

**Our reference:** 19SAV20 – RBGP2 400 MW AEL Rev 4

16 September 2020

**Your reference:** SE2795

Savannah Environmental (Pty) Ltd  
P.O. Box 148, Sunninghill, 2157  
1st Floor, Block 2, 5 Woodlands Drive Office Park,  
Woodlands Drive, Woodmead, 2191

**Attention:** Gideon Raath

**Specialist Opinion Letter Regarding the Part II Substantive Amendment Process of the Authorised Project DEA Ref: 4/12/16/3/3/2/867**

Dear Gideon

The following opinion is applicable to the project with valid environmental authorisation (DEA Ref: 4/12/16/3/3/2/867) the development and operation of a 400 MW gas-to-power station in Zone 1F of the Richards Bay Industrial Development Zone (IDZ). Richards Bay Gas Power 2 (Pty) Ltd – the project developers – intend to propose changes to the gas-to-power plant design and operation that require a Part II Substantive Amendment Process of the valid Environmental Authorisation (EA).

Airshed Planning Professionals (Pty) Ltd was appointed by Savannah Environmental (Pty) Ltd to provide a professional opinion in support of the proposed amendments, specifically as it relates to air quality.

Updated site layouts and project background documentation were provided (by Savannah Environmental) and reviewed as a basis for the opinion provided below.

### **GAS TO POWER PLANT DESIGN**

The authorised power plant design was based on a combined cycle generation process of 300 MW (fuelled by diesel and liquified petrol gas (LPG) during Phase I of operation with a conversion to liquified natural gas during Phase II of operation) with another 100 MW generated through heat recovery. The EA authorises six (6) gas turbines for mid-merit/peaking plant power provision, with two (2) steam turbines utilising the heat from the engines in a separate steam cycle. The EA details multiple engine halls, each of ~60 MW containing one engine. Stack heights associated with the engine halls may be up to 20 m tall. On-site fuel storage was provided for by three (3) diesel storage tanks of 2 000 m<sup>3</sup> capacity each.

The assessment of impact of the original facility design was conducted by uMoya-NILU (2016<sup>1</sup>) where the impact of operation of the gas to power plant was deemed to be *low* without and including mitigation (Table 1).

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<sup>1</sup> uMoya-NILU (2016): Atmospheric Impact Report in support of the EIA for the Proposed Gas to Power Plant in Zone 1F of the Richards Bay IDZ, Report No. uMN052-2013, April 2016.

**Table 1: Summary of air quality impacts during operation of the proposed Gas to Power Plant – applicable to all operational scenarios – Original facility design**

|   |  |  |
|---|--|--|
| <b>Nature:</b> Air quality impacts are caused by the inhalation of SO <sub>2</sub> , NO <sub>2</sub> , PM <sub>10</sub> , CO and benzene, which are contained in emissions from the proposed Gas to Power Plant. The inhalation of the SO <sub>2</sub> , NO <sub>2</sub> , PM <sub>10</sub> , CO and benzene at concentrations exceeding health-based air quality standards; and which are greater than the permitted number of exceedances per year, will result in negative health impacts. |  |  |
|   | <b>Without mitigation</b>                      | <b>With mitigation</b>                         |
| <b>Extent</b>   | Limited to site and immediate surroundings (1) | Limited to site and immediate surroundings (1) |
| <b>Duration</b>   | Long term (4)                                  | Long term (4)                                  |
| <b>Magnitude</b>  | Low (4)  | Low (4)  |
| <b>Probability</b>  | Probable (3)                                   | Probable (3)                                   |
| <b>Significance</b>   | <b>Low (27)</b>                                | <b>Low (27)</b>                                |
| <b>Status (positive or negative)</b>  | Negative                                       | Negative                                       |
| <b>Reversibility</b>  | High   | High   |
| <b>Irreplaceable loss of resources?</b>   | No   | No   |
| <b>Can impacts be mitigated?</b>  | Yes  | N/A  |
| <b>Mitigation:</b> NO <sub>x</sub> control mechanisms - water-steam injection/lean-premix mechanism   |  |  |
| <b>Cumulative Impacts:</b> Yes  |  |  |
| <b>Residual Impacts:</b> No   |  |  |

The following amendments are relevant to the project:

