

GREENHOUSE GAS EMISSION INVENTORY AND REPORT FOR THE KALABASFONTEIN PROJECT ENVIRONMENTAL IMPACT MANAGEMENT SERVICES (PTY) LTD

12 NOVEMBER 2019

CONFIDENTIAL





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ENVIRONMENTAL IMPACT
MANAGEMENT SERVICES
(PTY) LTD

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EXECUTIVE SUMMARY

Forzando Coal Mines (Pty) Ltd. operates mining operations at both the Forzando North Shaft and Forzando South Shaft in Mpumalanga. Through an intensive drilling exercise on these areas, economically viable blocks of coal have been defined with the intention to access these newly defined blocks of coal from the existing Forzando South incline. As such, a proposed extension of the current mining area is planned, known as the Kalabasfontein project. The Kalabasfontein project will require minimal new surface infrastructure as the mining method to be employed is underground mining and existing surface infrastructure from the Forzando South Mine will be used. Further, commissioning of Kalabasfontein will not add to the production of Forzando South, but will provide relocation areas for existing Forzando South sections.

Kalabasfontein project area is located to the east and south of the existing Forzando South 380MR and Forzando North 381MR respectively. The project area comprises two prospecting rights, 1035PR & 1170PR, which covers a total of approximately 1,548 ha over portions 7, 8, RE, 11 and 13 of the farm Kalabasfontein 232 IS. A new ventilation shaft will be located either on Portion 7 of the farm Uitgedacht 229 IS or on Portion 22 of the farm Uitgedacht 229 IS as part of the Kalabasfontein project.

WSP Environmental (Pty) Ltd has been appointed by Environmental Impact Management Services (Pty) Ltd (EIMS) to compile a Greenhouse Gas (GHG) emissions inventory and report for the proposed Kalabasfontein project in Mpumalanga.

In line with the National Environmental Management: Air Quality Act 39 of 2004 (NEM:AQA), Government Notice of 275 of 2017 (Government Gazette 40762), the National Greenhouse Gas Emission Reporting Regulations promulgated on 3 April 2017 requires all qualifying process activities in Annexure 1 to be quantified and submitted. Activities undertaken for the Kalabasfontein project fall within the Energy Sector for *Coal Mining and Handling* under Annexure 1 of the National Greenhouse Gas Reporting Regulations and as such, must quantify such information. Under Section 29 of the NEM:AQA 39 of 2004, Government Notice 710 of 2017 (Government Gazette 40996), the GHGs (carbon dioxide, (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆)) have been declared as priority pollutants. The key GHG emissions associated with activities for the Kalabasfontein project will only include CO₂, CH₄, and N₂O from the diesel, coal and electricity usage for mining operations. Further, persons falling within the list of production processes, specified in Annexure A, which involves emission of GHGs in excess of 0.1 Mt annually are required to prepare and submit to the Minister pollution prevention plans for approval. It is understood that operations for the proposed Kalabasfontein project triggers the *Coal Mining* process outlined in Annexure A, but will not be in excess of 0.1 Mt GHG annually. As such, a pollution prevention plan will not be required.

As per the GHG reporting regulations, Tier 1 emission factors (IPCC default factors) are applied for diesel consumption and Tier 2 (country specific) emission factors are applied for coal and electricity consumption to estimate GHG emissions for the Kalabasfontein project. Additionally, GHG emission activities are divided into three scopes of which only two scopes are applicable to the Kalabasfontein project (Scope 1 – direct emissions, and Scope 2 – indirect emissions) within the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard.

The Kalabasfontein project will not add to the production of Forzando South, but will provide relocation areas for the existing Forzando South sections. As such, existing diesel, coal and electricity consumption data from the Forzando South relocation sections for the 2015-2017 period was used to estimate the current emissions.

The total GHG emissions for the year 2017 was estimated to be 63,868 t CO_{2eq} (CO₂ equivalent terms to reflect the contribution of the various GHG emissions), which is approximately an 11% decrease from both 2016 and 2015, respectively. Within the Scope 1 sources for 2015 to 2017, the coal consumption from underground mining contribute the highest GHG emissions, which make up 47%, 58% and 60%, respectively of the total CO_{2eq} emissions. Scope 2 (i.e. electricity consumption) contributes to 52%, 41% and 39% for 2015, 2016 and 2017 of the total CO_{2eq} emissions.

Proposed emissions for the Kalabasfontein project has thus been determined by taking an average of the existing diesel, coal and electricity consumption data from the Forzando South relocation sections for the 2015-2017 period. Given the similar trends over the past three years, it is assumed that this will be an accurate representation of the likely GHG emissions emitted from the Kalabasfontein project. It is understood that the proposed

consumption data from the Kalabasfontein project will also include an additional 800-900 litres of diesel during construction and a vent shaft operating continuously throughout the year at 1.728 MW /annum. As such, this diesel and electricity consumption data has been further added to the average existing emissions in order to obtain the total proposed emissions from the Kalabasfontein project.

The total GHG emissions for the Kalabasfontein project was estimated to be 82,917.49 t CO_{2eq}. Within the Scope 1 sources, the coal consumption from underground mining contributes the highest GHG emissions, which make up 44%, respectively of the total CO_{2eq} emissions. Scope 2 contributes to 55% of the total CO_{2eq} emissions.

Additionally, according to the climate action tracker analysis, South Africa will need to implement additional policies to reach its proposed targets to limit GHG emissions to between 398 and 614 MtCO_{2eq} over the period 2025–2030, and as such, the Kalabasfontein project should seek methodologies in order to reduce their GHG emissions and become environmentally friendly.

DECLARATION OF INDEPENDENCE

Novania Reddy is a Senior Consultant with over 5 years' experience in the environmental industry. Her area of expertise lies within the air quality and acoustics fields related to sectors ranging from mining to the oil and gas industry. She holds the responsibility of data collection, inventory development, compilation of air emission licence and scientific modelling and reporting. Novania has a broad understanding of the various laws and regulations associated with the air quality and noise procedures.

I hereby declare that I am fully aware of my responsibilities in terms of the National Environmental Management Act: Environmental Impact Assessment Regulations of 2014 and that I have no financial or other interest in the undertaking of the proposed activity other than the imbursement of consultants fees.

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1 INTRODUCTION

Forzando Coal Mines (Pty) Ltd. operates mining operations at both the Forzando North Shaft and Forzando South Shaft in Mpumalanga. Through an intensive drilling exercise on these areas, economically viable blocks of coal have been defined with the intention to access these newly defined blocks of coal from the existing Forzando South incline. As such, a proposed extension of the current mining area is planned, known as the Kalabasfontein project. The Kalabasfontein project will require minimal new surface infrastructure as the mining method to be employed is underground mining and existing surface infrastructure from the Forzando South Mine will be used. Further, commissioning of Kalabasfontein will not add to the production of Forzando South, but will provide relocation areas for existing Forzando South sections.

