Monitoring report form for CDM project activity
(Version 07.0)

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT		
Title of the project activity	Transalloys Manganese Alloy Smelter Energy Efficiency Project	
UNFCCC reference number of the project activity	1027	
Version number of the PDD applicable to this monitoring report	1.0	
Version number of this monitoring report	1	
Completion date of this monitoring report	04/11/2019	
Monitoring period number	Fifth Monitoring Period	
Duration of this monitoring period	01/05/2011 – 30/06/2014 (including both days)	
Monitoring report number for this monitoring period	1	
Project participants	Highveld Steel and Vanadium Corporation Limited and EcoSecurities Group plc.	
Host Party	Republic of South Africa	
Applied methodologies and standardized baselines	Methodology: AM0038 - Methodology for improved electrical energy efficiency of an existing submerged electric arc furnace used for the production of SiMn ver. 1 and ACM0002 ver. 6 - Consolidated methodology for grid-connected electricity generation from renewable sources	
Sectoral scopes	Sectoral Scopes: 9 (Metal production) and 1 (Energy industries (renewable - / non-renewable sources))	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	504,662	229,967
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	224,957	

SECTION A. Description of project activity

A.1. General description of project activity

At its facility close to Emalahleni, South Africa Transalloys (Pty) Ltd. produces silicomanganese (SiMn) alloy which is a key component in steel making). The Transalloys facility currently operates 5 submerged electric arc furnaces (designation; F1, F3, F5, F6 and F7).

Purpose of the project activity
The Transalloys Manganese Alloy Smelter Energy Efficiency Project (the "Project") is an industrial energy efficiency project that reduces the electricity consumption in the production of SiMn alloy.

Measures taken for GHG emission reductions
The Project displaces electricity from the South African grid, which is predominantly coal based by retrofitting and implementing new technology into the existing furnace infrastructure.

A.2. Location of project activity

The Project is located approximately 100 km east of Tshwane (formerly known as Pretoria). The location of the Project site can be uniquely identified as follows:

- Host Country: Republic of South Africa
- Region/State/Province: Mpumalanga
- City/Town/Community: Emalahleni, formerly known as Witbank
- GPS Coordinates: S25º53'43" E29º07'00"

The below map assists in the identification of the Project location:

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Republic of South Africa (host)	Highveld Steel and Vanadium Corporation Limited	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Group plc	No
Switzerland	EcoSecurities Group plc.	No

A.4. References to applied methodologies and standardized baselines

- AM0038 - Methodology for improved electrical energy efficiency of an existing submerged electric arc furnace used for the production of SiMn ver. 1; https://cdm.unfccc.int/filestorage/C/D/M/CDMWF_AM_TP3XH1K34Q0RXZRQYH1LI1ECI91N87/EB26_repan05_AM0038-NM0146.pdf?t=VGd8cHgwM3NnfDAPJ9gyD2eksOHIPKg1nWor

- ACM0002 ver. 6 - Consolidated methodology for grid-connected electricity generation from renewable sources; https://cdm.unfccc.int/filestorage/C/D/M/CDMWF_AM_BW759ID58ST5YEEV6WUCN5744MN763/eb24_repan07_ACM0002_ver06_for_web.pdf?t=NDN8cHgwM3ZsfDDsde9FgdcJAI0J7alYtuDA

A.5. Crediting period type and duration

Fixed crediting period: 01/10/2004 – 30/09/2014 (including both days).

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

Furnaces 1, 3, and 5 (subsequently “F1”, “F3”, and “F5”) are of “Elkem” design, while Furnace 6 (subsequently “F6”) is a self built furnace based on that design. Furnace 7 (subsequently “F7”) is of “Demag” design. The electric capacities of the furnaces are 48MVA (F5 and F7), 22MVA (F6) and 21MVA (F1 and F3).

The retrofit of the furnaces consists of the following:

- F5 and F7: the Pitch Centre Diameter (subsequently “PCD”) which measures the distance between the three electrodes (please refer to Figure 3 of the registered PDD), was optimised in order to reduce electricity consumption. If the PCD is too large, then the furnace requires a higher current density; whereas if the PCD is too small, the outside of the furnace(s) cool(s) excessively, resulting in operational difficulties. The decision to change the PCD was based on assumptions and mathematical models that still require actual confirmation in practice, since such innovative changes imply an element of uncertainty. Changing the PCD means that all 3 electrode column assemblies and the material inlets have to be changed, in addition to adaptation of the existing roofing structure (to the new dimensions). For F5, the investment cost was relatively high since the off-take systems (i.e. stacks) also had to be changed, and new lining and foundations installed for the furnace. “Pyromet” provided the technology for these furnaces, and it was the first time such technology was employed for a Brownfield project.

- The same principles apply to F1, F3, and F6, however, these units being smaller, the design was slightly different. For instance, F3 was converted from a rotating (around its vertical axle) to a static furnace, and the old pneumatic slipping system (allowing the electrode paste down the electrode) was changed – both elements make the scope of this retrofitting unique and challenging. “Bateman” provided the technology for these furnaces.

The diagram below is a schematic of one furnace, representing inputs and outputs of products and energy:

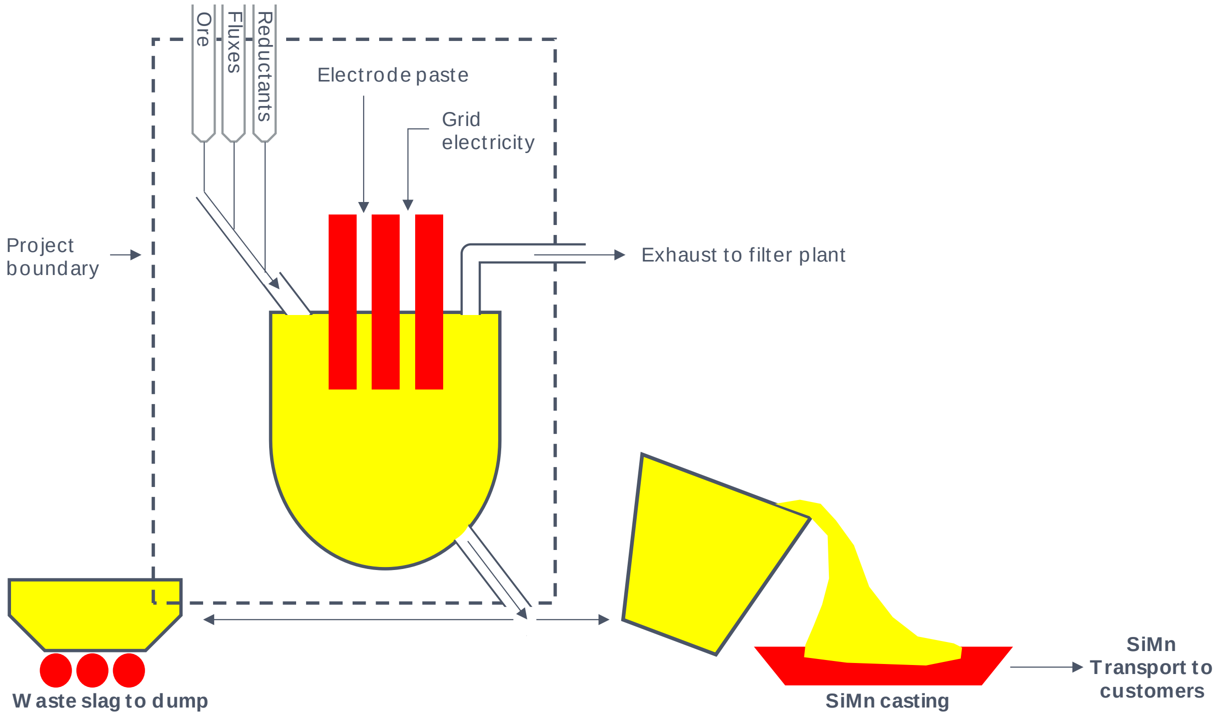

Diagram 1: Schematic of furnace (representing input(s)/output(s) of product(s)/energy

Commencement date of operation of the project activity

The project employs a phased implementation since it covers 5 furnaces at the project site. The project commenced operations on 01/10/2004, and the retrofit schedule is as the table below:

#	Retrofit status
F7	Retrofit completed 09/2004. Operation commencement 01/10/2004.
F3	Retrofit completed 10/2005. Operation commencement 30/11/2005.
F5	Retrofit completed 12/2005. Operation commencement 04/12/2005.
F6	Originally planned to be retrofitted in 2008, but delayed due to poor market conditions. To date, no retrofit.
F1	Originally planned to be retrofitted in 2009, but delayed due to poor market conditions. To date, no retrofit.