1. A validity extension of the EA for an additional five (5) years;
2. An update to the capacity and configuration of the power plant in the EA project description from: '300 MW (fuelled) and 100 MW (steam) in a combined cycle', to: 'a 400 MW (fuelled) simple cycle process'.
3. The removal of various infrastructure which would become redundant with the use of a simple cycle process mentioned in the project description of the EA, which relate to a combined cycle (that are no longer applicable if amendment 2 is approved).
4. To include in the project description of the EA the use of Liquefied Natural Gas (LNG), Liquefied Petroleum Gas (LPG), Regasified Liquefied Natural Gas (RLNG) or pipeline gas as the fuel source (as assessed for the approved EA) for the project in addition to the specification of LNG (in various forms) in future (also as approved in the EA).
5. The removal of diesel as a fuel source from the project description of the EA.
6. The specification of up to 10 000 m<sup>3</sup> of fuel storage which will be required for the power station – this is an increase from the approved 6 000 m<sup>3</sup>, up to a maximum storage capacity of 10 000 m<sup>3</sup>. The size of the tanks to be used will be confirmed in the final design of the facility.
7. A replacement of the one reference of the word 'peaking' in the EA to correctly reflect 'Mid-Merit/Peaking', to ensure that both peaking and mid-merit options/scenarios have been considered for the development consistently throughout the EA.
8. A correction on the EA to specify Activity 2 of Listing Notice 2 in the EA.
9. Amendment to conditions 14,15,16 and 17 of the approved EA to specify that the layout submitted and EMP submitted have been approved.

Of the project amendments listed above, the power station configuration (simple cycle); fuel choice (LPG with option to later convert to natural gas); and, LPG storage have relevance to air quality.

The gas to power plant developers (Richards Bay Gas Power 2 (Pty) Ltd) intend to change the fuel source and technology type used in the facility to deploy a 400 MW simple cycle generation process with no heat recovery. The initial fuel is LPG which can, in the future be replaced, by liquefied natural gas (LNG), regasified LNG, or natural gas supplied via a pipeline. With the intended fuel source change, the diesel storage tanks would be replaced with LPG storage pressure vessels



(individual capacity to confirmed in final designs), with 8 loading bays. Small quantities of diesel (<10 m<sup>3</sup>) will be stored on-site for black start generators. Small quantities of various oils, used for heating the LPG, will also be used and stored on site. The facility footprint will not change with this amendment. The facility will use six (6) gas turbines for mid-merit power provision with single stacks per turbine and emission release height of 18 m.

The effects of these amendments relating to air quality are discussed below.

## IMPACT OF PROPOSED AMENDMENTS

The proposed facility amendments will influence operational atmospheric emissions through the: choice of fuel (LPG instead of diesel) and the quantity of fuel used to generate 400 MW via a simple cycle gas turbine; as well as, the storage of fuel (LPG pressure vessels compared with fixed-roof diesel tanks).

For comparative purposes, atmospheric emissions from the various plant options considered were provided by the turbine manufacturer's (PWPS) assuming the selected turbines (FT4000® SWIFTPAC® 120) ran on liquid fuel (diesel), LPG or natural gas (Table 2). The emission rates for the of criteria atmospheric pollutants<sup>2</sup> from the amended plant are likely to be lower for SO<sub>2</sub>, NO<sub>x</sub>, PM and VOCs than the original plant design even though the fuelled generative capacity will be higher than the originally authorised capacity (Table 2). The impact of the amended plant on ambient air quality is therefore likely to be similar to or lower than originally assessed by uMoya-NILU.

On-site storage of LPG will be bullet-style pressure vessels that will be mounded in sand bed foundations. The pressure vessels are required to keep the LPG in a liquified state. If properly maintained, fugitive losses from the LPG loading and storage are only likely to take place during unloading events from the transport tankers, where losses are expected to be negligible if adequately controlled<sup>3</sup>. Fugitive losses from diesel tanks include working losses (loading / unloading) as well as breathing losses from safety release vents<sup>4</sup>. Although, the on-site storage capacity is proposed to increase relative to the authorised quantities (6 000 m<sup>3</sup> diesel vs a maximum of 10 000 m<sup>3</sup> LPG), the fuel type and conditions of storage will result in emission rates that will be similar to or lower than the original plant design assessed.

