CONVERSION OF THE ATLANTIS POWER STATION OPEN CYCLE GAS TURBINE (OCGT) UNITS TO COMBINED CYCLE GAS TURBINE (CCGT) UNITS

Air Pollution and Noise Impact Assessment: Scoping

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1. INTRODUCTION

Savannah Environmental (Pty) Ltd has appointed DDA in order to provide input regarding air pollution and noise to the Scoping and Environmental Impact Assessment (EIA) phases of the conversion of the Atlantis Power Station Open Cycle Gas Turbine (OCGT) units to Combined Cycle Gas Turbine (CCGT) units.

This scoping report identifies the air pollution- and noise-related issues and impacts that are likely to occur in the surrounding environment and suggests the approach to their assessment in the EIA phase. The main aims of the air pollution and noise scoping study are outlined below:

Air Pollution

- Describe the environment that may be affected by the proposed activity;
- Identify all the relevant air quality legislation and guidelines that have been considered in the preparation of the scoping report;
- Highlight potential air pollution impacts that should be investigated further during the EIA process.
- Describe the methodology to be followed for the assessment of the air quality impacts in the EIA phase.

Noise

- Describe the noise environment that may be affected by the proposed activity;
- Identify all related noise legislation and guidelines that have been considered in the preparation of the scoping report;
- Highlight potential noise impacts that should be investigated further during the EIA process.
- Describe the methodology to be followed for the assessment of the noise impacts in the EIA phase.

2. STUDY AREA AND EMISSION SOURCES

2.1 Study Area

The Ankerlig Power Station is situated on the western side of the Atlantis Industrial Zone (see Figure 2-1). This area is located 7 km inland from the Cape West Coast, approximately 40 km north of Cape Town. The existing Ankerlig Power Station is approximately 10 km northeast of Eskom's Koeberg Nuclear Power Station.

Potentially sensitive receptors within the study area include:

- The residential township of Atlantis;
- The informal settlement of Witzand;
- Open farmlands around the power station site.

