-7 were assumed for the sources offshore.

Table 9-7: Stack parameters used in SCREEN3 for routine sources

Parameter	Point source
Stack height (m)	10
Stack diameter (m)	0.5
Stack temperature (K)	500
Stack velocity (m/s)	10
Urban/rural	Rural
Receptor height (m)	1.5

9.3.1 Simulated Ambient NO₂ Concentrations

Simulated ambient NO₂ concentrations are within the hourly and annual NAAQS at the nearest AQSRs (Table 9-8). The NAAQS may be exceeded from 500 m to 2 km from the source, but this is away from any AQSRs.

Table 9-8: Simulated NO₂ ground level concentrations at the nearest AQSRs

AQSR	Simulated SCREEN3 NO ₂ hourly concentration (µg/m ³)	Extrapolated NO ₂ annual concentration (µg/m ³)
Maximum concentration (419 m) – neutral conditions	2 065	165
Nearest AQSRs (~100 km) – neutral conditions	1.7	0.14
Maximum concentration (2 001 m) – stable conditions	1 006	80
Nearest AQSRs (~100 km) – stable conditions	23.1	1.85
NAAQS	200	40

9.3.2 Simulated Ambient CO Concentrations

Simulated ambient CO concentrations are within the hourly NAAQS at the nearest AQSRs (Table 9-9).

Table 9-9: Simulated CO ground level concentrations at the nearest AQSRs

AQSR	Simulated SCREEN3 CO hourly concentration (µg/m ³)
Maximum concentration (419 m) – neutral conditions	727
Nearest AQSRs (~100 km) – neutral conditions	0.6
Maximum concentration (2 001 m) – stable conditions	354
Nearest AQSRs (~100 km) – stable conditions	8.1
NAAQS	30 000

9.3.3 Simulated Ambient SO₂ Concentrations

Simulated ambient SO₂ concentrations are within the hourly, daily and annual NAAQS at the nearest AQSRs (Table 9-10).

Table 9-10: Simulated SO₂ ground level concentrations at the nearest AQSRs

AQSR	Simulated SCREEN3 SO ₂ hourly concentration (µg/m ³)	Extrapolated SO ₂ daily concentration (µg/m ³)	Extrapolated SO ₂ annual concentration (µg/m ³)
Maximum concentration (419 m) – neutral conditions	50	20	4
Nearest AQSRs (~100 km) – neutral conditions	0.04	0.016	0.003
Maximum concentration (2 001 m) – stable conditions	24	9.6	1.9
Nearest AQSRs (~100 km) – stable conditions	0.56	0.224	0.045
NAAQS	350	125	50

9.3.4 Simulated Ambient PM₁₀ and PM_{2.5} Concentrations

All PM was conservatively assumed to be 100 % PM_{2.5}. Simulated ambient PM_{2.5} concentrations are within the daily and annual NAAQS at the nearest AQSRs (Table 9-11).

Table 9-11: Simulated PM ground level concentrations at the nearest AQSRs

AQSR	Extrapolated PM _{2.5} daily concentration (µg/m ³)	Extrapolated PM _{2.5} annual concentration (µg/m ³)
Maximum concentration (419 m) – neutral conditions	11.4	2.3
Nearest AQSRs (~100 km) – neutral conditions	0.008	0.002
Maximum concentration (2 001 m) – stable conditions	5.6	1.1
Nearest AQSRs (~100 km) – stable conditions	0.128	0.026
NAAQS	40	20

9.3.5 Simulated Ambient VOC Concentrations

Simulated ambient VOC concentrations are shown in Table 9-12. Simulated annual average VOC concentrations are well below the ECA guideline of 200 µg/m³ at all of the AQSRs.

Table 9-12: Simulated VOC ground level concentrations at the nearest AQSRs

AQSR	Simulated SCREEN3 VOC hourly concentration (µg/m ³)	Extrapolated VOC annual concentration (µg/m ³)
Maximum concentration (419 m) – neutral conditions	237	19
Nearest AQSRs (~100 km) – neutral conditions	0.2	0.02
Maximum concentration (2 001 m) – stable conditions	116	9
Nearest AQSRs (~100 km) – stable conditions	2.7	0.22
ECA guideline	-	200

Given the conservative nature of the impact assessment, it can be concluded that routine emissions from the proposed exploration will not result in exceedances of NAAQS at the closest sensitive receptors.

9.4 Dispersion modelling of proposed exploration activities (upset operations)

Simulations were undertaken to determine highest hourly pollutant concentrations. Highest daily and annual average ground level concentrations were extrapolated through the application of factors specified in the Regulations Regarding Air Dispersion Modelling. Averaging periods were selected to facilitate the comparison of predicted pollutant concentrations to relevant NAAQS and screening criteria.

Results are presented in tabular form as maximum ground level pollutant concentrations in comparison with assessment criteria.

Simulations are for the incremental concentrations due to the exploration activities. The stack parameters provided in Table 9-7 were assumed for the sources offshore.

Table 9-13: Area parameters used in SCREEN3 for upset sources

Parameter	Area source
Area width (m) (as per maximum allowed in SCREEN3)	10 000
Area length (m) (as per maximum allowed in SCREEN3)	10 000
Release height (m)	0
Urban/rural	Rural
Receptor height (m)	1.5

As the spill would be at the sea surface, the release height was assumed to be 0 m. The actual spill area (80 – 100% probability) was 400 000 000 m² for the condensate, and 40 000 000 000 m² for the crude oil spill (see Figures 9-1 and 9-2). Emissions were then converted to a representative g/s/m² to be used in the SCREEN model for the maximum area that could be modelled. The worst-case scenario for NMVOC impact is the condensate scenario, as it has emissions less than 10 times lower, however impacts on a much smaller area, so the g/s/m² emission rate is larger. The results shown in Table 9-14 are the worst-case impacts, but emissions are higher for the crude oil scenario.

