Air Quality Specialist Scoping Report for the Proposed Thermal Power Dual Fuel Facility, near Kathu, Northern Cape Province

Project done on behalf of **Savannah Environmental (Pty) Ltd**

Report Compiled by:
T Bird

Reviewed by:
G Petzer

Report No: 20SAV10a | **Date:** October 2020

Address: 480 Smuts Drive, Halfway Gardens | **Postal:** P O Box 5260, Halfway House, 1685
Tel: +27 (0)11 805 1940 | **Fax:** +27 (0)11 805 7010
www.airshed.co.za

Air Quality Specialist Scoping Report for the Proposed Thermal Power Dual Fuel Facility, near Kathu, Northern Cape Province

1 COMPANY INTRODUCTION

Airshed Planning Professionals (Pty) Ltd, a South African company, was established in 2003, specialising in all aspects of air quality, ranging from nearby neighbourhood concerns to regional air pollution impacts. The company originated in 1990 as Environmental Management Services, which amalgamated with its sister company, Matrix Environmental Consultants, in 2003.

Airshed comprises a team of professional air quality scientists drawn from a range of disciplines including chemical and mechanical engineering, meteorology, geography and environmental management. Our team holds extensive expertise and experience in all aspects of air pollution impact assessments and air quality management. Airshed is at the forefront of air quality science encouraging and facilitating further study and skills development among our staff and through our association with Universities and research organisations. The team is motivated, capable and well equipped to meet the challenge of managing air quality within the sustainable development concept.

Airshed Planning Professionals (Pty) Ltd was appointed by Savannah Environmental (Pty) Ltd to undertake a Scoping Level Assessment for a proposed Thermal Power Dual Fuel Facility (hereafter referred to as the project).

2 SPECIALIST TEAM INTRODUCTION

Report author: Dr Theresa (Terri) Bird, Pr. Sci. Nat., PhD (University of the Witwatersrand)

Dr Terri Bird holds a PhD from the School of Animal, Plant and Environmental Sciences, University of the Witwatersrand, Johannesburg. The focus of her doctoral research was on the impact of sulfur and nitrogen deposition on the soil and waters of the Mpumalanga Highveld. Since March 2012 she has been employed at Airshed Planning Professionals (Pty) Ltd. In this time, she has been involved in air quality impact assessments for various mining operations (including coal, mineral sand, diamond and platinum mines); coal-fired power station ash disposal facilities; waste incineration and landfilling; and power generation facilities using fuels such as coal, diesel, LPG, natural gas, and biogas from anaerobic digestion. She has been a team member on the development of Air Quality Management Plans, both provincial and for specific industries. Recent projects include assessing the impact of Postponement and/or Suspension of Emission Standards for various Listed Activities.

Report reviewer: G P Petzer (Pr Eng), BEng (Chem. Eng.), University of Pretoria

Gillian Petzer holds a bachelor's degree in chemical engineering from the University of Pretoria. Her experience in air quality started in 2000 with the "Indoor Air Quality" division of Building Research Establishment (BRE) in the UK. She started with air quality impact assessments at Airshed in 2003. She has been involved in several EIA projects and has conducted specialist studies for air pollution impact components of EIAs. Over the last decade Gillian Petzer has been actively involved in the development of atmospheric dispersion modelling and its applications, air pollution compliance assessments, health risk assessments, mitigation measures, development of air quality management plans, as well as meteorological and air quality monitoring programmes. Whilst most of her working experience has been in South Africa, a number of investigations were made in countries elsewhere, including Botswana, Equatorial Guinea, Eritrea, Ghana, Guinea, Kenya, Mauritania, Mozambique, Namibia and Nigeria.