## AVOIDANCE, MANAGEMENT AND MITIGATION OF IMPACTS

The monitoring of emissions from the gas engines (turbines) will be mandated within the Atmospheric Emissions License (AEL) when issued. A minimum of one annual measurement campaign will be required where the measurement methodology will also be stipulated in the AEL. The conditions of the AEL should be included in the Environmental Management Programme (EMPr).

To minimise losses from the LPG loading and storage facility during loading and via leaks, additional management measures should include regular maintenance and monitoring of all LPG loading and storage equipment. A Leak Detection and Repair (LDAR) programme should be included in the EMPr. Should the fuel change to natural gas (in any form) the LDAR programme should continue.

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<sup>2</sup> Criteria Pollutants as per Section 21 of the National Environmental Management: Air Quality Act Section 21 for Gas Combustion Installations larger than 50 MW.

<sup>3</sup> US EPA (1993) Emission Factor Documentation for AP-42 Section 1.5 Liquified Petroleum Gas Combustion

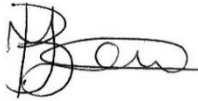
<sup>4</sup> US EPA (2020) AP-42 Section 7.1, Organic Liquid Storage Tanks (<https://www3.epa.gov/ttn/chief/ap42/ch07/index.html>)



## ASSESSMENT OF IMPACT DUE TO AMENDED FACILITY

The proposed changes are likely to have a zero or negligible effect on the significance of impacts identified in the EIA report. Therefore, ratings as per Table 1 apply to the amended plant.

Yours sincerely,



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(PhD, Wits)(Pr.Sci.Nat)  
**Senior Consultant**



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Gillian Petzer  
(Pr. Eng.) (BEng Chem, University of Pretoria)  
**Principal Consultant**



**Table 2: Comparative emissions between fuel types**

| Fuel source                | Net capacity per gas turbine (MW) | Emission concentration (mg/Nm <sup>3</sup> ) <sup>(d)</sup> |                 |           |    |     | Total Plant generating capacity (MW) | Plant total emission rate (kg/hour) <sup>(e)</sup> |                 |                   |     |     |
|----------------------------|-----------------------------------|---|-----------------|-----------|----|-----|--------------------------------------|--|-----------------|-------------------|-----|-----|
|                            |                                   | NO <sub>x</sub> as NO <sub>2</sub>                          | SO <sub>2</sub> | PM        | CO | VOC |                                      | NO <sub>x</sub> as NO <sub>2</sub>                 | SO <sub>2</sub> | PM <sup>(f)</sup> | CO  | VOC |
| LPG <sup>(a)</sup>         | 132.8                             | <b>50</b>   | 0.61            | <b>10</b> | 75 | 2.9 | 400                                  | 158  | 1.5             | 25.3              | 231 | 9.7 |
| Natural gas <sup>(b)</sup> | 134.3                             | <b>50</b>   | 1.79            | <b>10</b> | 75 | 2.9 | 400                                  | 157  | 5.2             | 25.3              | 229 | 9.6 |
| Liquid fuel <sup>(c)</sup> | 132.6                             | 84  | 0.60            | 20        | 14 | 3.6 | 300                                  | 130  | 1.1             | 23.5              | 34  | 9.2 |

**Notes:**  
a – LPG more than 90% propane.  
b – Natural gas as liquified natural gas (LNG), regasified LNG, or natural gas supplied via a pipeline  
c – Liquid fuel as diesel  
d – Provided by PWPS Original Equipment Manufacturer of the FT4000@ SWIFTPAC@ 120  
e – Plant total emission rates calculated by Ken Gafner, Single Destination Engineering based on information from PWPS  
f – Particulate Matter emission rates not provided by PWPS. Estimated rates were based on site and plant engineering design parameters provided by the developers and engineers.  
All values have reference point temperature of 25°C and 61% relative humidity for comparison.  
Bold text indicates where design emission concentrations are the same as the Minimum Emission Standards (MES) for gas-fired combustion installations (NEM:AQA Section 21 Subcategory 1.4). Only NO<sub>x</sub>, SO<sub>2</sub>, and particulate matter are controlled under Section 21 Subcategory 1.4.

