# MONITORING REPORT FORM (CDM-MR)
## Version 01 - in effect as of: 28/05/2010

## CONTENTS

**MONITORING REPORT**
**Version 1 – 16/05/2011**

**Transalloys Manganese Alloy Smelter Energy Efficiency Project**
**Reference number 1027**
**Monitoring period number 4 - 01/03/2010 - 30/04/2011**

## SECTION A. General description of the project activity

### A.1. Brief description of the project activity: >>

>>

1. Purpose of the project activity and the measures taken to reduce greenhouse gas emissions:

The Transalloys Manganese Alloy Smelter Energy Efficiency Project is an industrial energy efficiency project that reduces the electricity consumption in the production of silicomanganese (subsequently "SiMn") alloy (a key component in steel making) at its Witbank facility in South Africa.
The project displaces electricity from the South African grid, which is predominantly coal based. Usage of coal and coke (employed as reductants), and paste (predominantly carbon, employed as electrode) in the submerged electric arc furnaces are also included in the emission reduction calculation.

2. Brief description of the installed technology and equipment:

The Transalloys facility currently employs 5 submerged electric arc furnaces for SiMn alloy production. 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 approach of the project, for the 5 furnaces producing SiMn at the facility, is to retrofit new technology into the existing furnace infrastructure.

3. Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods etc.):

The project is a prompt start project claiming carbon credits as of October 2004 for the retrofit of the five furnaces. The retrofit schedule is as per Table 1 (below):

| | |
|---|---|
| **F7** | Retrofit completed 09/2004 |
| **F3** | Retrofit completed 10/2005 |
| **F5** | Retrofit completed 12/2005 |
| **F6** | Originally planned to be retrofitted in 2008, but delayed due to poor market conditions. To date, it remains without retrofit. |
| **F1** | Originally planned to be retrofitted in 2009, but delayed due to poor market conditions. To date, it remains without retrofit. |

**Table 1:** Project furnace(s) retrofit schedule

4. Total emission reductions achieved in this monitoring period:

   232,417 $tCO_2e$

## A.2. Project Participants

>>

Host party:

Republic of South Africa, indirectly involved; Authorised Participant(s): Transalloys (Pty) Ltd. (formerly Highveld Steel and Vanadium Corporation Ltd.).

Other parties involved:

- United Kingdom of Great Britain and Northern Ireland, indirectly involved; Authorised Participant(s): EcoSecurities Group plc;
- Switzerland, indirectly involved; Authorised Participant(s): EcoSecurities Group plc.

## A.3. Location of the project activity:

>>

Clewer Road, Witbank 1035, Mpumalanga, Republic of South Africa.

## A.4. Technical description of the project

>>

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.

Diagram 1 (below) is a schematic of one furnace, representing inputs and outputs of products and energy:

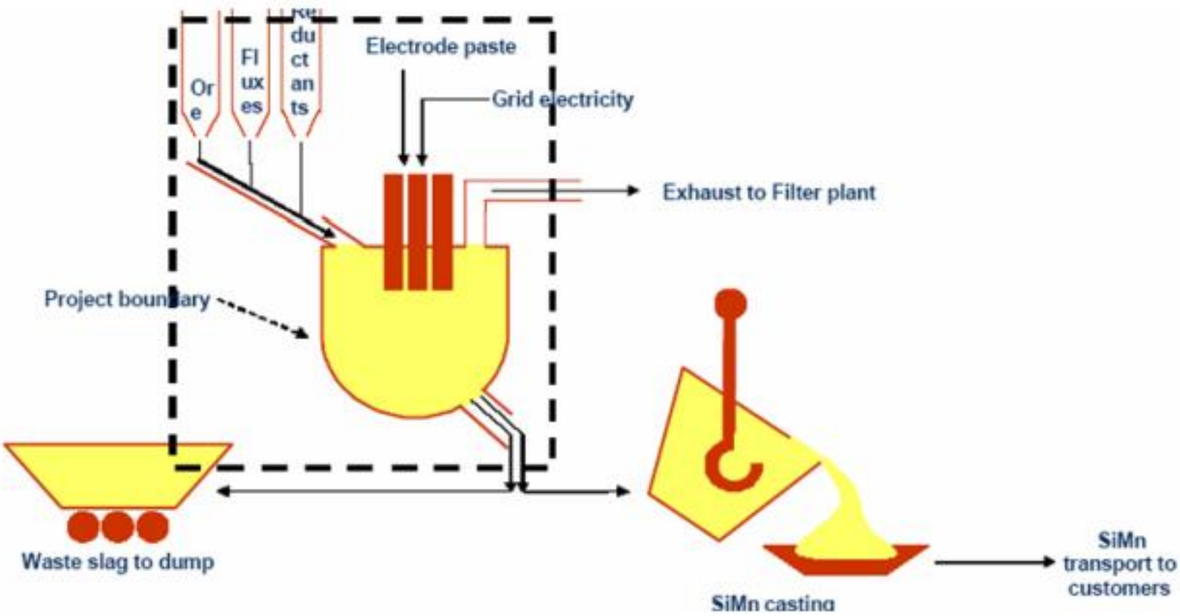


**Diagram 1:** Schematic of furnace (representing input(s)/output(s) of product(s)/energy

**A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:**

>>

- AM0038 version 1 - Methodology for improved electrical energy efficiency of an existing submerged electric arc furnace used for the production of SiMn;
- ACM0002 ver. 6 - Consolidated methodology for grid-connected electricity generation from renewable sources.