Kalabasfontein project area is located to the east and south of the existing Forzando South 380MR and Forzando North 381MR respectively. The project area comprises two prospecting rights, 1035PR & 1170PR, which covers a total of approximately 1,548 ha over portions 7, 8, RE, 11 and 13 of the farm Kalabasfontein 232 IS. A new ventilation shaft will be located either on Portion 7 of the farm Uitgedacht 229 IS or on Portion 22 of the farm Uitgedacht 229 IS as part of the Kalabasfontein project.

WSP Environmental (Pty) Ltd has been appointed by Environmental Impact Management Services (Pty) Ltd (EIMS) to compile a Greenhouse Gas (GHG) emissions inventory and report for the proposed Kalabasfontein project in Mpumalanga.

In line with the National Environmental Management: Air Quality Act 39 of 2004 (NEM:AQA), Government Notice of 275 of 2017 (Government Gazette 40762), the National Greenhouse Gas Emission Reporting Regulations promulgated on 3 April 2017 requires all qualifying process activities in Annexure 1 to be quantified and submitted. Activities undertaken for the Kalabasfontein project fall within the Energy Sector for *Coal Mining and Handling* under Annexure 1 of the National Greenhouse Gas Reporting Regulations and as such, must quantify such information. Under Section 29 of the NEM:AQA 39 of 2004, Government Notice 710 of 2017 (Government Gazette 40996), the GHGs (carbon dioxide, (CO₂), methane (CH₄), nitrous oxide (N₂O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆)) have been declared as priority pollutants. The key GHG emissions associated with activities for the Kalabasfontein project will only include CO₂, CH₄, and N₂O from the diesel, coal and electricity usage for mining operations. Further, persons falling within the list of production processes, specified in Annexure A, which involves emission of GHGs in excess of 0.1 Mt annually are required to prepare and submit to the Minister pollution prevention plans for approval. It is understood that operations for the proposed Kalabasfontein project triggers the *Coal Mining* process outlined in Annexure A, but will not be in excess of 0.1 Mt GHG annually. As such, a pollution prevention plan will not be required.

1.1 TERMS OF REFERENCE

The following scope of works is proposed:

- Compilation of a comprehensive GHG emissions inventory for activities associated with the Kalabasfontein project; and
- Submission of a GHG Emissions Report for the Kalabasfontein project.

2 PROJECT BOUNDARIES

The Kalabasfontein project area is situated in Mpumalanga, 20 kilometres north of Bethal and 20 kilometres east of Ga-Nala (Kriel). It is located to the east and south of the existing Forzando South 380MR and Forzando North 381MR Mine respectively, which fall within the Msukaligwa Local Municipality.

The project area comprises two prospecting rights, 1035PR & 1170PR, which covers a total area of ~ 1 547.8296ha over portions 7, 8, Remaining Extent (RE), 11 and 13 of the farm Kalabasfontein 232 IS. As part of the Kalabasfontein project, two alternative sites have been proposed for a new ventilation shaft, namely Portion 7 of the farm Uitgedacht 229IS and Portion 22 of the farm Uitgedacht 229 IS. **Figure 2-1** and **Figure 2-2** illustrates the locality map of the Kalabasfontein Project area and new ventilation shaft on Portion 7 and Portion 22, respectively of the farm Uitgedacht 229 IS. Additionally, two powerline alternatives have been proposed for the

ventilation shafts, namely; powerline alternative 1 (initial powerline route) and powerline alternative 2 (revised powerline route). However, it must be noted that the powerlines do not impact the air quality study.

