CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

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Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Transalloys Manganese Alloy Smelter Energy Efficiency Project
PDD Version Number 3
03 November 2006

A.2. Description of the project activity:

The Transalloys Manganese Alloy Smelter Energy Efficiency Project (hereafter, the "Project"), developed by Transalloys division of Highveld Steel and Vanadium Corporation Ltd (hereafter referred to as the "Project Developer"), is an industrial energy efficiency project that will reduce the electricity consumption in the production of silicomanganese (SiMn) alloy (a key component in steel making) at its Witbank facility in South Africa (hereafter referred to as the "Host Country").

The production of each tonne of manganese alloy produced in the current submerged electric arc furnaces requires approximately 5MWh of grid-fed electricity. The project is to retrofit current furnaces with new design of electric arc furnaces, electrode assemblies, and control and peripheral systems. This will reduce the specific electricity consumption of alloy production by some 10-20% to between 4.5-4MWh per tonne of alloy produced. The aim is to achieve approximately a 0.5MWh reduction in specific electricity consumption, with a belief that up to 1MWh could be achieved under the correct operating conditions, should the retrofitting be successful. The project will therefore displace electricity from the South African grid, which is mostly produced from coal. The amounts of coal and coke used as reductants, and paste (mostly made of carbon) used as electrode in the submerged electric arc furnaces are not expected to be affected by the project.

Five furnaces are covered by the project. The first one (#7) was retrofitted in late 2004, two more (#5 and #3) in 2005 and the last two (#1 and #6) are expected to be retrofitted, although plans have been delayed due to poor market conditions that directly affected the viability of the projects. The project is a prompt start project claiming carbon credits since October 2004 for retrofitting of the five furnaces. These credits, generated from electricity savings, were and are a determining factor in the decision to retrofit all furnaces and were considered in the setup of the project since 2003.

The project is helping the Host Country fulfil its goals of promoting sustainable development. Specifically:

- Makes a significant contribution to maintaining the livelihoods of the workers employed in this and ancillary industries both up and down stream of the facility;
- Reduces directly the amount of electricity needed to produce the silico-manganese alloy and hence reduces the demand placed upon the South African national grid on the demand side;
- Acts as a clean technology demonstration project, encouraging development of modern and more efficient utilisation of electricity throughout the Country;
- Has a more effective capture of fugitive dust from process, allowing better particulate capture and a reduced emission to the local environment.
- Allows Transalloys to maintain and increase its competitive advantage in what is a competitive, global, export focussed market. Transalloys currently contributes $130m(+) to the national balance of

payments through export sales. Recently, export focussed sectors have seen an increased risk of facilities going out of business as a result of the strong Rand, this project will contribute to mitigating some of this currency risk.

A.3. Project participants:

Table 1 - Project participants

Name of party involved (*) ((host) indicates a host party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (Yes/No)
South Africa(host)	Transalloys Division of the Highveld Steel and Vanadium Corporation Ltd.	No
United Kingdom of Great Britain and Northern Ireland	EcoSecurities Group Plc	No

(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time requesting registration, the approval by the Party(ies) involved is required.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

South Africa (the "Host Country")

A.4.1.2. Region/State/Province etc.:

Gauteng Province

A.4.1.3. City/Town/Community etc:

Witbank

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

Clewer Road, Witbank, 1035, Mpumalanga, RSA

A.4.2. Category(ies) of project activity:

According to Annex A of the Kyoto Protocol, this project fits in Sectoral Category 9, Metal production

A.4.3. Technology to be employed by the project activity:

The Transalloys facility currently uses 5 submerged electric arc furnaces for silicomanganese alloy production (see figure 1). Furnaces 1, 3 and 5 are Elkem design, while #6 is a self-built furnace based on that design. Furnace 7 is a Demag design. The electric capacities of the furnaces are 48MVA (#7 and #5), 22MVA (#6) and 21MVA (#1 and #3).

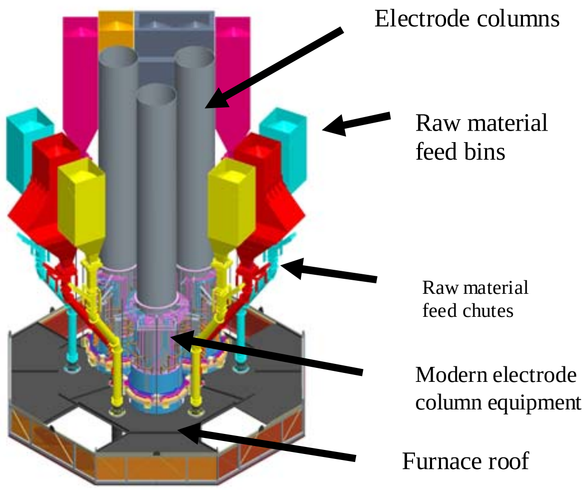
The approach of the project, for all furnaces, is to retrofit new technology into the existing furnace infrastructure, which is designed for a different technology. Under normal circumstances such technology would not be installed into old furnaces, but repairs would be done regularly to maintain the furnace at acceptable level.

More specifically, the central elements that are changed in the project are the following:

- Furnaces 7 and 5: the PCD (pitch centre diameter), which measures the distance between the three electrodes (see figure 3), is optimized in order to reduce electricity consumption. If the PCD is too big, then the furnace requires a higher current density; if the PCD is too small, the outside of the furnaces cools excessively, resulting in operational difficulties. The decision to change this PCD was based on assumptions and mathematical models that still need actual confirmation in practice, as such innovative changes have an important element of uncertainty. Changing this PCD means in particular that all 3 electrode column assemblies as well as the material inlets have to be changed and the existing roofing structure adapted to this new dimensions. For furnace 5, the investment cost is higher as offtake systems (stacks) also have to be changed and new lining and foundations have to be given to the furnace. Pyromet provides the technology for these furnaces, and it is the first time such technology is used for a brownfield project.

- The same principles are applied for furnaces 1, 3, and 6. These units being smaller, the design is a bit different and the elements needed to be changed for the project are not all the same. For instance, #3 is converted from a rotating (around its vertical axle) to a stationary furnace and the old pneumatic slipping system (to let the electrode paste down the electrode) is changed – both elements make the scope of this retrofitting unique and challenging. Bateman provide the technology for these furnaces.