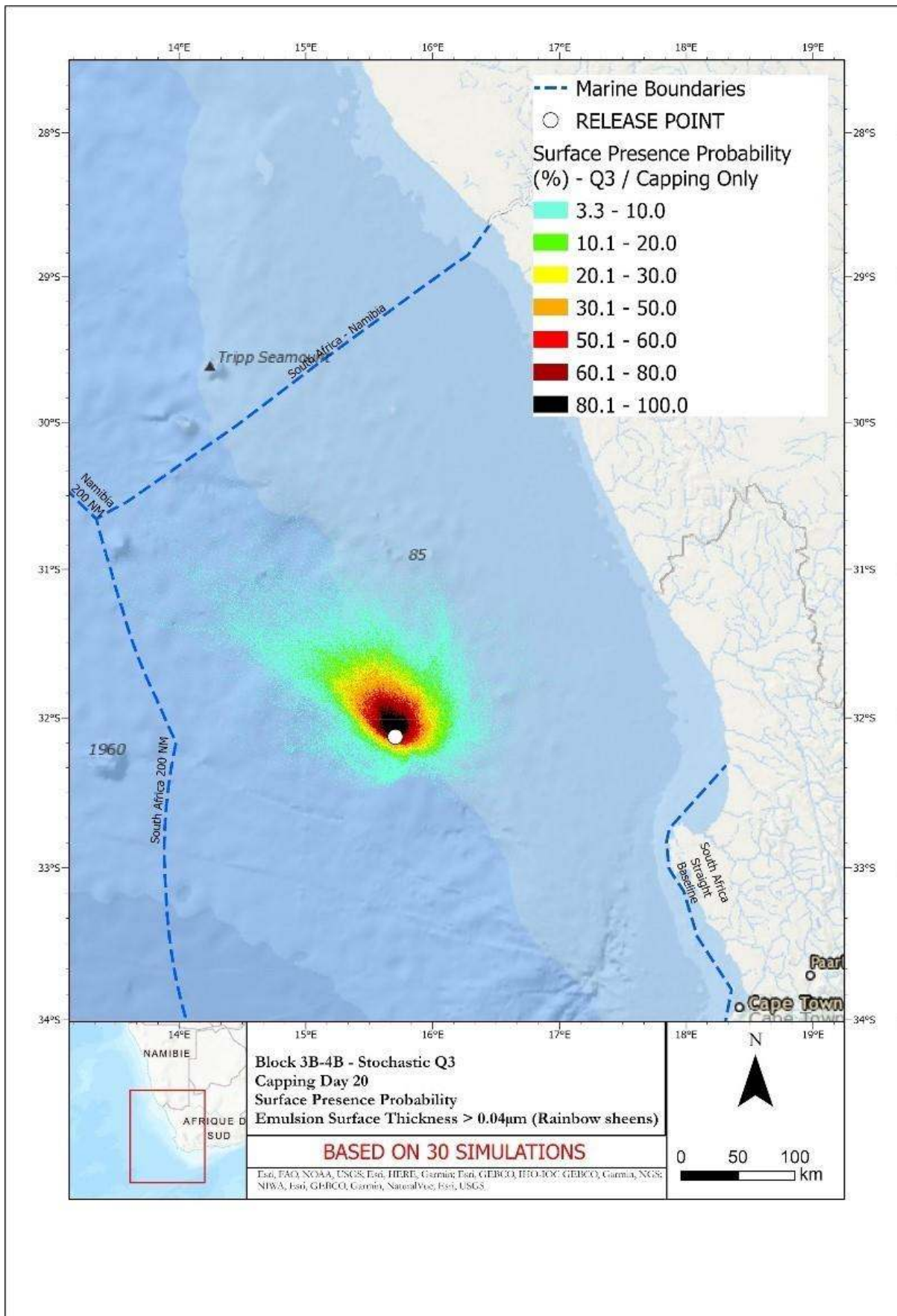


Figure 9-1: Oil spill for condensate

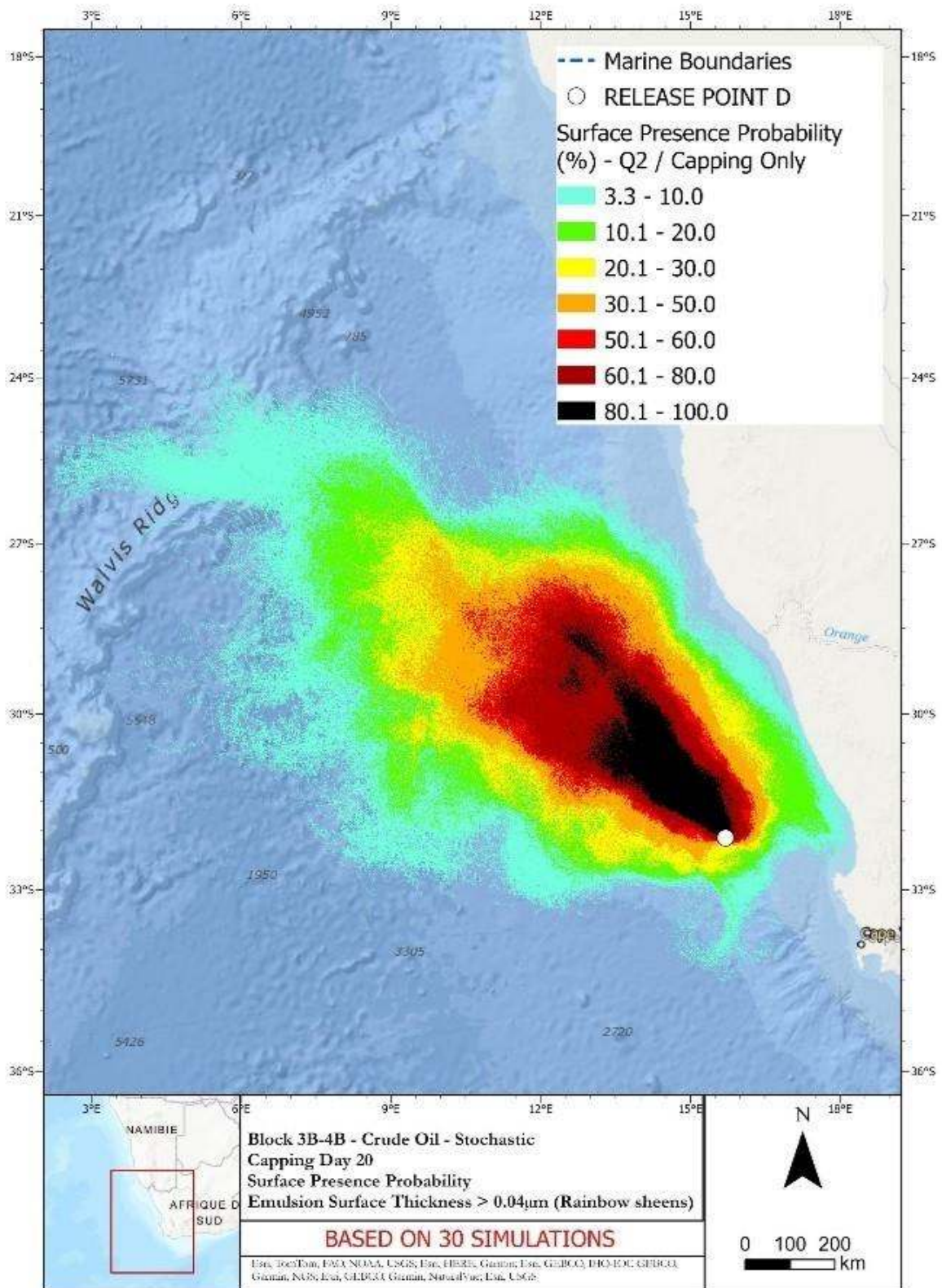


Figure 9-2: Oil spill for crude oil

9.4.1 Simulated Ambient VOC Concentrations

Simulated ambient VOC concentrations are shown in Table 9-12. Simulated annual average VOC concentrations are below the ECA guideline of 200 µg/m³ at all of the AQSRs.

Table 9-14: Simulated VOC ground level concentrations at the nearest AQSRs

AQSR	Simulated SCREEN3 VOC hourly concentration (µg/m ³)	Extrapolated VOC annual concentration (µg/m ³)
Maximum concentration (7 km) – neutral conditions	922	74
Nearest AQSRs (~100 km) – neutral conditions	37	3
Maximum concentration (7 km) – stable conditions	2 121	170
Nearest AQSRs (~100 km) – stable conditions	241	19
ECA guideline	-	200

9.5 Significance of Impact on the Environment (Routine operations)

The methodology used for assessing the significance of the impact was obtained from EIMS. The environmental risk is dependent on the consequence and the probability that the impact will occur.

Step 1: Determine the CONSEQUENCE of the impact by using the factors below.

Table 9-15: Consequence of the impact

Score	Source				
	Duration of impact	Extent	Magnitude Intensity	Reversibility	Nature
-2.25	Short term 2	Local 3	Low 2	Reversible without significant time and cost 2	Negative -1

Step 2: Determine the PROBABILITY of the impact.

Table 9-16: Probability of the impact

Score	Probability
3	Medium probability

Step 3 Determine the ENVIRONMENTAL RISK (ER) of the impact by using the values that were obtained above for Probability and Consequence.

Table 9-17: Environmental risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