3 DESCRIPTION OF PROPOSED PROJECT

The development of a hybrid facility consisting of a fully dispatchable, dual fuel (liquid or gas) thermal generation plant that will operate in combination with the authorised Hyperion PV Solar Energy Facility (SEF) complex. The power generated by the thermal facility and authorised Hyperion PV facility complex will connect via an overhead 132 kV power line to the existing Eskom Kalbas substation. The thermal generation plant will include the following infrastructure:

- gas turbines or reciprocating engines;
- access road;
- truck entrance and parking facility;
- regasification plant and fuel preparation plant;
- dry cooling system for operating oils/chemicals;
- fuel off-loading facility;
- fuel storage facility (~4 000 m³ diesel and/or ~5 500 m³ for LPG);
- water demineralisation plant; and,
- substation, cabling, O&M building, fencing, warehouses and workshops.

The thermal power facility will have a generating capacity of 75 MW, where the generating capacity and fuel storage will trigger the need for an Atmospheric Emissions License (AEL) under the following Listed Activities (as per Section 21 of the National Environmental Management: Air Quality Act (Act no 39 of 2004)). The exact listed activity category will be dependent on the final technology and fuel type choices:

- **Liquid Combustion Installations** (Subcategory 1.2) – Liquid fuel combustion used primarily for steam raising or electricity generation (more than 50 MW heat input per unit) applicable during normal operation of gas turbines using diesel.
- **Gas Combustion Installations** (Subcategory 1.4) – Gas combustion used primarily for steam raising or electricity generation (more than 50 MW heat input per unit) applicable for gas turbines operating using LPG.
- **Reciprocating Engine Installations** (Subcategory 1.5)– Liquid and gas fuel stationary engines used primarily for electricity generation (more than 10 MW heat input per unit) applicable during normal operation using diesel or LPG with gas engines.
- **LPG or Diesel Storage** – The storage and handling of petroleum products within permanent immobile liquid tanks larger than 1000 m³ in total triggers Subcategory 2.4.
    - Subcategory 2.4 NMES distinguishes between petroleum products with various vapour pressures. The vapour pressure of LPG is above 91 kPa. However, LPG is in a liquid phase as a result of the application of pressure or low temperatures for the purposes of storage and transport and would not be liquid at room temperature and pressure. The constituents of LPG (predominantly propane) are non-volatile[1].
    - Diesel, however, is liquid at room temperature and contains volatile constituents, requiring a Type 1 storage tank.

The primary goal of the Project is to assist in providing additional capacity to Eskom as a response of the Risk Mitigation procurement process when there are grid constraints. It is also intended to reduce the carbon footprint of the electrical grid under operation by Eskom merging thermal with solar hybrid solutions. The location has been chosen for its abundant solar resources.

[1] US EPA Compendium Method TO-14A https://www3.epa.gov/ttn/amtic/files/ambient/airtox/to-14ar.pdf (accessed 24-07-2020)

4 DESCRIPTION OF STUDY AREA

The project's proposed location is on the Remainder of Farm Lyndoch 432 (with the access road affecting Portion 1 of Farm 464) 15 km north of Kathu in the Northern Cape Province (Figure 1). There are 17 individual homesteads within 10 km of the proposed facility, while nearby residential areas include Kathu (south), Deben (west), and Sesheng (south west).

The aim of this investigation was to determine baseline air quality conditions, delineate potential sensitive receptors and identify potential impacts to air quality that may arise from the proposed project; all of which will form the basis for the air quality impact assessment to be conducted.