Figure 1: Current furnace electrodes



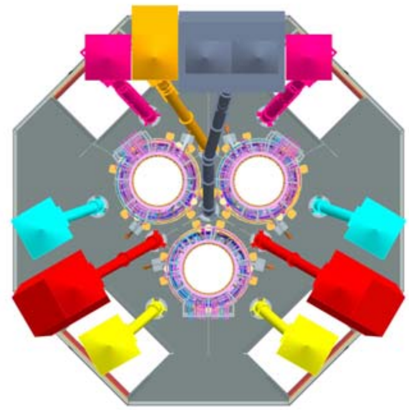


Figure 3 (above): View of the electrodes and raw material inlet from the top

Figure 2 (left): Plan view of electrodes and material feed bin (from the top)

The project involves taking furnaces out of production for several weeks to install the new system. The original and actual retrofitting schedule of the five furnaces is given in table 2. Retrofitting of furnaces 6 and 1 have been postponed to 2008 and 2009 if market conditions allow for it.

Table 2: Furnace Retrofitting Timetable

Furnace	**Size**	**Commissioning date (age of the furnace)**	**Original retrofitting Schedule**	**Actual retrofitting schedule**
7	48MVA	1990	July – September 2004	12July – 06 September 2004
5	48MVA	1979	March – May 2005	30May – 04 December 2005
6	22MVA	1980	July – September 2005	Expected 2008
1	21MVA	1964	March – May 2006	Expected 2009
3	21MVA	1964	July – September 2006	28May – 18 October 2005

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

Assuming savings of 0.6MWh per tonne of SiMn produced once the furnaces are retrofitted, the following emission reductions can be expected from the project:

Table 3: Estimated emissions reductions from the project

Estimated emission reductions from the project	
Years	**Annual estimation of emission reductions in tonnes of CO2e**
2004-05	28,862
2005-06	70,687
2006-07	70,687
2007-08	70,687
2008-09	85,587
2009-10	99,829
2010-11	99,829
2011-12	99,829
2112-13	99,829
2013-14	99,829
Total estimated reductions (tonnes of CO2e)	825,657
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	82,566

A.4.5. Public funding of the project activity:

The project will not receive any public funding from Parties included in Annex I of the UNFCCC.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the project activity:

The project uses approved methodology AM0038 ("Methodology for improved electrical energy efficiency of an existing submerged electric arc furnace used for the production of SiMn"), version 01, dated 29.11.06.

To calculate the grid emission factor, the project uses approved methodology ACM0002 ("Consolidated baseline methodology for grid-connected electricity generation from renewable sources"), version 06, dated 19.05.06.

To select the baseline and demonstrate additionality, the project uses the step-wise approach defined in AM0038, which refers to the latest version of the "Tool for the demonstration and assessment of additionality". Version 02 of this Tool, dated 28.11.05, is used.

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

The project meets all the applicability criteria as set out in the methodology AM0038:

a) Submerged electrical arc furnaces are used for production of silicomanganese (SiMn) both in the project case and baseline.
   - This is indeed the case in the baseline and there are no plans to change this in the future.

b) The electricity consumed, both in the project case and the baseline, by the submerged electric arc furnace is sourced from the grid and not by onsite generation.
   - All the electricity is bought from national utility Eskom.

c) The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available
   - There is only one national grid for South Africa, and therefore the geographic and system boundaries can be clearly identified. Information on the characteristics of the grid (mostly electricity generation and fuel consumption of all the plants) has been gathered in order to determine the grid emission factor according to ACM0002.

d) The quality of the raw material and SiMn produced is not affected by the project activity and remains unchanged;
   - This quality will indeed be unchanged and this will be monitored in the project and compared against the baseline. In particular, the production has to meet certain specifications and it is shown that these specifications are still met in the project.

e) The local regulations/programs do not cap the level of grid electricity that can be procured by the SiMn production facility where the project activity is implemented;

- South African and local regulations/programs do not constrain the facility from using electricity from the grid.

f) Data for at least three years preceding the implementing the project activity is available to estimate the baseline emission.
- Data for seven years is available (1997-2003) and will be used to estimate the baseline emissions.

g) Emission reduction credits shall be claimed only until the end of the lifetime of the equipment;
- There is no specified lifetime of the equipment by the manufacturer. For the user (the project developer), the equipment can be kept as long as its availability and/or efficiency is sufficient to make it economically viable to run the furnace. This is ensured by performing regular maintenance and refurbishment operations, which is the current situation and which is what would continue to happen during the whole crediting period in the absence of the project activity (see also section B.4). We can see from table 1 that the furnaces of the project are between 16 and 42 years old, and the schedule of retrofitting is independent of that age.

h) The project activity does not result in increase in production capacity of the SiMn production facility, where the project is implemented, during the crediting period.
- The production capacity of each furnace (determined by its electric capacity (MVA) indicated in table 2) remains constant. Actual production can fluctuate as a result of operational requirements, market conditions and demand. No significant increase is expected in the project, but if the production in a given year is higher than the historic average, no emission reductions will be claimed for the extra-production (see equation 3 in section B.6.1).

All the above conditions being met, the methodology is applicable to the project.

B.3. Description of the sources and gases included in the project boundary

Spatial boundaries

The project boundary comprises of the following two components:

- The electricity grid from which the electricity used in the project activity is purchased, as defined in ACM0002; in this case, it is all the plants connected to the South African grid, owned and operated by Eskom.
- The physical structure of the submerged electric arc furnace, as described in figure 4 below. The project includes furnaces #1, 3, 5, 6 and 7 at Transalloys facility. Each furnace will be included in the project boundary only once it is retrofitted, as the retrofitting is scheduled over several years (see table 2).

