INFOTOX (Pty) Ltd

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Retrieval and scientific interpretation of ecotoxicological information

PostNet Suite 112 Private Bag X25723 Monumentpark 0105 SOUTH AFRICA

Tel: 27(12) 346 4668 Fax: 086 513 5478 Cell: 082 416 5864

e-mail: Info@infotox.co.za www.infotox.co.za

Project conducted on behalf of
Savannah Environmental (Pty) Ltd

Rapid Appraisal Health Impact Assessment for the Phakwe Richards Bay Gas Power 3 Combined Cycle Power Plant in Richards Bay

Report No 042-2022 Rev 2.0

Compiled by

MH Fourie PhD MSc Pr Sci Nat (Toxicological Science)
WCA van Niekerk PhD Environmental Toxicologist QEP (USA)
Pr Sci Nat (Environmental Science) (RSA)

3 August 2022

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WCA van Niekerk PhD QEP (USA) Pr Sci Nat (Environmental Science)
Managing Director

3 August 2022

Expertise and Declaration of Independence

This report was prepared by INFOTOX (Pty) Ltd ("INFOTOX"). Established in 1991, INFOTOX is a professional scientific company, highly focused in the discipline of Health Sciences. Both occupational and environmental human health risks, as well as risks to ecological receptors, are addressed.

Dr Willie van Niekerk, Managing Director of INFOTOX, has BSc, Hons BSc and MSc degrees from the University of Potchefstroom and a PhD from the University of South Africa. He is a Qualified Environmental Professional (Environmental Toxicologist QEP), certified by the Institute of Professional Environmental Practice (IPEP) in the USA (No 07960160), and a registered Professional Natural Scientist (Pr Sci Nat, Environmental Science, No 400284/04). Dr Van Niekerk has specialised in chemical toxicology and human health risk assessment, but he has experience in many other areas in the disciplines of analytical and environmental sciences.

Dr Marlene Fourie has BSc and Hons BSc degrees from the University of Stellenbosch and MSc and PhD degrees from the University of Pretoria. Her field of specialisation is reproductive biology/toxicology. Dr Fourie also has an MSc-degree in epidemiology from the University of Pretoria. Following positions as Medical Natural Scientist at the Andrology Unit, Department of Urology, University of Pretoria and the Pretoria Academic Hospital from 1987 to 2001, she joined INFOTOX as a Medical Biological Scientist. Dr Fourie has conducted many health risk assessments and projects relating to the health status of communities. She is registered as a Professional Natural Scientist (Pr Sci Nat, Toxicological Science, No 400190/14).

Dricky Simpson has a higher diploma in Quality Assurance as well as in Medical Technology. Dricky worked in pathology laboratories and she has done research in human toxicology and pharmacology. She also has experience in animal toxicology and pharmacology. During the last fifteen years as Director of INFOTOX she worked in human health risk assessment for a wide range of industries. She is experienced in contaminated site investigations and waste classification.

This specialist report was compiled for Savannah Environmental (Pty) Ltd. We do hereby declare that we are financially and otherwise independent of Savannah Environmental (Pty) Ltd.

Signed on behalf of INFOTOX (Pty) Ltd, duly authorised in the capacity of Managing Director:

Willem Christiaan Abraham van Niekerk

3 August 2022

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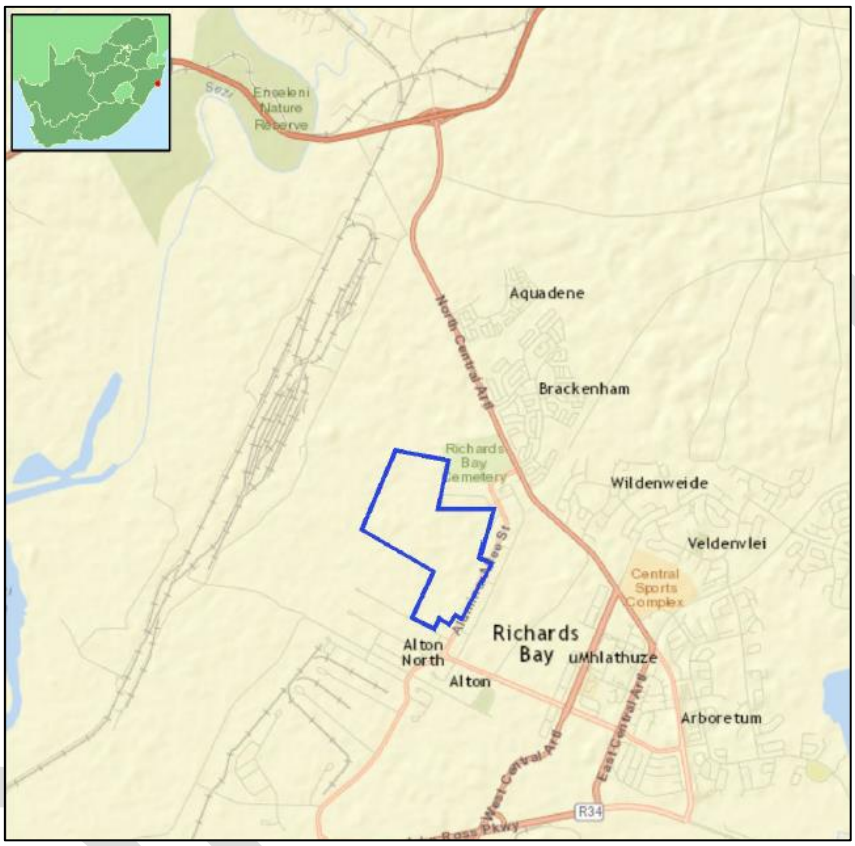
1 Introduction