**A.6. Registration date of the project activity:**

>>

19/10/2007. The project was "prompt start" with crediting period commencing 01/10/2004.

**A.7. Crediting period of the project activity and related information (start date and choice of crediting period):**

>>

Fixed crediting period: 01/10/2004 – 30/09/2014.
There was no post-registration change to the start date of the crediting period.

**A.8. Name of responsible person(s)/entity(ies):**

>>

The Monitoring Report is compiled by EcoSecurities International Ltd.

| | | | |
|---|---|---|---|
| Mr. Amin Bekai | EcoSecurities | Project Manager | mark.ghorayeb@ecosecurities.com |
| Mr. Mark Ghorayeb | EcoSecurities | Verification Lead | amin.bekai@ecosecurities.com |

| | | | |
|---|---|---|---|
| Mr. Steve Anzarouth | EcoSecurities | Technical Reviewer | steve.anzarouth@ecosecurities.com |

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Telephone: +971 4 446 9754/8

## SECTION B. Implementation of the project activity

### B.1. Implementation status of the project activity

>>

1. Commencement date of operation of the project activity:

The project employs 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 per Table 2 below:

| | |
|---|---|
| **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

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

F3, F5, and F7 operated throughout this monitoring period.

3. Events or situations affecting the applicability of the methodology:

No events occurred that affected the applicability of the methodology.

### B.2. Revision of the monitoring plan

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

### B.3. Request for deviation applied to this monitoring period

>>
No request for deviation was applied during this monitoring period.

## B.4. Notification or request of approval of changes

>>
No notification or request of approval of changes has been made.

## SECTION C. Description of the 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 taken directly from the PDD and entered in the CDM workbook, as per the Monitoring Plan.

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 Diagram 2 (below):

