

African Rainbow Minerals
Greenhouse Gas Pollution Prevention Plan: Annual
Progress Report 1

31 March 2019

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1 INTRODUCTION

ARM submitted its first pollution prevention plan (PPP) covering the period from 21 July 2017 up to 31 December 2020. The plan was accepted by the Department of Environmental Affairs. This document represents the first annual progress report as per the regulations.

ARM's Greenhouse Gas PPP annual progress report (GHG-PPP Progress Report) 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 GHG-PPP Progress Report:

- 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:

- a) Name of the person submitting annual progress report on behalf of the company
- b) Company name and registration (in accordance with the Company Act):
- c) Full details of the person submitting the annual progress report:
 - I. Name and surname
 - II. Position in the company
 - III. Contact details, including address, telephone number, mobile number, email address and fax number
- d) Completed declaration as per Annexure I of the guidelines.
- e) An overview of any material changes that are relevant to the PPP, such as the sale, purchase or transfer of a facility, a significant change in production outputs, or a significant change in the way operations are conducted.
- f) Completed Table 1 of Annexure I of the guidelines.
- g) Completed Table 3 of Annexure II of the Guidelines.

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), 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:

- Nerine Botes-Schoeman, Executive Sustainable Development
- Tel: +27 (0) 11 779 1545; Fax: +27 (0) 865759024
- Email: nerine.botes@arm.co.za

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: Alyson D'Oyley
- Tel: +27 (0) 11 779 1300; Fax: +27 (0) 11 779 1318
- E-mail: alyson.doyley@arm.co.za

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

ARM has capacity to produce ferromanganese at its Cato Ridge Works and ferromanganese and ferrochrome at its Machadodorp Works. During the period under review (2018 calendar year), only three of the six furnaces at Cato Ridge Works were operating due to economic and market considerations. At Machadodorp Works, the only active process during 2018 was the recovery of ferrochrome from 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 ARM's GHG 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 26th day of March 2019


Signature

Executive Sustainable Development
Capacity of Signatory

3 OVERVIEW OF ANY MATERIAL CHANGES THAT ARE RELEVANT TO THE PPP

There have been no material changes with respect to ARM's operations and the production outputs of those operations between calendar year 2018 and 2017.

4 GHG EMISSIONS DATA: CY2018 EMISSIONS

Table 4-1: GHG Emissions Inventory for Calendar Year 2018 (Table 1 of the guidelines)

Activity Source (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	2018	594	0.023	0.005	n/a	n/a	n/a	Tier 1: IPCC 2006 Guidelines*	594
1A2m	2018	847	0.013	0.001	n/a	n/a	n/a	Tier 1: IPCC 2006 Guidelines*	847
2C2	2018	180 545	n/a	n/a	n/a	n/a	n/a	Tier 2: Mass Balance Approach	180 545
Total by gas	2018	181 986	0.037	0.006	n/a	n/a	n/a	Tier 1	181 986

*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.

5 MITIGATION MEASURES: PROGRESS

Progress with respect to the mitigation measure included in ARM's GHG-PPP is included below. Note that there are very few options to reduce the emissions included within the scope of ARM's PPP (notably process emissions associated with Cato Ridge Works).

Table 5-1: Mitigation Measures Progress (Table 3 of the guidelines)

Mitigation measures	Affected GHG	Anticipated emission reduction (tonnes CO ₂ e)					Actual emission reduction achieved (tonnes CO ₂ e)					Description of deviations from the approved pollution prevention plan and remedial actions put into place.
		2016	2017	2018	2019	2020	2017	2018	2019	2020	Total actual reductions (Y1-Y5)- to date	
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.	CO ₂	0.00	11.16	66.80	66.80	66.80	9.99	112.12	n/a	n/a	122.10	Achieved performance of the winch driven bogey was better than expected.
	CH ₄	0.00	0.01	0.06	0.06	0.06	0.01	0.10	n/a	n/a	0.11	
	N ₂ O	0.00	0.03	0.16	0.16	0.16	0.02	0.27	n/a	n/a	0.29	

Total	0.00	11.20	67.02	67.02	67.02	10.02	112.49	122.51
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* this PPP Progress Report 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 Ferrrous 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.