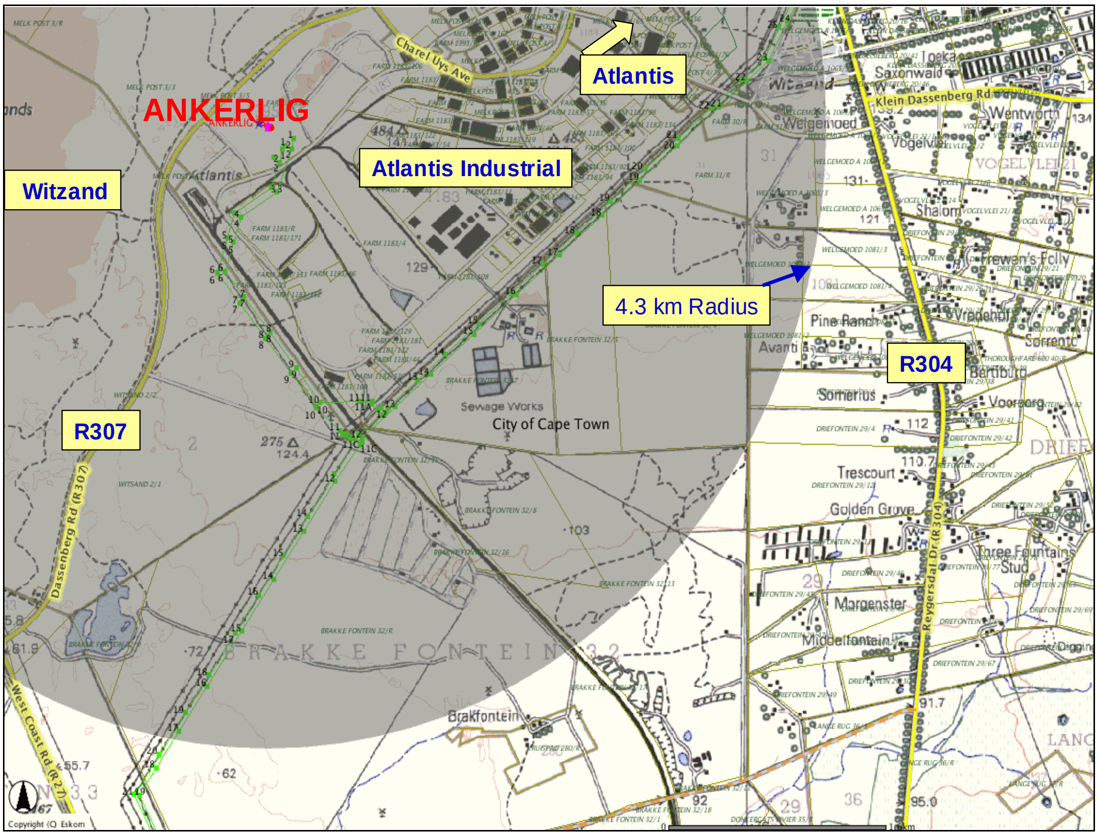

Figure 2-1. Ankerlig Power Station Locality Map

2.2 Air Pollution Emission Sources

The Ankerlig Power Station upgrade project entails the conversion of the 9 open cycle gas turbine (OCGT) units (4 existing units and 5 that are currently under construction) to combined cycle gas turbine (CCGT) units.

The main air pollution sources have been identified as:

- The various construction activities during the construction phase.
- The turbine combustion emissions during the normal operation phase.
- The turbine combustion emissions during start-up and upset conditions.

The type of emissions are not expected to change from those generated by the 9 OCGT units, since instead of being released into the atmosphere after the turbines, the same gases will pass through a heat recovery system and then be released.

The only variations to the OCGT emissions will be the different release heights of the new stacks and the temperature of the emitted gases.

These changes could have a small additional negative impact increase at certain distances from the power station. These impact changes will be assessed in detail in the EIA phase.

2.3 Noise Emission Sources

The conversion of the Ankerlig Power Station units from open cycle to combined cycle gas turbine will introduce additional noise sources, since the gases will have to pass through a new heat recovery steam generator (HRSG) system after the gas turbines. This process will increase the efficiency of the power station. The main noise sources have been identified as:

- The construction equipment and activities during the construction phase.
- The equipment during the operational phase such as:
  - the air filters;
  - the gas compressor;
  - the gas turbine;
  - the generator;
  - the electricity transformers;
  - the stacks;
  - the heat recovery equipment;
  - the steam generator;
  - the steam turbine; and
  - the air-cooled condenser system associated with the dry-cooling system.

It is understood that the new equipment will potentially be sheltered by an appropriately designed noise enclosure, in order to reduce the noise emissions to the environment and ensure compliance with relevant legislation and guidelines. The information regarding the reduction efficiency and the noise emissions will be obtained by the design engineers and included in the assessment within the detailed EIA phase. The noise sources will then be used in a noise model in order to calculate the resulting noise levels around the power station and assess the impacts. This detailed assessment will be performed in the EIA phase.

3. NATURE AND EXTENT OF AIR POLLUTION IMPACTS

3.1 Air Quality

3.1.1 Construction

Dust will be generated through the various construction activities of the proposed CCGT power station. The greatest impact of the dust will be limited to the immediate vicinity of the proposed site. With appropriate mitigation, such as dust suppression, this impact can be of low significance. Air pollution impacts arising from exhaust emissions during construction are expected to be of short duration and local extent. The air pollution impacts associated with these activities are anticipated to be small and, therefore, need not be modelled.

Operation

The exhaust emissions during normal operation, start-up and upset conditions can have a negative impact on the air quality of residential townships in close proximity to the power station. Potential impacts on human health could potentially occur where people live in close proximity to the power station site. The duration of these impacts will be long-term, i.e. for the lifespan of the project, and their extent will be assessed in the EIA.