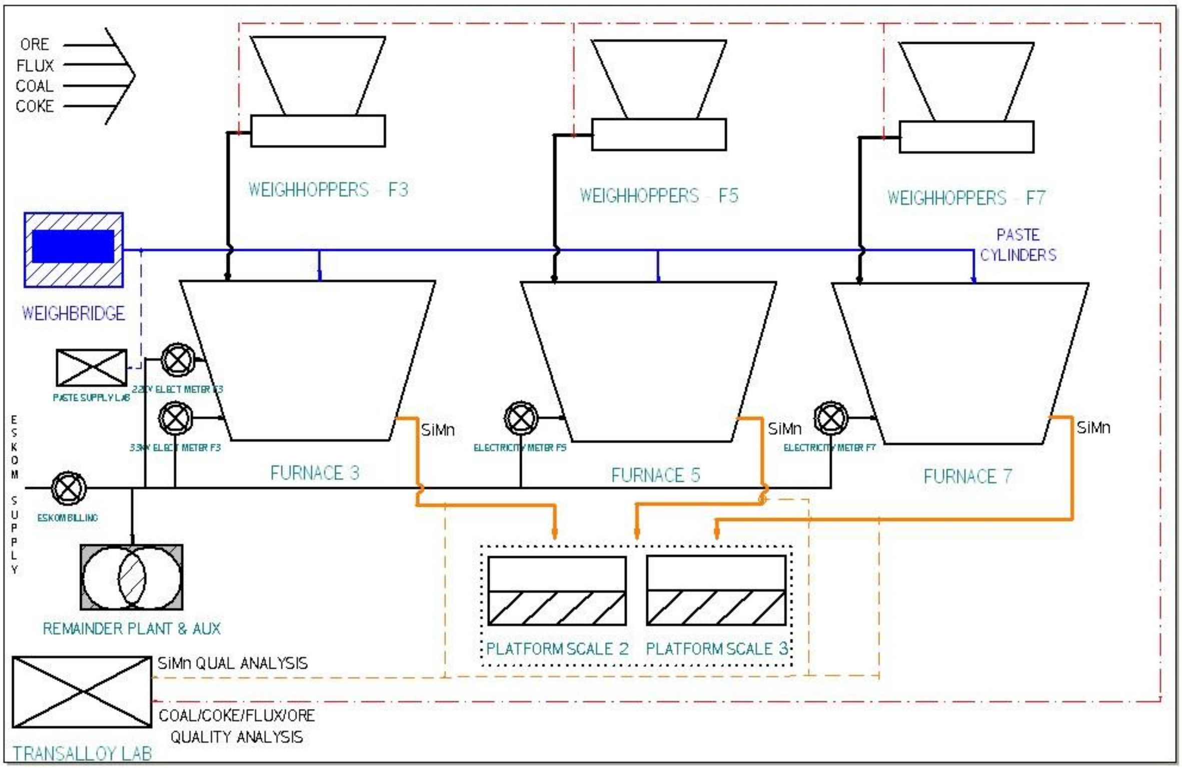


**Diagram 2:** Transalloys metering system

## SECTION D. Data and parameters

### D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors

| **Data / Parameter:** | **$QP_i$** |
|---|---|
| Data unit: | Tonnes of SiMn/year |
| Description: | Annual SiMn production for 7 years preceding the project activity |
| Source of data used: | Project proponent |
| Value(s): | see table below |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission | Baseline emission calculations |

| **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 |

| | |
|---|---|
| calculations) | |
| Additional comment: | Measurement methods are the same as the ones used for $QP_{y,monitored}$ (see section D.2) |

| **Data / Parameter:** | **$EC_i$** |
|---|---|
| Data 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 used: | Project proponent |
| Value(s) : | see table below |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Baseline emission calculations |
| Additional comment: | Measurement methods are the same as the ones used for $EC_y$ (see section D.2) |

| **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 |

| **Data / Parameter:** | **$Q_{bcoal,i}$** |
|---|---|
| Data unit: | Tonnes of coal/year |
| Description: | Annual consumption of coal used as reductant in the submerged electric arc furnace(s) for 7 years preceding the project activity |
| Source of data used: | Project proponent |
| Value(s) : | see table below |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Baseline emission calculations |
| Additional comment: | Measurement methods are the same as the ones used for $Q_{pcoal,i}$ (see |

| **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 |

| | |
|---|---|
| | section D.2) |

| **Data / Parameter:** | **$Q_{bcoke, i}$** |
|---|---|
| Data 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 used: | Project proponent |
| Value(s): | see table below |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Baseline emission calculations |
| Additional comment: | Measurement methods are the same as the ones used for $Q_{pcoke,i}$ (see section D.2) |

| **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:** | **$Q_{bpaste, i}$** |
|---|---|
| Data 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 used: | Project proponent |
| Value(s): | see table below |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Baseline emission calculations |
| Additional comment: | Measurement methods are the same as the ones used for $Q_{p\ paste,i}$ (see section D.2) |

| **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:** | **$EF_{bcoal,i}$** |
|---|---|
| Data unit: | $tCO_2$/tcoal |
| Description: | Emission factor applied for the coal consumed as reductant based on carbon content |
| Source of data used: | IPCC (2006) – Vol. 3, Ch. 4, section 4.3.3.2, table 4.6, p. 4.37 |
| Value(s): | **EFbcoal,i (tCO2/tcoal)**: 3.1 tCO2/tcoal — *Source: IPCC (2006) Vol3, Ch4, p4.37, Table 4.6* |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Baseline emission calculations |
| Additional comment: | Project specific values cannot be used because previous coal carbon contents monitoring precluded a calculation of $EF_{b\ coal}$ (several coal types have been used and no weighted average can be done). |

| **EFbcoal,i (tCO2/tcoal)** | |
|---|---|
| 3.1 | tCO2/tcoal |
| *Source: IPCC (2006) Vol3, Ch4, p4.37, Table 4.6* | |

| **Data / Parameter:** | **$EF_{bcoke,i}$** |
|---|---|
| Data unit: | $tCO_2$/tcoke |
| Description: | Emission factor applied for the coke consumed as reductant based on carbon content |
| Source of data used: | Project proponent |
| Value(s): | See table below |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Baseline emission calculations |
| Additional comment: | Measurement methods are the same as those that will be used for $EF_{p\ coke,y}$ (see section D.2) |

| **EFbcoke,i (tCO2/tcoke)** | |
|---|---|
| **Year** | **EF** |
| 1997 | 3.09 |
| 1998 | 3.13 |
| 1999 | 3.10 |
| 2000 | 3.12 |
| 2001 | 3.15 |
| 2002 | 3.17 |
| 2003 | 3.19 |
| Average 97-03 | 3.13 |

| **Data / Parameter:** | **$EF_{bpaste,i}$** |
|---|---|
| Data unit: | $tCO_2$/tcarbon paste |
| Description: | Emission factor applied for the electrode paste consumed as electrode based on carbon content |