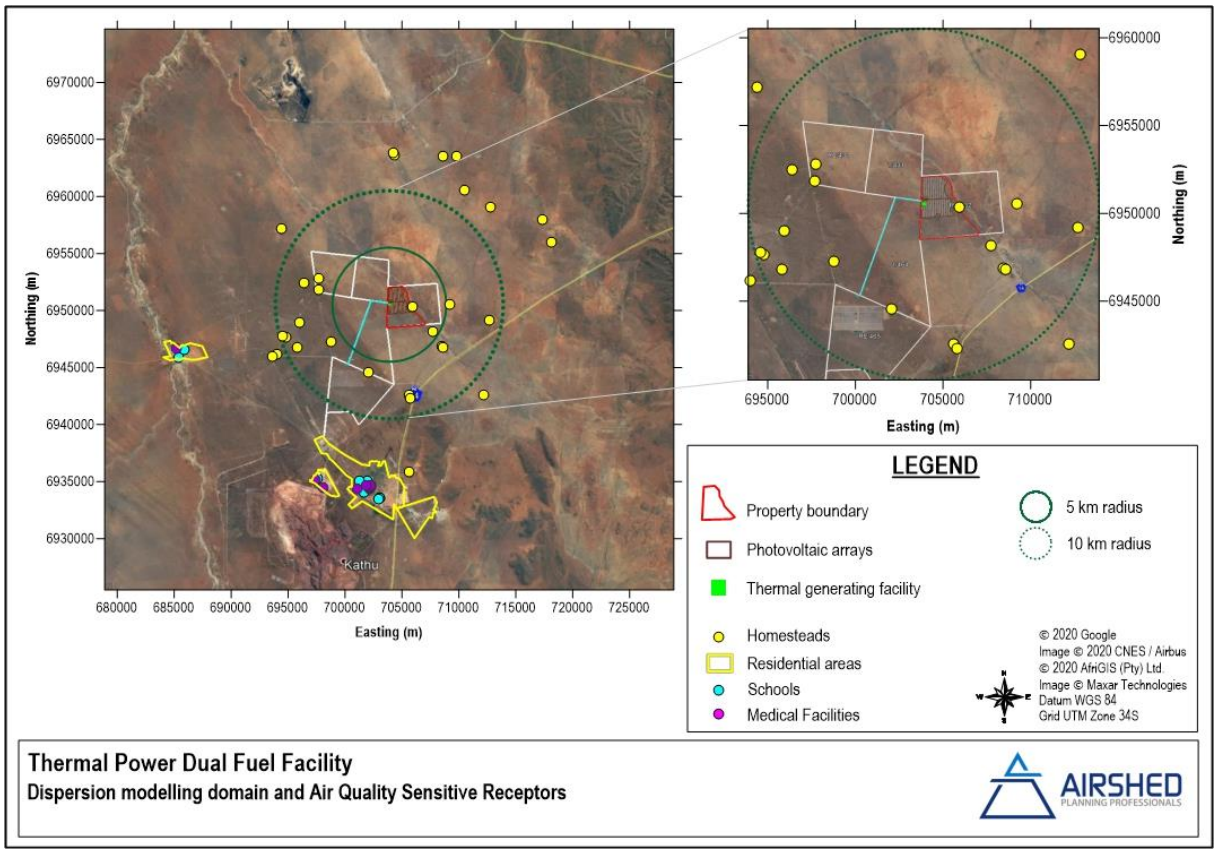

Figure 1: Locality map showing proposed project site and nearby AQSRs

Existing pollutant sources in the vicinity include: wind-blown dust from exposed or unvegetated areas; fugitive particulate matter entrainment by vehicles travelling on paved and unpaved roads; iron-ore and manganese mining in the vicinity; and, construction of solar power facilities. Existing monitoring networks in the area show that baseline ambient particulate concentrations are elevated in Kathu and Sesheng (Figure 2).

