

# **POLLUTION PREVENTION PLAN FROM 2016 TO 2020**

**ANGLO AMERICAN COAL SOUTH AFRICA**

## COMPANY DETAILS

<b>Name</b>	Anglo Operations Proprietary Limited	Anglo American Inyosi Coal Proprietary Limited
<b>Company registration no.</b>	1921/006730/07	2005/016701/07
<b>Address</b>	44 Main Street Johannesburg 2001	55 Marshall Street Johannesburg 2001

## CONTACT PERSONS

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## 1. PURPOSE

The purpose of this document is to outline the Pollution Prevention Plan based on our energy and carbon emission management plan used for Anglo American Coal SA from 2016 to 2020, referred to as ECO<sub>2</sub>MAN.

## 2. DEFINITIONS AND ACRONYMS

AACSA	Anglo American Coal South Africa
AOL	Anglo Operations (Pty) Ltd
AAIC	Anglo American Inyosi Coal (Pty) Ltd
DEA	Department of Environmental Affairs
DOE	Department of Energy
ECO <sub>2</sub> MAN	Energy and CO <sub>2</sub> Management
GHG	Greenhouse Gas
OC	Opencast
UG	Underground

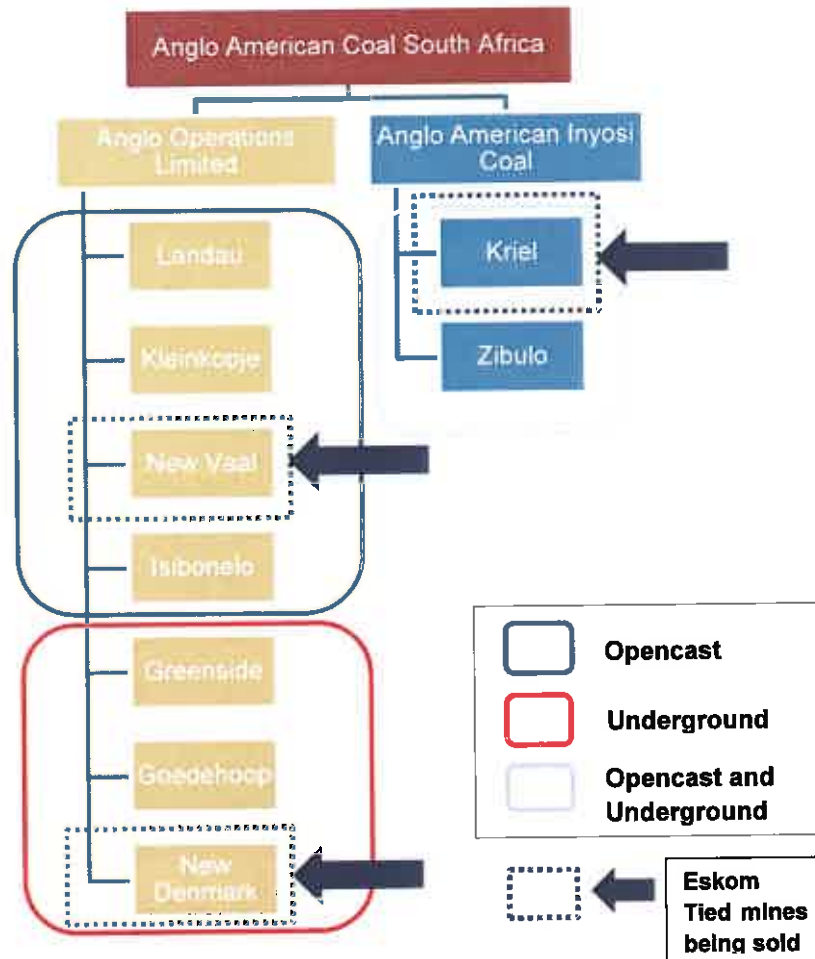
## 3. OVERVIEW

### 3.1. Company Structure

Anglo American Coal South African (AACSA) is part of the Anglo American Coal business unit, which includes operations in South Africa, Australia, Colombia and Canada.



Figure 3-1 below shows the structure, ownership and mines in AACSA. It also shows by means of a dotted box and arrows, those operations that are in the process of being sold.



**Figure 3-1. Map indicating the location of the various Anglo American Coal SA operations. Numbered items are the operations included in this plan.**

Anglo American Coal South Africa publically reports scope 1 and 2 emissions for all managed operations. As such, these include all of the operations above, as AACSA is responsible for managing the AAIC operations.

The emissions reported in this document have been rolled up into a single figure for AACSA.

**3.2. Activities undertaken by the company**

The activities undertaken by AACSA include the following from the list provided by the Department in the Data Questionnaire:

- 1A2i Fuel combustion activities**
- 1B1ai1 Underground Mines (mining)**
- 1B1ai2 Post-mining seam gas emissions**

**1B1ai4 Flaring of drained methane to CO<sub>2</sub>**

**1B1aii1 Surface mines (mining)**

**1B1aii2 Post-mining seam gas emissions**

### **3.3. Carbon Budget**



## **4. SCOPE AND BOUNDARIES**

The Eskom-tied mines referred to in section 3 above will be sold by January 2018. As such, these mines are included in the PPP for 2016 – 2017, but removed from scope for the period 2018 – 2020. The sale of the mines is subject to a final approval. Should the sale not proceed for any reason, the Department will be notified in a timely manner.