<table>
<tr><td>Source of data used:</td><td>Paste supplier</td></tr>
<tr><td>Value(s) :</td><td>3.32</td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Baseline emission calculations</td></tr>
<tr><td>Additional comment:</td><td>The paste supplier supplied the following information on the composition of the paste:
<table>
<tr><th>PROPERTY</th><th>UNIT</th><th>STANDARD</th><th>TYPICAL</th></tr>
<tr><td>Ash Content</td><td>%</td><td><6 - 7</td><td>6.4</td></tr>
<tr><td>Volatile Matter</td><td>%</td><td>13 - 15</td><td>13.6</td></tr>
<tr><td>Fixed Carbon Content</td><td>%</td><td>> 79</td><td>79.8</td></tr>
</table>
<br>The emission factor is then calculated using equation 4.19, p. 4.33 of IPCC (2006):<br><br>
EQUATION 4.19<br>
CARBON CONTENT OF FERROALLOY REDUCTING AGENTS<br>
Total C-content in reducing agent i = Fix C in i + Content of volatiles in i • Cv<br>
Where:<br>
Cv = Carbon content in volatiles. Unless other information is available, Cv = 0.65 is used for coal and 0.80 for coke.<br><br>
$C_v$ value employed is the same as for coke (0.80), since both have similar characteristics:<br>
- 78.5% of the paste is anthracite, which is a form of coal with high calorific value and carbon content (like coke)<br>
- 21.5% of the paste is the binder, which itself is composed of a minimum of 45% of coking-value.<br><br>
Therefore the %m/m of carbon in the paste is 79.8 + (13.6 * 0.80) = 90.68% and $EF_{b\ paste}$ = 3.32t$CO_2$/t paste (which is still lower than the IPCC value of 3.4).</td></tr>
</table>

## D.2. Data and parameters monitored

| **Data / Parameter:** | **$QP_{y,\ monitored}$** |
|---|---|
| Data unit: | Tonnes of SiMn |
| Description: | Quantity of SiMn production |
| Measured /Calculated /Default: | Measured |
| Source of data: | Weighing platforms 2 and 3 |
| Value(s) of monitored parameter: | F3 = 28,092<br>F5 = 54,617<br>F7 = 57,787 |
| Indicate what the data are used for (Baseline/ Project/ | Baseline and Project emission calculations |

| | |
|---|---|
| Leakage emission calculations) | |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | Weighing platforms 2 and 3 are calibrated daily following internal procedure SOP:SiMn161, as per manufacturer requirements. The accuracy of the weighing platforms is 2.5%. |
| Measuring/ Reading/ Recording frequency: | The data is recorded at every tapping of the furnaces. Daily total is recorded daily. |
| Calculation method (if applicable): | Daily total is obtained by summing data from all tappings that occurred on that day. |
| QA/QC procedures applied: | Saleable product has been cross-checked against sales and stock difference for the monitoring period, demonstrating agreement (i.e. sales + stock difference = 177,828t, which is 7.55% less than total production (192,347t) for the monitoring period. |

| **Data / Parameter:** | **$EC_y$** |
|---|---|
| Data unit: | MWh |
| Description: | Grid electricity consumption by the submerged electric arc furnace(s) |
| Measured /Calculated /Default: | Measured |
| Source of data: | Electricity meter |
| Value(s) of monitored parameter: | F3 = 106,148<br>F5 = 228,805<br>F7 = 230,584 |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Project emission calculations |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | The electricity meters are calibrated every 5 years to ensure optimal accuracy, in line with manufacturer requirements and national standards. (see table below) |
| Measuring/ Reading/ Recording frequency: | An electricity meter per project furnace continuously measures electricity consumed. The value is recorded daily. |
| Calculation method (if applicable): | |
| QA/QC procedures applied: | Values reported are cross-checked against electricity metered monthly |

| Furnace | Serial number | Accuracy class | Calibration date | Valid until |
|---|---|---|---|---|
| F3 – 22kV | 06470035 | 0.5 | 24/11/2006 | 23/11/2011 |
| F3 – 33kV | 00061498 | 1 | 25/04/2008 | 24/04/2013 |
| F3* – 22kV | 95679335 | 0.5 | 02/06/2009 | 01/06/2014 |
| F5 | 06460054 | 0.5 | 22/11/2006 | 21/11/2011 |
| F7 | 06390018 | 0.5 | 28/09/2006 | 27/09/2011 |
| F7** | 96505392 | 0.5 | 11/03/2010 | 10/03/2015 |