It should be noted that the utilisation of natural gas instead of diesel is currently under investigation. Should this fuel change occur, it is expected that the operational impacts will be reduced dramatically, since natural gas has much lower SO_2, CO and particulate emissions than diesel. The emission reductions due to the fuel conversion will be estimated and the impact reductions assessed in the detailed EIA.

Air pollution impacts associated with emissions from fuel storage tanks are anticipated to be small since the utilised fuel is diesel, and if the storage tanks have vapour recovery systems, they therefore need not be included in the modelling.

3.1.2 Noise

Construction

Noise associated with construction activities is generally of local extent and short duration. The construction operations are not expected to have any significant impact on the nearest communities in Atlantis. The noise impact therefore is expected to be of low significance. The noise impact of the construction activities will be determined in the detailed EIA phase.

Operation

The introduction of additional noise sources could have additional impacts as a result of the increase of the noise levels within and around the power station site. If the CCGT enclosures, however, are designed appropriately, then the expected cumulative noise increase can be limited. The information of the design engineers and the noise modelling will be utilised in the detailed EIA phase in order to determine the cumulative noise levels.

The duration of the noise impact is expected to be long-term, i.e. for the duration of the operational life of the project. The extent is expected to be of low to medium significance and will be assessed in detail in the EIA phase of the project.

4. EXISTING ENVIRONMENT, LEGISLATIVE CONTEXT AND GUIDELINES

4.1 Meteorology

The climate of Atlantis and the Cape West Coast is similar to Mediterranean countries and is influenced by the effects of the nearby Atlantic Ocean. resulting in warm to hot summers and cool winters. The average daily maximum and minimum temperatures in summer are 27°C and 13°C respectively. In winter, the daily temperatures range between an average maximum of 18°C and an average minimum of 6°C.

Rain occurs predominantly in the winter, and the summer months are generally dry. The average annual rainfall is 466 mm. The month with the highest rainfall is July, with a total of 77 mm, and the driest month is February, with a monthly total of 10 mm.

The predominant wind directions in the area are south-westerly to south-easterly during the spring and summer months, and north-westerly to north-north-westerly during the winter months. The strength of the wind is generally greater during the summer months.

4.2 Air Quality

4.2.1 Existing Air Quality

The existing air quality in the area appears to be relatively good. There are several air pollution sources in the Atlantis Industrial area that could potentially have a negative impact on the ambient air quality. Other sources include vehicular traffic, domestic fires, ploughed fields and non-vegetated land.

There is currently one NOx monitoring station in the area at the Atlantis Hospital Reservoir. This information, together with the available study from the EIA performed for the existing OCGT units, will be utilised in the EIA study in order to assess any potential cumulative impacts.

4.2.2 Relevant Legislation and Air Quality Guidelines

The relevant legislation and guidelines that will be considered in the Air Quality Study are:

- The National Environmental Management Act, Air Quality Act (NEMAQA) (Act No. 39 of 2004).
- The South African National Standard 1929 of 2005, Ambient air Quality – Limits for Common Pollutants.

The Air Quality Act came into effect on 11 September 2005 and replaced the Atmospheric Pollution Prevention (APPA) Act of 1965 (Act No. 45 of 1965). The new Act outlines the South African air quality standards in Schedule 2 and includes margins of tolerance, compliance time frames and permissible frequencies by which the standards may be exceeded.

The South African National Standards (SANS) were established in order to assist the Department of Environmental Affairs and Tourism (DEAT) to develop ambient air quality standards for seven pollutants of concern. These include sulphur dioxide, nitrogen dioxide, carbon monoxide, particulate matter (PM_{10}), ozone, lead and benzene.

The Department of Environmental Affairs and Tourism (DEAT) has published dust deposition criteria for South Africa (DEAT, 2005). SANS has also published dust deposition standards that are based on the cumulative South African dust-fall levels in SANS 1919:2005. Four bands have been developed against which dust fallout can be evaluated. These dust fall-out levels will be taken into consideration for the determination of the levels of nuisance in surrounding communities.