Table 4-1 below shows the total attributable production for each mine. As methane emissions are a result of the tons mined at each operation, and opencast mines (OC) do not emit methane (IPCC Tier 2 factor of 0) this is an important influencer of the AACSA carbon budget.

Table 4-1. List of operations included in this plan.

Mine	Duration in scope	Mining Method	Total attributable production 2016*
1. Goedehoop	2016 - 2020	UG	4.7 Mt
2. Greenside	2016 - 2020	UG	3.9 Mt
3. Kleinkopje	2016 - 2020	OC	3.9 Mt
4. Landau	2016 - 2020	OC	4.3 Mt
5. Isibonelo	2016 - 2020	OC	4.4 Mt
6. Zibulo	2016 - 2020	UG & OC	6.0 Mt
7. New Vaal	2016 – end 2017	OC	15.9 Mt
8. New Denmark	2016 – end 2017	UG	2.5 Mt
9. Kriel	2016 – end 2017	UG & OC	6.3 Mt
<b>Total South African Production</b>			<b>51.9 Mt</b>

\* Source: Anglo American Plc Annual Report 2017

## 5. DETAILS OF METHODOLOGY

### 5.1. Fuel combustion activities (use of mobile machinery)

#### 5.1.1. CO<sub>2</sub><sup>e</sup> from Fossil fuels

Fossil fuels consumed at operations release GHG as a result of the combustion process in mobile machinery.

IPCC 2006 Guideline factors are applied, as per the National GHG Inventory (DEA, 2014).

**Table 5-1: Emission factors applied to fuel combustion**

	Diesel (t/TJ)	Petrol (t/TJ)
CO <sub>2</sub>	74.1	69.3
CH <sub>4</sub>	3.9	33
N <sub>2</sub> O	3.9	3.2

### 5.2. Fugitive emissions from coal mining and handling

Coal-mine methane is the in-situ seam gas that is released from the mined coal seams during the mining process and post-mining.

#### 5.2.1. CH<sub>4</sub> and CO<sub>2</sub> from coal mining and post-mining

The methodology and emission factors used in the National GHG Inventory (DEA, 2014) were used as the basis for calculating the CH<sub>4</sub> and CO<sub>2</sub> emissions from mining and post-mining activity. These are the specific emission factors for South Africa, which are lower than those in the IPCC 2006 guidelines.

These factors are applied to the Run of Mine tonnages.

Formula used:

$$CH_4 = ROM \text{ production} * \text{Gas content} * 1000 \text{ L} / \text{Gas constant} * \text{molar weight} / 1000 \text{ 000 grams}$$

CH<sub>4</sub> (ton/yr)

ROM Production (ton/yr)

Gas Constant 22.4

Molar weight 16.04

Gas content = emission factor as shown in table 5-2.



Table 5-2: Emission factors for CH<sub>4</sub> and CO<sub>2</sub> from coal mining and handling

Mining method	Activity	CH <sub>4</sub> Gas Content (m <sup>3</sup> /tonne)	CO <sub>2</sub> Gas content (m <sup>3</sup> /tonne)
Underground mining	Coal mining	0.77	0.077
	Post-mining	0.18	0.018
Surface mining	Coal mining	0	0
	Post-mining	0	0

CH<sub>4</sub> (ton/yr) released is then multiplied by the GWP of 23 to achieve annual CO<sub>2</sub>e emissions.

### 5.2.2. CO<sub>2</sub><sup>e</sup> from Methane flared

The CO<sub>2</sub> emissions from methane flared are calculated in accordance with the IPCC 2006 Guidelines, a factor is applied to the tonnes of methane flared and the flare efficiency is assumed to be 98%.

Formula used:

*Emissions of CO<sub>2</sub> from CH<sub>4</sub> combustion (t/year) = 0.98 X Volume of methane flared (m<sup>3</sup>/year) X emission factor*

Factor: 2.749 ton CO<sub>2</sub> / ton CH<sub>4</sub>

Parameter: Methane flared (ton)

Methane is only flared intermittently at New Denmark Colliery.

## 6. TOTAL EMISSIONS FOR 2016

Emissions are provided in table 6-1 below based the template provided in the Guidelines for Development of Pollution Prevention Plans.

The total projected emissions for 2016 presented in the AACSA carbon budget submission was 536,833 tCO<sub>2</sub>e. In table 6-1, one can see that the actual emissions were close to the projection with a total of 532,749 tCO<sub>2</sub>e for 2016. The actual emissions were 4,086 t CO<sub>2</sub>e lower than projected.