* meter used since 23/10/2010
** meter used since 28/09/2010

| | |
|---|---|
| | by the grid company ESKOM. The two values correlate satisfactorily during this Monitoring Period, with a 99.7% correlation coefficient. The total difference over the period was 143MWh, or 0.02%. |

| **Data / Parameter:** | **$Q_{pcoal, y}$** |
|---|---|
| Data 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: | F3 = 19,900<br>F5 = 42,822<br>F7 = 41,669 |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Project emission calculations |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | The load cell based weigh hoppers are maintained regularly and tested weekly for accuracy, according to internal procedure TAOP230 which is in line with manufacturer requirements. |
| Measuring/ Reading/ Recording frequency: | The amount of coal used in the project furnaces is metered by weigh hoppers, and is automatically summed and recorded daily per furnace. |
| Calculation method (if applicable): | |
| QA/QC procedures applied: | In addition, Procedure SiMn300 is applied to all log-sheets which stipulates the procedure for Supervisors to ensure that data has been captured correctly. |

| **Data / Parameter:** | **$Q_{pcoke, y}$** |
|---|---|
| Data 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: | F3 = 435<br>F5 = 1,946<br>F7 = 1,520 |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Project emission calculations |
| Monitoring equipment (type, accuracy class, serial number, calibration | The load cell based weigh hoppers are maintained regularly, and tested weekly for accuracy according to internal procedure TAOP230, which is in line with manufacturer requirements. |

| | |
|---|---|
| frequency, date of last calibration, validity) | |
| Measuring/ Reading/ Recording frequency: | The amount of coke used in the project furnaces is metered by weigh hoppers, and is automatically summed and recorded daily per furnace. |
| Calculation method (if applicable): | |
| QA/QC procedures applied: | In addition, Procedure SiMn300 is applied to all log-sheets which stipulate the procedure for Supervisors to ensure that data has been captured correctly. |

<table>
<tr><td>Data / Parameter:</td><td>$Q_{ppaste, y}$</td></tr>
<tr><td>Data unit:</td><td>Tonnes of paste</td></tr>
<tr><td>Description:</td><td>Consumption of electrode paste used as electrode in the submerged electric arc furnace</td></tr>
<tr><td>Measured /Calculated /Default:</td><td>Measured and calculated</td></tr>
<tr><td>Source of data:</td><td>Weighbridge (for the weight of the cylinders) and production log (for the number of cylinders)</td></tr>
<tr><td>Value(s) of monitored parameter:</td><td>F3 = 720<br>F5 = 1,706<br>F7 = 1,712</td></tr>
<tr><td>Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)</td><td>Project emission calculations</td></tr>
<tr><td>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</td><td>The weighbridge is calibrated in line with manufacturer requirements, as detailed in the table below:
<table>
<tr><th>Serial number</th><th>Accuracy [%]</th><th>Calibration date</th><th>Valid until</th></tr>
<tr><td>991019*</td><td>0.2</td><td>28/01/2010</td><td>27/01/2012</td></tr>
<tr><td rowspan="2">TA19072010**</td><td rowspan="2">0.2</td><td>30/07/2010</td><td>29/07/2012</td></tr>
<tr><td>12/01/2011</td><td>11/01/2013</td></tr>
</table>
* ended use 30/07/2010<br>**began use 30/07/2010</td></tr>
<tr><td>Measuring/ Reading/ Recording frequency:</td><td>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.</td></tr>
<tr><td>Calculation method (if applicable):</td><td>The annual figure is obtained by summing the daily product of number of cylinders used and monthly average weight.</td></tr>
<tr><td>QA/QC procedures applied:</td><td>Average weight of each cylinder is compared to supplier values. The figures are within 0.05% of supplier values for the 700mm cylinders</td></tr>
</table>

| | |
|---|---|
| | (used in F5 and F7), and within 0.24% for the 500mm cylinders (used in F3). The result of this cross-check is satisfactory, since measurements are made by two different weighbridges once the paste has been loaded onto the delivery truck(s). |

| **Data / Parameter:** | **$EF_{pcoal,y}$** |
|---|---|
| Data 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) – Vol. 3, Ch. 4, section 4.3.3.2, table 4.6, p. 4.37 |
| Value(s) of monitored parameter: | 3.1 |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Project emission calculations |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | N/A |
| Measuring/ Reading/ Recording frequency: | The 2006 IPCC value of 3.1$tCO_2$/t coal is employed in the project.<br>If new IPCC guidelines are released, this value may be updated according to latest relevant EB guidance. |
| Calculation method (if applicable): | |
| QA/QC procedures applied: | IPCC data is used to ensure consistency with the emission factor employed in the baseline. |

| **Data / Parameter:** | **$EF_{pcoke,y}$** |
|---|---|
| Data unit: | $tCO_2$/t coke |
| Description: | Emission factor applied for the coke consumed as reductant in year y |
| Measured /Calculated /Default: | Calculated |
| Source of data: | Calculated based on:<br>- Carbon content and volatiles proportion sourced from laboratory analyses.<br>- Carbon content of volatiles from IPCC (2006). |
| Value(s) of monitored parameter: | **2010**: 3.03; **2011**: 3.08 |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Project emission calculation |
| Monitoring equipment (type, accuracy class, serial | N/A |