The City of Cape Town Air Pollution Control has also issued a by-law regarding the air pollution control zones, monitoring requirements and impact assessment requirements (By-Law 12649. Provincial Gazette Extraordinary 5979, 4 February 2003).

All of the above-mentioned regulation, guidelines and standards will be taken into consideration for the air quality impact assessment of the EIA phase.

4.3 Noise

4.3.1 Existing Noise Environment

The Ankerlig Power Station is situated on the western border of the Atlantis Industrial area. The areas on the north-western and western sides of the power station are rural, with relatively low levels of noise away from the R27 and R307 roads. Along these, the noise environment is expected to be affected primarily by the vehicular traffic and be much higher than the rural district guidelines.

The existing noise environment in the Atlantis communities is typical of a suburban residential area next to an industrial zone. The noise environment is affected by localised vehicular traffic, human activities and the industrial activities in the Atlantis Industrial Zone. There is, however, an adequate buffer zone between the industries and the Atlantis communities in order to maintain the noise levels within the recommended guidelines for suburban residential areas.

4.3.2 Relative Legislation and Noise Level Guidelines

In the Western Cape, the control of noise is legislated in the form of the Noise Control Regulations of the Environment Conservation Act No. 73 of 1989 as adopted by the Provincial Gazette Number 5309 of 20 November 1998.

These regulations stipulate that for industrial noise the local authority may designate an area as “controlled” if the calculated or measured noise level exceeds 61 dBA and define noise as “disturbing” if it causes the ambient noise level to increase by 7 dBA or more.

In terms of Schedule 3(c) of the Noise Control Regulations: “No person shall make changes to existing facilities or existing use of land or buildings or erect new buildings, if these will house or cause activities that will, after such changes or erection, cause a disturbing noise, unless precautionary measures to prevent the disturbing noise have been taken to the satisfaction of the local authority.”

In terms of Clause 4 of the Noise Control Regulations: "No person shall make, produce or cause a disturbing noise, or allow it to be made, produced or caused by any person, animal, machine, device or apparatus or any combination thereof."

In addition, the South African National Standards (SANS) has issued guidelines for the determination of the noise impact in various districts and the assessment of the expected community response due to changes in the noise environment: SANS Code of Practice 10103:2004 'The measurement and rating of environmental noise with respect to annoyance and to speech communication'. This Code of Practice follows the World Health Organisation (WHO) recommendations and is generally utilised in most EIA studies in South Africa.

The new draft noise control regulations for the Western Cape are currently out for discussion. In these regulations it is stipulated that the maximum allowed noise levels at the boundary of an industrial plant are 70 dBA during daytime and 60 dBA during night-time, in accordance with the guidelines provided in the SANS Code of Practice 10103:2004. For other districts it follows the recommendations of the same Code of Practice (Provincial Gazette No 6412, of 25 January 2007).

The above-mentioned regulations and guidelines will be taken into consideration in the EIA phase for the noise measurements, noise modelling and impact assessment.

5. WAY FORWARD

5.1 Air Pollution

A specialist study will be undertaken in order to determine existing air quality and potential air pollution impacts as a result of the proposed conversion project and to make recommendations for mitigation measures, as well as air quality monitoring if deemed necessary.

The main aims of the air quality study will be:

- The establishment of the dispersion potential of the area utilising localised meteorological data or data from the extended area.
- The establishment of an emissions inventory for dust, total suspended particulates, PM_{10} SO_2, NO_x, CO and CO_2, in which emissions from all project-related activities are quantified under the following conditions:
    a. During construction;
    b. Under normal operations; and
    b. During start-up and upset conditions.
- The estimation of the potential emission reductions due to fuel conversion form diesel to natural gas.
- The prediction of ambient air pollutant concentrations and dust fallout, in terms of dispersion modelling for each of the above-mentioned scenarios. Different climatic conditions for different times of the day and year will be utilised in order to determine the average and worst-case conditions.
- The assessment of the impacts based on comparisons of the resulting concentration against the pre-construction ambient conditions, as well as

against relevant standards and guidelines. The cumulative effect of existing air pollution levels will be taken into consideration in the impact assessment if relevant information is available.