Savannah Environmental (Pty) Ltd ("Savannah") appointed INFOTOX (Pty) Ltd ("INFOTOX") to conduct a rapid appraisal health impact assessment (RAHIA) for the development of the Phakwe Richards Bay Gas Power 3 Combined Cycle Power Plant and related infrastructure located in Alton North, Richards Bay, within the uMhlathuze Local Municipality (LM) in the uThungulu District Municipality (DM), KwaZulu-Natal. The current General Orientation Map, compiled by Maroga (2020) is presented in Figure 1.1.



Note to Figure: The blue outline represents the proposed project site location.

Figure 1.1: General Orientation Map of the Richards Bay Gas-to-Power project (Maroga 2020).

This document presents the RAHIA, according to the Good Practice guidance of the International Finance Corporation (IFC), a member of the World Bank Group (IFC 2009). INFOTOX is guided, amongst other IFC guidelines, by the *Introduction to Health Impact Assessment*. The RAHIA is based on the following INFOTOX reports presented under separate cover, which should be consulted in conjunction with this RAHIA report:

- Baseline Health Assessment Report for the Rapid Appraisal Health Impact Assessment of the Phakwe Richards Bay Gas Power 3 Combined Cycle Power Plant in Richards Bay. INFOTOX Report No 022-2022 Rev 1.0 (Fourie and Van Niekerk 2022a).

- Human Health Risk Assessment (HHRA) for the Phakwe Richards Bay Gas Power 3 Combined Cycle Power Plant in Richards Bay. INFOTOX Report No 035-2022 Rev 1.0 (Fourie and Van Niekerk 2022b).

2 Study approach

According to the Good Practice guidance of the IFC, a RAHIA is suitable for the Phakwe project, because an influx of people settling in the area, due to the construction and operation of the facility, is not foreseen, as explained in the accompanying INFOTOX report (Fourie and Van Niekerk 2022a). According to the IFC, the RAHIA does not require new health data collection within the communities of concern. Baseline health data on the underlying burden of disease, used to identify specific vulnerabilities that might influence health impacts associated with the proposed power plant operations, are extracted from existing health data sources in a desktop review, presented in the accompanying INFOTOX report (Fourie and Van Niekerk 2022a). The main focus is the health risks in surrounding receptor communities due to the dispersion of substances emitted by the proposed power plant operations (the source of exposure) into air (the pathway of exposure).

In terms of the RAHIA, the geographical study area considered as impacted includes those areas and communities where the proposed developments may have an impact on the environmental quality, particularly through airborne emissions from the project site. The impact of such emissions on air quality has been determined by air dispersion modelling specialists of Airshed Planning Professionals (Pty) Ltd ("Airshed"). Amongst other factors, the specialist takes into account the local topographical and meteorological conditions in the modelling domain (Figure 2.1, provided by Airshed).

