

African Rainbow Minerals

Greenhouse Gas Pollution Prevention Plan 1: 2017 - 2020

December 2017

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1 INTRODUCTION

This first pollution prevention plan (PPP) covers the period from 21 July 2017 up to 31 December 2020 and the subsequent pollution prevention plans will cover periods of five calendar years each.

ARM's Greenhouse Gas PPP (GHG-PPP) has been developed in line with the requirements of:

- The National Air Quality Act, 2004 (Act No.39 of 2004) and the Greenhouse Gas Regulations under the Act:
 - Declaration of Greenhouse gases as Priority Air Pollutants (Government Gazette Number 40996 61, No 710 of 21 July 2017);
 - National Pollution Prevention Plans Regulations (Government Gazette Number 40996 81, No 712 of 21 July 2017); and
 - National Greenhouse Gas Emission Reporting Regulations (Government Gazette Number 40762 of 3 April 2017).

The following documents have been used to inform the preparation of this PPP:

- Guidelines for the Development of Pollution Prevention Plans in Respect of Greenhouse Gases (Department of Environmental Affairs, 2017a);
- Technical Guidance for Monitoring, Reporting and Verification of Greenhouse Gas Emissions by Industry (Department of Environmental Affairs, 2017b); and
- 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines.

The PPP was compiled to provide the following required information:

- Provision of details for the reporting company;
- Description of production processes in terms of Annexure A of the National Pollution Prevention Plan Regulations;
- Description of GHG emissions associated with the production processes in terms of Annexure A of the National Pollution Prevention Plan Regulations;
- Quantification of total GHG emissions from the production process for the calendar year preceding the submission of the PPP;
- Description of methodology used by the reporting company to monitor annual GHG emissions; and
- Description of mitigation measures that can be implemented to reduce the overall carbon footprint of the company.

2 COMPANY INFORMATION

African Rainbow Minerals (ARM) (Pty) Ltd (referred to hereafter at "ARM") is a leading South African diversified mining and minerals company with long-life, low unit cost operations. ARM mines and beneficiates iron ore, manganese ore, platinum group metals (PGMs), copper, nickel and coal. ARM also produces manganese alloys, recovers chrome metal from slag and has an investment in gold through its shareholding in Harmony.

2.1 Details of the person submitting the plan

Name and contact details of a person submitting the PPP on behalf of the company:

- [Redacted]
- Tel: [Redacted] Fax: [Redacted]
- Email: [Redacted]

Company name and registration details (in terms of the Companies Act):

- African Rainbow Minerals (Pty) Ltd
- Registration number 1933/004580/06 ISIN code: ZAE 000054045

Contact details, including address, telephone number, mobile number, email address and fax number

- ARM House, 29 Impala Road, Chislehurst, Sandton, 2196
- Company Secretary: [Redacted]
- Tel: [Redacted] Fax: [Redacted]
- E-mail: [Redacted]

2.2 Description of production processes as listed in Annexure A to these Regulations

Through Cato Ridge Works and Machadodorp Works, ARM has capacity to produce ferromanganese and ferrochrome. Only three of the six furnaces at Cato Ridge Works are operating due to current economic and market considerations. Machadodorp Works is currently only recovering ferrochrome from its historical slag dumps through the Metal Recovery Plant. There are no process emissions associated with this activity.

Khumani and Beeshoek mines produce iron ore. Black Rock Mine produces high quality manganese ore. Approximately 12MW of diesel generator capacity at Black Rock Mine is synchronised to the grid.

The following processes are included in this PPP:


- 1A2i: Energy: Manufacturing Industries and Construction- Mining & Quarrying (Stationary combustion at Beeshoek, Black Rock and Khumani mines);
- 1A2m: Energy: Manufacturing Industries and Construction- Non-specified Industry (Stationary combustion at Cato Ridge Works and Machadodorp Works); and
- 2C2: Industrial Processes and Product Use: Metal Industry - Ferroalloys Production (process emissions at Cato Ridge Works only).

2.3 Completed Declaration as per Annexure 1 of the GHG PPP Guidelines

Declaration of accuracy of information provided:

I, Nerine Botes-Schoeman, declare that the information provided in this report is in all respects factually true and correct to the best of my knowledge and as at the date of signature.

Signed at Sandton on this 19th day of December 2017.