**Table 6-1: Total annual emissions from each activity measured as CO<sub>2</sub>e for the preceding calendar year.**

Activity (IPCC Source Category)	Year	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	GHG4	GHG5	GHG6	Methodology and GHG emission factors used to estimate baseline emissions	Total GHG emissions in CO <sub>2</sub> equivalents
1A2i Fuel combustion activities	2016	200,499.52	10.83	10.55				IPCC 2006 Tier 1	203,870.92
1B1a1 Underground Mines (mining)	2016	8,254.81	12,611.66	-				IPCC 2006 Tier 2	298,323.00
1B1a2 Post-mining seam gas emissions	2016	825.48	1,261.17	-				IPCC 2006 Tier 2	29,832.30
1B1a4 Flaring of drained methane to CO <sub>2</sub>	2016	617.33	4.58	-				IPCC 2006 Tier 2	722.74
1B1ai1 Surface mines (mining)	2016	-	-	-				IPCC 2006 Tier 2	-
1B1ai2 Post-mining seam gas emissions	2016	-	-	-				IPCC 2006 Tier 2	-
<b>Total by gas</b>	<b>2016</b>	<b>210,197.14</b>	<b>13,888.24</b>	<b>10.55</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>-</b>	<b>532,748.97</b>

## 7. PLANNED MITIGATION MEASURES

The Scope 1 emissions in our business emanate from the fugitive methane from coal mining and from combustion of fossil fuels in mobile machinery.

We currently do not have any capital approved projects for fossil fuel combustion. As such, we have included the following two projects in our Pollution Prevention Plan.

### 1. Advanced Process Control (APC) on Coal Processing Plants:

Advanced Process Control Technology will be installed at three coal processing plants. The technology will be installed at one plant in late 2018, with operation expected in March 2019. The installation at the other two plants will follow with the technology to be operational in Q4 2019.

Currently the coal processing plants do not have any automated control that considers multiple variables to optimise the plant efficiency in real time.

This system is a proven control and optimisation technology that will deliver measurable and sustainable improvements in process stability, product yield/recovery, energy optimisation and process throughput/capability.

The system reads the real-time data from the SCADA and other relevant sources and then automatically controls the plant operation to ensure stable performance and allow for predictive maintenance.

### 2. Continuous Methane Monitors:

The gas concentrations of the vent air methane are so low that there are currently no known technologies that can reduce these emissions (globally). As was outlined above, we currently use the IPCC Tier 2 methodology for South Africa as the basis for our emissions estimates. However, there is a large amount of inaccuracy in these estimates as they were based on a limited number of samples at a limited number of sites over a very short period of time. Our ad-hoc monitoring indicates that the methane levels in our underground coal mines are lower than what we are currently reporting.

As such, we have installed a continuous methane monitor at a new ventilation shaft at Greenside Colliery and at Zibulo Colliery. See Table 8-1 below for further details (based on table 2 of Annexure 1 of the Guidelines).

It is important to note that this technology will NOT reduce the actual emission but will rather provide us with a true reading of what our methane emissions are. This will have benefits for the country in the long term, as it is likely that the methane emissions from fugitives are being overestimated at many mines.

## 8. RESULTS OF MITIGATION INTERVENTIONS

There are no results to report yet. These will be reported in the 2019 Progress Report.



POLLUTION PREVENTION PLAN FROM 2016 TO 2020

6 August 2018

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Table 8-1: Details of planned 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 <sub>2e</sub> )					Total over 5 years
					2016	2017	2018	2019	2020	
Advanced Process Control on Coal Processing Plants	<p>Installation of Advanced Process Control at 3 coal processing plants. The technology will be installed at one plant in late 2018, with operation expected in March 2019. The installation at the other two plants will follow with the technology to be operational in Q4 2019. This system is a proven control and optimisation technology that will deliver measurable and sustainable improvements in process stability, product yield/recovery, energy optimisation and process throughput/capability. The system reads the real-time data from the SCADA and other relevant sources and then automatically controls the plant operation to ensure stable performance and allow for predictive maintenance.</p>	<p>Plant 1 March 2019 Plants 2 and 3 September 2019</p>	<p>The electrical energy savings is anticipated to be approximately 3% per annum per plant</p>	CO <sub>2</sub>	0					4184

Mitigation Measure	Description of mitigation measure	Anticipated implementation date	Assumptions used to estimate anticipated GHG emission reduction	Affected GHG	Anticipated Emission Reduction (tonnes CO <sub>2</sub> e)					
					2016	2017	2018	2019	2020	Total over 5 years
Continuous methane monitoring	The accuracy of the South African IPCC Tier 2 emission factors for fugitive methane from coal mining is low as the numbers are based on a spot measurement from a small number of samples from a limited number of mines. In South African, methane levels in coal seams is very low and can be highly variable. It would benefit South Africa to have a more accurate estimate of fugitive methane levels. We have installed continuous methane monitors on a ventilation shaft at each of our Greenside and Zibulo mines. The continuous methane monitor measures the methane concentration at regular intervals (15 or 30 minutes) intervals with a high level of accuracy. Although the technology does not reduce the emissions, it does provide us with accurate readings of the methane levels, which initial results are showing are much lower than estimates calculated using the IPCC Tier 2 methodology.	Jan-17	The continuous methane monitor is not expected to decrease emissions per say, but rather to give an actual reading of what the emission are for an individual mine.	CH <sub>4</sub>	0					

**APPENDIX A. AACSA CARBON BUDGET LETTER**