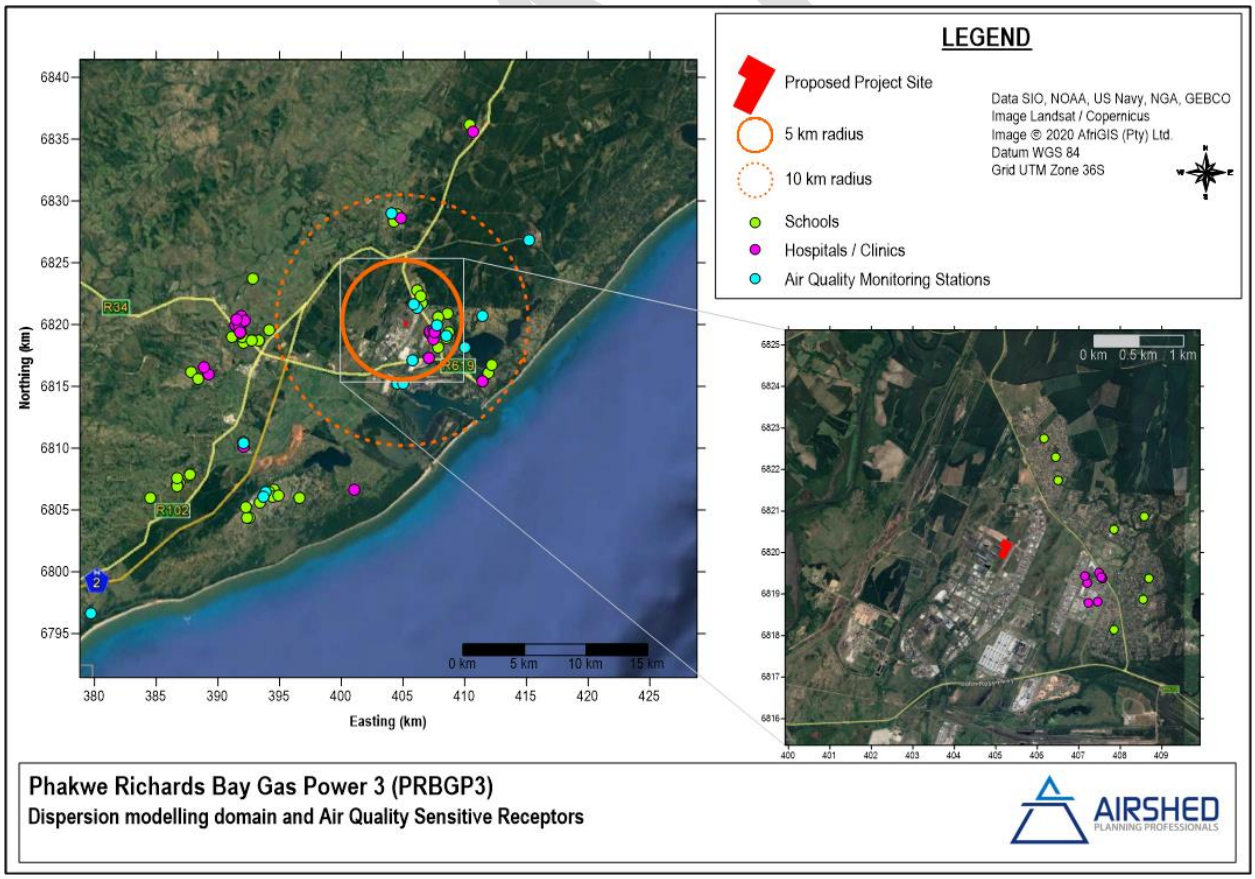


Figure 2.1: Air quality modelling domain of the Phakwe Richards Bay Gas Power 3 combined cycle power plant.

Air dispersion modelling and the results thereof, used by INFOTOX as input into the RAHIA, are described in the Airshed Air Quality Impact (AQI) report (Bird and Von Gruenewaldt 2022).

The ambient air contaminants of concern in the construction phase, identified by Bird and Von Gruenewaldt (2022) are dust falls, modelled as PM10 concentrations due to construction phase emissions. Detailed PM2.5 concentrations for the construction phase were not modelled by Airshed and were thus not assessed in the INFOTOX human health risk assessment (HHRA). However, the air modelling specialists have concluded that the construction phase particulate matter impact area would be limited to the near-site area and mostly to within the Richards Bay Industrial Development Zone (RBIDZ). Furthermore, comparison of the isopleth maps in the AQI report shows that the impact at the closest receptors during the construction phase is similar to the impact in the operational phase. Thus, it can be concluded that the health impact due to particulate matter exposure in the construction phase will also be similar to that in the operational phase.

The ambient air contaminants of concern in the operational phase of the plant are four criteria pollutants, namely, the PM2.5 fraction of airborne inorganic particulate matter, sulfur dioxide (SO_2), nitrogen oxides as NO_2, carbon monoxide (CO), and VOCs (as an unspecified group of substances). These were assessed in detail in the HHRA (Fourie and Van Niekerk 2022(a)).

According to the AQI, for the purposes of assessment of impact, it is assumed that the decommissioning phase would have similar impacts to the construction phase, since activities would be similar. INFOTOX thus assessed health impacts of the decommissioning phase as similar to the construction phase.

The impacts of the Phakwe power plant construction, operations and decommissioning are assessed based on impact assessment criteria provided by Savannah.

3 Impact assessment

3.1 Methods and criteria

The criteria for the assessment of impacts on the receptor communities are stipulated by Savannah as follows:

The nature, which shall include descriptions of what causes the effect, what will be affected and how it will be affected.

The extent, wherein it will be indicated whether the impact will be local (limited to the immediate area or site of development) or regional, and a value between 1 and 5 is assigned as appropriate (with 1 being low and 5 being high).

The duration, wherein it is indicated whether:

- the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1
- the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2
- medium-term (5–15 years) – assigned a score of 3
- long term (> 15 years) - assigned a score of 4
- permanent - assigned a score of 5

The consequences (magnitude), quantified on a scale from 0-10, where 0 is small and will have no effect on the environment, 2 is minor and will not result in an impact on processes, 4 is low and will cause a slight impact on processes, 6 is moderate and will result in processes continuing but in a modified way, 8 is high (processes are altered to the extent that they temporarily cease), and 10 is very high and results in complete destruction of patterns and permanent cessation of processes.

The probability of occurrence, which shall describe the likelihood of the impact actually occurring. Probability is estimated on a scale of 1–5, where 1 is very improbable (probably will not happen), 2 is improbable (some possibility, but low likelihood), 3 is probable (distinct possibility), 4 is highly probable (most likely) and 5 is definite (impact will occur regardless of any prevention measures).