Signature


Capacity of Signatory 1

3 GHG EMISSIONS INVENTORY

3.1 Methodology

Descriptions of activities for which GHG data is required, and reported here, is based on the National Greenhouse Gas Emission Reporting Regulations published under General Notice 275 in the Government Gazette Number 40762 of 3 April 2017.

3.1.1 Reporting boundary

The operations within the ARM Ferrous Division form part of the Joint Venture between ARM and Assore, trading as Assmang and are jointly managed by ARM and Assore. ARM's GHG-PPP includes all facilities within the ARM Ferrous Division, that are under our direct or joint operational control. These include:

- Beeshoek Iron Ore Mine;
- Khumani Iron Ore Mine;
- Black Rock Manganese Mine;
- Cato Ridge Works; and
- Machadodorp Works.

The reporting boundary does not include emissions associated with operations within the ARM Platinum Division as the activities associated with this division are not included in the "List of Production Processes" (Annexure A) of the GHG-PPP Regulations. All projects and operations outside of the country are excluded from the boundary.

3.1.2 Gases

The greenhouse gases covered by these guidelines are defined in the Regulations and include:

- carbon dioxide (CO₂);
- methane (CH₄);
- nitrous oxide (N₂O);
- hydrofluorocarbons (HFCs);
- perfluorocarbons (PFCs); and
- sulphur hexafluoride (SF₆).

3.1.3 Emissions sources

The table below details the sources of emissions included and excluded within this PPP:

ARM GHG-PPP Emissions Sources:

IPCC Category	ARM Sources
(1A) Fuel combustion, which deals with emissions released from fuel combustion activities.	
<ul style="list-style-type: none"> 1A2i: Energy: Manufacturing Industries and Construction- Mining & Quarrying 	<ul style="list-style-type: none"> Stationary combustion at Beeshoek, Black Rock and Khumani Mines (Diesel, Paraffin, Acetylene, Natural Gas, LPG, Explosives)
<ul style="list-style-type: none"> 1A2m: Energy: Manufacturing Industries and Construction- Non-specified Industry 	<ul style="list-style-type: none"> Stationary combustion at Cato Ridge Works and Machadodorp Works (Diesel, Paraffin, Acetylene, Natural Gas, LPG)
(2) Industrial processes emissions, which deals with emissions released from the consumption of carbonates and the use of fuels as feed stocks or as carbon reductants, and the emission of synthetic gases in particular cases.	
<ul style="list-style-type: none"> 2C2: Industrial Processes and Product Use: Metal Industry - Ferroalloys Production 	<ul style="list-style-type: none"> Process emissions at Cato Ridge Works

Mobile combustion sources are excluded based on ARM's interpretation of the Regulations, supported by confirmation received from DEA (Ms Phindile Mangwana, Climate Change M&E: Change Information, confirmed that "All onsite mobile combustion must not be included"). This includes aviation fuel-based emissions associated with ARM's aircraft operated from Beeshoek Mine, as consumption of fuel is below the 100 000 litre/year threshold (during the 2017 financial year from 1 July 2016 to 30 June 2017, a total of 19 048 litres of aviation fuel was consumed by the ARM aircraft).

3.1.4 Methodology tiers

ARM has applied a Tier 1 methodology for calculating the relevant emissions included in this PPP.

Activity	Tier
1A2i	Tier 1
1A2m	Tier 1
2C2	Tier 1 (we are in the process of reporting according a Tier 2 methodology: using a mass balance approach)

3.2 Reporting

ARM has a robust GHG reporting process that will be used to monitor annual greenhouse gas emissions and evaluate progress towards meeting greenhouse gas emission reductions in line with the National Greenhouse Gas Emission Reporting Regulations.

Operational environmental management systems (EMS) align with the international Standard on EMS, ISO 14001 and operations included in the scope of this PPP are certified in terms of or aligned with this Standard. Environmental management systems are based on the plan-do-check principle to identify potential environmental impacts and guide the implementation of our environmental management plans and performance monitoring to mitigate environmental impact.

Emissions data is reported internally every quarter, discussed at the individual operational sustainability meetings and assessed in terms of the risk it poses to the business as part of quarterly risk management workshops. ARM has initiated a project to comply with the new GHG Regulations. This is part of our continuous improvement process - to improve our monitoring and reporting systems and to build capacity to meet the current and evolving requirements. Within this context, the project objectives are:

- To comply with the regulatory requirements to submit a GHG Pollution Prevention Plan and greenhouse gas emissions to the DEA;
- To identify gaps in climate change and water management and reporting to inform a practical and realistic strategy for filling gaps and to support ongoing reporting needs; and
- To identify and address opportunities to improve performance through regular monitoring and reporting.