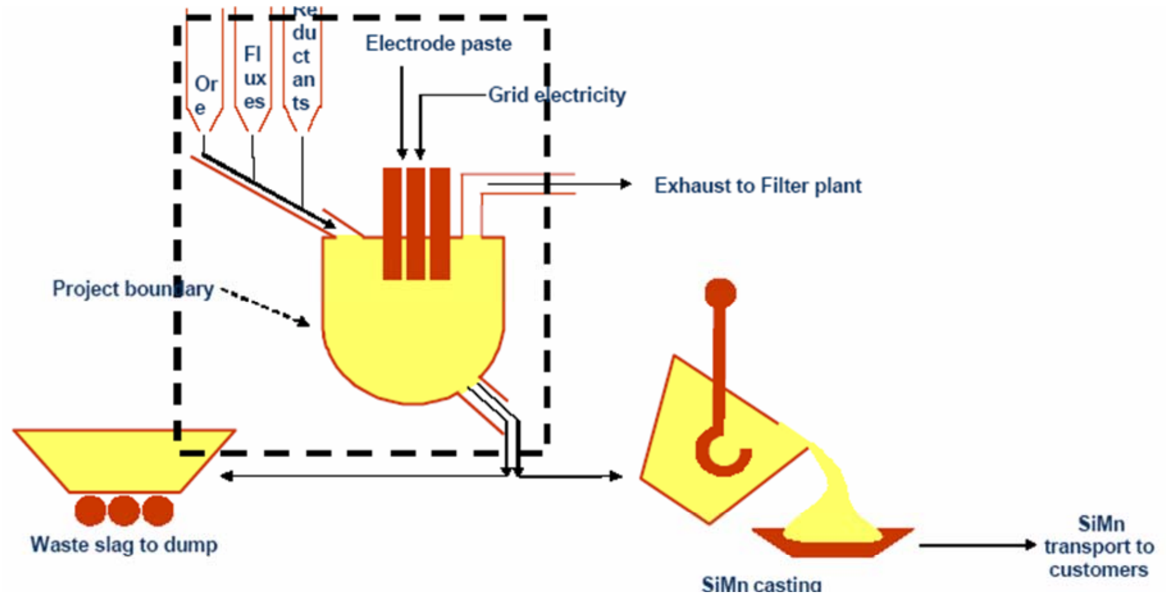


Figure 4: Spatial extent of the project boundary
(excluding the grid generation capacity according to ACM0002)

Emissions sources
The emissions sources included in the project boundary are defined in table 3 below.

Table 4: Emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Grid electricity generation	CO_2	Included	▪ Only CO2 emissions associated with the electricity consumption of the Submerged arc electric furnace will be counted, according to ACM0002.
		CH_4	Excluded	
		N_2O	Excluded	
	Emissions from the consumption of reductants	CO_2	Included	▪ Although some part of the carbon will end up in the end product it is assumed that 100% will be emitted to the air via the exhaust gases. Carbon content is measured on 7 year historic average reductant consumption.
		CH_4	Excluded	▪ No CH_4 emissions.
		N_2O	Excluded	▪ N_2O emissions are excluded for simplification.[a]
	Emissions from the consumption of electrode paste	CO_2	Included	▪ Based on 7 year historic average electrode paste consumption.
		CH_4	Excluded	▪ No CH_4 emissions.
		N_2O	Excluded	▪ N_2O emissions are excluded for simplification.[a]
Project Activity	Grid electricity generation	CO_2	Included	▪ Only CO2 emissions associated with the electricity consumption of the Submerged arc electric furnace will be counted, according to ACM0002.
		CH_4	Excluded	
		N_2O	Excluded	
	Emissions from the consumption of reductants	CO_2	Included	▪ Although some part of the carbon will end up in the end product it is assumed that 100% will be emitted to the air via the exhaust gases. Reductant consumption is monitored during project.
		CH_4	Excluded	▪ No CH_4 emissions.
		N_2O	Excluded	▪ N_2O emissions are excluded for simplification.[a]
	Emissions from the consumption of electrode paste	CO_2	Included	▪ Electrode paste consumption is monitored during the project.
		CH_4	Excluded	▪ No CH_4 emissions.
		N_2O	Excluded	▪ N_2O emissions are excluded for simplification.[a]

Note [a]: N_2O emissions are excluded for simplification

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The determination of the baseline scenario is done according to the step-wise approach defined in AM0038. The project involves the implementation of energy efficient, new design technology in five furnaces. As required by the methodology, baseline and additionality shall be determined per individual furnace – the approach here is to highlight the main elements that come into play for all furnaces and for each of these elements see how/if they apply to each furnace separately.

Step 1. Identify technically feasible options to increase energy efficiency within the project boundary

For each furnace, the same following alternatives are considered:

a) Continued use of installed furnace technology
   - Under this scenario, current submerged electric arc furnace will continue to be used, producing silicomanganese alloy at a specific energy consumption of about 5 MWh per tonne of alloy produced. Normal repair and refurbishing operations (i.e. replacing existing equipment as it is) will be carried out occasionally to maintain the availability of the furnace at an acceptable level, but electrical efficiency cannot be increased significantly because the design of the furnace is still the same.

b) The project activity, installation of a new-build design, not implemented as a CDM project
   - Under this scenario, current furnace is retrofitted in-situ with technology designed for new furnace, reducing specific electricity consumption to about 4-4.5 MWh per tonne of alloy owing to this new design. Core elements of the furnace (e.g. electrode columns) are rebuilt with a new design.

c) Complete replacement of the installation
   - Under this scenario, current furnace as well as ancillary equipment are entirely replaced by a new installation.

d) All other plausible and credible alternatives to the project activity that provide energy efficiency improvement to the furnace which are technically feasible to implement with comparable quality, properties and application areas
   - Although several different technology providers where considered (in addition to Pyromet and Bateman) by the project proponents, no additional alternative project activities were identified.

Table 4 below outlines some key differences between the three technically feasible options a), b) and c) identified. Only the change of the design can deliver consistent electricity savings – any normal repair/refurbishment (or new build with same design) could not decrease electricity consumption, or only marginally by improving overall furnace use (e.g. by decreasing the number of switch on/off during which electricity consumption is not efficient).