The significance, which shall be determined through a synthesis of the characteristics described above and can be assessed as low, medium or high; and

The status, which will be described as either positive, negative or neutral.

Significance is calculated as prescribed by Savannah, namely:

S =(E+D+M)P
S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability

Significance weightings are as follows:

- < 30 points: Low - this impact would not have a direct influence on the decision to develop in the area
- 30-60 points: Medium - the impact could influence the decision to develop in the area unless it is effectively mitigated
- > 60 points: High - the impact must have an influence on the decision process to develop in the area

3.2 Incremental impact assessment for the construction and decommissioning phases

Nature and extent of the impact of respirable particulates

Construction and decommissioning activities are likely to result in emissions of particulates due to earthmoving by heavy duty vehicles and other activities during the construction phase, and due to demolition activities during the decommissioning phase (Bird and Von Gruenewaldt 2022). PM2.5 is the most important particulate fraction with regard to health effects and community exposure to PM2.5 is the basis for the assessment of the health impact of airborne particulates (Fourie and Van Niekerk 2022b). The air dispersion modelling specialists reported in the AQI that increased air concentrations of particulates are mostly limited to the RBIDZ. INFOTOX concluded from the modelling results that the concentrations of PM2.5 to which community receptors would be exposed in the construction and decommissioning phases are similar to those of the operational phase. Therefore, the health impact of particulates during the construction and decommissioning phases is assessed as being similar to the operational phase.

Based on the assessment of the baseline health of the receptor community (Fourie and Van Niekerk 2022a) there are no grounds to assume a significantly increased vulnerability to the effects of exposure to the air pollutants of interest in the 1-to-14-years population in the receptor area, as compared to the KwaZulu-Natal population. A slightly to moderately increased vulnerability is possible in the age group 65 years and older. These vulnerabilities are considered in the rating of the significance of health impacts.

The impact significance ratings are presented in Table 3.2.1.

Table 3.2.1: Impact rating for PM2.5 in the construction and decommissioning phases.

Criteria	**Rating before mitigation**		**Motivation**	**Significance**
Duration	Short-term	2	Construction duration provided as 36 months	• Significance: 3 • Significance weighting: low • Status: neutral
Extent	Low	1	Only the closest community receptors are likely to be impacted	
Consequence (magnitude)	Small	0	The AQI indicates that mitigation measures should be implemented, but are not expected to have a significant effect on the off-site (community) air quality impact. The assessed health risks are in the negligible range and do not indicate any reason for concern with regard to human health effects as a consequence of the foreseen construction and decommissioning activities at the Phakwe power plant. This is valid even for the sensitive age groups.	
Probability	Very improbable	1	The risk of health effects occurring due to exposure to particulates is indicated as negligible (unlikely)	
Proposed mitigation measures: Dust suppression as described by Bird and Von Gruenewaldt (2022)				
Post Mitigation / Enhancement Measures				
Criteria	**Rating after mitigation**		**Motivation**	**Significance**
Duration	Short-term	2	Construction duration provided as 36 months	• Significance: 3 • Significance weighting: low • Status: neutral
Extent	On-site	1	Only the closest community receptors are likely to be impacted	
Consequence (magnitude)	Small	0	The assessed health risks are in the negligible range and do not indicate any reason for concern with regard to human health effects as a consequence of the foreseen construction and decommissioning activities at the Phakwe power plant. This is valid even for the sensitive age groups.	
Probability	Very improbable	1	The risk of health effects occurring due to exposure to particulates is indicated as negligible (unlikely)	
Cumulative Impacts				
Construction (and decommissioning) activities are likely to result in a negligible impact on health in the receptor communities.				
Residual Impacts				
Expected to be insignificant if mitigation measures are properly implemented.				

Nature and extent of the impact of VOCs

Construction and decommissioning activities are likely to result in emissions of VOCs due to earthmoving by heavy duty vehicles and other vehicular traffic during the construction phase, and due to demolition activities during the decommissioning phase (Bird and Von Gruenewaldt 2022). The air dispersion specialists have determined that the air quality impact of gaseous pollutants, assessed as VOCs in the HHRA, is likely to be minor. INFOTOX interprets this as not exceeding the impact during the operational phase, and assesses the health impacts during the construction

and decommissioning phases based on this understanding. There are no residences within the relevant AQI area. However, even if there had been residential exposure in the impact area, the concentrations (assessed as equal to those modelled for the operational phase) would not be in the range associated with an impact on community health.

As explained above, there are no grounds to assume a significantly increased vulnerability to the effects of exposure to the air pollutants of interest in the 1-to-14-years population in the receptor area. A slightly to moderately increased vulnerability is possible in the age group 65 years and older and these vulnerabilities are considered in the rating of the significance of health impacts.

The impact significance ratings for VOC emissions are presented in Table 3.2.2.

Table 3.2.2: Impact rating for VOCs in the construction and decommissioning phases.