This work builds on earlier work focused on identifying gaps in water management and reporting and will ensure that systems for reporting are integrated to be robust and efficient.

ARM's carbon footprint is reported in our annual integrated and sustainability reports as well as to the Carbon Disclosure Project (CDP). In all cases, data is reported according to our financial year (1 July to 30 June) on an attributable basis, which weights operational carbon footprints according to our shareholding in the joint venture operations. Therefore the GHG data reported publicly will differ from the calendar year, operational control, data reported here (and in subsequent reporting as part of the GHG Reporting Regulations).

In respect of ARM's sustainable development reporting process, external assurance of sustainability data is performed annually by an external assurance provider and includes a focus on material GHG sources.

3.3 2016 emissions

Table 3-1: GHG Emissions Inventory for Calendar Year 2016 (the year preceding the regulations)

Activity (IPCC Source Category)	Year (insert calendar years for which data is provided)	CO ₂	CH ₄	N ₂ O	HFCs	PFCs	SF ₆	Methodology and GHG emission factors used to estimate baseline emissions	Total GHG emissions in CO ₂ equivalents
1A2i	2016	1 306	0.011	0.002	n/a	n/a	n/a	Tier 1: IPCC 2006 Guidelines*	1 307
1A2m	2016	839	0.013	0.001	n/a	n/a	n/a	Tier 1: IPCC 2006 Guidelines*	840
2C2	2016	199 315	n/a	n/a	n/a	n/a	n/a	Tier 1: 1.3 tonne CO ₂ /tonne product	199 315
Total by gas	2016	201 460	0.024	0.004	n/a	n/a	n/a	Tier 1	201 462

*Emission factors for Ammonia Nitrate (0.0453 kg C/kg), Emulsion (0.0453 kg C/kg) and ANFO (0.0485 kg C/kg) are based on Australian AGO Factors and Methods Workbook, Department of the Environment and Heritage, December 2006 on page 20.

4 MITIGATION MEASURES

There are very few options to reduce the emissions included within the scope of this PPP (notably process emissions associated with Cato Ridge Works). The relevant measure is included in the table below.

Table 4-1: Mitigation Measures

Mitigation measure	Description of mitigation measure	Anticipated implementation date	Assumptions used to estimate anticipated GHG emission reduction	Affected GHG	Anticipated emission reduction (tonnes CO ₂ e)					
					2016*	2017*	2018	2019	2020	Total over 5 years
Alternative transport of hot metal	Replacement of a diesel-powered slag hauler with a winch-driven bogey to transport the hot metal ladle from the furnace to the alloys bay for further processing. The measure shifts the fuel from diesel to electricity and enables a more direct route, reducing the travel distance.	1/11/2017	The shift allowed for a reduction in diesel consumption by 68 litres per day.	CO ₂ , CH ₄ , N ₂ O	0					212

* this PPP only includes mitigation measures from July 2017 as per the requirements of the regulations.

Cato Ridge Works could reduce process emissions through the use of higher quality reductants such as coking coal, however this is uneconomical. The plant is as efficient as possible given the current operating conditions. There are no opportunities to limit the number of processes (e.g. eliminating agglomeration and sintering as this happens outside of ARM's operating boundary). The current furnaces are too small to support co-generation: the carbon monoxide (CO) concentration is regularly below the 34% required for burning. There are additional opportunities to reduce heat losses and improve efficiencies (especially with regard to electricity consumption which is outside of the scope of this PPP) but this would require a new design and unfeasible capital expenditure for the construction of new furnaces. This is not economically viable. Cato Ridge is optimised according to the existing design.

There are a number of interventions implemented and planned at the operations within the ARM Ferrous Division that reduce electricity consumption or diesel consumption associated with mobile combustion. These include:

- Installing light controls and LED light replacement at the mines;
- Installing solar geysers;
- Vehicle optimization and traffic management systems: reducing idle time, optimizing routes, and using diesel additives to reduce emissions;
- Black Rock Mine is currently investigating the use of electric vehicles for transporting employees to underground workings as well as purchasing more efficient vehicles;
- Installing more energy efficient motors, pumps and ventilation fans;
- Installing cap-banks at sub-stations to act as a form of storage;
- Investigating renewable energy options to reduce electricity-related emissions and improve energy security; and
- Various behaviour change and awareness initiatives.