| | |
|---|---|
| number, calibration frequency, date of last calibration, validity) | |
| 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.<br><br>This emission factor is calculated using equation 4.19, p. 4.33 of IPCC (2006):<br><br>**EQUATION 4.19**<br>**CARBON CONTENT OF FERROALLOY REDUCING AGENTS**<br>Total C-content in reducing agent i = Fix C in i + Content of volatiles in i • Cv<br><br>Where:<br>Cv = Carbon content in volatiles. Unless other information is available, Cv = 0.65 is used for coal and 0.80 for coke.<br><br>The annual emission factor is calculated as the average of monthly emission factors and employed for emission calculations. |
| QA/QC procedures applied: | Lab analyses are undertaken according to national SABS standards. When values are missing or inconsistent for some months, the average of the previous 3 and next 3 months are used. |

| **Data / Parameter:** | $\mathbf{EF_{ppaste, y}}$ |
|---|---|
| Data unit: | $tCO_2$/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: | Calculated from supplier analyses and/or IPCC. |
| Value(s) of monitored parameter: | **2010**: 3.67; **2011**: 3.67 |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Project emission calculations |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | N/A |
| Measuring/ Reading/ Recording frequency: | Monthly |
| Calculation method (if applicable): | This emission factor is calculated using equation 4.19, p. 4.33 of IPCC (2006): |

| | |
|---|---|
| | EQUATION 4.19<br>CARBON CONTENT OF FERROALLOY REDUCTING AGENTS<br>Total C-content in reducing agent i = Fix C in i + Content of volatiles in i • Cv<br>Where:<br>Cv = Carbon content in volatiles. Unless other information is available, Cv = 0.65 is used for coal and 0.80 for coke.<br><br>For the months when supplier analysis reports are not available, a conservative value of 3.67 $tCO_2/t$ (as suggested by the methodology AM0038 v1) is employed. |
| QA/QC procedures applied: | 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 $EF_{ppaste,y}$.<br>In the event a monthly analysis is not available, a conservative value of 3.67 $tCO_2/t$ is employed for that month. |

| **Data / Parameter:** | **Quality of coal$_p$** |
|---|---|
| Data 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 |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | N/A |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | 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 applied: | Lab analyses are undertaken according to national SABS standards. |

| **Data / Parameter:** | **Quality of coke$_p$** |
|---|---|
| Data 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 |

| | |
|---|---|
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | N/A |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | N/A |
| Measuring/ Reading/ Recording frequency: | Monthly |
| Calculation method (if applicable): | Laboratory analyses are performed at least monthly, and fixed carbon, volatiles, S, and P contents are reported. |
| QA/QC procedures applied: | Lab analyses are performed according to national SABS standards. |

| **Data / Parameter:** | **Quality of electrode paste$_p$** |
|---|---|
| Data unit: | Mass fraction of each component (%m/m) |
| Description: | Quality of electrode paste based on elementary analyses and other relevant properties |
| Measured /Calculated /Default: | Calculated |
| Source of data: | Supplier |
| Value(s) of monitored parameter: | N/A |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | N/A |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | N/A |
| Measuring/ Reading/ Recording frequency: | N/A |
| Calculation method (if applicable): | This is based on supplier laboratory analyses reports. |
| QA/QC procedures applied: | The IPCC 2006 Volume 3, p. 4.38, Table 4.6 "$CO_2$ Emission Factors for Ferroalloy Production" gives a typical emission factor of 3.4$tCO_2/t_{paste}$. When new paste analyses are received it is checked that the characteristics measured correspond reasonably with this value. |

| **Data / Parameter:** | **$EF_{y, offsite}$** |
|---|---|
| Data unit: | $tCO_2$/MWh |
| Description: | Grid emission factor |
| Measured /Calculated /Default: | Calculated |
| Source of data: | Registered PDD |

| | |
|---|---|
| Value(s) of monitored parameter: | The factor of 1.221t$CO_2$/MWh is used during the whole crediting period. |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | Baseline and project emissions |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | N/A |
| Measuring/ Reading/ Recording frequency: | Once for the crediting period |
| Calculation method (if applicable): | The Grid electricity emission factor ($EF_{y,offsite}$ in t$CO_2$e/MWh) for South Africa is established ex-ante, according to ACM0002 v6. |
| QA/QC procedures applied: | |

| **Data / Parameter:** | **Quality of $SiMn_p$** |
|---|---|
| Data 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 |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | N/A |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | 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 applied: | Lab analyses are undertaken to national SABS standards to ensure accuracy. Results are reviewed, and anomalous results investigated. |

| **Data / Parameter:** | **Quality of ore** |
|---|---|
| Data 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 | N/A |

| | |
|---|---|
| parameter: | |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | N/A |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | 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 applied: | Lab analyses are undertaken to national SABS standards to ensure accuracy. Results are reviewed, and anomalous results investigated. |

| **Data / Parameter:** | **Quality of fluxes** |
|---|---|
| Data 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 |
| Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations) | N/A |
| Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity) | 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 applied: | Lab analyses are undertaken to national SABS standards to ensure accuracy. Results are reviewed, and anomalous results investigated. |

## SECTION E. Emission reductions calculation

### E.1. Baseline emissions calculation

>>

The calculation of baseline emissions applying actual values and including formulae used is included in the spreadsheet provided.