Applying the criterion given above, the significance for the proposed exploration is given in Table 9-18.

Table 9-18: Environmental Risk Score

Description	ER Score
Low (i.e. where this impact is unlikely to be a significant environmental risk)	<9

9.6 Significance of Impact on the Environment (Routine operations)

The methodology used for assessing the significance of the impact was obtained from EIMS. The environmental risk is dependent on the consequence and the probability that the impact will occur.

Step 1: Determine the CONSEQUENCE of the impact by using the factors below.

Table 9-19: Consequence of the impact

Score	Source				
	Duration of impact	Extent	Magnitude Intensity	Reversibility	Nature
-2.5	Immediate 1	Regional 4	Medium 3	Reversible without significant time and cost 2	Negative -1

Step 2: Determine the PROBABILITY of the impact.

Table 9-20: Probability of the impact

Score	Probability
2	Low probability

Step 3 Determine the ENVIRONMENTAL RISK (ER) of the impact by using the values that were obtained above for Probability and Consequence.

Table 9-21: Environmental risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
	Probability					

Applying the criterion given above, the significance for the proposed exploration is given in [Table 9-22](#).

Table 9-22: Environmental Risk Score

Description	ER Score
Low (i.e. where this impact is unlikely to be a significant environmental risk)	<9

10 AIR QUALITY MANAGEMENT PLAN

The principal sources of emissions to air will be exhaust gas emissions produced by the combustion of fuel in engines for vessels and to a minor extent from the helicopter. Flaring could contribute to emissions, however information on flaring is currently uncertain.