Table 5: Typical characteristics of the three alternative scenarios identified in step 1

All elements per furnace and prices in Rands	a) Continued use - refurbish	b) Project activity – retrofit/rebuild	c) Complete new installation
Costs of short-term repairs	ca. R9mn/yr	ca. R5mn/yr	R3mn/yr (?)
Investment cost	0 (0.5 – 3mn for each repair)	R17-45mn depending on the furnace (see table 6)	R200mn (?)
Time offline	1-11 weeks	8-27 weeks depending on the furnace (see table 2)	Depends on whether new installation replaces an existing one
Typical increase in availability*	5%	10%	n/a
Electricity savings	0	0.5-1 MWh/tSiMn	Depends on design

*The increase in availability of a furnace depends on so many factors that it is difficult to estimate the increase in availability through any of the alternatives. A brand new furnace could start off with poor availability due to "teething problems" – so can a repair or rebuild.

Step 2. Identify baseline alternatives that do not comply with legal or regulatory requirements:

For each furnace, all the alternatives comply with the laws and regulatory requirements for SiMn production in the project location; there are no government policies to impose energy efficiency improvements to the metal sector. Therefore, no alternatives shall be eliminated at this stage.

Step 3. Eliminate baseline alternatives that face prohibitive barriers:

This step is carried out by identifying a common set of barriers that can apply to at least one of the three alternatives remaining after steps 1 and 2. The description of each barrier is combined with an assessment of how this barrier affects the various alternatives considered for each furnace.

1. Low electricity price

South Africa is very rich in coal resources and almost 90% of the country's electricity is generated in coal-fired power plants, mostly owned by state-owned utility Eskom. As a result, South Africa is "one of the four cheapest electricity producers in the world"[1]. This situation provides no incentive for electrical efficiency projects, and there is no important energy efficiency culture in South Africa. Project developers going beyond this usual culture in order to reduce their electricity consumption (alternatives b and c) will reduce electricity costs, but this is highly dependent on the actual electrical performance of the furnace (see point 5. below), and requires up-front investment in new equipment (see point 2. below).

2. High investment cost

Implementing a complete replacement of a furnace and ancillary equipments would require extremely high levels of investment. Even if CDM was considered to alleviate some of this financial pressure, this option does not present an economically feasible alternative; therefore, alternative c is eliminated from the rest of the analysis.

The project activity (alternative b) also incurs significant investment costs, which need to be recouped through electricity savings, increased availability, and decreased cost of repairs. These revenues are highly dependent on the price of SiMn, the exchange rate of the Rand and the technical performance of the project.

This applies to each furnace, although figures are different depending on the size of each furnace and the magnitude of the retrofit. Furnace 7 is big (48MVA – approximately 40,000tSiMn produced per year) but needs only replacement of the core elements. Furnace 5 is big and also needs some peripheral elements to be changed (especially offtake system), making the retrofit much more expensive. Furnaces 1,6 and 7 are smaller but need significant changes and therefore incur a similar cost to furnace 7. Figures per individual furnace are given in the table below.

[1] *South Africa 2005/2006 Yearbook*, Chapter 16: Minerals, energy and geology, p469 (available at http://www.gcis.gov.za/docs/publications/yearbook/minerals_energy.pdf). See also http://www.dme.gov.za/energy/electricity.stm.

Table 6: Investment cost of the project activity, furnace by furnace

Furnace	Size	Investment cost (mn Rand)
7	48MVA	17
5	48MVA	45
6	22MVA	ca. 20
1	21MVA	ca. 20
3	21MVA	ca. 18

3. Increased competition - uncertainty of silicomanganese and raw material prices

In the project activity (alternative b), the new improved furnace has an increased fixed cost (as opposed to variable costs from electricity and raw materials use) per unit of silicomanganese produced. One objective of the project is to compensate this increased fixed cost by an increased availability of the furnace compared to the availability with the continued operation of the existing furnace (alternative a). The balance between the two effects ("net profit/loss") is highly dependent on:

- the actual technical performance of the project (increased availability);
- the global price of SiMn (in $);
- the exchange rate of the $ (in Rand/$).

The uncertainty associated with the technical performance of the project will be discussed in point 5. and the exchange rate in point 4. The global price of SiMn itself is affected by highly increased competition from China, which puts pressure on both SiMn price (downwards because of increased production) and raw material prices (upwards because of increased consumption). Between 2003 and 2004, when the decision to go ahead with the first furnace was made, production of SiMn from Asia and Oceania increased by 22% (2.63 to 3.21mn tSiMn)[2] while production at each furnace of Transalloys remained the same.

Therefore, expected increased revenues from increased availability in the project activity (alternative b) were and still are very uncertain and threatened by changes in market conditions. Alternative a (continued use of current furnaces) is less affected by such changes. These external changes apply equally to all furnaces (they all produce SiMn) but increased availability will depend on the actual performance of each furnace.

4. Uncertainty of exchange rate

The project developer's business is focused on exports of SiMn to a global market. The price of SiMn is fixed in dollars while most operating costs are mostly expressed in Rands on the South African market; therefore, the project is highly dependent on the exchange rate of the dollar. The Rand was becoming increasingly strong when the decision to embark on the programme and go ahead with the first 3 furnaces was made (2004), as a result of the attractiveness of the South African economy following a successful transition from apartheid to an internationally attractive market economy.

Although this effect has been decreased to a certain extent in 2005-2006, overall market conditions (taking into account points 3 and 4 above) have deteriorated since 2004 and the retrofitting of the last two furnaces

[2] See International Manganese Institute (August 2006) – World Overview Q2 2005 (available from: http://www.manganese.org/marketresearch.php).

has been put on hold (see section B.5, step 3), which demonstrates the importance of barriers 3 and 4 to the viability of the project activity.

5. *Technology risks*

The attractiveness of the project is crucially dependent on its ability to deliver the expected savings from electricity use, lower repair costs, and to a lower extent increased availability. This represents a very high risk in the project activity due to its innovative character (see point 6. below) and the fact that metal production is to a large extent an art of craftsman. It is impossible to determine with certainty in advance how the performance of the furnaces will be improved by the project, and this will be different in each furnace.

6. *Lack of prevailing practice*

As highlighted above in section A.4.3 and below in section B.5 (Step 3), the technology used in the project is not common practice. This causes extra-technical complications and increases the uncertainty of the performance of the project as it is even more difficult to assess how the features of the new design will fit in the existing infrastructure; the only advantage compared to a complete new build is the limited investment cost.

Illustration and conclusion

To illustrate points 3 to 6 above and put some figures on the qualitative arguments advanced, below are the financial results to date (as of May 2006) from the retrofitting of furnaces 7 and 5:

Table 7: Financial results of the first two retrofittings covered by the project activity, as of May 2006.