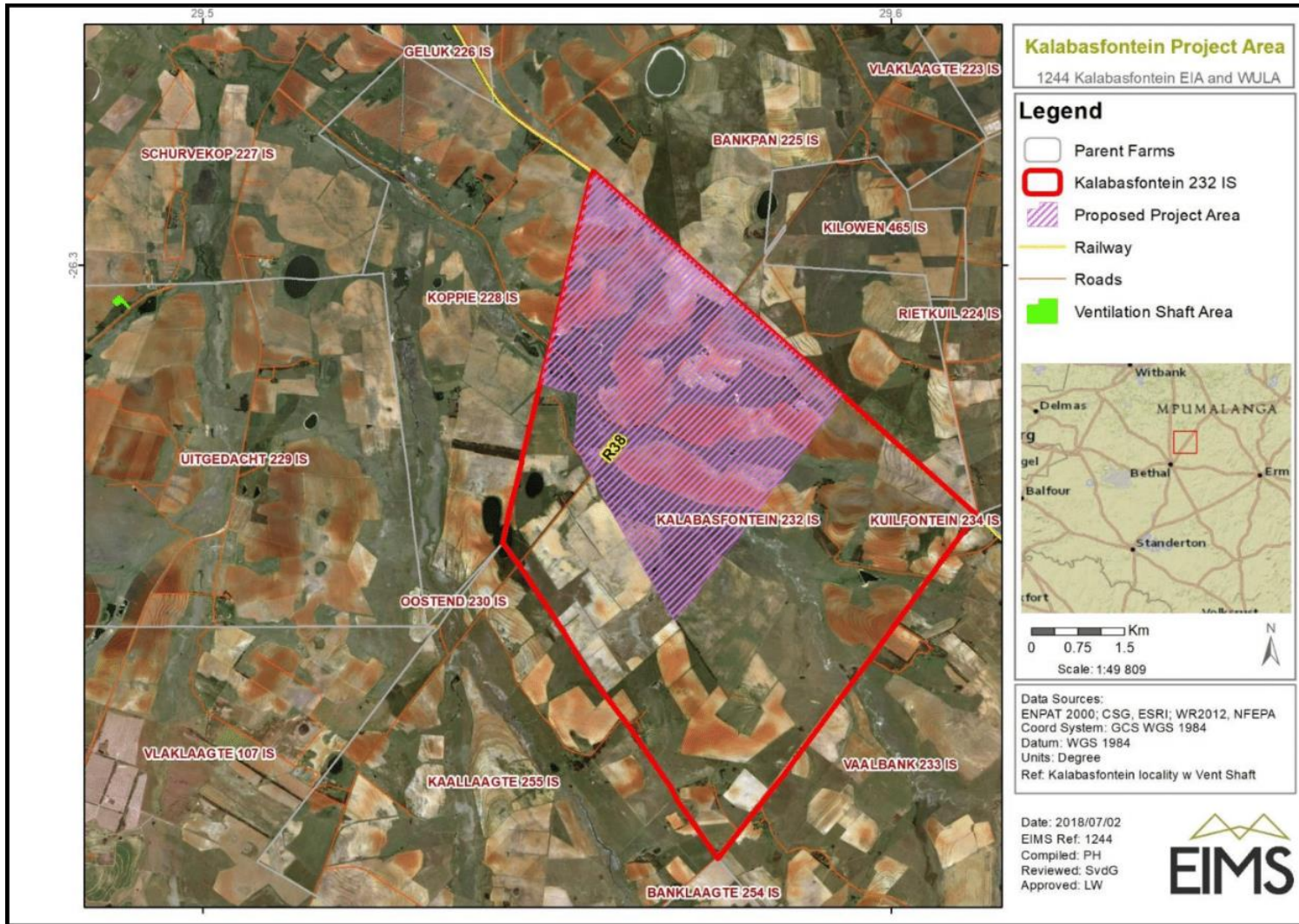


Figure 2-1: Locality map of Kalabasfontein project area and new ventilation shaft on Portion 7 of the farm Uitgedacht 229 IS

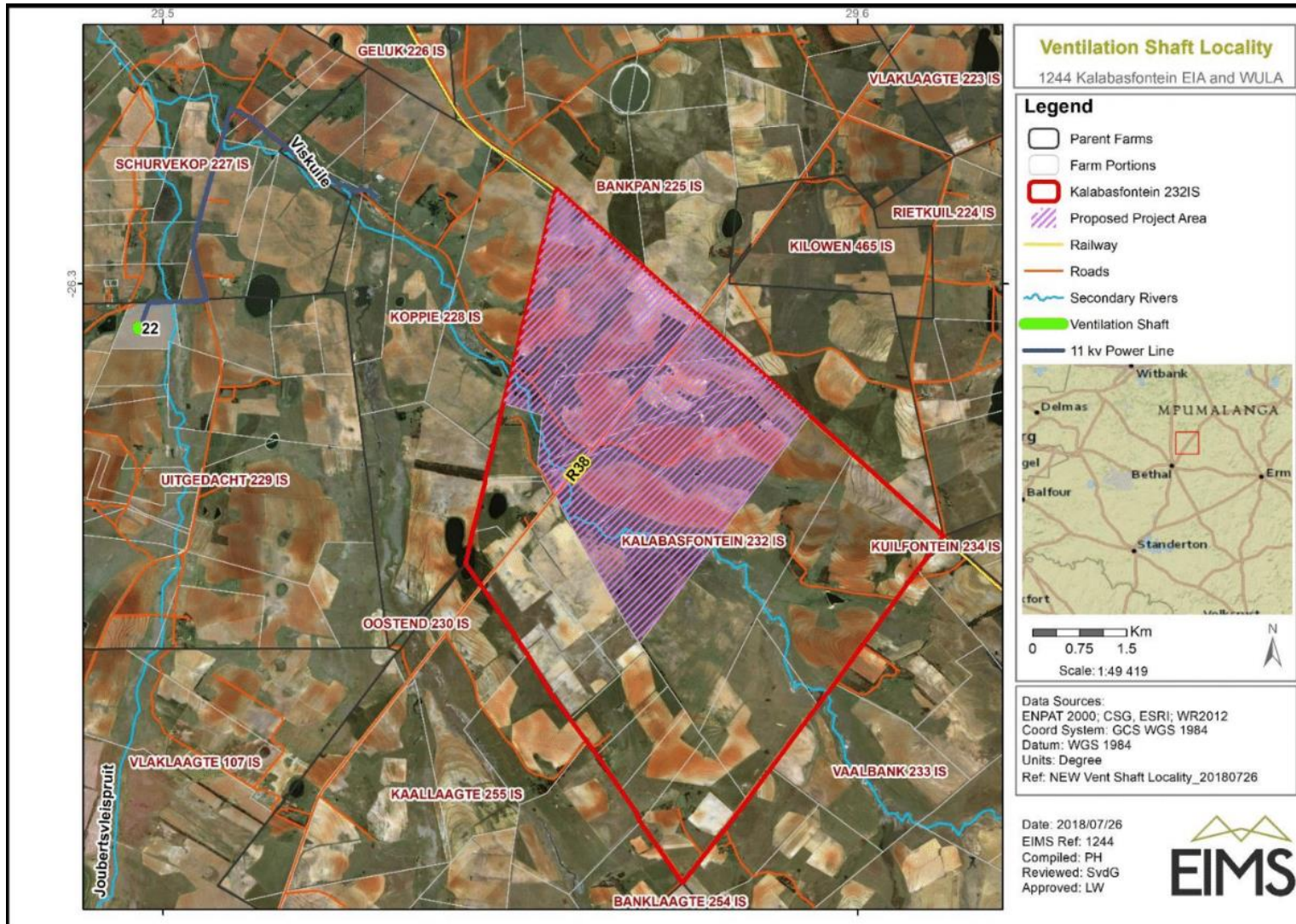


Figure 2-2: Locality map of Kalabasfontein project area and new ventilation shaft on Portion 22 of the farm Uitgedacht 229 IS

3 PROJECT DESCRIPTION

Although Kalabasfontein annexation is intended to extend the Life of Mine (LOM) of Forzando South Coal Mine, it will come into production a year after the annexation is granted by the DMR. The Kalabasfontein project has an estimated LOM of 17 years with the project schedule and timeframe being based on the Forzando South equipment availabilities, efficiencies and both skilled and unskilled labour force. Mining in the Kalabasfontein project area is based on two Continuous Miner (CM) sections.

The access corridor to Kalabasfontein Reserves was identified during exploration drilling. Reserves will be mined through access from one of Forzando South Reserves block. This will eliminate intense preparation work of developing a new incline, as there will be infrastructure available at the face.

Currently, Forzando South mine is scheduled until 2037. However, the Kalabasfontein portion will be mined as soon as permission is granted, in order to ensure sustained production volumes and quantities from the 5 CM sections that are currently being mined. The mine will maintain its production rate of 2.2 Million tonnes (Mt) per annum. Commissioning of Kalabasfontein will not add to the production of Forzando South but will provide relocation areas for existing Forzando South sections. Since the Kalabasfontein project will be mined concurrently with Forzando South, production decline will be due to depletion of Reserves. In the second quarter of year 17 (2037), the first section will pull out and leave the one section to deplete the remaining Reserves.