**E.2. Project emissions calculation**

>>

The calculation of project emissions applying actual values and including formulae used is included in the spreadsheet provided.

**E.3. Leakage calculation**

>>

The calculation of leakage emissions applying actual values and including formulae used is included in the spreadsheet provided.

**E.4. Emission reductions calculation / table**

>>

| Project Summary | | | | | |
|---|---|---|---|---|---|
| **Overall Emission Reductions (all furnaces)** | | | | | |
| Monitoring Period 3 | **UNIT** | **2010** | **2011** | **TOTAL** | Formulas involved |
| **Furnace 3** | | | | | |
| Baseline emissions | $tCO_2e$ | 140,643 | 56,257 | 196,900 | 1 |
| Project emissions | $tCO_2e$ | 114,410 | 42,801 | 157,212 | 2 |
| Leakage | $tCO_2e$ | 0 | 0 | 0 | 3 |
| **Emission reductions** | **$tCO_2e$** | **26,232** | **13,456** | **39,688** | 4 |
| Onsite emission reductions (for uncertainty) | $tCO_2e$ | 3,942 | 2,373 | 6,316 | 5 |
| **Furnace 5** | | | | | |
| Baseline emissions | $tCO_2e$ | 304,526 | 121,810 | 426,336 | 1 |
| Project emissions | $tCO_2e$ | 248,597 | 94,322 | 342,920 | 2 |
| Leakage | $tCO_2e$ | 0 | 0 | 0 | 3 |
| **Emission reductions** | **$tCO_2e$** | **55,928** | **27,488** | **83,416** | 4 |
| Onsite emission reductions (for uncertainty) | $tCO_2e$ | 11,783 | 5,787 | 17,570 | 5 |
| **Furnace 7** | | | | | |
| Baseline emissions | $tCO_2e$ | 320,707 | 128,283 | 448,990 | 1 |
| Project emissions | $tCO_2e$ | 239,033 | 96,296 | 335,329 | 2 |
| Leakage | $tCO_2e$ | 0 | 0 | 0 | 3 |
| **Emission reductions** | **$tCO_2e$** | **81,674** | **31,987** | **113,661** | 4 |
| Onsite emission reductions (for uncertainty) | $tCO_2e$ | 17159 | 7262 | 24,420 | 5 |
| TOTAL | | | | | |
| Baseline Emissions | tCO2 | 765,875 | 306,350 | **1,072,226** | 6 |
| Project Emissions | tCO2 | 602,041 | 233,420 | **835,461** | 7 |
| Leakage | tCO2 | 0 | 0 | **0** | 8 |
| **Emission Reductions** | **tCO2** | **163,835** | **72,930** | **236,765** | 9 |
| Onsite emission reductions (for uncertainty) $ER_{onsite,y}$ | tCO2 | 32,884 | 15,422 | **48,306** | 10 |
| Emissions to be deducted for uncertainty if $ER_{onsite,y}>0$ | tCO2 | 2,960 | 1,388 | **4,348** | 11 |
| **Emission Reductions (adjusted for uncertainty)** | **tCO2** | **160,875** | **71,542** | **232,417** | 12 |

| | Formulas involved: |
|---|---|
| 1. | BEy = BEy,offsite + BEy,onsite for each furnace<br>BEy,offsite = QPy,max x secb x EFy,offsite<br>BEy,onsite = QPy,max x EFb,onsite<br>EFb,onsite = (Qb,coal x EFb,coal + Qb,coke x EFb,coke + Qb,paste x EFb,paste) / QP<br>QPy,max = minimum(QPy,monitored, QPhistoric) |
| 2. | PEy = PEy,offsite + PEy,onsite for each furnace<br>PEy,offsite = QPy,max x secp x EFy,offsite<br>PEy,onsite = QPy,max x EFp,y,onsite<br>EFp,y,onsite = (Qp,coal x EFp,coal + Qp,coke x EFp,coke + Qp,paste x EFp,paste) / QP<br>QPy,max = minimum(QPy,monitored, QPhistoric) |
| 3. | Ly = 0 |
| 4. | ERy = BEy - PEy - Ly for each furnace |
| 5. | ERy,onsite = BEy,onsite - PEy,onsite |
| 6. | $BEy = BEy,_{F3} + BEy,_{F5} + BEy,_{F7}$ |
| 7. | $PEy = PEy,_{F3} + PEy,_{F5} + PEy,_{F7}$ |
| 8. | $L = L_{F3} + L_{F5} + L_{F7} = 0$ |
| 9. | ERy,not adjusted = BEy - PEy - Ly |
| 10. | $ERonsite,y = ERonsite,y,_{F3} + ERonsite,y,_{F5} + ERonsite,y,_{F7}$ |
| 11. | Uncertainty adjustment component = 0.91 x ERonsite,y if ERonsite,y > 0<br>Uncertainty adjustment component = 0 if ERonsite,y ≤ 0 |
| 12. | ERy = ERy,not adjusted - Uncertainty adjustment component |