Table 2: Retrofit schedule for furnaces

Information regarding the actual operation of the project activity during this monitoring period:

F3, F5, and F7 operated throughout this monitoring period. The table below provides an overview of the downtime of F3, F5, and F7 during the monitoring period.

#	Event	F#	Date off	Date on	Duration (d)
1	Furnace Downtime	3	05/07/2011	20/07/2011	15
2	Furnace Downtime	3	12/12/2011	29/03/2012	108
3	Furnace Downtime	3	14/06/2012	15/06/2012	1
4	Furnace Downtime	3	27/07/2012	28/07/2012	1
5	Furnace Downtime	3	26/09/2012	01/10/2012	5
6	Furnace Downtime	3	01/12/2012	03/06/2013	184
7	Furnace Downtime	3	05/06/2013	06/06/2013	1
8	Furnace Downtime	5	23/06/2011	24/06/2011	1
9	Furnace Downtime	5	05/07/2011	31/07/2011	26
10	Furnace Downtime	5	01/08/2011	02/08/2011	1
11	Furnace Downtime	5	03/08/2011	04/08/2011	1
12	Furnace Downtime	5	30/11/2011	01/12/2011	1
13	Furnace Downtime	5	12/12/2011	01/06/2012	172
14	Furnace Downtime	5	02/06/2012	03/06/2012	1
15	Furnace Downtime	5	26/09/2012	01/10/2012	5
16	Furnace Downtime	5	25/02/2013	04/07/2013	129
17	Furnace Downtime	5	22/11/2013	09/12/2013	17
18	Furnace Downtime	5	18/08/2014	20/08/2014	2
19	Furnace Downtime	7	04/07/2011	23/07/2011	19
20	Furnace Downtime	7	04/08/2011	05/08/2011	1
21	Furnace Downtime	7	03/11/2011	04/11/2011	1
22	Furnace Downtime	7	12/12/2011	01/04/2012	111
23	Furnace Downtime	7	26/09/2012	01/10/2012	5
24	Furnace Downtime	7	01/12/2012	25/02/2013	86
25	Furnace Downtime	7	01/03/2013	01/04/2013	31
26	Furnace Downtime	7	06/04/2013	28/05/2013	52
27	Furnace Downtime	7	01/09/2013	03/09/2013	2
28	Furnace Downtime	7	11/09/2013	03/10/2013	22
29	Furnace Downtime	7	11/10/2013	12/12/2013	62
30	Furnace Downtime	7	26/08/2014	29/08/2014	3
Total					**1066**

Table 3: Furnace downtime

Events or situations affecting the applicability of the methodology:

No events occurred that affected the applicability of the methodology.

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

No temporary deviations have been applied.

B.2.2. Corrections

No Corrections have been made for this monitoring period.

B.2.3. Changes to the start date of the crediting period

No changes to the start of the crediting period have been made.

B.2.4. Inclusion of monitoring plan

Following the revision and approval of the monitoring plan on 25/10/2009 it was included.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

The Monitoring Plan was revised and approved on 25/10/2009. No other revision is pending.

B.2.6. Changes to project design

No changes to the project design have been made.

B.2.7. Changes specific to afforestation or reforestation project activity

Not applicable to this project type.

SECTION C. Description of monitoring system

Data collection procedures

The monitored data is collected at different stages of the process, in different parts of the plant, as explained below:

- Amount of SiMn produced, electricity, paste, coke, and coal used at the project furnaces are collected from meters via a Distributed Control System (subsequently “DCS”) and directly displayed on an interface in the control room directly. The values are entered in the respective furnace log-sheets by the furnace operator. After being checked by the Production Engineer, the daily totals are then summed and entered in the CDM workbook. Paste cylinders are tallied as they are placed into their casings. To obtain the monthly average weight of the paste cylinders (used to calculate the amount of paste as per Monitoring Plan), the readings from the weighbridge (at the facility entrance) are recorded in a spreadsheet by the weighbridge personnel for each paste delivery. The monthly total weight and number of cylinders weighed is then entered in the CDM workbook, where the monthly average weight of the paste cylinders is calculated.

- Quality of coal, coke (used to calculate emission factor for coke in the CDM workbook), SiMn, ore, and fluxes are obtained via composition analysis performed at the plant laboratory. The results are then entered in the CDM workbook. - Paste quality details are obtained from the supplier. - Values for grid emission factor and coal emission factor are

Please refer to sections D.2 and E for detail of emission reduction calculation. The monitored parameter data is taken from the CDM workbook and reported in the CDM Monitoring Report prior to verification.

Organisational structure, roles, and responsibilities

An on-site CDM Manager is responsible for organising the monitoring team and ascertaining that the monitoring system is as per the Monitoring Plan. Furnace operators who collect monitored data report to the Production Engineer who checks the production data (including CDM monitored data). Laboratory staff performing the analyses are organised under a Laboratory Manager. Maintenance teams are in place at the plant to ascertain that monitoring equipment is maintained and calibrated as per the Monitoring Plan. Roles and responsibilities are clearly defined in the site procedures that are part of the ISO9001 certified quality management system.

Emergency procedures for the monitoring system

Since all measurements and analyses employed for project CDM monitoring are also used for internal reporting, emergency procedures are in place on-site for possible equipment failures. The metering system is represented in the diagram below.