3.1 INFRASTRUCTURE REQUIREMENTS

As the Kalabasfontein project will use the existing Forzando South and Forzando North infrastructure, it is envisaged that additional infrastructure requirements will be minimal. Anticipated demand for water, power and the on-site infrastructure requirements is detailed in the mine works programme (MWP). These requirements are based on staff required over the production period for permanent employees and contractors. Water and electricity requirements for the construction of mine access (ventilation shaft) and surface infrastructure are temporary, lasting for approximately 12 months.

The Forzando North plant is designed to treat run of mine (ROM) of approximately 4.2 Mtpa. This will include coal from the proposed Kalabasfontein Project. The plant will be manned for operations on a 24 hour/day, 7 days/week basis, with the exclusion of statutory public holidays.

Below are some of the plant design parameters used:

- A production of 10,000t per day;
- A production of 3,300t per shift;- 3 shift rotation
- Feed to ROM bin (peak) of 3,600t per hour at 50mm Top Size;
- ROM material top size (mm): 350mm;
- Primary crusher feed: 1,200t per hour (peak); and
- ROM stockpile surge capacity 10,000t (max): 4,500t (live).

3.2 THE MINERAL RESOURCES

The exploration work to date forms the basis for the current evaluation. Between 2006 and 2017, a total of 88 boreholes have been drilled.

Coal measures at Kalabasfontein are hosted within an approximately 160m thick horizon consisting of sandstone and siltstone, subordinate mudstone and shale within the Vryheid Formation of the Ecca Group of the Karoo Super group.

3.3 MINING METHOD TO BE EMPLOYED: UNDERGROUND MINING

Bord and pillar mining using CM's was selected as the primary extraction method. In bord and pillar mining, parallel roads are developed in the development direction. Perpendicular roads, called splits, are developed at predetermined intervals to the parallel roads. These roads interlink, creating pillars. The roads mined concurrently are determined by the size of the pillars required to support the overburden above the coal seam and the length of the production equipment trailing cables. Pillar size is determined by the safety factor formula; which is the pillar strength divided by the pillar load (mass of the overburden carried by the pillar). Panel design will be based on either the Probability of Failure (PoF) or the safety factor design criterion. A PoF of 0.1% or SF of 2.0 will be used for main development, whereas a PoF of 1% or SF of 1.6 will be used for production panels depending on the stability and rock engineering characteristics that will be determined by a Rock/Geotechnical Engineer. The dimensions of the roads and the support requirements are determined by a Geotechnical Engineer and documented in a code of practice for the prevention of roof falls as illustrated below.

3.4 MINERALS PROCESSING

Although Forzando complex has two mines, namely Forzando North and Forzando South, Kalabasfontein ROM will be crushed at Forzando South prior to conveying to Forzando North beneficiation plant for processing. Beneficiated coal is railed by means of a rapid loader to Richards Bay Coal Terminal (RBCT) and then shipped from the harbour to clients overseas. All existing surface infrastructure will be retained to service production from Forzando South inclusive of Kalabasfontein Project.

3.4.1 DRY STAGE:

The raw coal is transported from a ROM stockpile by front end loaders and fed into a shallow hopper. The coal is then fed by conveyor to a feeder breaker where the coal is reduced to a size smaller than 400mm before conveyed to a primary crusher for reduction to the size to smaller than 75mm. A primary dry screen removes oversize coal (greater than 75mm) for re-crushing and raw duff (smaller than 3mm) for sale or to stockpile while the 75mm x 3mm product is conveyed to a secondary dry screen. The secondary dry screen removes the coal fractions that are larger than 25mm in size and transfer it to a wet screening section, with the coal fragments smaller than 25mm being conveyed to a transfer point for feeding to a surge bin which feeds to the two Heavy Medium Settlers (HMS) plants. Any coal material larger than 75mm is transferred to a secondary crusher for reduction and returned to the circuit.

3.4.2 WET STAGE:

The wet screen section consists of a rinsing screen to remove any retained coal fragments with a size smaller than 6mm, followed by a picking belt to remove obvious waste in the coal material larger than 25mm. The material is then transferred to a final dry screen where the large nuts (45mm – 75mm) and small nuts (25mm – 45mm) are removed. Any undersized coal fragments are returned to the ROM feed point. Note that this stage does not use additives in the water and thus no external pollutants are added. The surge bin can feed separately, or simultaneously, the two washing plants which washes peas (25mm x 6mm or 25mm x 4mm) and duff (6mm x 1mm or 4mm x 1mm) in a cyclone, plus fine coal (1mm x 0.1mm) in the spirals section. Magnetite grains are used as a heavy density medium in the flotation circuit. This is the only additive used in the plant process and has no water pollution potential.

The slurry (smaller than 1.5mm) is piped to a settling pond system (water to solid ratio of 5,7:1) where the water is reclaimed and returned to the washing plant for reuse. Solid discards from the cyclones and spiral plant are hauled to the discard dump for disposal.

3.5 RESIDUE STOCKPILES

3.5.1 RUN OF MINE STOCKPILES

The Kalabasfontein ROM will be crushed at Forzando South prior to conveying to Forzando North beneficiation plant for processing. Beneficiated coal is railed by means of a rapid loader to Richards Bay Coal Terminal (RBCT) and then shipped from the harbour to clients overseas. All existing surface infrastructure will be retained to service production from Forzando South inclusive of Kalabasfontein Project.

3.5.2 NON-CARBONACEOUS STOCKPILES

All discard will be stored on a discard dump and be rehabilitated /cladded as mining progresses. All product coal is stored on existing product stockpiles until it is transported to clients. Forzando North and South operations currently have a ROM coal stockpile and a coal product stockpile as well as a coal discard dump.

3.5.3 CARBONACEOUS STOCKPILES

The only coal waste anticipated is coal that may fall off trucks at the ROM stockpile prior to transportation. This will be collected and transported to the existing Forzando plant off-site.

All product coal is stored on existing product stockpiles until it is transported to clients. Forzando North and South operations currently have a ROM coal stockpile and a coal product stockpile as well as a coal discard dump. ROM coal is beneficiated as produced. An emergency stockpile is provided to cater for situations when beneficiation is not matched with ROM production. This stockpile increases and decreases in volume as “balancing” between the ROM production rate and the beneficiation rate are required.

3.5.4 SOIL STOCKPILES

Before any construction activities are undertaken, the vegetation will be removed, and the topsoil will be stripped and stockpiled. This will apply to the construction of the ventilation shaft. It is anticipated that existing stockpile areas will be used for this purpose.

3.6 WASTE

The following types of solid waste will be generated by the proposed Kalabasfontein project:

- Domestic waste;
- Hazardous waste;
- Industrial and mine waste; and
- Mine residue.