All figures in Rands	**Without carbon credits**		**With carbon credits**	
	Expected	**Actual**	**Expected**	**Actual**
FURNACE 7				
Cost				
TOTAL Investment cost	17,238,000			
Revenues to date (Oct04-May06)				
Increased furnace availability	15,101,619	-3,055,016		
Savings on MWh	21,443,779	333,469		
Savings on short term repairs	33,858,000	5,698,582		
TOTAL revenues to date	70,403,399	2,977,036	74,698,969	7,272,606
FURNACE 5				
Cost				
TOTAL Investment cost	45,000,000			
Revenues to date (Dec05-May06)				
Increased furnace availability	-1,549,456	-485,086		
Savings on MWh	2,539,003	134,521		
Savings on short term repairs	3,422,528	3,043,583		
TOTAL revenues to date	4,412,075	2,693,018	5,495,730	3,776,673

Note: This table includes only investment cost. However, a finer analysis would also include the opportunity cost from lost production during the months of retrofitting – such a cost would add significantly to the investment cost.
Source: Highveld, Payback evaluation schedule

This shows that although the projects may look profitable on the paper ("expected revenues"), payback is far from being reached after 6 months to 2 years of actual operation and that the projects are clearly underperforming financially. This is due to both technical elements (see point 5 above) and market conditions (see points 3 and 4 above).

The technical performance of the project will certainly increase in future years due to better handling of the new design – metal production has an important craftsmanship aspect to it, with a lot of learning by doing when it comes to adjusting operating parameters to a new furnace design. In particular, the availability of both retrofitted furnaces has been particularly low and several significant repairs/adjustments had to be made to furnace 7, and it can be expected that such circumstances will improve in the future. Nevertheless, the payback of the project activity is relatively long and, maybe more importantly, very uncertain – any additional, secure and diversified revenue from carbon credits therefore contributes importantly to the project viability.

The highlighted variability and sensitivity of some key parameters suggests that it is more suited to take into account the whole decision making context and the risks involved with the project in order to assess its attractiveness and additionality. That is why such an analysis has been performed here (using step 3 of AM0038's baseline selection process), rather than a strict financial analysis based on such varying parameters (step 4), which will not be carried out.

In conclusion, this section demonstrates that for each furnace, the project activity (installation of new-build design) not implemented as a CDM project (alternative b), is not the most realistic alternative because it faces a number of barriers. The project undertaken as a CDM still faces some of these barriers but they are alleviated and diminished to an acceptable level (see step 3 of section B.5). Therefore, the only realistic baseline alternative is alternative a) continued use of current furnace technology, and there is no need to perform Step 4: Compare economic attractiveness of the remaining alternatives.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality):

Step 0. Preliminary screening based on the starting date of the project activity:

The project began construction prior to the registration of the first CDM project, commencing construction in July 2004 (and operation in September 2004), which falls between 1 January 2000 and the date of the registration of a first CDM project activity (18 November 2004).

The project developer started engaging with EcoSecurities and Standard Bank for the CDM component of the project in 2003. Highveld's financial director attended a workshop held at Standard Bank (Johannesburg) in July 2003 and subsequent follow-up was made between the companies to determine how the proposed project could benefit from carbon credits.

This was a key element in the decision to embark on the programme of retrofitting all furnaces, which matured at the end of 2003 and beginning of 2004. Formal decision to go ahead with the first retrofitting (furnace 7) was voted in January 2004. After a successful trial period at the end of 2004 for furnace 7, it was decided to pursue with furnace 3 and 5 (approved in January 2005).

In terms of formal CDM milestones, final CDM contract was signed in August 2004 after several proposals were made. This accelerated the process of developing a new methodology, which was finally approved on 30 September 2006 after 3 submissions (NM0092 rated B, NM0092-rev rated C, NM0146 rated A and approved as AM0038). The prospect of CDM revenues has been and continues to be a central element in the decision to pursue the programme and retrofit each furnace. Retrofitting of furnaces 1 and 6 has been delayed due in particular to the market conditions.

Step 1. Investment and sensitivity analysis:

A barriers analysis (section B.4 – step 3) has been used to demonstrate that the project activity undertaken without the CDM (alternative b) is economically less attractive than the most plausible baseline scenario (alternative a) continued use of existing furnace technology) because of the perceived, but also real risks and uncertainties associated with the project activity. The analysis included a description of the sensitivity of various parameters to the financial attractiveness of the project activity.

Step 2. Common practice analysis

To date there has been no identifiable example of a similar project in South Africa, or the wider region, of a project approach that retrofits new technology into an infrastructure designed for a completely different technology. The adjustment of PCD of a furnace would normally only take place when the product is changed (for instance: chrome, manganese and silicon alloys can be made in the same furnace) as the optimal PCD differs. Project developers are not aware of anyone who has made PCD adjustments for optimisation purposes, as it was done in furnaces 7 and 5, or changed the slipping device type of an existing electrode to the type now used in furnace #3 or the nature of the furnace (from rotating to stationary). It is the first brownfield project of this sort for technology providers Bateman and Pyromet.

Therefore, the project is not common practice in the manganese alloy, or wider metals production industry. Standard practice is to continue running existing stock, refurbishing as appropriate (typically every 3-5 years). Refurbishing would maintain the levels of consumption at about 5MWh per tonne of manganese alloy produced – the only way to change that efficiency is through a change in design. In some cases, facilities may build completely new furnaces but this would be very costly.

Step 3. Impact of CDM registration

The financial benefit from the revenues obtained by selling the certified emissions reductions has been one of the key issues encouraging investment in the proposed project activity. The CDM has been considered from an early stage (see step 0) and it is an integral part of the decision to go ahead with each retrofitting.

As shown in table 7 (in the examples of furnaces 7 and 5), revenues from carbon credits makes a significant contribution to the overall profitability of the retrofitting project. Furthermore, it diversifies the sources of revenues in an industry under pressure from competitivity in its core business. In this sense, it is a more secure source of revenues than other principal sources of revenues of the project (savings from reduced repair costs and electricity use, and increased availability), although it is still subject to a certain extent to the technical performance of the furnaces.