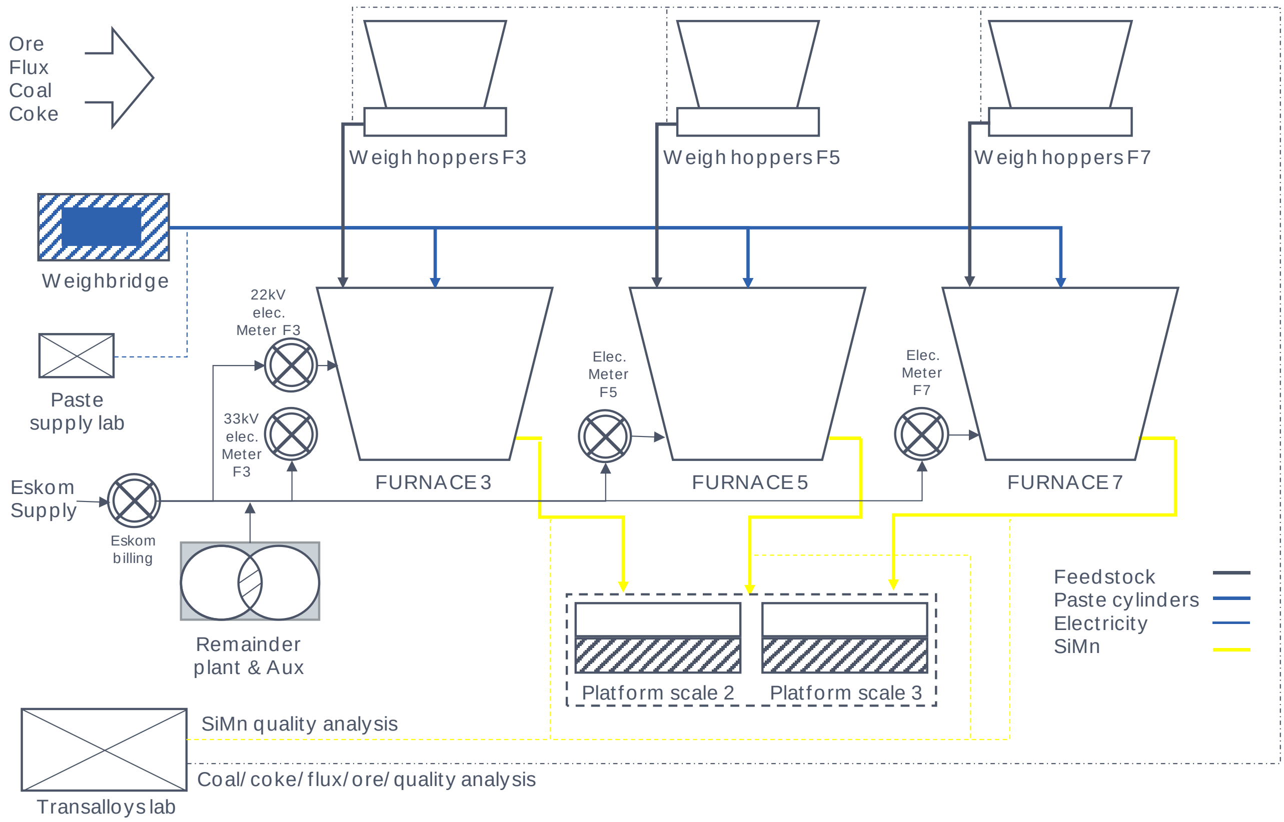

Diagram 2: Transalloys metering system

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

Data/Parameter	**QP_i**
Unit	Tonnes of SiMn/year
Description	Annual SiMn production for 7 years preceding the project activity
Source of data	Project proponent
Value(s) applied	

QPi (tSiMn/y)					
Furnace	**1**	**3**	**5**	**6**	**7**
1997	21,685	21,930	38,847	22,571	40,685
1998	7,506	9,518	42,005	24,188	42,399
1999	21,779	17,680	35,788	8,238	44,477
2000	18,641	19,731	35,877	21,269	34,862
2001	21,809	22,660	34,843	21,846	31,933
2002	23,349	22,159	41,898	22,618	43,700
2003	21,321	21,601	35,108	21,632	37,717
Total 97-03	**136,090**	**135,279**	**264,366**	**142,362**	**275,773**

Choice of data or measurement methods and procedures	Measurement methods are the same as the ones used for $QP_{y,monitored}$ (see section D.2)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**EC_i**
Unit	MWh/year
Description	Annual grid electricity consumption by the submerged electric arc furnace(s) for 7 years preceding the project activity
Source of data	Project proponent
Value(s) applied	

ECi (MWh/y)					
Furnace	**1**	**3**	**5**	**6**	**7**
1997	115,511	115,381	224,774	130,113	231,635
1998	41,735	51,814	248,046	136,458	256,158
1999	111,837	93,474	205,295	44,755	260,410
2000	97,656	100,458	214,388	120,804	208,377
2001	107,293	111,287	168,826	107,474	173,106
2002	109,409	104,833	200,136	119,525	216,880
2003	99,142	99,678	172,039	110,109	192,187
Total 97-03	**682,583**	**676,925**	**1,433,504**	**769,238**	**1,538,753**

Choice of data or measurement methods and procedures	Measurement methods are the same as the ones used for EC_y (see section D.2)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	**$Q_{bcoal,i}$**
Unit	Tonnes of coal/year

Description	Annual consumption of coke used as reductant in the submerged electric arc furnace(s) for 7 years preceding the project activity
Source of data	Project proponent
Value(s) applied	(see table below)
Choice of data or measurement methods and procedures	Measurement methods are the same as the ones used for $Q_{pcoal,i}$ (see section D.2)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Qbcoal,i (tcoal/y)					
Furnace	**1**	**3**	**5**	**6**	**7**
1997	14,538	15,064	28,939	17,345	31,098
1998	4,494	5,862	33,313	16,586	31,741
1999	13,005	11,529	31,738	5,764	37,165
2000	13,426	13,055	33,574	17,146	31,216
2001	16,304	17,863	31,619	19,936	26,698
2002	16,704	16,871	35,932	20,993	37,788
2003	18,501	19,475	32,739	20,195	33,883
Total 97-03	**96,972**	**99,719**	**227,854**	**117,965**	**229,589**

Data/Parameter	$Q_{bcoke,i}$
Unit	Tonnes of coke/year
Description	Annual consumption of coke used as reductant in the submerged electric arc furnace for 7 years preceding the project activity
Source of data	Project proponent
Value(s) applied	(see table below)
Choice of data or measurement methods and procedures	Measurement methods are the same as the ones used for $Q_{pcoke,i}$ (see section D.2)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Qbcoke,i (tcoke/y)					
Furnace	**1**	**3**	**5**	**6**	**7**
1997	1,480	1,718	3,644	1,734	3,702
1998	554	803	3,361	2,245	4,172
1999	1,652	1,479	2,986	788	3,517
2000	1,234	1,409	2,656	1,687	2,085
2001	1,163	1,234	1,151	1,002	1,964
2002	563	836	2,247	823	1,880
2003	1,011	973	1,507	1,118	1,689
Total 97-03	**7,657**	**8,452**	**17,552**	**9,397**	**19,009**

Data/Parameter	$Q_{bpaste,i}$
Unit	Tonnes of paste/year
Description	Annual consumption of electrode paste used as electrode in the submerged electric arc furnace(s) for 7 years preceding the project activity
Source of data	Project proponent

Value(s) applied	Qbpaste,i (tpaste/y) Furnace: 1 / 3 / 5 / 6 / 7 1997: 1,127 / 1,136 / 2,123 / 1,175 / 2,023 1998: 350 / 487 / 2,344 / 1,275 / 2,045 1999: 1,086 / 946 / 1,763 / 417 / 2,123 2000: 1,032 / 104 / 2,045 / 1,143 / 2,009 2001: 1,141 / 1,147 / 2,031 / 958 / 1,543 2002: 1,029 / 1,025 / 1,968 / 975 / 1,739 2003: 1,097 / 956 / 1,690 / 1,028 / 1,721 **Total 97-03: 6,862 / 5,801 / 13,964 / 6,971 / 13,203**
Choice of data or measurement methods and procedures	Measurement methods are the same as the ones used for $Q_{p\ paste,i}$ (see section D.2)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Qbpaste,i (tpaste/y):

Furnace	1	3	5	6	7
1997	1,127	1,136	2,123	1,175	2,023
1998	350	487	2,344	1,275	2,045
1999	1,086	946	1,763	417	2,123
2000	1,032	104	2,045	1,143	2,009
2001	1,141	1,147	2,031	958	1,543
2002	1,029	1,025	1,968	975	1,739
2003	1,097	956	1,690	1,028	1,721
Total 97-03	**6,862**	**5,801**	**13,964**	**6,971**	**13,203**