The existing Forzando facilities will be utilised to temporarily store waste and all waste will be collected by an approved, registered waste contractor for removal and final disposal. No landfill will be established on the proposed Kalabasfontein project site.

3.7 WATER SUPPLY

The proposed Kalabasfontein project will require bulk water for its mining operations as well as domestic water for drinking and ablutions purposes. Bulk water is required for dust suppression and any other mining operations that may require large volumes of water.

3.8 CLEAN AND DIRTY WATER SYSTEMS

3.8.1 POLLUTION CONTROL DAMS AND ASSOCIATED DIRTY WATER MANAGEMENT

Forzando South has implemented clean and dirty water management systems. A stormwater diversion trench has been constructed around the offices and workshop areas. There are three lined pollution control dams at Forzando South and all dirty water collected on site is channelled to them for re-use. All dirty water is to be collected and stored with no discharge to the environment. A surface water monitoring program has been implemented in order to detect any changes in surface water quality. PCD's are de silted on a regular basis in order to maintain the required capacity of the dams. The existing pollution control dams will be used to store waste water.

3.9 BULK POWER SUPPLY

Power is supplied to the mine via a 2 by 22kV overhead power line to a surface sub-station from where it is transformed to 550V and 400V for surface use and 11KV for underground use. Two powerline alternatives have been proposed for the ventilation shafts, namely; powerline alternative 1 (initial powerline route) and powerline alternative 2 (revised powerline route). However, it must be noted that the powerlines do not impact the air quality study.

4 APPLICABLE LEGISLATION

4.1 NATIONAL GREENHOUSE GAS EMISSION REPORTING REGULATIONS

On 3 April 2017, the National Greenhouse Gas Emission Reporting Regulations were published as General Notice 275 of 2017 (Government Gazette 40762). These regulations include a list of activities for which GHG emissions must be reported, which include:

- Energy;
- Industrial Processes and Product Use;
- Agriculture, Forestry and Other Land Use; and
- Waste Sector.

Further, these Regulations apply to the categories of emission sources listed in Annexure 1 to these Regulations and a corresponding data provider as classified in regulation 4 of these Regulations.

The purpose of these Regulations is to introduce a single national reporting system for the transparent reporting of GHG emissions, which will be used:

- To update and maintain a National Greenhouse Gas Inventory;
- For the Republic of South Africa to meet its reporting obligations under the United Nations Framework Convention on Climate Change (UNFCCC) and instrument treaties to which it is bound; and
- To inform the formulation and implementation of legislation and policy.

For purposes of these Regulations, a data provider is classified as follows:

- Category A: any person in control of or conducting an activity marked in the Category A column above the capacity given in the threshold column of the table in Annexure 1 to these Regulations; and
- Category B: any organ of state, research institution or academic institution, which holds GHG emission data

or activity data relevant for calculating GHG emissions relating to a category identified in table in Annexure 1 to these Regulations.

Notwithstanding category A, the Minister may identify additional GHGs, sources and associated data providers by following the consultative process set out in sections 56 and 57 of the Act and, in writing, require such data providers to register and to submit data for their emissions within a specified period to the competent authority.

A person classified as a Category A data provider in terms of regulation 4(1)(a) of these Regulations must register all facilities where activities exceed the thresholds listed in Annexure 1 by providing the relevant information as listed in Annexure 2 to these Regulations, within 30 days after the commencement of these Regulations or within 30 days after commencing such an activity after the commencement of these Regulations. A data provider must ensure that the registration details are complete and are an accurate reflection of the Intergovernmental Panel on Climate Change (IPCC) emission sources at each facility. The registration contemplated in sub-regulation (1) must be done as follows:

- On the National Atmospheric Emissions Inventory System (NAEIS); and
- In cases where the NAEIS is unable to meet the registration requirements, the registration must be done by submitting the information specified in Annexure 2 in an electronic format to the competent authority.

A Category A data provider must submit the GHG emissions and activity data as set out in the Technical Guidelines for Monitoring, Reporting and Verification of Greenhouse Gas Emissions by Industry for each of the relevant GHGs and IPCC emission sources specified in Annexure 1 to these Regulations for all of its facilities and in accordance with the data and format requirements specified in Annexure 3 to these Regulations for the preceding calendar year, to the competent authority by 31 March of each year.

4.2 DECLARATION OF PRIORITY POLLUTANTS AND POLLUTION PREVENTION PLANS

Under Section 29 of the NEM:AQA 39 of 2004, Government Notice 710 of 2017 (Government Gazette 40996), GHGs (CO₂, CH₄, N₂O, HFCs, PFCs and SF₆) have been declared as priority pollutants. Further, persons falling within the list of production processes, specified in Annexure A, which involves emission of GHGs in excess of 0.1 Mt annually are required to prepare and submit to the Minister pollution prevention plans for approval in line with NEM:AQA, Government Notice 712 of 2017 (Government gazette 40996). On 22 May 2018, in Government Notice 513 in Government Gazette 41642, the Minister of Environmental Affairs amended the National Pollution Prevention Plan Regulations (published in Notice 712 on 21 July 2017). In terms of this amendment, the first pollution prevention plan was due on or before 21 June 2018.

A pollution and prevention plan must include:

- Details of the person submitting the plan, including company name and company registration number in terms of the Companies Act, name and contact details of person responsible for submitting the pollution prevention plan on behalf of the company;
- Description of production processes as listed in Annexure A to these Regulations;
- Greenhouse gases generated from the production processes listed in Annexure A to these Regulations and their activities reported in accordance with the National Greenhouse Gas Emission Reporting Regulations;
- Total GHG emissions from the production process for the calendar preceding the submission of pollution prevention plan;
- Details of the methodology that is to be used by the person to monitor annual GHG emissions and evaluate progress towards meeting GHG emission reductions must be in line with the National Greenhouse Gas Emission Reporting Regulations; and
- Description of mitigation measures, based on the best information available at time, that will be implemented and result in deviation from the GHG emissions baseline over the pollution prevention plan's period, and the projected emissions reductions that will be achieved.

A first pollution prevention plan must cover a period from the date of promulgation of these Regulations up to 31 December 2020 and the subsequent pollution prevention plans must cover periods of five calendar years each.