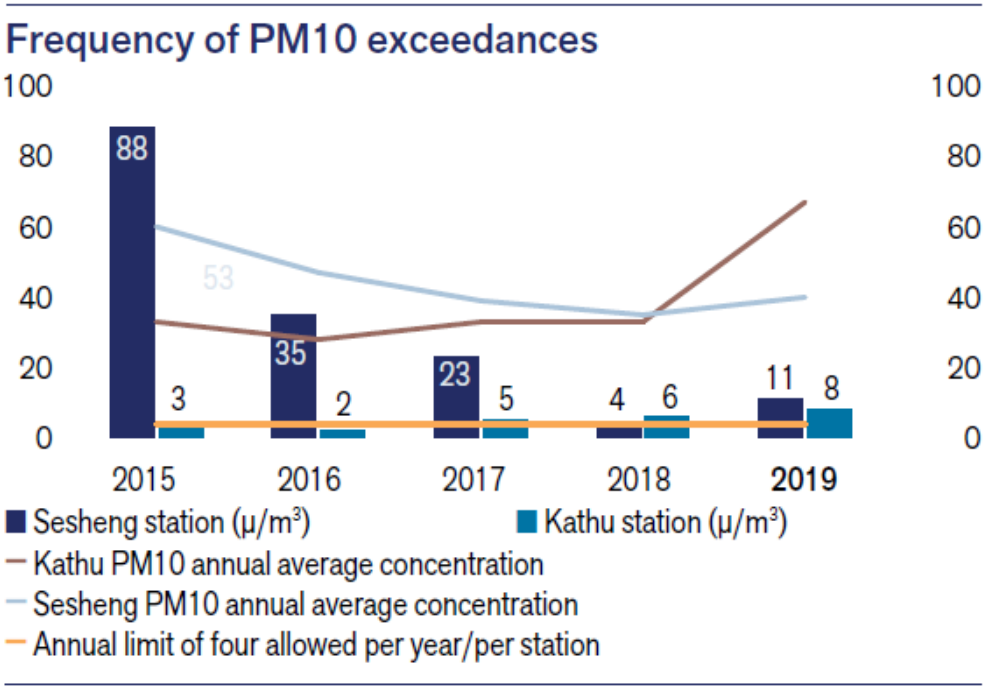

Figure 2: Ambient PM_{10} (daily frequency of exceedance and annual average) concentrations in Kathu and Sesheng[2]

The period, day, and night-time wind roses (Figure 2) depict the predominance of the northerly, north-easterly, and north-westerly winds, however wind direction can be variable. Wind speeds are frequently above 4 m/s and rarely calm (when the wind speeds are lower than 1 m/s). Impacts as a result of the project are expected to be south-west.

[2] AngloAmerican Kumba Iron Ore Limited, Sustainability Report 2019, https://www.angloamericankumba.com/investors/annual-reporting/reports-archive/2019 , accessed 29-09-2020