Criteria	**Rating before mitigation**		**Motivation**	**Significance**
Duration	Short-term	2	Construction duration provided as 36 months	• Significance: 3 • Significance weighting: low • Status: neutral
Extent	Low	1	Only the closest community receptors are likely to be impacted	
Consequence (magnitude)	Small	0	The AQI indicates that mitigation measures should be implemented, but are not expected to have a significant effect on the off-site (community) air quality impact. There are no residences within the relevant AQI area. Even if there had been residential exposure, the concentrations are not in the range associated with an impact on community health.	
Probability	Very improbable	1	The risk of health effects occurring due to exposure to VOCs, assessed as benzene, is indicated as negligible (unlikely)	
Proposed mitigation measures: Adherence to a regular vehicle maintenance programme, in order to limit VOC emissions.				
Post Mitigation / Enhancement Measures				
Criteria	**Rating after mitigation**		**Motivation**	**Significance**
Duration	Short-term	2	Construction duration provided as 36 months	• Significance: 3 • Significance weighting: low • Status: neutral
Extent	Low	1	Only the closest community receptors are likely to be impacted	
Consequence (magnitude)	Small	0	The exposure concentrations are highly unlikely to be in the range associated with an impact on community health, even in the sensitive age groups.	
Probability	Very improbable	1	The risk of health effects occurring due to exposure to VOCs is indicated as negligible (unlikely)	
Cumulative Impacts				
Construction (and decommissioning) activities are likely to result in a negligible impact on health in the receptor communities.				
Residual Impacts				
Expected to be insignificant if mitigation measures are properly implemented.				

3.3 Incremental impact assessment for the operational phase

Nature and extent of the impact of PM2.5, SO_2 and CO

Air concentrations of PM2.5 and SO_2 were modelled in detail at all 95 identified community receptors by the air dispersion specialists and the health risks assessed accordingly by INFOTOX.

Regarding CO, it was determined that there are no residences within the impact area delineated by the results of air dispersion modelling. The impacted area is mostly within Zone 1F of the RBIDZ, within agricultural fields and covering only a small are within the light industrial area just to the north of the RBIDZ boundary. It is INFOTOX's considered opinion that, although daily concentrations were not calculated, the 99th percentile of the daily concentrations at even the closest receptor or residential area is likely to not be higher than background concentrations, or that the difference from background concentrations would be so slight as to be of no practical significance as far as risks to health are concerned. The impact significance ratings are presented in Table 3.3.1. As in the assessment of construction and decommissioning activities, the health vulnerabilities of the receptor communities are considered.

Table 3.3.1: Impact rating for PM2.5, SO_2 and CO in the operational phase.

Criteria	**Rating before mitigation**		**Motivation**	**Significance**
Duration	Long-term	4	Indicative power purchase agreement is for 20+ years	• Significance: 5 • Significance weighting: low • Status: neutral
Extent	Low	1	Only local community receptors are impacted	
Consequence (magnitude)	Small	0	The AQI indicates that mitigation measures should be implemented, but are not expected to have a significant effect on the off-site (community) air quality impact. The assessed health risks are in the negligible range and do not indicate any reason for concern with regard to human health effects as a consequence of the foreseen operational activities at the Phakwe power plant. This is valid even for the sensitive age groups.	
Probability	Very improbable	1	The risk of health effects occurring due to exposure to PM2.5, SO2 and CO is indicated as negligible (unlikely)	
Proposed mitigation measures as described by Bird and Von Gruenewaldt (2022): • Turbine maintenance as per manufacturers recommendations • A move to hydrogen fuel as soon as practically possible.				
Post Mitigation / Enhancement Measures				
Criteria	**Rating after mitigation**		**Motivation**	**Significance**
Duration	Long-term	4	Indicative power purchase agreement is for 20+ years	• Significance: 5 • Significance weighting: low • Status: neutral
Extent	Low	1	Only local community receptors are impacted	
Consequence (magnitude)	Small	0	The assessed health risks are in the negligible range and do not indicate any reason for concern with regard to human health effects as a consequence of the foreseen operational activities at the Phakwe power plant. This is valid even for the sensitive age groups.	
Probability	Very improbable	1	The risk of health effects occurring due to exposure to PM2.5, SO2 and CO is indicated as negligible (unlikely)	
Cumulative Impacts				
Operational activities are likely to result in a negligible impact on health in the receptor communities.				
Residual Impacts				
Expected to be insignificant if mitigation measures are properly implemented.				

Nature and extent of the impact of NO_2

NO_2 air concentrations at all 95 identified community receptors were reported in detail by the air dispersion specialists and the health risks assessed accordingly by INFOTOX. The impact significance ratings are presented in Table 3.3.2, including consideration of the health vulnerabilities of the receptor communities.

Table 3.3.2: Impact rating for NO_2 in the operational phase.