5 METHODOLOGY

5.1 EMISSION TIER APPROACH

Activities undertaken for the Kalabasfontein project fall within the Energy Sector for *Coal Mining and Handling* under Annexure 1 of the National Greenhouse Gas Reporting Regulations. These regulations include a tiered approach to determining GHG emissions, as follows:

- **Tier 1:** Default IPCC emission factors available in the 2006 IPCC Guidelines are used to calculate emissions from activity data;
 - **Tier 2:** Country specific emission factors published in the Technical Guidelines for Monitoring, Reporting and Verification of Greenhouse Gas Emissions by industry are used to calculate emissions from activity data; and
 - **Tier 3:** Emission models, material carbon balances and continuous emission measurements in the Technical Guidelines for Monitoring, Reporting and Verification of Greenhouse Gas Emissions by industry available on the DEA website (www.environment.gov.za) are utilized.
-

5.2 EMISSION CATEGORIES

GHG emission activities are divided into three scopes within the Greenhouse Gas Protocol Corporate Accounting and Reporting Standard, defined as:

- **Scope 1:** Direct emissions arise from activities owned or controlled by an organisation, such as emissions from combustion in boilers, furnaces, and vehicles operating onsite. In the case of the Kalabasfontein project, this refers to emissions associated with the underground machinery, and coal mining for export market;
- **Scope 2:** Indirect emissions released into the atmosphere associated with the consumption of purchased electricity, heat, steam and cooling; these emissions occur at a distance from the site (e.g. at a power plant). In the case of the Kalabasfontein project, this refers to GHG emissions due to their electricity consumption onsite; and
- **Scope 3:** Other indirect emissions, other than those associated with energy usage, including business travel by means not owned or controlled by the entity, waste disposal by means not owned or controlled by the entity, and extraction/production and transport of purchased materials or fuels. For the purposes of this inventory, Scope 3 emissions have been excluded. With the exception of electricity consumption emissions, this inventory focuses only on those activities occurring for the Kalabasfontein project.

Figure 5-1 depicts some of the emission activities divided into the three scopes.

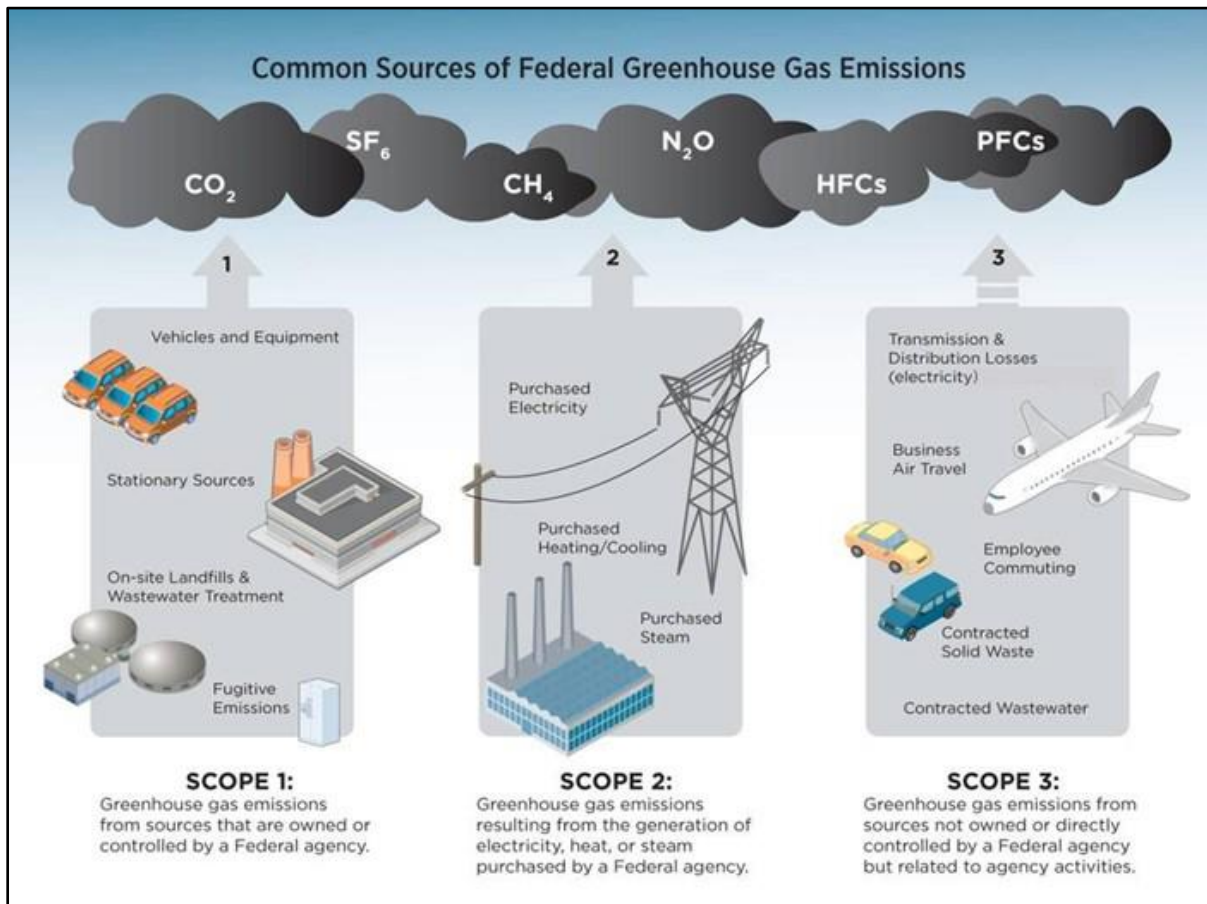


Figure 5-1: Emission categories and their sources (Common Sources of GHG Emissions, 2018)

6 GREENHOUSE GAS EMISSIONS

A GHG, as defined by the IPCC, is a compound which has the ability to trap heat over a certain lifetime in the atmosphere. The six priority pollutant GHGs, as listed within the Notice to declare GHG as Priority Air Pollutants (Government Notice 710 of 2017), are CO₂, CH₄, N₂O, HFCs, PFCs, and SF₆.

The key GHG emissions associated with activities for the Kalabasfontein project will include:

- CO₂;
 - Diesel, coal and electricity use for mining operations;
- CH₄;
 - Diesel, coal and electricity use for mining operations;
- N₂O;
 - Diesel and electricity use for mining operations.

The impact of these GHGs are quantified using their Global Warming Potential (GWP), which is a measure of their heat trapping effect relative to the effects of the same weight of CO₂ released over the same period of time. It is important to consider the GWP of GHG's, given that minor emissions of a high GWP gas could make a significant contribution to a carbon footprint. GHG emissions are therefore usually expressed in CO₂ equivalent terms (CO_{2eq}) to reflect the contribution of the various GHG emissions. **Table 6-1** shows the heat trapping ability of the major GHGs after 20 years and 100 years as compared to CO₂.