Data/Parameter	$\mathbf{EF_{bcoal,i}}$
Unit	tCO_2/tcoal
Description	Emission factor applied for the coal consumed as reductant based on carbon content
Source of data	IPCC (2006) – Vol. 3, Ch. 4, section 4.3.3.2, table 4.6, p. 4.37
Value(s) applied	EFbcoal,i (tCO2/tcoal): 3.1 tCO2/tcoal Source: IPCC (2006) Vol3, Ch4, p4.37, Table 4.6
Choice of data or measurement methods and procedures	Project specific values cannot be used because previous coal carbon contents monitoring precluded a calculation of EF_{bcoal} (several coal types have been used and no weighted average can be done)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	$\mathbf{EF_{bcoke,i}}$
Unit	tCO_2/tcoke
Description	Emission factor applied for the coke consumed as reductant based on carbon content
Source of data	Project proponent

Value(s) applied	EFbcoke,i (tCO_2/tcoke) Year | EF 1997 | 3.09 1998 | 3.13 1999 | 3.1 2000 | 3.12 2001 | 3.15 2002 | 3.17 2003 | 3.19 **Average 97-03** | **3.13**
Choice of data or measurement methods and procedures	Measurement methods are the same as those that will be used for $EF_{p\ coke,y}$ (see section D.2)
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

Data/Parameter	$EF_{bpaste,i}$
Unit	tCO_2/t of carbon paste
Description	Emission factor applied for the electrode paste consumed as electrode based on carbon content
Source of data	Paste supplier
Value(s) applied	3.32
Choice of data or measurement methods and procedures	The paste supplier supplied the following information on the composition of the paste: PROPERTY | UNIT | STANDARD | TYPICAL Ash Content | % | <6 - 7 | 6.4 Volatile Matter | % | 13 - 15 | 13.6 Fixed Carbon Content | % | > 79 | 79.8 The emission factor is then calculated using equation 4.19, p. 4.33 of IPCC (2006): **Equation 4.19** Carbon Content of Ferroalloys Reducting Agents Total C-content in reducing agent i = fix C in i + Content of volatiles in i * Cv Where: Cv = Carbon content in volatiles. Unless other information is available, Cv = 0.65 is used for coal and 0.80 for coke. Cv value employed is the same as for coke (0.80), since both have similar characteristics: - 78.5% of the paste is anthracite, which is a form of coal with high calorific value and carbon content (like coke) - 21.5% of the paste is the binder, which itself is composed of a minimum of 45% of coking-value. Therefore the %m/m of carbon in the paste is 79.8 + (13.6 * 0.80) = 90.68% and EFb paste = 3.32tCO2/t paste (which is still lower than the IPCC value of 3.4).

Purpose of data/parameter	Calculation of baseline emissions
Additional comments	-

D.2. Data and parameters monitored

<table>
<tr><th>Data/Parameter</th><th>$QP_{y,monitored}$</th></tr>
<tr><td>Unit</td><td>Tonnes of SiMn</td></tr>
<tr><td>Description</td><td>Quantity of SiMn production</td></tr>
<tr><td>Measured/calculated/ default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>Weighting platform 2 and 3</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>
<table>
<tr><th>Year</th><th>Months</th><th>Furnace 3</th><th>Furnace 5</th><th>Furnace 7</th></tr>
<tr><td>2011</td><td>8</td><td>15,909</td><td>27,995</td><td>30,392</td></tr>
<tr><td>2012</td><td>12</td><td>17,902</td><td>31,357</td><td>37,988</td></tr>
<tr><td>2013</td><td>12</td><td>15,191</td><td>32,342</td><td>19,314</td></tr>
<tr><td>2014</td><td>9</td><td>21,084</td><td>42,197</td><td>41,001</td></tr>
<tr><td colspan="2">Total</td><td>70,085</td><td>133,891</td><td>128,695</td></tr>
</table>
</td></tr>
<tr><td rowspan="14">Monitoring equipment</td><td>Weighting platform 2</td></tr>
<tr><td>Type:</td></tr>
<tr><td>Accuracy class: +/- 2.5%</td></tr>
<tr><td>Serial number:</td></tr>
<tr><td>Calibration frequency:</td></tr>
<tr><td>Date of last calibration: Weekly</td></tr>
<tr><td>Validity:</td></tr>
<tr><td>Weighting platform 3</td></tr>
<tr><td>Type:</td></tr>
<tr><td>Accuracy class: +/- 2.5%</td></tr>
<tr><td>Serial number:</td></tr>
<tr><td>Calibration frequency:</td></tr>
<tr><td>Date of last calibration: Weekly</td></tr>
<tr><td>Validity:</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>The data is recorded at every tapping of the furnaces. Daily totals are recorded daily.</td></tr>
<tr><td>Calculation method (if applicable)</td><td>Daily total is obtained by summing data from all tappings that occurred on that day.</td></tr>
<tr><td>QA/QC procedures</td><td>Measured data will be cross-checked with product sales records.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Baseline and Project emission calculations</td></tr>
<tr><td>Additional comments</td><td>-</td></tr>
</table>

Data/Parameter	**EC_y**	
Unit	MWh	
Description	Grid electricity consumption by the submerged electric arc furnace(s)	
Measured/calculated/ default	Measured	
Source of data	Electricity meter(s)	

Value(s) of monitored parameter:

Year	Furnace 3	Furnace 5	Furnace 7
2011	56,773	115,540	120,126
2012	68,113	112,183	149,371
2013	61,284	139,451	84,733
2014	82,798	171,741	168,330
Total	**268,968**	**538,915**	**522,560**

Monitoring equipment:

Furnace 3 (22kV)	
Type:	Electricity meter
Accuracy class:	0.5%
Serial number:	06470035
Calibration frequency:	5 year
Date of last calibration:	24/11/2006
Validity:	23/11/2011
Furnace 3 (33kV)	
Type:	Electricity meter
Accuracy class:	1.00%
Serial number:	00061498
Calibration frequency:	5 year
Date of last calibration:	25/04/2008
Validity:	24/04/2013
Furnace 3 (22kV)[1]	
Type:	Electricity meter
Accuracy class:	0.50%
Serial number:	95679335
Calibration frequency:	5 year
Date of last calibration:	02/06/2009
Validity:	01/06/2014
Furnace 5	
Type:	Electricity meter
Accuracy class:	0.50%
Serial number:	06460054
Calibration frequency:	5 year
Date of last calibration:	22/11/2006
Validity:	21/11/2011
Furnace 7	
Type:	Electricity meter
Accuracy class:	0.50%
Serial number:	06390018
Calibration frequency:	5 year
Date of last calibration:	28/09/2006
Validity:	27/09/2011

	Furnace 7[2]
	Type: Electricity meter
	Accuracy class: 0.50%
	Serial number: 06390018
	Calibration frequency: 5 year
	Date of last calibration: 28/09/2006
	Validity: 27/09/2011
	[1] meter started 23/10/2010 [2] meter started 19/09/2010
Measuring/reading/recording frequency	Continuously measures per furnace and recorded daily.
Calculation method (if applicable)	Not applicable
QA/QC procedures	Consumption of each furnace is cross-checked monthly with total electricity bills.
Purpose of data/parameter	Project emission calculation
Additional comments	-

Data/Parameter	$Q_{pcoal,y}$
Unit	Tonnes of coal
Description	Consumption of coal used as reductant in the submerged electric arc furnace(s)
Measured/calculated/ default	Measured
Source of data	Load cells based weigh hoppers
Value(s) of monitored parameter	see table below

Year	Furnace 3	Furnace 5	Furnace 7
2011	11,171	22,816	22,684
2012	12,540	24,210	26,695
2013	13,084	29,488	15,933
2014	17,171	33,491	30,885
Total	**53,967**	**110,005**	**96,196**