## E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

>>

This section includes a comparison of actual values of the emission reductions achieved during the monitoring period with the estimations in the registered CDM-PDD.

| Item | Values applied in ex-ante calculation of the registered CDM-PDD | Actual values reached during the monitoring period |
|---|---|---|
| **Emission reductions [$tCO_2e$]** | **66,553**[1] | **232,417**[2] |

## E.6. Remarks on difference from estimated value in the PDD

>>

The forecasted emission reduction in the PDD for the period 2010 - 2011 is 66,553 $tCO_2e$/year. When this is pro-rated to the 14 month long monitoring period, the forecast becomes 77,645 $tCO_2e$. During

[1] Per annum

[2] For the 14 months covering the monitoring period

this monitoring period the emission reductions amount to 232,417 $tCO_2e$, which exceeds the forecast by 199%. The reasons for this difference are detailed below:

1. **On-site emission reductions.** On-site emission reductions (due to consumption of coal, coke, and paste) are 43,959 $tCO_2$[3], due to a specific emission factor of 2.49 $tCO_2$/tSiMn in the project (which is *lower* than the 2.93 $tCO_2$/SiMn factor in the baseline). 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. This methodology requirement reduces the difference from 199% to 143% as indicated in Table 3 (below).

2. **Higher electricity savings during the monitoring period than 0.4 MWh/tSiMn originally forecast in the PDD.**

    a. **Methodology effect on baseline electricity consumption**. PDD estimates of reductions in specific electricity consumption assumed a value of 0.4 MWh/tSiMn. The methodology established a baseline consumption of 5.4 MWh/tSiMn (based on 1997-2003 data), however when the electricity saving of 0.4 MWh/tSiMn was estimated by the project developer at the time of decision making (2003), the specific consumption was 4.91 MWh/tSiMn. When validation commenced in 11/2006, it was appropriate to retain the 0.4 MWh/tSiMn savings compared to the 7 years baseline level of 5.4 MWh/tSiMn in view of the monitoring data available at the time. If the estimated saving of 0.4 MWh/tSiMn had been increased by the difference between the specific consumption level of 2003 alone (4.91 MWh/tSiMn) and the one obtained by the methodology required longer baseline of 7 years (5.4 MWh/tSiMn), the saving would have been estimated at 0.40 + 0.49 = 0.89 MWh/tSiMn. Seen from the other side, if the baseline employed for this monitoring period was based on the 2003 specific electricity consumption of 4.91 MWh/tSiMn instead of the 7 years baseline, the difference between emission reductions claimed and PDD estimates would change from 143% to 58% as shown in Table 3 (below).

    b. **Higher electricity savings during the monitoring period**. Compared to the PDD estimate of 0.40MWh/t electricity savings, the project achieved 0.89MWh/t (compared to the 2003 baseline). This effect changes the difference from 58% to -29% as shown in Table 3 (below).

3. **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 are adjusted in order to *only* cover the emission reduction generated by F3, F5, and F7 (the furnaces retrofitted to date). This narrows the gap between the estimated and reported emission reductions from -29% to 0% as illustrated in Table 3 (below).

[3] 48,306 $tCO_2$ less 9% for uncertainty.

| | | All furnaces | | | |
|---|---|---|---|---|---|
| | | PDD forecast | Monitoring report value | Difference | % |
| | Start assumptions | 77,645 | 232,417 | 154,772 | 199% |
| 1 | After adjustment for on-site emissions | 77,645 | 188,459 | 110,814 | 143% |
| 2a | After adjustment for baseline electricity consumption factor | 77,645 | 122,470 | 44,825 | 58% |
| 2b | After adjustment for project electrical efficiency | 77,645 | 54,979 | - 22,666 | -29% |
| 3 | After adjustment for furnace 1 & 6 retrofit being delayed | 54,979 | 54,979 | 0 | 0% |

**Table 3:** Summary of monitoring period performance compared to PDD estimate.

- - - - -

**History of the document**

| Version | Date | Nature of revision |
|---|---|---|
| 01 | EB 54, Annex 34<br>28 May 2010 | Initial adoption. |
| **Decision Class**: Regulatory<br>**Document Type**: Guideline, Form<br>**Business Function**: Issuance | | |