- The identification of emission reduction opportunities and cost-effective emission abatement strategies.
- Provision of recommendations regarding the optimum air quality monitoring positions and the establishment of an air quality monitoring programme, if necessary.

5.1.1 Air Pollution Study Methodology

The emission inventory will be based on emission factors specifically applicable to the different operations of the combined cycle gas turbines (CCGTs), as well as information from the design engineers. The construction emissions will be estimated via utilising internationally acceptable emission inventory methodologies for construction operations.

The selected proposed air pollution dispersion model is the new-generation AEROMOD View, which is a complete and powerful package incorporating into one interface the popular preferred U.S. EPA models: AEROMOD, ISCST3, ISC-PRIME, and AEROMOD-PRIME. These models are used extensively worldwide to assess air pollution concentrations and deposition from a wide variety of industrial sources and are appropriate for point, area, volume, flare and line sources.

Different emission scenarios will be generated for the construction and operational phases of the project. The local meteorological conditions will be parameterised for input into the model and the worst-case scenario maximum concentrations will be generated for each identified emission scenario.

The modelled ambient concentration will take into consideration any possible accumulation effects due to existing sources, if information is available. These results will be compared against South African and International Air Quality Guidelines, such as from the WHO and the World Bank.

5.2 Noise

The noise impact assessment study of the EIA phase will:

- Determine the existing noise levels within and around the perimeter of the power station site, as well as within surrounding communities and sensitive receptors in the extended area.
- Create a representative noise model in order to simulate the noise propagation and determine the resulting noise levels due to the upgrade.
- Determine the noise impacts based on South African legislation and international guidelines.
- Identify potential noise emission reduction opportunities and cost-effective emission abatement strategies.
- Provide recommendations regarding the optimum noise monitoring positions and the establishment of a noise monitoring programme.

5.2.1 Noise Study Methodology

The baseline noise study will be based on noise measurements in accordance with the SANS 10103: 2004 and SANS 10328:2001, or equivalent national or international standards required by Eskom or DEAT.

An initial assessment of the site will be performed, in order to determine the optimum selection of the noise measurement points.

The noise measurements will be made during daytime and night-time hours, in order to generate results comparable to legislation and the Codes applicable at the time of the survey.

All measurements will be A-weighted equivalent sound pressure levels obtained with I-time weighting or those required by the applicable standard. The occurring maximum and minimum levels during the measurement period will also be recorded. Abnormal disturbances, such as loud noise generation in close proximity or sudden noise bursts that affect the measurement, will be discarded.

The internationally recognised 3-dimensional software CADNAA for predicting noise contours from all the noise sources will be utilised in the noise study. This will enable different scenarios to be realised and tested to optimise layouts of potentially noisy activities, the plant and equipment and determine the resulting noise levels in the area.

The model utilises standard and user-defined noise profiles and terrain as inputs. The profile and noise calculation algorithms are based on several guidance documents that address atmospheric absorption and noise attenuation.

The main outputs from the model will be noise exposure contours that are used for land use compatibility mappings and impact assessment. The model supports 16 different predefined noise metrics such as A-Weighted, C-Weighted, and user-defined metrics may also be created from these families.

The noise levels at specific sites, such as dwellings, schools, hospitals or other sensitive locations can also be predicted. For these grid points, the model reports detailed information for the analyst to determine the noise at each location.

The predicted noise levels will then be compared against current legislated limits, as well as local and international guidelines in order to quantify the noise impacts in the surrounding areas. Based on the expected locations with maximum impact, an appropriate noise monitoring programme will be put forward, in order to ensure future compliance with noise guidelines.

REFERENCES

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