Monitoring equipment	**Furnace 3 Weigh Hoppers**	
	Type:	Weigh hopper
	Accuracy class:	2.50%
	Serial number:	
	Calibration frequency:	Weekly
	Date of last calibration:	28/08/2014, 04/09/2014, 25/09/2014
	Validity:	04/09/2014, 11/09/2014, 02/10/2014
	Furnace 5 Weigh Hoppers	
	Type:	Weigh hopper
	Accuracy class:	2.50%
	Serial number:	
	Calibration frequency:	Weekly
	Date of last calibration:	11/09/2014, 18/09/2014, 25/09/2014
	Validity:	18/09/2014, 25/09/2014, 02/10/2014
	Furnace 7 Weigh Hoppers	
	Type:	Weigh hopper
	Accuracy class:	2.50%
	Serial number:	
	Calibration frequency:	Weekly
	Date of last calibration:	11/09/2014, 18/09/2014, 25/09/2014
	Validity:	18/09/2014, 25/09/2014, 02/10/2014
Measuring/reading/recording frequency	Weighted per batch used in each furnace, recorded daily	
Calculation method (if applicable)	Not applicable	
QA/QC procedures	In addition, Procedure SiMn300 is applied to all log-sheets which stipulates the procedure for Supervisors to ensure that data has been captured correctly.	
Purpose of data/parameter	Project emission calculation	
Additional comments	-	

Data/Parameter	$Q_{pcoke,y}$
Unit	Tonnes of coke
Description	Consumption of coke used as reductant in the submerged electric arc furnace
Measured/calculated/ default	Measured
Source of data	Load cells based weigh hoppers
Value(s) of monitored parameter	(see table below)

Year	Furnace 3	Furnace 5	Furnace 7
2011	61	1,417	1,006
2012	572	1,564	2,009
2013	29	1,000	1,071
2014	105	2,270	2,200
Total	**766**	**6,250**	**6,285**

Monitoring equipment	**Furnace 3 Weigh Hoppers**	
	Type:	Weigh hopper
	Accuracy class:	2.50%
	Serial number:	
	Calibration frequency:	Weekly
	Date of last calibration:	28/08/2014, 04/09/2014, 25/09/2014
	Validity:	04/09/2014, 11/09/2014, 02/10/2014
	Furnace 5 Weigh Hoppers	
	Type:	Weigh hopper
	Accuracy class:	2.50%
	Serial number:	
	Calibration frequency:	Weekly
	Date of last calibration:	11/09/2014, 18/09/2014, 25/09/2014
	Validity:	18/09/2014, 25/09/2014, 02/10/2014
	Furnace 7 Weigh Hoppers	
	Type:	Weigh hopper
	Accuracy class:	2.50%
	Serial number:	
	Calibration frequency:	Weekly
	Date of last calibration:	11/09/2014, 18/09/2014, 25/09/2014
	Validity:	18/09/2014, 25/09/2014, 02/10/2014
Measuring/reading/recording frequency	Weighted per batch used in each furnace, recorded daily	
Calculation method (if applicable)	Not applicable	
QA/QC procedures	In addition, Procedure SiMn300 is applied to all log-sheets which stipulates the procedure for Supervisors to ensure that data has been captured correctly.	
Purpose of data/parameter	Project emission calculation	
Additional comments	-	

Data/Parameter	**$Q_{ppaste,y}$**
Unit	Tonnes of paste
Description	Consumption of electrode paste used as electrode in the submerged electric arc furnace
Measured/calculated/ default	Measured and calculated
Source of data	Weighbridge (for the weight of the cylinders) and production log (for the number of cylinders)
Value(s) of monitored parameter	see table below

Year	Furnace 3	Furnace 5	Furnace 7
2011	327	386	335
2012	461	1,234	1,194
2013	507	1,457	875
2014	653	1,611	1,430
Total	**1,948**	**4,687**	**3,834**

Monitoring equipment	**Furnace 3 Weigh Hoppers**	
	Type:	Weigh hopper
	Accuracy class:	2.50%
	Serial number:	
	Calibration frequency:	Weekly
	Date of last calibration:	28/08/2014, 04/09/2014, 25/09/2014
	Validity:	04/09/2014, 11/09/2014, 02/10/2014
	Furnace 5 Weigh Hoppers	
	Type:	Weigh hopper
	Accuracy class:	2.50%
	Serial number:	
	Calibration frequency:	Weekly
	Date of last calibration:	11/09/2014, 18/09/2014, 25/09/2014
	Validity:	18/09/2014, 25/09/2014, 02/10/2014
	Furnace 7 Weigh Hoppers	
	Type:	Weigh hopper
	Accuracy class:	2.50%
	Serial number:	
	Calibration frequency:	Weekly
	Date of last calibration:	11/09/2014, 18/09/2014, 25/09/2014
	Validity:	18/09/2014, 25/09/2014, 02/10/2014
Measuring/reading/recording frequency	The number of paste cylinders inserted into the electrode is logged each time a new cylinder is added. The weight of the cylinders is obtained by weighing paste delivery trucks (arriving at the facility) on a weighbridge and dividing (on a monthly basis) the total weight by the number of cylinders delivered to the facility. The annual paste figure is obtained by summing the daily product of number of cylinders used and monthly average weight for the year.	
Calculation method (if applicable)	The annual figure is obtained by summing the daily product of number of cylinders used and monthly average weight.	
QA/QC procedures	The weighbridge will be maintained and calibrated regularly in line with the manufacturer's requirements to ensure its accuracy. Average weight of each cylinder will be compared to indications of the supplier.	
Purpose of data/parameter	Project emission calculation	
Additional comments	-	

Data/Parameter	**$EF_{coal,y}$**
Unit	tCO_2/t coal
Description	Emission factor applied for the coal consumed as reductant in year y
Measured/calculated/ default	Default
Source of data	IPCC (2006) – Vol3, Ch4, section 4.3.3.2, table 4.6 page 4.37
Value(s) of monitored parameter	3.1
Monitoring equipment	N/A
Measuring/reading/recording frequency	The 2006 IPCC value of 3.1tCO_2/t coal is employed in the project. If new IPCC guidelines are released, this value may be updated according to latest relevant EB guidance.
Calculation method (if applicable)	-
QA/QC procedures	IPCC data is used to ensure consistency with the emission factor employed in the baseline.

Purpose of data/parameter	Project emission calculation
Additional comments	-

Data/Parameter	**$EF_{pcoke,y}$**
Unit	tCo_2/tcoke
Description	Emission factor applied for the coke consumed as reductant in year y
Measured/calculated/ default	Calculated
Source of data	- Carbon content provided by laboratory analyses - Carbon content of volatiles from IPCC (2006)
Value(s) of monitored parameter	see table below
Monitoring equipment	N/A
Measuring/reading/recording frequency	Monthly
Calculation method (if applicable)	Coke samples are prepared at Transalloys and sent to the laboratory for analysis of volatile and fixed carbon content. Monthly averages of carbon contents are employed for the calculation of a monthly emission factor. The emission factor is then calculated using equation 4.19, p. 4.33 of IPCC (2006): **Equation 4.19** **Carbon Content of Ferroalloys Reducing Agents** Total C-content in reducing agent i = fix C in i + Content of volatiles in i * Cv Where: Cv = Carbon content in volatiles. Unless other information is available, Cv = 0.65 is used for coal and 0.80 for coke. The annual emission factor is calculated as the average of monthly emission factors and used for emission calculations.
QA/QC procedures	Lab analyses are done according to applicable national and international standards. If values are missing or inconsistent for some months, the average of previous and next 3 months will be used.
Purpose of data/parameter	Project emissions calculation
Additional comments	This project-specific approach is preferred to IPCC values

Value(s) of monitored parameter:

Year	Furnace 3	Furnace 5	Furnace 7
2011	3.03	3.03	3.03
2012	3.06	3.06	3.06
2013	3.04	3.04	3.04
2014	3.01	3.01	3.01

Data/Parameter	**$EF_{ppaste,y}$**
Unit	tCo2/t of carbon paste
Description	Emission factor applied for the electrode paste consumed as electrode in year y
Measured/calculated/ default	Calculated
Source of data	- Carbon content provided by laboratory analyses - Carbon content of volatiles from IPCC (2006)