Criteria	Rating before mitigation		Motivation	Significance
Duration	Long-term	4	Indicative power purchase agreement is for 20+ years	• Significance: 5 • Significance weighting: low • Status: neutral
Extent	Low	1	Only local community receptors are impacted	
Consequence (magnitude)	Small	0	The AQI indicates that mitigation measures should be implemented, but are not expected to have a significant effect on the off-site (community) air quality impact. The HHRA indicates health risks in the range viewed as very low to negligible and cannot be interpreted as indicating a significant or serious risk to health. This is valid even for the sensitive age groups.	
Probability	Very improbable	1	The risk of health effects is indicated as very low to negligible	
Proposed mitigation measures as described by Bird and Von Gruenewaldt (2022): • Turbine maintenance as per manufacturers recommendations • A move to hydrogen fuel as soon as practically possible.				
Post Mitigation / Enhancement Measures				
Criteria	**Rating after mitigation**		**Motivation**	**Significance**
Duration	Long-term	4	Indicative power purchase agreement is for 20+ years	• Significance: 5 • Significance weighting: low • Status: neutral
Extent	Low	1	Only local community receptors are impacted	
Consequence (magnitude)	Small	0	The HHRA indicates health risks in the range viewed as very low to negligible. This is valid even for the sensitive age groups.	
Probability	Very improbable	1	The risk of health effects is indicated as very low to negligible	
Cumulative Impacts				
Very low to negligible and cannot be interpreted as indicating a significant or serious risk to health.				
Residual Impacts				
Expected to be insignificant if mitigation measures are properly implemented.				

Nature and extent of the impact of VOCs

VOCs are associated with the gas turbine operations (Bird and Von Gruenewaldt 2022). The air dispersion specialists have determined that there are no residences within the relevant AQI area. However, even if there had been residential exposure in the impact area, the concentrations are not in the range associated with an impact on community health, even when the health vulnerabilities of the receptor communities are considered.

The impact significance ratings for VOC emissions, assessed as benzene, are presented in Table 3.3.3.

Table 3.3.3: Impact rating for VOCs in the operational phase.

Criteria	Rating before mitigation		Motivation	Significance
Duration	Long-term	4	Indicative power purchase agreement is for 20+ years	• Significance: 5 • Significance weighting: low • Status: neutral
Extent	Low	1	Only the closest community receptors are likely to be impacted	
Consequence (magnitude)	Small	0	The AQI indicates that mitigation measures should be implemented, but are not expected to have a significant effect on the off-site (community) air quality impact. There are no residences within the relevant AQI area. Even if there had been residential exposure, the concentrations are not in the range associated with an impact on community health.	
Probability	Very improbable	1	The risk of health effects occurring due to exposure to VOCs, assessed as benzene, is indicated as negligible (unlikely)	
Proposed mitigation measures as described by Bird and Von Gruenewaldt (2022): • Turbine maintenance as per manufacturers recommendations • A move to hydrogen fuel as soon as practically possible.				
Post Mitigation / Enhancement Measures				
Criteria	**Rating after mitigation**		**Motivation**	**Significance**
Duration	Long-term	4	Indicative power purchase agreement is for 20+ years	• Significance: 5 • Significance weighting: low • Status: neutral
Extent	On-site	1	Only the closest community receptors are likely to be impacted	
Consequence (magnitude)	Small	0	The exposure concentrations are highly unlikely to be in the range associated with an impact on community health, even in the sensitive age groups.	
Probability	Very improbable	1	The risk of health effects occurring due to exposure to VOCs is indicated as negligible (unlikely)	
Cumulative Impacts				
Power plant operations are likely to result in a negligible impact on health in the receptor communities.				
Residual Impacts				
Expected to be insignificant.				

3.4 Cumulative impact assessment for the construction and decommissioning phases

Nature and extent of the impact of respirable particulates

The cumulative health impact assessment is viewed as the sum of the current (without the Gas Power 3 Combined Cycle Power Plant) and future (with the construction and decommissioning activities at the plant) health impact in Alton North, Richards Bay, in the uThungulu DM. The impact area of interest is the identified receptor area of the Power Plant.

The current sources of PM2.5 in the receptor area are industries, human settlements burning biofuels to generate household energy where electricity is not yet in supply, agricultural activities such as ploughing of fields and burning of sugar cane, vehicular traffic, emissions from vehicles relying on internal combustion for energy generation, and background (environmental) contributions such as veldfires. The current health impact from all these sources is represented by the health vulnerabilities of the communities and sensitive receptors within the identified receptor area. The health vulnerabilities are assessed and discussed in the Baseline health assessment report (Fourie and Van Niekerk 2022a).

The cumulative health impact is thus assessed as a combination of the current health vulnerabilities and the assessed health impact associated with construction and decommissioning

activities at the Power Plant, as presented in Table 3.2.1 (Section 3.2). Only PM2.5 is assessed, as the quantification of particulate matter emissions (and the atmospheric dispersion thereof) is generally considered a better key-indicator pollutant for construction phase impacts than gaseous emissions, such as VOCs (Bird and Von Gruenewaldt 2022).