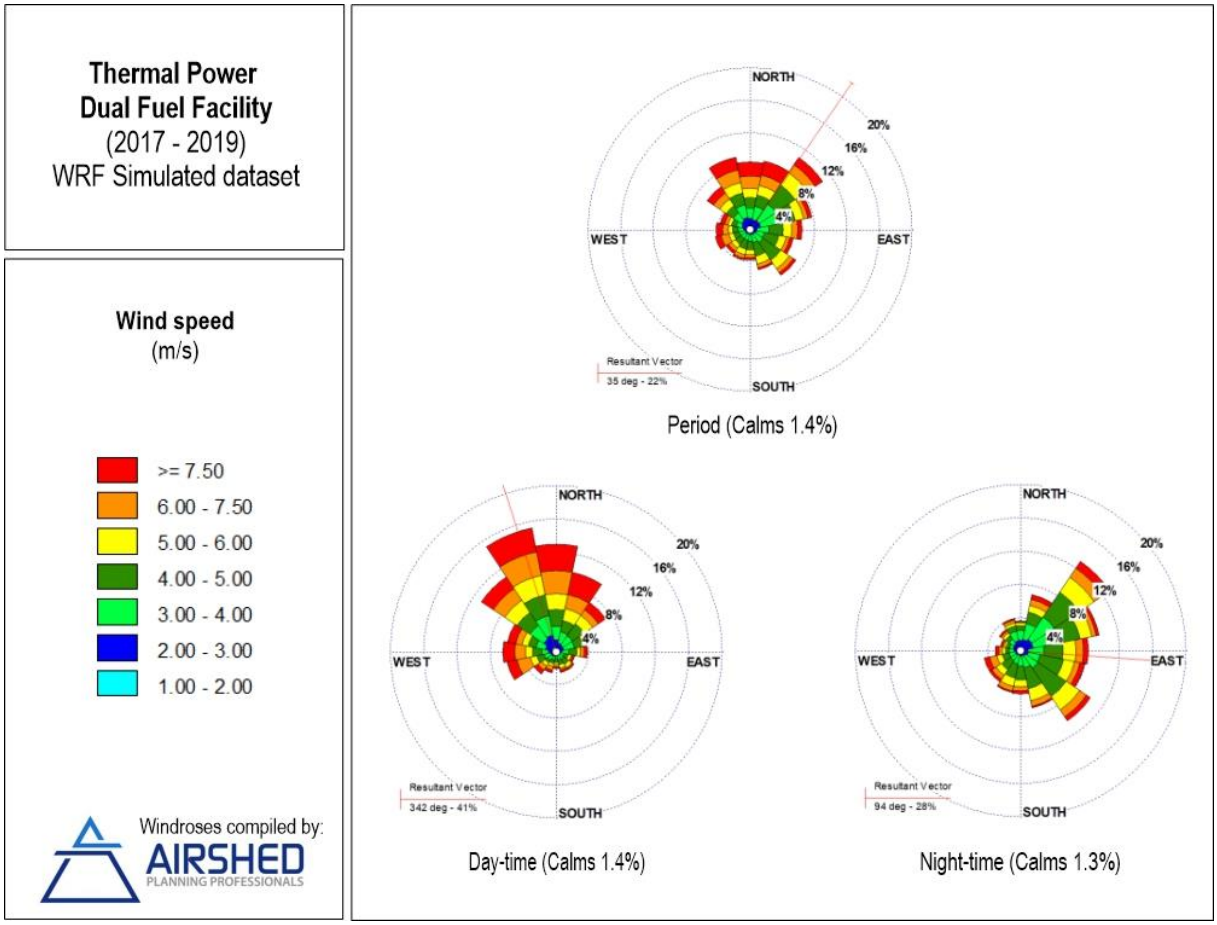

Figure 3: Period, day- and night-time wind rose for the proposed project location for the period 2017 - 2019

Potential impacts form the proposed project include:

- Fugitive particulate matter and vehicle exhaust emissions during the construction phase.
- Elevated concentrations of gaseous pollutants (such as, sulfur dioxide, nitrogen dioxide, carbon monoxide) during the operational phase, from the combustion facility and from delivery-vehicle exhaust gases.
- Elevated particulate concentrations as a result of the combustion facility, from delivery-vehicle exhaust, and from entrainment along the paved access road.

5 SCOPING PHASE IMPACT ASSESSMENT

The purpose of the Scoping Report is to identify the main issues and potential impacts of the proposed project based on a desktop assessment of existing information. The impact assessment methodology provided by Savannah Environmental was used to summarise the potential impacts of the construction (Table 1) and operation phases (Table 2) of the proposed project. It should be noted that this is a preliminary assessment based on the information available during the Scoping Phase. The assessment will be updated during the Impact Assessment Phase.

Table 1: Expected Potential Impact Associated with the Construction of the project at the Scoping Phase

Nature: Elevated ambient concentrations of particulate and gaseous atmospheric pollutants as a result of construction activities.		
	Without mitigation	**With mitigation**
Extent	Local (1)	Local (1)
Duration	Short-term (2)	Short-term (2)
Magnitude	Minor (2)	Minor (2)
Probability	Probable (3)	Probable (3)

Significance	**Low (15)**	**Low (15)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: Impacts from these activities can, through good housekeeping practices, be limited to a local extent.		
Cumulative impacts: Bulk earth works and vehicle activity on-site will result in cumulative local impacts, with possible non-compliance with the NAAQS[3] near site within the industrial area but not at sensitive receptors.		
Residual Risks: With mitigation, construction activities are not likely to result in a significant change to current levels.		
Gaps in knowledge & recommendations for further study The duration and scale of construction activities is expected to last between 14 and 20 months over the 5 ha area for the proposed facility. Construction impacts will be assessed during the EIA phase. Relevant information required includes: expected fuel use; vehicle types, activity patterns and on-site road usage; and, full extent of bulk earthworks.		