10.1 Source Specific Recommended Management and Mitigation Measures

10.1.1 Navigation by ships

MARPOL 73/78, Annex VI outlines international requirements to reduce harmful air emissions from ships. The regulations include emission limits for SO₂, NO_x and PM. General emission control technologies that have been used on ships include:

- Ultra-Low diesel fuels : PM reduction 5-15%; SO₂ reduction up to 99%
- Emission filters : PM reduction efficiencies up to 90%
- Selective catalytic Reduction (SCR) : NO_x reduction efficiencies 70%-90%
- Gas scrubbers : SO₂ reduction efficiencies 90%-99%
- On-Engine modifications
- Vessel speed reduction

10.1.2 Flaring and venting

Associated gas brought to the surface with crude oil during oil production is sometimes disposed of at offshore facilities by venting or flaring. This practice is now widely recognized to be a waste of valuable resources as well as a significant source of GHG emissions. At this stage information on flaring is currently uncertain, however general control measures for flaring of gas given by the World Bank Group can be found in Appendix D. The applicant stated in the RFI in the Info folder that "During testing the gas flaring is normally limited to a max of 30MMscfd gas. Oil will be burnt through the flare boom, rates vary between 100 to 1000 bbl/day but only for a max duration of 4 hours."

10.1.3 Oil spills

The applicant should have an Oil Spill Response Plan (OSRP) before operations begin and must operate their facilities in accordance with that OSRP. The plan holder needs to be prepared to quickly and effectively respond to a worst-case discharge from a facility to the maximum extent practicable.

An OSRP is an important contingency planning document. It contains numerous details including, exercise and equipment testing procedures, spill response strategies and tactics, spill command and control procedures, and emergency contact information.

11 CONCLUSION

11.1 Main Findings

NAAQS pollutant **routine** emissions are summarised in Table 9-2 and Table 9-3 using the EMEP/EEA emission factors. Emissions of NO₂ range between 211 and 216 tpa with fuel combustion being the dominant source. Emissions of CO range between 54 and 76 tpa, with waste gas disposal being the dominant source. Emissions of NMVOC range between 17 and 25 tpa, with waste gas disposal being the dominant source. Emissions of PM and SO₂ are low.

NAAQS pollutant **upset** emissions due to an oil spill are summarised in Table 9-2 and Table 9-3 using the EMEP/EEA emission factors. Combustion emissions are fairly similar to routine emissions. Emissions of NMVOC due to evaporation and fugitive gas release are elevated for NMVOC. It should be kept in mind that this is only potential emissions and may not happen. NMVOC emissions range between 3 568 and 43 308 tpa, with evaporation emissions and gas released during the blowout being the dominant source.

Meteorological scenarios that reflect worst-case atmospheric conditions were selected to perform dispersion simulations. These include calm stable night-time conditions (wind speed of 1.5 m/s) and neutral daytime conditions with a relatively low wind speed of 3 m/s. These atmospheric conditions are more likely to occur during winter winds and in order to impact on the coastline, has to be from westerly wind sector. Based on the wind field for the study area, the wind could blow from this direction approximately 7% of the year.

Screening dispersion modelling using the US EPA SCREEN3 model was used to calculate the maximum concentrations at the closest coastal area, approximately 100 km downwind from the nearest seismic survey location. This model was used with the **routine and upset** emission rates calculated using the EMEP/EEA emission factors.

Conservatively all NO_x was assumed to be NO₂. The highest hourly average NO₂ concentrations expected at Saldanha Bay (closest receptor at 120 km from a location on the eastern boundary of the Area of Interest) is 12% of the NAAQS limit value. This represents the maximum ground level concentration that would occur under conditions of weak atmospheric dispersion, i.e., low vertical turbulence and calm wind speeds that would otherwise assist with the dilution of air pollutants. Similarly, the highest hourly average SO₂ concentration is predicted to be 0.16% of the NAAQS limit value. The extrapolated highest PM_{2.5} daily average concentration is 0.32% of the NAAQS. The predicted highest CO hourly average concentration is only 0.002% of the NAAQS. There are no NAAQS for NMVOCs; however, the highest predicted hourly average NMVOC concentration is still **lower at the nearest receptor** than the annual average NAAQS limit value for benzene. **Since the calculated maximum predicted ground level concentrations (under worst-case atmospheric conditions) are considerably lower than the NAAQS limit values, it is expected that the exposure to any significant concentration levels would be infrequent and insignificant with respect to the NAAQS. Such emissions are therefore unlikely to have a direct effect on any receptor or other activity, other than the project vessels themselves.**

The impact of the estimated operational emissions from the proposed project is considered to be **local**, and of **short-term duration** and **low intensity**. The potential impact on the air quality emissions is of **low significance** without further mitigation.

The impact from upset emissions is higher than for routine emissions for NMVOC. The impact at the nearest AQSR is still however below the guideline value of 200 µg/m³.

11.2 Recommendations

The means to minimise emissions from the Project would be achieved by

- Implement a maintenance plan to ensure all ship engines and boilers receive adequate maintenance to minimise soot and unburnt fuel released to the atmosphere and maximize energy efficiency.
- Ensure no incineration (subject to obtaining an atmospheric emissions license) of waste occurs within the port limits.

However, if incineration of waste material is to be undertaken (within port limits), and the vessel is considered an 'installation' (as per the NEM:AQA MES) and more than 10 kg waste is incinerated per day, this will require an AEL. The relevant listed activity would be *Category 8.1 - Thermal Treatment of Hazardous and General Waste*.

The applicant should have an OSRP before operations begin and must operate their facilities in accordance with that OSRP. The plan holder needs to be prepared to quickly and effectively respond to a worst-case discharge from a facility to the maximum extent practicable.

An OSRP is an important contingency planning document. It contains numerous details including, exercise and equipment testing procedures, spill response strategies and tactics, spill command and control procedures, and emergency contact information.