According to the baseline health assessment report, there are no grounds to assume a significantly increased vulnerability in the 1-to-14-years population, to the effects of exposure to the air pollutants of interest, when comparing the baseline health of this age group in the uThungela DM with the KwaZulu-Natal population in this age group. The baseline health assessment report found a possible slightly to moderately increased vulnerability in the age group 65 years and older. The available health database is limited to DM and provincial data, and not differentiated to receptor levels (e.g., at the schools within the receptor area). The available national health database also does not cover hospitalisation statistics for respiratory or other diseases related to air pollution.

Based on the above assessment of the current health data, the current health impact in the Power Plant receptor area is assessed as presented in Table 3.4.1. Following on the assessment of the current health impact, the cumulative impact is presented in Table 3.5.1.

Table 3.4.1: Impact rating for current exposure to PM2.5.

Criteria	Rating before mitigation		Motivation	Significance
Duration	Long-term	4	Current sources are unlikely to change in the near future	• Significance: 27 • Significance weighting: medium • Status: negative
Extent	Regional	1	Only the current impact in the power station receptor area is assessed	
Consequence (magnitude)	Low	4	The current impact in the 1-to-14-years population is shown to be not significant (small) and the impact in the age group 65 years and older is moderate at most. On average, considering these two vulnerable populations, the consequence of the current impact cannot be viewed as more than low, which would already be a conservative assessment.	
Probability	Probable (distinct possibility)	3	It is probable that the slightly to moderately increased vulnerability in the age group 65 years and older can be partly attributed to air pollution in the DM. Other factors contributing to current vulnerability include the state of health services, the nutritional and communicable burden of disease in the DM.	

Table 3.5.1: Impact rating for cumulative exposure to PM2.5 during the construction and decommissioning phases.

Criteria	Overall impact of the proposed project considered in isolation (Table 3.2.1)	Cumulative impact of the project and other projects in the area
Duration	Short-term	Long-term
Extent	Low	Regional
Consequence (magnitude)	Small	Low
Probability	Very improbable	Probable (distinct possibility)
Significance	**3**	**30**
	Low	**Medium**
Status (neutral, positive or negative)	Neutral	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No

Criteria	Overall impact of the proposed project considered in isolation (Table 3.2.1)	Cumulative impact of the project and other projects in the area
Can the impacts to mitigated?	To some extent	To some extent
Confidence in findings:	Moderate	
Potential mitigation measures proposed by Bird and Von Gruenewaldt (2022) and by INFOTOX: • Liaise with industry to optimise abatement controls to minimise emissions. • Use community and industry fora to discuss air pollution issues and progress towards minimising impacts. • Promote the use of cleaner heat sources (electricity, LPG, and/or bioethanol gel) for cooking, heating and lighting by residents. • Liaise with local and provincial health service providers to optimise health services. • Use community and industry fora to discuss and promote healthy lifestyles.		
Residual impacts: Expected to be low if mitigation measures can be effectively implemented.		

3.5 Cumulative impact assessment for the operational phase

Nature and extent of the impact of PM2.5, SO_2, CO and NO_2

As previously described in Section 3.4, the cumulative health impact assessment is viewed as the sum of the current (without the Gas Power 3 Combined Cycle Power Plant) and future (with operations at the plant) health impact in Alton North. The impact area of interest is the identified receptor area of the power plant.

The impact rating for current exposure to PM2.5 is as described in Section 3.4 and assessed in Table 3.4.1.

The current sources of exposure to SO_2 and CO in the receptor area are industries, human settlements burning biofuels to generate household energy, agricultural activities such as burning of sugar cane, emissions from vehicles relying on internal combustion, in the case of SO_2 particularly of diesel, for energy generation, and background (environmental) contributions such as veldfires. The current sources of exposure to NO_2 in the receptor area are industries, human settlements where household energy is generated with biofuels burning, agricultural activities such as burning of sugar cane, emissions from internal combustion vehicles, and human activities such as agriculture and wastewater management. NO_2 is also naturally present in the atmosphere as part of Earth's biotic and abiotic nitrogen cycle.

The current health impact from all these sources of PM2.5, SO_2, CO and NO_2 are represented by the health vulnerabilities of the communities and sensitive receptors within the identified receptor area, as assessed and discussed in the Baseline health assessment report (Fourie and Van Niekerk 2022a). The current health impact rating due to exposure to SO_2, CO and NO_2 is identical to that for PM2.5 (Table 3.4.1), because of overlapping baseline health endpoints among these pollutants, namely, respiratory and cardiovascular diseases.

The cumulative health impact is thus assessed as a combination of the current health vulnerabilities and the assessed incremental health impact associated with operations at the Power Plant, as presented in Table 3.3.1 for PM2.5, SO_2 and CO and in Table 3.3.2 for NO_2 (Section 3.2).

The cumulative impact rating for exposure to PM2.5, SO_2 and CO during the operational phase is presented in Table 3.5.1 and the cumulative impact rating for exposure to NO_2 during the operational phase in Table 3.5.2.