Table 6-1: GWP of greenhouse gases

Greenhouse Gas	GWP after 20 years	GWP after 100 years
CO ₂	1	1
CH ₄	72	25
N ₂ O	289	298

As per the GHG reporting regulations, Tier 1 emission factors (IPCC default factors) are applied for diesel consumption and Tier 2 (country specific) emission factors are applied for coal and electricity consumption to estimate CO₂ emissions. The emission factors are presented in **Table 6-2**.

Table 6-2: Greenhouse gas emission factors

Scope	Source	Emission Factor Unit	CO ₂	CH ₄	N ₂ O
Scope 1	Diesel consumption	Kg per GJ	74.1	0.003	0.0006
	Coal consumption (underground mining)	m ³ per tonne	0.077	0.77	-
	Coal consumption (post underground mining – handling, storage and transport)	m ³ per tonne	0.018	0.18	-
Scope 2	Electricity	Kg per kWh	1.07	1.09E-05	1.63E-05

6.1 EXISTING EMISSIONS BASED ON FORZANDO SOUTH RELOCATION AREA

Kalabasfontein will not add to the production of Forzando South but will provide relocation areas for the existing Forzando South underground mining sections. As such, existing diesel, coal and electricity consumption data from the Forzando South relocation sections for the 2015-2017 period was used to estimate the current emissions and are presented in **Table 6-3**.

Table 6-3: Gas, petrol, diesel and electricity consumption data for 2015-2017

Scope	Source	Main Activity	Unit	2015 Quantity/Annum	2016 Quantity/Annum	2017 Quantity/Annum
Scope 1	Diesel consumption	Underground machinery	Litres	248,894	248,875	309,714
	Coal consumption	Mined for export market	Tonnes	2,102,460	2,344,008	2,381,712
Scope 2	Electricity consumption	Underground machinery, support services, administration buildings and change house	MWh	34,479	24,317	23,009

The total GHG emissions for the year 2017 was estimated to be 63,868 t CO_{2eq}, which is approximately an 11% decrease from both 2016 and 2015, respectively (**Table 6-4**). Within the Scope 1 sources for 2015 to 2017, the coal consumption from underground mining contribute the highest GHG emissions, which make up 47%, 58% and 60%, respectively of the total CO_{2eq} emissions. Scope 2 (i.e. electricity consumption) contributes to 52%, 41% and 39% for 2015, 2016 and 2017 of the total CO_{2eq} emissions.

Table 6-4: Source specific greenhouse gas emissions for 2015 – 2017

Scope	Source	Main Activity	2015 Total CO _{2e} (tons/year)	2016 Total CO _{2e} (tons/year)	2017 Total CO _{2e} (tons/year)
Scope 1	Diesel consumption	Underground machinery	662.52	662.47	824.42
	Coal consumption	Mined for export market	33,814.92	37,699.85	38,306.26
Scope 2	Electricity consumption	Underground machinery, support services, administration buildings and change house	37,069.92	26,143.72	24,737.58
TOTAL GHG EMISSIONS			71,547.36	64,506.04	63,868.26

6.2 PREDICTED EMISSIONS FROM THE PROPOSED EMISSIONS FROM THE KALABASFONTEIN PROJECT

Proposed emissions for the Kalabasfontein project has thus been determined by taking an average of the existing diesel, coal and electricity consumption data from the Forzando South relocation sections for the 2015-2017 period. Given the similar trends over the past three years (**Table 6-4**), it is assumed that this will be an accurate representation of the likely GHG emissions emitted from the Kalabasfontein project. It is understood that the proposed consumption data from the Kalabasfontein project will also include an additional 800-900 litres of diesel during construction and a vent shaft operating continuously throughout the year at 1.728 MW /annum. As such, this diesel and electricity consumption data has been further added to the average existing emissions in order to obtain the total proposed emissions from the Kalabasfontein project. The diesel, coal and electricity consumption data are presented in **Table 6-5**.

Table 6-5: Gas, petrol, diesel and electricity consumption data for the Kalabasfontein project

Scope	Source	Main Activity	Unit	Quantity/Annum
Scope 1	Diesel consumption	Underground machinery	Litres	270,061.10
	Coal consumption	Mined for export market	Tonnes	2,276,060
Scope 2	Electricity consumption	Underground machinery, support services, administration buildings and change house	MWh	42,405.68

The total GHG emissions for the Kalabasfontein project was estimated to be 82,917 t CO_{2eq}. Within the Scope 1 sources, the coal consumption from underground mining contributes the highest GHG emissions, which make up 44%, respectively of the total CO_{2eq} emissions. Scope 2 contributes to 55% of the total CO_{2eq} emissions (Figure 6-1 and Figure 6-2).

Additionally, according to the climate action tracker analysis, South Africa will need to implement additional policies to reach its proposed targets to limit GHG emissions to between 398 and 614 MtCO_{2eq} over the period 2025–2030, and as such, the Kalabasfontein project should seek methodologies in order to reduce their GHG emissions and become environmentally friendly.

It should be noted that in line with the National Greenhouse Gas Emission Reporting Regulations in Annexure 1, activities taking place for the Kalabasfontein project within the *Coal Mining* activity, have no listed reporting threshold. As such, the GHG emissions emitted at the site should be considered that which need be reported by the data provider.

Table 6-6: Source specific greenhouse gas emissions for the Kalabasfontein project

Scope	Source	Main Activity	CO ₂ (tons/year)	CH ₄ (tons/year)	N ₂ O (tons/year)	Total CO _{2e} (tons/year)
Scope 1	Diesel consumption	Underground machinery	716.41	0.73	1.73	718.87
	Coal consumption	Mined for export market	389.21	36,217.80	-	36,607.01
Scope 2	Electricity consumption	Underground machinery, support services, administration buildings and change house	45,374.08	11.56	205.98	45,591.61
TOTAL GHG EMISSIONS						82,917.49

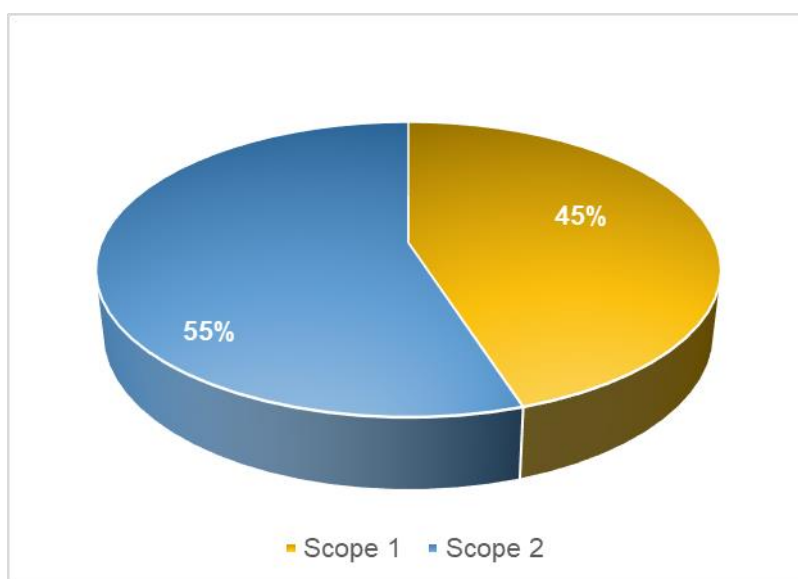


Figure 6-1: CO_{2eq} percentage contribution from Scope 1 and Scope 2 sources for the Kalabasfontein project