12 ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

Several assumptions had to be made in the study. These, along with other limitations are listed below and should be noted when interpreting the outcomes of the study:

- The quantification of sources of emission was restricted to project activities provided by the client including drilling, support vessels, etc.
- The fuels assumed to be consumed by these sources was provided by the client.
- As the details of the venting and flaring are not yet certain, it was assumed that flaring may occur for 10 days during the exploration project. The applicant stated in the RFI in the Info folder that "During testing the gas flaring is normally limited to a max of 30MMscfd gas. Oil will be burnt through the flare boom, rates vary between 100 to 1000 bbl/day but only for a max duration of 4 hours."
- No incineration of waste was assumed to occur onboard the vessels.
- Where a range of emission factors were available, the upper range was used in the screening assessment as a worst-case estimate.
- Conservatively all NO_x was assumed to be NO₂.
- The drill rig was assumed to be a mobile combustion source, however it will be both stationary and mobile.
- Vessels and aircraft to be used in the case of an oil spill were assumed to be similar to those used internationally and a typical fuel consumption was assumed.
- It was assumed all the gas released during a blowout would escape as fugitive emissions at the water surface.
- The amount anticipated to be evaporated from the oil spill was based on modelled done in the oil spill report.
- A typical gas composition was assumed from the IPCC to determine the NMVOC content of the gas being released.

13 REFERENCES

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14 APPENDICES

APPENDIX A: SPECIALIST DECLARATION FORM

APPENDIX B: CURRICULUM VITAE OF PROJECT TEAM

CURRICULUM VITAE

GILLIAN PETZER

CURRICULUM VITAE

Name	Gillian Petzer (née Möhle)
Date of Birth	1 December 1975
Nationality	South African
Employer	Airshed Planning Professionals (Pty) Ltd
Position	Principal Consultant and Project Manager
Profession	Chemical Engineer employed as an Air Quality Assessment Consultant
Years with Firm	19 years

MEMBERSHIP OF PROFESSIONAL SOCIETIES

- South African Institute of Chemical Engineers, 2003 to present
- Institution of Chemical Engineers (IChemE) - Membership number 99964317
- National Association for Clean Air (NACA), 2003 to present
- Professional Engineer – Registration number 20170315

EXPERIENCE

Gillian has nineteen years of experience in air quality impact assessment and management. She is an employee of Airshed Planning Professionals (Pty) Ltd and is involved in the compilation of emission inventories, air pollution mitigation and management, and air pollution impact work.

A list of projects completed in various sectors is given below.

Air Quality Management

- Richards Bay Air Quality Management Plan
- Tshwane Air Quality Management Plan
- Dust Management Plan for various mines

Mining Sector

Lusthof Colliery, South Deep Mine, Kangra, MacWest, Sishen Iron Ore Mine, SA Chrome, Esaase Gold Project (Ghana), Mampon Gold Mine (Ghana), Mittal Newcastle, Navachab (Namibia), Skorpion Zinc mine (Namibia), Debswana Diamond Mines (Botswana), Quarries: Afrisam Pietermaritzburg, AMT operations (Rustenburg and Wonderstone)

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Industrial Sector

Various Brickworks, Middelburg Ferrochrome, Impala Platinum (Springs), Delta EMD Project, PetroSA, Alfluorco Aluminium Fluoride Project, PPC, Rand Carbide, Vanchem, BCL Incinerator, AEL, Namakwa Sands Plant, Liquid Natural Gas Refinery (Equatorial Guinea), Phalaborwa Mining Company, Asphalt plants, Ceramic facilities

Energy Sector

Walvis Bay Power Station Project (Namibia), various small power stations (Eritrea, Nigeria, Mauritania, Kenya), Matimba Power Station, Mossel Bay OCGT Power Station, Sese Power Station (Botswana), Geothermal Power Station (Kenya)

Waste Disposal and Treatment Sector

Roslyn and Chloorkop Waste Disposal Sites, Organic waste disposal site

Transport and Logistics Sector

Kolomela Iron Ore Railway Line, Guinea Port and Railway Project (Guinea), Grindrod Coal Terminal, VALE Port Project (Mozambique), various fuel depots.

Ambient Air Quality and Noise Sampling

- Gravimetric Particulate Matter (PM) and dustfall sampling
- Passive diffusive gaseous pollutant sampling

SOFTWARE PROFICIENCY

- Atmospheric Dispersion Models: AERMOD, ISC, CALPUFF, ADMS (United Kingdom), CALINE, GASSIM, TANKS
- Graphical Processing: Surfer, ArcGIS (basic proficiency)
- Other: MS Word, MS Excel, MS Outlook

EDUCATION

- BEng: (Chemical Engineering), 2002, University of Pretoria

COURSES COMPLETED AND CONFERENCES ATTENDED

- Conference: NACA (October 2003), Attended
- Conference: NACA (October 2005), Attended and presented a paper
- Conference: NACA (October 2007), Attended and presented a paper
- Conference: NACA (October 2008), Attended and presented a poster
- Conference: NACA (October 2009), Attended and presented a paper
- Conference: NACA (October 2012), Attended
- Conference: IUAPPA (October 2013), Attended
- Course: Climate change and carbon management. Presented by Environmental & Sustainability Solutions (July 2014)
- Conference NACA (October 2016), Attended
- Conference NACA (October 2017), Attended
- Process Vessel and Tank Design Course (May 2019), Attended

COURSES PRESENTED

- National Environmental Management: Air Quality Act and its Implementation (course arranged by the North-West University - NWU)

COUNTRIES OF WORK EXPERIENCE

South Africa, Namibia, Botswana, Ghana, Eritrea, Mauritania, Mozambique, Kenya, Guinea, Equatorial Guinea and Nigeria

LANGUAGES

Language	Proficiency
English	Native language
Afrikaans	Full professional proficiency

REFERENCES

Name	Position	Contact Number
Dr. Gerrit Komelius	Associate of Airshed Planning Professionals	+27 (82) 925 9569 gerrit@airshed.co.za

Dr Lucian Burger	Director at Airshed Planning Professionals	+27 (82) 491 0385 Lucian@airshed.co.za
Dr. Hanlie Liebenberg Enslin	Managing Director at Airshed Planning Professionals	+27 (83) 416 1955 hanlie@airshed.co.za

CERTIFICATION

I, the undersigned, certify that to the best of my knowledge and belief, these data correctly describe me, my qualifications and my experience.