The current impact rating for VOCs is indeterminable, because sufficient detailed health data are not available at the local, DM, national or provincial level for the health effects of interest. Thus, a cumulative impact assessment for VOCs is not presented. The only determinable impact is the incremental impact on health, associated with operations at the power plant, presented in Table 3.3.3 in Section 3.3.

Table 3.5.1: Cumulative impact rating for exposure to PM2.5, SO_2 and CO during the operational phase.

Criteria	**Overall impact of the proposed project considered in isolation (Table 3.3.1)**	**Cumulative impact of the project and other projects in the area**
Duration	Long-term	Long-term
Extent	Low	Regional
Consequence (magnitude)	Small	Low
Probability	Very improbable	Probable (distinct possibility)
Significance	**5**	**32**
	Low	**Medium**
Status (neutral, positive or negative)	Neutral	Negative
Reversibility	Reversible	Reversible
Irreplaceable loss of resources?	No	No
Can the impacts to mitigated?	To some extent	To some extent
Confidence in findings:	Moderate	
Potential mitigation measures proposed by Bird and Von Gruenewaldt (2022) and by INFOTOX: • Liaise with industry to optimise abatement controls to minimise emissions. • Use community and industry fora to discuss air pollution issues and progress towards minimising impacts. • Promote the use of cleaner heat sources (electricity, LPG, and/or bioethanol gel) for cooking, heating and lighting by residents. • Liaise with local and provincial health service providers to optimise health services. • Use community and industry fora to discuss and promote healthy lifestyles.		
Residual impacts: Expected to be low if mitigation measures can be effectively implemented.		

Table 3.5.2: Cumulative impact rating for exposure to NO_2 during the operational phase.

Criteria	**Overall impact of the proposed project considered in isolation (Table 3.3.2)**	**Cumulative impact of the project and other projects in the area**
Duration	Long-term	Long-term
Extent	Low	Regional
Consequence (magnitude)	Small	Low
Probability	Very improbable	Probable (distinct possibility)
Significance	**5**	**32**
	Low	**Medium**
Status (neutral, positive or negative)	Neutral	Negative
Reversibility	Reversible	Reversible

Criteria	Overall impact of the proposed project considered in isolation (Table 3.3.2)	Cumulative impact of the project and other projects in the area
Irreplaceable loss of resources?	No	No
Can the impacts to mitigated?	To some extent	To some extent
Confidence in findings:	Moderate	
Potential mitigation measures proposed by Bird and Von Gruenewaldt (2022) and by INFOTOX: • Liaise with industry to optimise abatement controls to minimise emissions. • Use community and industry fora to discuss air pollution issues and progress towards minimising impacts. • Liaise with local and provincial health service providers to optimise health services. • Use community and industry fora to discuss and promote healthy lifestyles.		
Residual impacts: Expected to be low if mitigation measures can be effectively implemented.		

4 Conclusions

- The assessment has been conducted with consideration of the health vulnerabilities of certain age groups in the receptor population, as indicated in the community baseline health report.

- Incremental impacts on health associated with PM2.5, SO_2, NO_2, CO and VOC emissions from the proposed Phakwe power plant project during the construction, operational and decommissioning phases are assessed as of low significance, with a neutral status.

- Implementation of the proposed power plant is associated with a low impact on health, even in sensitive receptor communities.

- Cumulative impacts on health associated with PM2.5, SO_2, NO_2 and CO emissions from the proposed Phakwe power plant project during the construction, operational and decommissioning phases are assessed as of medium significance, with a negative status. However, residual impacts are expected to be low if mitigation measures can be effectively implemented.

5 References

Bird T and Von Gruenewaldt R. 2022. Air Quality Impact Assessment for the Proposed Development of the Phakwe Richards Bay Gas Power 3 Combined Cycle Gas to Power Plant and associated Infrastructure on a site near Richards Bay, KwaZulu-Natal Province. Report No. 19SAV22b. Halfway Gardens: Airshed Planning Professionals (Pty) Ltd.

Fourie MH and Van Niekerk WCA. 2022a. Baseline Health Assessment Report for the Rapid Appraisal Health Impact Assessment of the Phakwe Richards Bay Gas Power 3 Combined Cycle Power Plant in Richards Bay. Report No 022-2022 Rev 1.0. Pretoria: INFOTOX (Pty) Ltd.

Fourie MH and Van Niekerk WCA. 2022b. Human Health Risk Assessment (HHRA) for the Phakwe Richards Bay Gas Power 3 Combined Cycle Power Plant in Richards Bay. INFOTOX Report No 035-2022 Rev 1.0. Pretoria: INFOTOX (Pty) Ltd.

IFC. 2009. Introduction to Health Impact Assessment. Washington DC, USA: International Finance Corporation.
http://www.ifc.org/wps/wcm/connect/corp_ext_content/ifc_external_corporate_site/home.

Maroga KR. 2020. Screening Report for an Environmental Authorization or for a Part Two Amendment of an Environmental Authorisation as Required by the 2014 EIA Regulations – Proposed Site Environmental Sensitivity. Generated: 01/06/2020 for Richards Bay Gas 2 Power (Pty) Ltd.