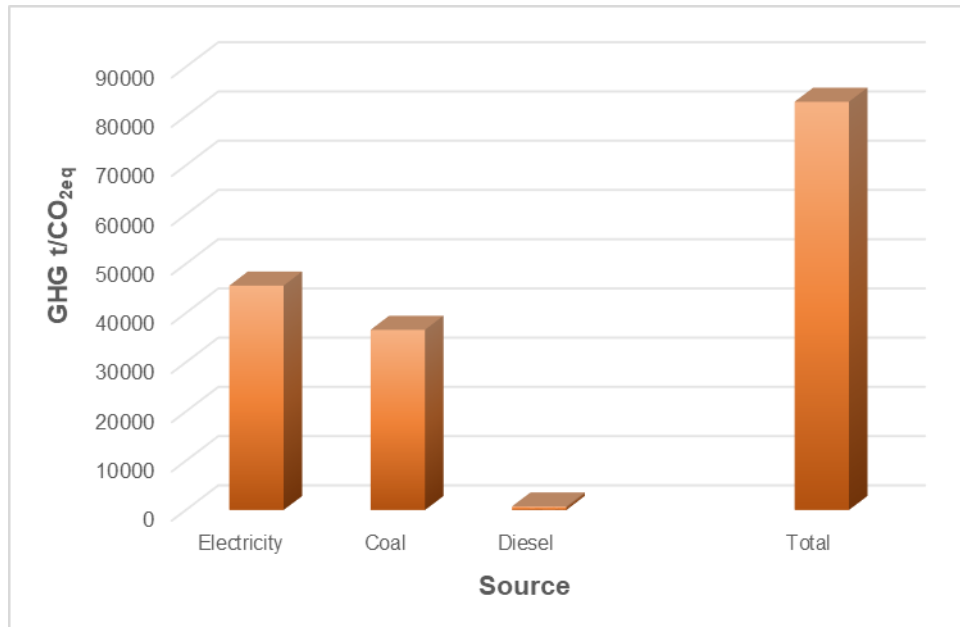


Figure 6-2: CO_{2eq} source contribution for the Kalabasfontein project

7 CONCLUSION

WSP has been requested by EIMS to undertake a GHG emissions inventory and report for the Kalabasfontein project in Mpumalanga.

The Kalabasfontein project will not add to the production of Forzando South, but will provide relocation areas for the existing Forzando South sections. As such, existing diesel, coal and electricity consumption data from the Forzando South relocation sections for the 2015-2017 period was used to estimate the current emissions.

The total GHG emissions for the year 2017 was estimated to be 63,868 t CO_{2eq}, which is approximately an 11% decrease from both 2016 and 2015, respectively. Within the Scope 1 sources for 2015 to 2017, the coal consumption from underground mining contribute the highest GHG emissions, which make up 47%, 58% and 60%, respectively of the total CO_{2eq} emissions. Scope 2 (i.e. electricity consumption) contributes to 52%, 41% and 39% for 2015, 2016 and 2017 of the total CO_{2eq} emissions.

Proposed emissions for the Kalabasfontein project has thus been determined by taking an average of the existing diesel, coal and electricity consumption data from the Forzando South relocation sections for the 2015-2017 period. Given the similar trends over the past three years, it is assumed that this will be an accurate representation of the likely GHG emissions emitted from the Kalabasfontein project. It is understood that the proposed consumption data from the Kalabasfontein project will also include an additional 800-900 litres of diesel during construction and a vent shaft operating continuously throughout the year at 1.728 MW /annum. As such, this diesel and electricity consumption data has been further added to the average existing emissions in order to obtain the total proposed emissions from the Kalabasfontein project.

The total GHG emissions for the Kalabasfontein project was estimated to be 82,917.49 t CO_{2eq}. Within the Scope 1 sources, the coal consumption from underground mining contributes the highest GHG emissions, which make up 44%, respectively of the total CO_{2eq} emissions. Scope 2 contributes to 55% of the total CO_{2eq} emissions.

Additionally, according to the climate action tracker analysis, South Africa will need to implement additional policies to reach its proposed targets to limit GHG emissions to between 398 and 614 MtCO_{2eq} over the period 2025–2030, and as such, the Kalabasfontein project should seek methodologies in order to reduce their GHG emissions and become environmentally friendly.

SPECIALIST DECLARATION

DETAILS OF THE SPECIALIST, DECLARATION OF INTEREST AND UNDERTAKING UNDER OATH

Application for authorisation in terms of the National Environmental Management Act, Act No. 107 of 1998, as amended and the Environmental Impact Assessment (EIA) Regulations, 2014, as amended (the Regulations)

PROJECT TITLE

Greenhouse Gas Report for the Kalabasfontein Project

1. SPECIALIST INFORMATION

Specialist Company Name:	WSP Environmental (Pty) Ltd			
B-BBEE	Contribution level (indicate 1 to 8 or non-compliant)	Level 5	Percentage Procurement recognition	
Specialist name:	Novania Reddy			
Specialist Qualifications:	BSc. Chemical Engineering			
Professional affiliation/registration:	N/A			
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Postal address:	PO Box 98867 Sloane Park 2152 South Africa			
Postal code:	2191	Cell:	+27 79 497 3460	
Telephone:	+27 11 361 1371	Fax:	-	
E-mail:	novania.reddy@wsp.com			

2. DECLARATION BY THE SPECIALIST

I, Novania Reddy, declare that –

- I act as the 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 the specialist report relevant to this application, 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 no, and will not engage in, conflicting interests in the undertaking of the activity;
- I undertake to disclose to the applicant and the 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;
- all the particulars furnished by me in this form are true and correct; and
- I realise that a false declaration is an offence in terms of regulation 48 and is punishable in terms of section 24F of the Act.

Signature of the Specialist

WSP Environmental (Pty) Ltd

Name of Company:

12 November 2019

Date

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