28/04/2022

APPENDIX C: IMPACT SIGNIFICANCE RATING METHODOLOGY

The impact significance rating methodology, as presented herein and utilised for all EIMS Impact Assessment Projects, is guided by the requirements of the NEMA EIA Regulations 2014 (as amended). The broad approach to the significance rating methodology is to determine the environmental risk (ER) by considering the consequence (C) of each impact (comprising Nature, Extent, Duration, Magnitude, and Reversibility) and relate this to the probability/ likelihood (P) of the impact occurring. The ER is determined for the pre- and post-mitigation scenario. In addition, other factors, including cumulative impacts and potential for irreplaceable loss of resources, are used to determine a prioritisation factor (PF) which is applied to the ER to determine the overall significance (S).

Determination of Environmental Risk:

The significance (S) of an impact is determined by applying a prioritisation factor (PF) to the environmental risk (ER). The environmental risk is dependent on the consequence (C) of the particular impact and the probability (P) of the impact occurring. Consequence is determined through the consideration of the Nature (N), Extent (E), Duration (D), Magnitude (M), and Reversibility (R) applicable to the specific impact.

For the purpose of this methodology the consequence of the impact is represented by:

$$C = \frac{(E + D + M + R) * N}{4}$$

Each individual aspect in the determination of the consequence is represented by a rating scale as defined in Table C-1 below.

Table C-1: Criteria for determining impact consequence

Aspect	Score	Definition
Nature	- 1	Likely to result in a negative/ detrimental impact
	+1	Likely to result in a positive/ beneficial impact
Extent	1	Activity (i.e. limited to the area applicable to the specific activity)
	2	Site (i.e. within the development property boundary),
	3	Local (i.e. the area within 5 km of the site),
	4	Regional (i.e. extends between 5 and 50 km from the site)
	5	Provincial / National (i.e. extends beyond 50 km from the site)
Duration	1	Immediate (<1 year)
	2	Short term (1-5 years),
	3	Medium term (6-15 years),
	4	Long term (the impact will cease after the operational life span of the project),
	5	Permanent (no mitigation measure of natural process will reduce the impact after construction).
Magnitude/ Intensity	1	Minor (where the impact affects the environment in such a way that natural, cultural and social functions and processes are not affected),
	2	Low (where the impact affects the environment in such a way that natural, cultural and social functions and processes are slightly affected),
	3	Moderate (where the affected environment is altered but natural, cultural and social functions and processes continue albeit in a modified way),
	4	High (where natural, cultural or social functions or processes are altered to the extent that it will temporarily cease), or

Aspect	Score	Definition
	5	Very high / don't know (where natural, cultural or social functions or processes are altered to the extent that it will permanently cease).
Reversibility	1	Impact is reversible without any time and cost.
	2	Impact is reversible without incurring significant time and cost.
	3	Impact is reversible only by incurring significant time and cost.
	4	Impact is reversible only by incurring prohibitively high time and cost.
	5	Irreversible Impact

Once the C has been determined the ER is determined in accordance with the standard risk assessment relationship by multiplying the C and the P. Probability is rated/scored as per Table C-2.

Table C-2: Probability scoring

Probability	1	Improbable (the possibility of the impact materialising is very low as a result of design, historic experience, or implementation of adequate corrective actions; <25%),
	2	Low probability (there is a possibility that the impact will occur; >25% and <50%),
	3	Medium probability (the impact may occur; >50% and <75%),
	4	High probability (it is most likely that the impact will occur- > 75% probability), or
	5	Definite (the impact will occur),

The result is a qualitative representation of relative ER associated with the impact. ER is therefore calculated as follows:

$$ER = C \times P$$

Table C-3: Determination of environmental risk

Consequence	5	5	10	15	20	25
	4	4	8	12	16	20
	3	3	6	9	12	15
	2	2	4	6	8	10
	1	1	2	3	4	5
		1	2	3	4	5
Probability						

The outcome of the environmental risk assessment will result in a range of scores, ranging from 1 through to 25. These ER scores are then grouped into respective classes as described in Table -4.

Table C-4: Significance classes

Environmental Risk Score	
Value	Description
< 9	Low (i.e. where this impact is unlikely to be a significant environmental risk),
≥9; <17	Medium (i.e. where the impact could have a significant environmental risk),
≥ 17	High (i.e. where the impact will have a significant environmental risk).

The impact ER will be determined for each impact without relevant management and mitigation measures (pre-mitigation), as well as post implementation of relevant management and mitigation measures (post-mitigation). This allows for a prediction in the degree to which the impact can be managed/mitigated.

Impact Prioritisation:

Further to the assessment criteria presented in the section above, it is necessary to assess each potentially significant impact in terms of:

- Cumulative impacts; and
- The degree to which the impact may cause irreplaceable loss of resources.

To ensure that these factors are considered, an impact prioritisation factor (PF) will be applied to each impact ER (post mitigation). This prioritisation factor does not aim to detract from the risk ratings but rather to focus the attention of the decision-making authority on the higher priority/significance issues and impacts. The PF will be applied to the ER score based on the assumption that relevant suggested management/mitigation impacts are implemented.