It is also important to highlight the fact that the retrofitting of the last two furnaces of the project (#1 and #6) has been put on hold temporarily because of the difficult market conditions, technical challenges and other barriers faced by the project (see section B.4, step 3). The perspective of CDM is an important element in the overall attractiveness of those retrofittings, and the registration of the project will certainly encourage project developers to pursue the project activity.

B.6 Emission reductions

B.6.1. Explanation of methodological choices:

1. Baseline emissions

Emissions associated with SiMn production in the baseline are determined as follows:

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

where:

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_2e in year y)
$BE_{y,onsite}$	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)

- The vintage period used for the determination of baseline emissions is 1997-2003 (7 years preceding the start of the project activity).

1.1. Offsite baseline emissions

Offsite baseline emissions are calculated according to:

$$BE_{y,offsite} = QP_{y,\,max} \text{ x } sec_b \text{ x } EF_{y,offsite} \qquad (2)$$

where:

$BE_{y,offsite}$	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 (tSiMn/y) maximised at historic average via equation 3. This value is used in both the baseline and the project emission calculations
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 (tCO_2e/MWh), estimated using ACM0002.

1.1.1. Determination of $QP_{y,\,max}$

The SiMn production is limited to the historic level as follows:

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

where:

$QP_{y,\,max}$	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)

The historic average production of SiMn is calculated according to:

$$QP_{historic} = \frac{\sum_{i=1}^{n} QP_i}{n} \qquad (4)$$

where:

$QP_{historic}$	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)

1.1.2. Determination of sec_b

The average specific electricity consumption per tonne of SiMn produced in the baseline situation is calculated as follows:

$$sec_b = \frac{\sum_{i=1}^{n} EC_i}{\sum_{i=1}^{n} QP_i} \qquad (5)$$

where:

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

1.1.3. Determination of $EF_{y,offsite}$

AM0038 states that $EF_{y,offsite}$ should be estimated using the latest version of ACM0002; version 06 is used. $EF_{y,offsite}$ is calculating by estimating the Operating Margin and Build Margin emission factors of the South African grid

- STEP 1: Calculate the Operating Margin emission factor (EF_{OM}):

  Four options are available to determine EF_{OM}:
  a) Simple OM
  b) Simple adjusted OM
  c) Dispatch Data Analysis OM
  d) Average OM.

  Although ACM0002's preferred option is c), this is not an option here due to the lack of data and the prohibitive cost of processing it if it was available. As low-cost and must-run resources (hydro, bagasse and nuclear in the South African grid) has always represented less than 50% of the electricity generation on the grid, option a) can be used and is used to determine EF_{OM}. The following equation is used:

$$EF_{OM,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} \qquad (6)$$

where:

$F_{i,j,y}$	Amount of fuel *i* (in mass or volume unit) consumed by relevant power sources *j* in year(s) *y*
j	Refers to the power sources delivering electricity to the grid, not including low-cost and must-run power plants

$COEF_{i,j}$ CO2 emission coefficient of fuel *i* (tCO_2/mass or volume unit of fuel) taking into account the carbon content of fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*

$GEN_{j,y}$ Electricity (MWh) delivered to the grid by source *j*

$EF_{OM,y}$ is determined ex ante for years 2002, 2003 and 2004 as this is the most recent period for which information is available (2004 figures are just in the process of being published by the National Energy Regulator). The value taken for EF_{OM} is the full generation weighed average of $EF_{OM,y}$. The values and sources of all data used are given in Annex 3. For some power sources, a default efficiency or specific fuel consumption have been used due to the lack of publicly available information (all assumptions made are conservative and explained in Annex 3). Coal emission factor is based on specific IPCC value for South Africa.

- SETP 2: Calculate the Build Margin emission factor (EF_{BM})

EF_{BM} is determined ex ante by using the same equation as above, except that the sample of plants used is not *i* (all power sources excluding low-cost and must-run) but *m* and only the latest available year is used (2004). Plants in sample group *m* are constituted by the 5 most recent plants, as they represented a higher electricity generation than the generation of the 20% (in terms of generation) more recent. The dates of commissioning of power plants are indicated in annex 3 when they are available.

Note: Using 2004 data to estimate the build margin underestimates the actual Build Margin emission factor, as the trend is to put back into use old, inefficient coal-fired power plants that had been shut down decades ago (Eskom 2006)[3]. This is due to "a sharp increase in the demand for electricity"; any effort to reduce this demand, such as the one undertaken in the project, could therefore directly avoid the production of electricity from these marginal plants (both in terms of operating margin and build margin), whose electricity production is more carbon intensive than any other plant on the grid.

- STEP 3: Calculate the Combined Margin (i.e baseline emission factor $EF_{y,offsite}$)
  A weighed-average of EF_{OM} and EF_{BM} is used to calculate $EF_{y,offsite}$ (which is determined ex ante and will be constant through the crediting period). Default weights of ½ for OM, ½ for BM are used:

$$EF_{y,offsite} = \frac{EF_{OM} + EF_{BM}}{2} \quad (7)$$

[3] See http://www.eskom.co.za/live/content.php?Item_ID=162M:

"the Eskom Board of Directors took a final decision in 2003 for the Return to Service (RTS) of the three power stations, Camden, Grootvlei and Komati, that were mothballed in the late 1980's and early 1990's. Unit 6 at Camden Power Station was then identified as the first unit to be commissioned. Another 2 units will be commissioned in 2006, 3 units in 2007 and the last of the 8 units in 2008. Unit 6 […] went on commercial load on 16 July 2005."

The results of the calculations of EF_{OM}, EF_{BM} and $E_{y,offiste}$ ("Combined margin" – CM) are given in section B.6.3.

1.2. Onsite baseline emissions

Onsite baseline emissions are calculated using the following equations:

$$BE_{y,onsite} = QP_{y,\,max} \text{ x } EF_{b,onsite} \qquad (8)$$

where:

$BE_{y,onsite}$ Onsite baseline emissions associated with the consumption of Reductant (Coal and Coke) and electrode paste during the production of SiMn (tCO2e 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

The onsite emission factor is determined as follows:

$$EF_{b,onsite} = \frac{\sum_{i=1}^{n} Q_{boal,i} * EF_{bcoal,i} + \sum_{i=1}^{n} Q_{boke,i} * EF_{bcoke,i} + \sum_{i=1}^{n} Q_{bpaste,i} * EF_{bpaste}}{\sum_{i=1}^{n} QP_i} \qquad (9)$$

where:

$EF_{b,onsite}$ 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). This value shall be taken into account when assessing the overall uncertainty for onsite emissions using project specific values.