<table>
<tr><td>Value(s) of monitored parameter</td><td>
<table>
<tr><th>Year</th><th>Furnace 3</th><th>Furnace 5</th><th>Furnace 7</th></tr>
<tr><td>2011</td><td>3.67</td><td>3.67</td><td>3.67</td></tr>
<tr><td>2012</td><td>3.67</td><td>3.67</td><td>3.67</td></tr>
<tr><td>2013</td><td>3.67</td><td>3.67</td><td>3.67</td></tr>
<tr><td>2014</td><td>3.67</td><td>3.67</td><td>3.67</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>N/A</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Monthly</td></tr>
<tr><td>Calculation method (if applicable)</td><td>The emission factor is then calculated using equation 4.19, p. 4.33 of IPCC (2006):

Equation 4.19
Carbon Content of Ferroalloys Reducing Agents
Total C-content in reducing agent i = fix C in i + Content of volatiles in i * Cv

Where:
Cv = Carbon content in volatiles. Unless other information is available, Cv = 0.65 is used for coal and 0.80 for coke.

The annual emission factor is calculated as the average of monthly emission factors and used for emission calculations.</td></tr>
<tr><td>QA/QC procedures</td><td>The annual emission factor obtained is compared to $EF_{bpaste,y}$ (3.32 tCO_2/t), and the maximum between the two values is employed for $EF_{ppaste,y}$. In the event a monthly analysis is not available, a conservative value of 3.67 tCO_2/t is employed for that month.</td></tr>
<tr><td>Purpose of data/parameter</td><td>Project emissions calculation</td></tr>
<tr><td>Additional comments</td><td>-</td></tr>
</table>

Data/Parameter	**Quality of coal$_p$**
Unit	Mass fraction of each component (%m/m)
Description	Quality of coal based on elementary analysis and other relevant properties
Measured/calculated/ default	Calculated
Source of data	Analysis report from internal laboratory
Value(s) of monitored parameter	N/A
Monitoring equipment	N/A
Measuring/reading/recording frequency	Monthly
Calculation method (if applicable)	Laboratory analyses are undertaken at least monthly, and fixed carbon, volatiles, S, and P contents are reported.
QA/QC procedures	Lab analyses are undertaken according to national SABS standards.
Purpose of data/parameter	N/A
Additional comments	-

Data/Parameter	**Quality of coke$_p$**
Unit	Mass fraction of each component (%m/m)
Description	Quality of coke based on elementary analysis and other relevant properties
Measured/calculated/ default	Calculated
Source of data	Analysis report from internal laboratory

Value(s) of monitored parameter	N/A
Monitoring equipment	N/A
Measuring/reading/recording frequency	Monthly
Calculation method (if applicable)	Laboratory analyses are undertaken at least monthly, and fixed carbon, volatiles, S, and P contents are reported.
QA/QC procedures	Lab analyses are undertaken according to national SABS standards.
Purpose of data/parameter	N/A
Additional comments	-

Data/Parameter	**Quality of electrode paste$_p$**
Unit	Mass fraction of each component (%m/m)
Description	Quality of electrode paste based on elementary analysis and other relevant properties
Measured/calculated/ default	Calculated
Source of data	Supplier
Value(s) of monitored parameter	N/A
Monitoring equipment	N/A
Measuring/reading/recording frequency	N/A
Calculation method (if applicable)	This is based on supplier laboratory analyses reports.
QA/QC procedures	The IPCC 2006 Volume 3, p. 4.38, Table 4.6 "CO2 Emission Factors for Ferroalloy Production" gives a typical emission factor of 3.4tCO_2/tpaste. When new paste analyses are received it is checked that the characteristics measured correspond reasonably with this value.
Purpose of data/parameter	N/A
Additional comments	-

Data/Parameter	**$EF_{y,offsite}$**
Unit	tCO_2/MWh
Description	Grid emission factor
Measured/calculated/ default	Calculated
Source of data	Registered PDD
Value(s) of monitored parameter	Grid Emission factor EF: OM = 1.195; BM = 1.248; CM = 1.221 (tCO2/MWh) The CM factor is used during the whole crediting period.
Monitoring equipment	N/A
Measuring/reading/recording frequency	Once for the crediting period
Calculation method (if applicable)	The Grid electricity emission factor ($EF_{y,offsite}$ in tCO_2e/MWh) for South Africa is established ex-ante, according to ACM0002 v6.

Grid Emission factor

EF	tCO2/MWh
OM	1.195
BM	1.248
CM	1.221

QA/QC procedures	-
Purpose of data/parameter	N/A
Additional comments	-

Data/Parameter	**Quality of $SiMn_p$**
Unit	Mass fraction of each component (%m/m)
Description	Quality of SiMn produced during the project activity
Measured/calculated/ default	Calculated
Source of data	Analysis report from internal laboratory
Value(s) of monitored parameter	N/A
Monitoring equipment	N/A
Measuring/reading/recording frequency	Daily
Calculation method (if applicable)	A sample is lab-analysed daily to ensure that the quality remains between pre-determined specifications for Mn, C, Si, P, and S.
QA/QC procedures	Lab analyses are undertaken to national SABS standards to ensure accuracy. Results are reviewed, and anomalous results investigated.
Purpose of data/parameter	N/A
Additional comments	-

Data/Parameter	**Quality of ore**
Unit	Mass fraction of each component (%m/m)
Description	Quality of ore
Measured/calculated/ default	Calculated
Source of data	Analysis report from internal laboratory
Value(s) of monitored parameter	N/A
Monitoring equipment	N/A
Measuring/reading/recording frequency	Monthly
Calculation method (if applicable)	A sample is lab analysed monthly to determine the composition of the ore (e.g. contents in Mn, Fe, SiO_2, and CaO).
QA/QC procedures	Lab analyses are undertaken to national SABS standards to ensure accuracy. Results are reviewed, and anomalous results investigated.
Purpose of data/parameter	N/A
Additional comments	-

Data/Parameter	**Quality of fluxes**
Unit	Mass fraction of each component (%m/m)
Description	Quality of fluxes
Measured/calculated/ default	Calculated
Source of data	Analysis report from internal laboratory
Value(s) of monitored parameter	N/A

Monitoring equipment	N/A
Measuring/reading/recording frequency	Monthly
Calculation method (if applicable)	A sample of each type of flux is lab-analysed at least monthly when new batches are used. During this monitoring period only pellets are considered as flux, slag not being re-introduced into the furnace any more during this monitoring period.
QA/QC procedures	Lab analyses are undertaken to national SABS standards to ensure accuracy. Results are reviewed, and anomalous results investigated.
Purpose of data/parameter	N/A
Additional comments	-

D.3. Implementation of sampling plan

Not applicable

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

The baseline emissions are calculated as follows:

$$\boldsymbol{BE_y = BE_{y,offsite} + BE_{y,onsite}}$$ Equation (1)

Variable		Definition	UoM
BE_y	=	Baseline emissions	tCO_2 in year y
$BE_{y,offsite}$	=	Offsite baseline (grid) electricity emissions associated with the electricity consumption of the submerged arc furnace	tCO_2 in year y
$BE_{Ey,\ onsite}$	=	Onsite baseline emissions associated with the consumption of Reductant (Coal and Coke) and electrode paste during the production of SiMn	tCO_2 in year y

$$\boldsymbol{BE_{y,offsite} = QP_{y,\ max} * sec_b * EF_{y,offsite}}$$ Equation (2)