Table C-5: Criteria for determining prioritisation

Cumulative Impact (CI)	Low (1)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is unlikely that the impact will result in spatial and temporal cumulative change.
	Medium (2)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is probable that the impact will result in spatial and temporal cumulative change.
	High (3)	Considering the potential incremental, interactive, sequential, and synergistic cumulative impacts, it is highly probable/definite that the impact will result in spatial and temporal cumulative change.
Irreplaceable loss of resources (LR)	Low (1)	Where the impact is unlikely to result in irreplaceable loss of resources.
	Medium (2)	Where the impact may result in the irreplaceable loss (cannot be replaced or substituted) of resources but the value (services and/or functions) of these resources is limited.
	High (3)	Where the impact may result in the irreplaceable loss of resources of high value (services and/or functions).

The value for the final impact priority is represented as a single consolidated priority, determined as the sum of each individual criteria represented in Table C-5. The impact priority is therefore determined as follows:

$$Priority = CI + LR$$

The result is a priority score which ranges from 2 to 6 and a consequent PF ranging from 1 to 1.5 (refer to Table C-6).

Table C-6: Determination of prioritisation factor

Priority	Prioritisation Factor
2	1
3	1.125
4	1.25
5	1.375
6	1.5

In order to determine the final impact significance, the PF is multiplied by the ER of the post mitigation scoring. The ultimate aim of the PF is an attempt to increase the post mitigation environmental risk rating by a factor of 0.5, if all the priority attributes are high (i.e. if an impact comes out with a high medium environmental risk after the conventional impact rating, but there is

significant cumulative impact potential and significant potential for irreplaceable loss of resources, then the net result would be to upscale the impact to a high significance).

Table C-7: Final environmental significance rating

Significance Rating	Description
≥-17	High negative (i.e. where the impact must have an influence on the decision process to develop in the area).
≥-17, ≤-9	Medium negative (i.e. where the impact could influence the decision to develop in the area).
>-9, <0	Low negative (i.e. where this impact would not have a direct influence on the decision to develop in the area).
0	No impact
>0, <9	Low positive (i.e. where this impact would not have a direct influence on the decision to develop in the area).
≥9, ≤17	Medium positive (i.e. where the impact could influence the decision to develop in the area).
>17	High positive (i.e. where the impact must have an influence on the decision process to develop in the area).

The significance ratings and additional considerations applied to each impact will be used to provide a quantitative comparative assessment of the alternatives being considered. In addition, professional expertise and opinion of the specialists and the environmental consultants will be applied to provide a qualitative comparison of the alternatives under consideration. This process will identify the best alternative for the proposed project.

APPENDIX D: WORLD BANK RECOMMENDATIONS ON FLARING AND VENTING AND WELL TESTING (WORLD BANK GROUP, 2015)

Associated gas brought to the surface with crude oil during oil production is sometimes disposed of at offshore facilities by venting or flaring. This practice is now widely recognized to be a waste of valuable resources as well as a significant source of GHG emissions.

However, flaring and venting are important safety measures on offshore oil and gas facilities, helping to ensure that gas and other hydrocarbons are safely disposed of in the event of an emergency, a power or equipment failure, or other facility upset condition. Risk assessment processes (e.g., hazard and operability study (HAZOP), hazard identification study (HAZID), etc.) to estimate the implications of situations of this type should be used in such facilities.

Measures consistent with the Global Gas Flaring and Venting Reduction Voluntary Standard (part of the Global Gas Flaring Reduction Public-Private Partnership) should be adopted when considering venting and flaring options for offshore activities. The standard provides guidance on how to eliminate or achieve reductions in the flaring and venting of natural gas.

Continuous venting of associated gas is not good practice and should be avoided. The associated gas stream should be routed to an efficient flare system, although continuous flaring of gas should be avoided if alternatives are available. Before flaring is adopted, all feasible alternatives for the gas's use should be evaluated to the maximum extent possible and integrated into production design. Alternative options may include gas utilization for on-site energy needs, gas injection for reservoir pressure maintenance, enhanced oil recovery using gas lift, or export of the gas to a neighbouring facility or to market. An assessment of alternatives should be made and adequately documented. If none of the options for the associated gas's use is feasible, measures to minimize flare volumes should be evaluated and flaring should be considered as an interim solution, with the elimination of continuous production associated gas flaring as the preferred goal.

New facilities should be designed, constructed, and operated so as to avoid routine flaring. Cost effective options to reduce flaring from existing or legacy facilities that offer sustainable social benefits (e.g., gas-to-power) should be identified and evaluated in collaboration with host country governments and other stakeholders and with a particular focus on GHG emissions.

If flaring is the only viable solution, continuous improvement of flaring through the implementation of good practices and new technologies should be demonstrated. The following pollution prevention and control measures should be considered for gas flaring:

- Implement source gas reduction measures to the extent possible.
- Use efficient flare tips and optimize the size and number of burning nozzles.
- Maximize flare combustion efficiency by controlling and optimizing flare fuel, air, and stream flow rates to ensure the correct ratio of assist stream to flare stream.
- Minimize flaring from purges and pilots—without compromising safety—through measures including installation of purge gas reduction devices, vapor recovery units, inert purge gas, soft seat valve technology where appropriate, and installation of conservation pilots.
- Minimize risk of pilot blowout by ensuring sufficient exit velocity and providing wind guards.
- Use a reliable pilot ignition system.
- Install high-integrity instrument pressure protection systems, where appropriate, to reduce overpressure events and avoid or reduce flaring situations.
- Minimize liquid carryover and entrainment in the gas flare stream with a suitable liquid separation system.