Table 2: Expected Potential Impact Associated with the Operation phase of the project at the Scoping Phase

Nature: Elevated ambient concentrations of gaseous atmospheric pollutants as a result of operational activities (LPG or diesel combustion in turbine units or reciprocal engines).		
	Without mitigation	**With mitigation**
Fuel type	**Diesel**	**LPG**
Extent	Surrounding farm portions (2)	Surrounding farm portions (2)
Duration	Long-term (4)	Long-term (4)
Magnitude	Low (4)	Low (4)
Probability	Probable (3)	Probable (3)
Significance	**Medium (30)**	**Medium (30)**
Status (positive or negative)	Negative	Negative
Reversibility	Low	Low
Irreplaceable loss of resources?	Yes	Yes
Can impacts be mitigated?	Yes	Yes
Mitigation: No additional mitigation is expected to be needed if the combustion facility complies with NMES.		
Cumulative impacts: Cumulative impacts are expected (to a limited extent) due to other sources in the vicinity.		
Residual Risks: Operational activities are not likely to result in a significant change from current levels.		
Gaps in knowledge & recommendations for further study As far as the specialist is aware, existing monitoring in the area do not include gaseous pollutants (sulfur dioxide, nitrogen dioxide, and carbon monoxide). Atmospheric dispersion modelling will be used during the EIA phase to assess the extent of the impact of the proposed facility. Cumulative impacts may not be able to be quantified for the gaseous pollutants due to the knowledge gap. However, due to the types of existing sources, the baseline concentrations of these pollutants are not expected to be elevated.		

6 PLAN OF STUDY FOR THE AIR QUALITY IMPACT ASSESSMENT

Task	Description
1	**Information review and collation:** This will include desktop impact study with: ○ A review and identification of legal requirements pertaining to air quality. ○ Establishment of the background information on dust fall, PM_{10}, and $PM_{2.5}$.
2	**Study of the receiving atmospheric environment.** A desktop study of the receiving atmospheric environment (baseline) incl.: ○ The identification of air quality sensitive receptors. ○ An analysis of site-specific atmospheric dispersion considering local meteorology, land-use and topography; and. ○ Analysis and assessment of existing (baseline) ambient air quality data (if available). Any available on-site/near-site ambient monitoring data would be sourced from monitoring networks in the vicinity.
3	**Meteorological modelling, including input data analysis and preparation.** This will consist of acquisition and processing of meteorological data such as ○ Surface wind field ○ Temperature

[3] National Ambient Air Quality Standards

Task	Description
	○ Rainfall This data will be acquired from a simulated (Weather Research and Forecasting model) dataset for the proposed site.
4	**Establishment of the facility's emissions inventory** A review of the entire process and assignment of emission factors at each stage of the process will be done. Assignment of USEPA and /or Australian emission factors will help in the completion of the inventory. Information needed to estimate the furnace emissions will include; ○ Stack parameters (Height, diameter, stack gas exit temperature, gas exit velocity or flow) ○ The emissions will be based on the minimum emissions standards (MES) for the potential subcategories (identified in Section 3).
5	**Atmospheric dispersion simulations (AERMOD)** Dispersion modeling will be done according to the regulations.
6	**Human inhalation health risk screening, compliance and impact assessment** The compliance assessment for the project should conform to ○ NAAQS ○ NDCR ○ Where South African Standards are not available, IFC, WHO and other international guidelines will be used.
7	**Impact report and management plan for EIA (draft and final)** An impact report, that conforms to Appendix 6 of the 2014 EIA regulations will be drafted.
8	**Completion and review of technical sections of AEL**