$EF_{bcoal,i}$ Emissions factor applied for the coal consumed as reductant. This factor can be calculated on a project specific basis or a default IPCC value can be applied. If project specific values are used this factor shall be taken into account when assessing the overall uncertainty for onsite emissions. If IPCC values are used the conservative end of the uncertainty range shall be applied.

$Q_{bcoke,\,i}$ 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). This value shall be taken into account when assessing the overall uncertainty for onsite emissions using project specific values.

$EF_{bcoke,i}$ Emissions factor applied for the coke consumed as reductant. This factor can be calculated on a project specific basis or a default IPCC value can be applied. If project specific values are used this factor shall be taken into account when assessing the overall uncertainty for onsite emissions. If IPCC values are used the conservative end of the uncertainty range shall be applied.

$Q_{bpaste, i}$ 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 (t paste consumed in year i). This value shall be taken into account when assessing the overall uncertainty for onsite emissions using project specific values.

EF_{bpaste} Emissions factor applied for the electrode paste consumed as electrode, using the relevant emissions factor (tCO2) for the carbon paste as specified by the manufacturer in year y. If manufacturer's specifications are used, the lower value of the uncertainty range provided by the manufacturer will have to be adopted. Alternatively, a conservative but not default factor of 0 tCO2 /t of Carbon paste can be used (based on the assumption that the paste is 0% carbon).

$QP_{i,}$ Annual SiMn production for the i^{th} year preceding the project activity (tSiMn)

- According to the preferred method of AM0038 and owing to the project's good monitoring practice, emission factors of the coal and coke are based on ex ante monitoring of the carbon content of the coal and coke used in the facility rather than IPCC values. Carbon content is recorded monthly and annual averages are taken for $EF_{bcoal,i}$ and $EF_{bcoke,i}$; if some monthly values are missing, average from previous and next months are used. Emission factor for the electrode paste is taken from IPCC (2006)[4].
- Uncertainty is determined in section B.6.3 by combining uncertainties of activity data and emission factors.

2. Project emissions

Emissions associated with SiMn production in the project are determined as follows:

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

where:

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_2e in year y)

$PE_{y,onsite}$ 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)

2.1. Offsite project emissions

Offsite project emissions are calculated according to:

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

where:

$PE_{y,offsite}$ Offsite project (grid) electricity emissions associated with the electricity consumption of the submerged arc furnace (tCO_2e in year y)

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[4] 2006 IPCC Guidelines for national greenhouse gas inventories, Volume 3, Chapter 4, p4.37, Table 4.6.

$QP_{y, max}$ Value of SiMn production used for estimating baseline and project emissions for the year y (tSiMn/y), estimated using equation 3 of the baseline emission section
$sec_{p,y}$ Grid specific electricity consumption per tonne of SiMn produced in the project situation (MWh/tSiMn) in year y
$EF_{y,offsite}$ Grid electricity emissions factor (tCO_2e/MWh), estimated according to ACM0002 (see 1.1.3 above)

The average specific electricity consumption per tonne of SiMn produced in the project situation is calculated as follows:

$$\sec_{p,y} = \frac{EC_y}{QP_{y,monitored}} \qquad (12)$$

where:
$sec_{p,y}$ Grid specific electricity consumption per tonne of SiMn produced in the project situation (MWh/tSiMn) in year y
$EC_{y,}$ 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)

2.2. Onsite project emissions

Onsite project emissions are calculated using the following equations:

$$PE_{y,onsite} = QP_{y, max} \text{ x } EF_{p,y,onsite} \qquad (13)$$

where:
$PE_{y,onsite}$ Onsite project emissions associated with the consumption of Reductant (Coal and Coke) and electrode paste during the production of SiMn (tCO2e in year y)
$QP_{y, max}$ Value of SiMn production used for estimating baseline and project emissions for the year y (tSiMn/y)
$EF_{p,y,onsite}$ Project emission factor associated with the (onsite) average consumption of reductant (Coal and Coke) and electrode paste per tonne of SiMn in year y (tCO_2e/tSiMn) as calculated in equation 12.

The onsite emission factor is determined as follows:

$$EF_{p,y,onsite} = \frac{Q_{poal,y} * EF_{pcoal,y} + Q_{poke,y} * EF_{pcoke,y} + Q_{ppaste,y} * EF_{ppaste,y}}{QP_{y,monitored}} \quad (14)$$

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

$Q_{pcoal,\ y}$	Consumption of coal used as reductant in the submerged electric arc furnace in tonnes of coal per year (tCoal/y). This value shall be taken into account when assessing the overall uncertainty for onsite emissions using project specific values.
$EF_{pcoal,y}$	Emissions factor applied for the coal consumed as reductant. This factor can be calculated on a project specific basis or a default IPCC value can be applied. If project specific values are used this factor shall be taken into account when assessing the overall uncertainty for onsite emissions. If IPCC values are used the conservative end of the uncertainty range shall be applied.
$Q_{pcoke,\ y}$	Consumption of coke used as reductant in the submerged electric arc furnace in tonnes of coke per year (tCoke/y). This value shall be taken into account when assessing the overall uncertainty for onsite emissions using project specific values.
$EF_{pcoke.y}$	Emissions factor applied for the coke consumed as reductant. This factor can be calculated on a project specific basis or a default IPCC value can be applied. If project specific values are used this factor shall be taken into account when assessing the overall uncertainty for onsite emissions. If IPCC values are used the conservative end of the uncertainty range shall be applied.
$Q_{ppaste,\ y}$	Consumption of electrode paste used as electrode in the submerged electric arc furnace in tonnes of electrode paste per year (tpaste/y). This value shall be taken into account when assessing the overall uncertainty for onsite emissions using project specific values.
$EF_{ppaste,y}$	Emissions factor applied for the electrode paste consumed as electrode, using the relevant emissions factor (tCO2) for the carbon paste as specified by the manufacturer for the vintage period. If manufacturer's specifications are used, the lower value of the uncertainty range provided by the manufacturer will have to be adopted. Alternatively, a conservative but not default factor of 3.67 tCO2 /t of Carbon paste can be used (based on the assumption that the paste is 100% carbon, which is the same as 44/12 tCO2eq).
$QP_{y,monitored,}$	Monitored production of SiMn in year y during the project activity (tSiMn/y)