- Minimize flame lift off and/or flame lick.
- Operate flare to control odor and visible smoke emissions (no visible black smoke). Situate flare at a safe distance from accommodation units.
- Implement burner maintenance and replacement programs to ensure continuous maximum flare efficiency.
- Meter flare gas.

In the event of an emergency or equipment breakdown, or when facility upset conditions arise, excess gas should not be vented but rather should be sent to an efficient flare gas system. Emergency venting may be necessary under specific field conditions where a flare gas system is not available or when flaring of the gas stream is not possible, such as when there is a lack of sufficient hydrocarbon content in the gas stream to support combustion or a lack of sufficient gas pressure to allow it to enter the flare system. Justification for excluding a gas flaring system on offshore facilities should be fully documented before an emergency gas venting facility is considered.

To minimize flaring events as a result of equipment breakdowns and facility upsets, plant reliability should be high (>95 percent) and provisions should be made for equipment sparing and plant turn-down protocols.

Flaring volumes for new facilities should be estimated during the initial commissioning period so that appropriate flaring targets can be developed. The volumes of gas flared for all flaring events should be recorded and reported.

During well testing, flaring of produced hydrocarbons should be avoided, especially in environmentally sensitive areas. Feasible alternatives should be evaluated for the recovery of these test fluids, with the safety of handling volatile hydrocarbons considered, either for transfer to a processing facility or for alternative disposal options. An evaluation of alternatives for produced hydrocarbons should be adequately documented.

If flaring is the sole option available for the disposal of test fluids, only the minimum volume of hydrocarbons required for the test should be flowed and well-test durations should be reduced to the extent practical. An efficient test flare burner head equipped with an appropriate combustion enhancement system should be selected to minimize incomplete combustion, black smoke, and hydrocarbon fallout to the sea. Volumes of hydrocarbons flared should be recorded.

		SPECIALIST DECLARATION	
EIMS Ref	1570	Project Name	PROPOSED AFRICA OIL SOUTH AFRICA CORP BLOCK 3B/4B EXPLORATION RIGHT

Project Details

Project Name	Proposed Africa Oil South Africa Corp Block 3b/4b Exploration Right
Applicant	Africa Oil SA Corp, Ricocure (Pty) Ltd and Azinam Limited (a wholly owned subsidiary of Eco Atlantic) (the Joint Venture (JV) Partners)
Competent Authority	Department of Mineral Resources

Specialist Details

Specialist Company	Airshed Planning Professionals			
Specialist Name	Gillian Petzer			
Contact details	Tel	—	Cell	0834793412
	E-mail	gillian@airshed.co.za		
	Postal Address	Postnet Suite #18, Private Bag X59		
	Physical Address	480 Sunsets Drive, Halfway Gardens		

General Declaration

By signing this form, I hereby declare that:

- I act as an independent specialist in this application.
- I 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 declare that there are no circumstances that may compromise my objectivity in performing such work.
- I have expertise in conducting undertaking the specialist work as required, including knowledge of the Act, Regulations and any guidelines that have relevance to the proposed activity.
- I will comply with the Act, Regulations, and all other applicable legislation.
- I have not, and will not engage in, conflicting interest in the undertaking of the activity.
- I understand to disclose to the applicant and competent authority 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 competent authority; and the objectivity of any report, plan or document to be prepared by myself for submission to the competent authority.
- I have taken into account, to the extent possible, the matters referred to in Regulation 18 when preparing the report, plan or document.
- I will provide the competent authority with access to all information at my disposal regarding the application, whether such information is favourable to the applicant or not.
- All the particulars furnished by me this form are true and correct.

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SPECIALIST DECLARATION

EIMS Ref	1570	Project Name	PROPOSED AFRICA OIL SOUTH AFRICA CORP BLOCK 3B/4B EXPLORATION RIGHT
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- I will perform all other obligations as expected from an environmental assessment practitioner in terms of the Regulations.
- I am aware of what constitutes an offence in terms of Regulation 48 and that a person convicted of an offence in terms of Regulation 48(1) is liable to the penalties as contemplated in Section 49B of the Act.

Disclosure of Vested Interest

- I do not have and will not have any vested interest (either business, financial, personal or other) in the proposed activity proceeding other than remunerative for work performed in terms of the Regulations.

Undertaking Under Oath/Affirmation

By signing this form, I swear under oath/affirm that all the information submitted or to be submitted for the purposes of this application is true and correct.

Signatures

Specialist			
Name	Gillian Petzer	Signature	[Signature]
Date	20/03/2024		
Commissioner of Oaths			
Name	Mk Kgwele	Signature	[Signature]
Date	2024-04-20		

Commissioner of Oaths Official Stamp

I, Mogana Kgwele, Full Name, do hereby certify that the Specialist, Gillian Petzer, is a duly qualified and registered environmental assessment practitioner in terms of the Environmental Assessment Act, 2014 (Act No. 103 of 2014) and that the Specialist is not a member of the same family as the applicant or any other person who has a vested interest in the proposed activity.

I, Mogana Kgwele, Full Name, do hereby certify that the Specialist, Gillian Petzer, is a duly qualified and registered environmental assessment practitioner in terms of the Environmental Assessment Act, 2014 (Act No. 103 of 2014) and that the Specialist is not a member of the same family as the applicant or any other person who has a vested interest in the proposed activity.

Dated at Umtata on this 20th day of April 2024.

Mogana Kgwele
 FULL NAME OF COMMISSIONER OF OATHS

25 Umkhonto Road Vukhatha
 BUSINESS ADDRESS (OFFICE ADDRESS)

CAJ
 RANK

SA POLISIEDING
 SA POLICE SERVICE