Variable		Definition	UoM
$BE_{y,offsite}$	=	Offsite baseline (grid) electricity emissions associated with the electricity consumption of the submerged arc furnace	tCO_2e in year y
$QP_{y,\ max}$	=	Quantity of SiMn production in year y maximised at historic average via equation 3. This value is used in both the baseline and the project emission calculations	tSiMn/y
sec_b	=	Historic (at least a three year vintage period) average grid electricity consumption per tonne of SiMn produced	MWh/tSiMn
$EF_{y,offsite}$	=	Grid electricity emissions factor, estimated using ACM0002	tCO_2e/MWh

$$\boldsymbol{QP_{y,\ max} = min^m\ of\ (QP_{y,\ monitored}\ ,\ QP_{historic})}$$ Equation (3)

Variable		Definition	UoM
$QP_{y,\ max}$	=	Value of SiMn production used for estimating baseline and project emissions for the year y	tSiMn/y
$QP_{y,\ monitored}$	=	Monitored production of SiMn in year y during the project activity	tSiMn/y
$QP_{historic}$	=	Historic (at least a three year vintage period) average annual production of SiMn	tSiMn/y

$$QP_{historic} = \sum_{i=1}^{n} Qp_i / n$$ Equation (4)

Variable		Definition	UoM
$QP_{historic}$	=	Historic (at least a three year vintage period) average annual production of SiMn	tSiMn/y
Qp_i	=	Annual SiMn production for the i^th^ year preceding the project activity	tSiMn/y

$$sec_b = \sum_{i=1}^{n} EC_i / \sum_{i=1}^{n} Qp_i$$ Equation (5)

Variable		Definition	UoM
sec_b	=	Historic (at least a three year vintage period) average grid electricity consumption per tonne of SiMn produced	MWh/tSiMn
EC_i	=	Annual grid electricity consumption by the submerged electric arc furnace for the i^{th} year preceding the project activity	MWh consumed in year i
Qp_i	=	Annual SiMn production for the i^{th} year preceding the project activity	tSiMn

$$EF_{y,offsite} = (EF_{OM} + EF_{BM}) / 2$$ Equation (7)

Variable		Definition	UoM
$EF_{y,offsite}$	=	Weighed-average of EF_{OM} and EF_{BM} determined exante and will be constant through the crediting period	tCO_2e/MWh
EF_{OM}	=	Determined ex ante for years 2002, 2003 and 2004 as this is the most recent period for which information is available	tCO_2e/MWh
EF_{BM}	=	Determined ex ante by using the same equation as above, except that the sample of plants used is not i	tCO_2e/MWh

$$BE_{y,onsite} = QP_{y,\ max} * EF_{b,onsite}$$ Equation (8)

Variable		Definition	UoM

Variable		Definition	UoM
$BE_{y,onsite}$	=	Onsite baseline emissions associated with the consumption of Reductant (Coal and Coke) and electrode paste during the production of SiMn	tCO_2e in year y
$QP_{y, max}$	=	Value of SiMn production used for estimating baseline and project emissions for the year y	tSiMn/y
$EF_{b,onsite}$	=	Baseline emission factor associated with the (onsite) consumption of reductant (Coal and Coke) and electrode paste per tonne of SiMn produced (tCO_2e/tSiMn). The average onsite emissions are based on historic (at least a three year vintage period) average annual consumption as calculated in equation 7	tCO_2e/MWh

$$EF_{b,onsite} = \left(\sum_{i=1}^{n} Q_{bcoal,i} * EF_{bcoal,i} + \sum_{i=1}^{n} Q_{bcoke,i} * EF_{bcoke,i} + \sum_{i=1}^{n} Q_{bpaste,i} * EF_{bpaste,i}\right) / \sum_{i=1}^{n} QP_i$$

Equation (9)

Variable		Definition	UoM
$EF_{b,onsite}$	=	Baseline emission factor associated with the (onsite) consumption of reductant (Coal and Coke) and electrode paste per tonne of SiMn produced	tCO_2e/tSiMn
$Q_{bcoal, i}$	=	Historic (at least a three year vintage period) annual consumption of coal used as reductant in the submerged electric arc furnace in tonnes of coal per year	tCoal consumed in year i
$EF_{bcoal,i}$	=	Emissions factor applied for the coal consumed as reductant	tCO_2e/tCoal
$Q_{bcoke, i}$	=	Historic (at least a three year vintage period) annual consumption of coke used as reductant in the submerged electric arc furnace in tonnes of coke per year	tCoke consumed in year i
$EF_{bcoke,i}$	=	Emissions factor applied for the coke consumed as reductant	tCO_2e/tCoke
$Q_{bpaste, i}$	=	Historic (at least a three year vintage period) annual consumption of electrode paste used as electrode in the submerged electric arc furnace in tonnes of electrode paste per year	tPaste consumed in year i
EF_{bpaste}	=	Emissions factor applied for the electrode paste consumed as electrode	tCO_2e/tPaste
QP_i	=	Annual SiMn production for the i^{th} year preceding the project activity	tSiMn

In the table below the baseline emission equations are applied across the monitoring period.

Period per furnace	BE_y	$BE_{y,offsite}$	$QP_{y, max}$	$QP_{historic}$	sec_b	$EF_{y,offsite}$	$BE_{y,onsite}$	$EF_{b,onsite}$
	tCO_2e	tCO_2e	tSiMn	tSiMn	MWh/t SiMn	tCO_2e	tCO_2e	tCO_2e/tSiMn
Furnace 3								

Period per furnace	BE_y	$BE_{y,offsite}$	$QP_{y,\ max}$	$QP_{historic}$	sec_b	$EF_{y,offsite}$	$BE_{y,onsite}$	$EF_{b,onsite}$
	tCO_2e	tCO_2e	tSiMn	tSiMn	MWh/t SiMn	tCO_2e	tCO_2e	tCO_2e/tSiMn
2011 (01/05/11 - 31/12/2011)	168,815	118,123	19,326	19,326	5.00	1.22	50,692	2.62
2012	156,376	109,419	17,902	19,326	5.00	1.22	46,957	2.62
2013	132,696	92,850	15,191	19,326	5.00	1.22	39,846	2.62
2014 (01/01/2014 - 30/06/2014)	173,427	118,123	19,326	19,326	5.00	1.22	55,304	2.62
Furnace 5								
2011 (01/05/11 - 31/12/2011)	335,672	250,146	37,767	37,767	5.42	1.22	85,525	3.06
2012	303,493	207,695	31,357	37,767	5.42	1.22	95,798	3.06
2013	313,019	214,214	32,342	37,767	5.42	1.22	98,804	3.06
2014 (01/01/2014 - 30/06/2014)	379,060	250,146	37,767	37,767	5.42	1.22	128,914	3.06
Furnace 7								
2011 (01/05/11 - 31/12/2011)	358,336	268,512	39,396	39,396	5.58	1.22	89,824	2.96
2012	371,191	258,916	37,988	39,396	5.58	1.22	112,275	2.96
2013	188,726	131,642	19,314	39,396	5.58	1.22	57,085	2.96
2014 (01/01/2014 - 30/06/2014)	389,691	268,512	39,396	39,396	5.58	1.22	121,179	2.96
Cumulative Baseline Emissions	**3,270,502**							

E.2. Calculation of project emissions or actual net removals

The project emissions are calculated as follows:

$$PE_y = PE_{y,offsite} + PE_{y,onsite}$$ Equation (10)

Variable		Definition	UoM
PE_y	=	Project emissions	tCO_2 in year y
$PE_{y,offsite}$	=	Offsite project (grid) electricity emissions associated with the electricity consumption of the submerged arc furnace	tCO_2 in year y
$PE_{Ey,\ onsite}$	=	Onsite project emissions associated with the consumption of Reductant (Coal and Coke) and electrode paste during the production of SiMn	tCO_2 in year y

$PE_{y,offsite} = QP_{y,\ max} * sec_{p,y} * EF_{y,offsite}$ Equation (11)

Variable		Definition	UoM
$PE_{y,offsite}$	=	Offsite project (grid) electricity emissions associated with the electricity consumption of the submerged arc furnace	tCO_2e in year y
$QP_{y,\ max}$	=	Value of SiMn production used for estimating baseline and project emissions for the year y, estimated using equation 3 of the baseline emission section	tSiMn/y
$sec_{p,y}$	=	Grid specific electricity consumption per tonne of SiMn produced in the project situation in year y	MWh/tSiMn
$EF_{y,offsite}$	=	Grid electricity emissions factor, estimated using ACM0002	tCO_2e/MWh

$sec_{p,y} = EC_y / QP_{y,monitored}$ Equation (12)

Variable		Definition	UoM
$sec_{p,y}$	=	Grid specific electricity consumption per tonne of SiMn produced in the project situation in year y	MWh/tSiMn
EC_y	=	Annual grid electricity consumption by the submerged electric arc furnace in year y	MWh
$QP_{y,monitored}$	=	Monitored production of SiMn in year y during the project activity	tSiMn/y

$PE_{y,onsite} = QP_{y,\ max} * EF_{p,onsite}$ Equation (13)

Variable		Definition	UoM
$PE_{y,onsite}$	=	Onsite project emissions associated with the consumption of Reductant (Coal and Coke) and electrode paste during the production of SiMn	tCO_2e in year y
$QP_{y,\ max}$	=	Value of SiMn production used for estimating baseline and project emissions for the year y	tSiMn/y
$EF_{p,onsite}$	=	Project emission factor associated with the (onsite) average consumption of reductant (Coal and Coke) and electrode paste per tonne of SiMn in year y as calculated in equation 12	tCO_2e/tSiMn

$EF_{p,y,onsite} = (Q_{pcoal,y} * EF_{pcoal,y} + Q_{coke,y} * EF_{pcoke,y} + Q_{ppaste,y} * EF_{ppaste,y}) / QP_{y,monitored}$

Equation (14)

Variable		Definition	UoM
$EF_{p,y,onsite}$	=	Project emission factor associated with the (onsite) average consumption of reductant (Coal and Coke) and electrode paste per tonne of SiMn produced in year y	tCO_2e/tSiMn

Variable		Definition	UoM
$Q_{pcoal, y}$	=	Consumption of coal used as reductant in the submerged electric arc furnace in tonnes of coal per year	tCoal consumed in year i
$EF_{pcoal,y}$	=	Emissions factor applied for the coal consumed as reductant	$tCO_2e/tCoal$
$Q_{pcoke, y}$	=	Consumption of coke used as reductant in the submerged electric arc furnace in tonnes of coke per year	tCoke consumed in year i
$EF_{pcoke,y}$	=	Emissions factor applied for the coke consumed as reductant	$tCO_2e/tCoke$
$Q_{ppaste, y}$	=	Consumption of electrode paste used as electrode in the submerged electric arc furnace in tonnes of electrode paste per year	tPaste consumed in year i
$EF_{ppaste,y}$	=	Emissions factor applied for the electrode paste consumed as electrode, using the relevant emissions factor for the carbon paste as specified by the manufacturer for the vintage period	$tCO_2e/tPaste$
$Qp_{y,monitored}$	=	Monitored production of SiMn in year y during the project activity	tSiMn

In the table below the project emission equations are applied across the monitoring period.

Period per furnace	PE_y	$PE_{y,offsite}$	$sec_{p,y}$	$PE_{y,onsite}$	$EF_{p,y,onsite}$
	tCO_2e	tCO_2e	MWh/tSiMn	tCO_2e	$tCO_2e/tSiMn$
Furnace 3					
2011 (01/05/11 - 31/12/2011)	127,954	84,206	3.57	43,748	2.26
2012	125,481	83,166	3.80	42,315	2.36
2013	120,822	74,828	4.03	45,994	3.03
2014 (01/01/2014 - 30/06/2014)	157,038	101,096	3.93	55,941	2.65
Furnace 5					
2011 (01/05/11 - 31/12/2011)	217,512	141,074	4.13	76,438	2.73
2012	221,340	136,976	3.58	84,364	2.69
2013	270,067	170,270	4.31	99,797	3.09
2014 (01/01/2014 - 30/06/2014)	326,266	209,696	4.07	116,571	2.76
Furnace 7					
2011 (01/05/11 - 31/12/2011)	221,270	146,674	3.95	74,596	2.45
2012	275,665	182,382	3.93	93,283	2.46

Period per furnace	PE_y	$PE_{y,offsite}$	$sec_{p,y}$	$PE_{y,onsite}$	$EF_{p,y,onsite}$
	tCO_2e	tCO_2e	MWh/tSiMn	tCO_2e	tCO_2e/tSiMn
2013	159,317	103,459	4.39	55,858	2.89
2014 (01/01/2014 - 30/06/2014)	313,142	205,531	4.11	107,612	2.62
Cumulative Project Emissions	**2,535,873**				

E.3. Calculation of leakage emissions

There are no leakage emissions from the Project.

E.4. Calculation of emission reductions or net anthropogenic removals

The project emissions are calculated as follows:

$$ER_y = BE_y - PE_y - L_y \qquad \text{Equation (15)}$$

Variable		Definition	UoM
ER_y	=	Emissions Reductions in year y	tCO_2e
BE_y	=	Emissions in the baseline scenario in year y	tCO_2e
EP_y	=	Emissions in the project scenario in year y	tCO_2e
L_y	=	Leakage in year y	tCO_2e

When applied over the full monitoring period this results in the emission reductions as outlined in the table below.

	Baseline GHG emissions or baseline net GHG removals (t CO_2e)	Project GHG emissions or actual net GHG removals (t CO_2e)	Leakage GHG emissions (t CO_2e)	GHG emission reductions or net anthropogenic GHG removals (t CO_2e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total	**3,270,502**	**2,535,873**	**0**	**504,662**	**229,967**	**734,629**

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO_2e)	Amount estimated ex ante for this monitoring period in the PDD (t CO_2e)
734,629	**224,957**

E.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the PDD”

The ex-ante calculation for the period overlapping the monitoring period is 1,368 days with a forecasted volume of emission reductions of 266,212 tCO_2e. By dividing the two figures a daily forecasted emission reduction volume of 194.599 tCO_2e is established.

The monitoring period runs from 01/05/2011till 30/06/2014 covering 1,156 days. The amount estimated ex ante for this monitoring period in the PDD is calculated by multiplying the days in the monitoring period with the estimated daily emission reduction volume (1,156 x 194.599) resulting in an estimated emission reduction forecast of 224,957 tCO_2e.

E.6. Remarks on increase in achieved emission reductions

The forecasted emission reduction in the PDD for the monitoring period is 224,957 tCO_2e. During this monitoring period the emission reductions amount to 734,629 tCO_2e, which exceeds the forecast by 227%. The reasons for this difference are listed below:

- **On-site emission reductions**: The methodology requires the inclusion of on-site emissions in the project boundary, although it was assumed in the PDD that they would not be affected.

- **Higher electricity savings**: The savings realised were much closer to the initial target (i.e. 1 MWh/tSiMn) than the saving of 0.4 MWh/tSiMn originally forecast in the PDD;

- **Delay of F1 & F6 retrofit**: In the PDD, F6 was expected to be retrofitted in early 2008, and F1 in 2009. However, due to poor market conditions, the retrofitting works have not yet commenced. Hence the PDD estimates incorporate more furnaces than have contributed to the achieved emission reductions.

E.7. Remarks on scale of small-scale project activity

Not applicable.

Document information

Version	*Date*	*Description*
07.0	31 May 2019	Revision to: • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

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