- According to the preferred method of AM0038, project-specific measurement of emission factors for the coal and coke will be based on ex post monitoring of the carbon content of the coal and coke used in the facility rather than IPCC values. Carbon content will be recorded monthly and annual averages are taken for $EF_{bcoal,i}$ and $EF_{bcoke,i}$. If some monthly values are missing, average from previous and next months will be used. Emission factor for the electrode paste will be taken from IPCC (2006)[5].
- Uncertainty of activity data and emission factors will be determined annually following the same method as for the uncertainty of onsite baseline emissions (see section B.6.3 for an example).

3. Leakage

There is no leakage associated with the project activity, whether under AM0038 or ACM0002.

4. Emission reductions

The emission reductions (ER_y) of the project activity during a given year y is the difference between the baseline, project emissions and emissions due to leakage, as expressed in the formula below:

[5] 2006 IPCC Guidelines for national greenhouse gas inventories, Volume 3, Chapter 4, p4.37, Table 4.6.

$$ER_y = BE_y - PE_y - L_y \quad (15)$$

where :

ER_y Emissions Reductions (t CO_2e) in year y
BE_y Emissions in the baseline scenario (t CO_2e) in year y
EP_y Emissions in the project scenario (t CO_2e) in year y
L_y Leakage (t CO_2e) in year y

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	**QPi**
Data unit:	Tonnes of SiMn/year
Description:	Annual SiMn production for 7 years preceding the project activity
Source of data used:	Project proponent
Value applied:	(see table below)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement methods are the same as the ones that will be used for QPy,monitored (see section B.7.2)
Any comment:	

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

Data / Parameter:	**ECi**
Data unit:	MWh/year
Description:	Annual grid electricity consumption by the submerged electric arc furnace for 7 years preceding the project activity
Source of data used:	Project proponent
Value 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

Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement methods are the same as the ones that will be used for ECy (see section B.7.2)
Any comment:	

Data / Parameter:	**Qboal,i**
Data unit:	Tonnes of coal/year
Description:	Annual consumption of coal used as reductant in the submerged electric arc furnace for 7 years preceding the project activity
Source of data used:	Project proponent
Value applied:	**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

Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement methods are the same as the ones that will be used for Qpcoal,y (see section B.7.2)
Any comment:	

Data / Parameter:	**Qbcoke,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 applied:	

	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
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement methods are the same as the ones that will be used for Qpcoke,y (see section B.7.2)
Any comment:	

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:	**Qbpaste,i**
Data unit:	Tonnes of paste/year
Description:	Annual consumption of electrode paste used as electrode in the submerged electric arc furnace for 7 years preceding the project activity
Source of data used:	Project proponent
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement methods are the same as the ones that will be used for Qppaste,y (see section B.7.2)
Any comment:	

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:	**EFbcoal,i**
Data unit:	tCO2/tcoal
Description:	Emission factor applied for the coal consumed as reductant based on carbon content
Source of data used:	Project proponent
Value applied:	

	EFbcoal,i (tCO_2/tcoal) **Year** / **EF** 1997 / 2.78 1998 / 2.84 1999 / 2.84 2000 / 2.78 2001 / 2.74 2002 / 2.66 2003 / 2.59 Average 97-03 / 2.75
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement methods are the same as the ones that will be used for EFpcoal,y (see section B.7.2)
Any comment:	A measured project-specific value for 7 years preceding the project activity has been preferred to IPCC values.

EFbcoal,i (tCO_2/tcoal)	
Year	**EF**
1997	2.78
1998	2.84
1999	2.84
2000	2.78
2001	2.74
2002	2.66
2003	2.59
Average 97-03	2.75

Data / Parameter:	**EFbcoke,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 applied:	(see table below)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement methods are the same as the ones that will be used for EFpcoke,y (see section B.7.2)
Any comment:	A measured project-specific value for 7 years preceding the project activity has been preferred to IPCC values.

EFbcoke,i (tCO_2/tcoke)	
Year	**EF**
1997	3.09
1998	3.13
1999	3.10
2000	3.11
2001	3.14
2002	3.16
2003	3.18
Average 97-03	3.13

Data / Parameter:	**EFbpaste,i**
Data 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 used:	IPCC (2006)

Value applied:	**EFbpaste** 3.4 tCO2/tpaste *Source: IPCC (2006) Vol3, Ch4, p4.37, Table 4.6*
Justification of the choice of data or description of measurement methods and procedures actually applied :	This emission factor comes from the latest IPCC guidelines (2006). It corresponds to the situation of the project (electrode paste, as opposed to prebaked electrodes).
Any comment:	

Data / Parameter:	**Quality of coalb**
Data unit:	Mass fraction of each component (%m/m)
Description:	Quality of coal based on elementary analysis and other relevant properties
Source of data used:	Project proponent
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement methods are the same as the ones that will be used for the Quality of coalp (see section B.7.2). The value for 2003 is used to facilitate the comparison with the quality of coal at the beginning of the project activity.
Any comment:	Project proponent's lab analyses are preferred to supplier's data and are used to determine the emission factor of the coal EFbcoal,i.

Quality of coalb				
Composition (%)	Fixed C	Volatiles	S	P
Average 2003	50.8	30.4	0.74	0.22

Data / Parameter:	**Quality of cokeb**
Data unit:	Mass fraction of each component (%m/m)
Description:	Quality of coke based on elementary analysis and other relevant properties
Source of data used:	Project proponent
Value applied:	see table below
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement methods are the same as the ones that will be used for the Quality of coalp (see section B.7.2). The value for 2003 is used to facilitate the comparison with the quality of coal at the beginning of the project activity.
Any comment:	Project proponent's lab analyses are preferred to supplier's data and are used to determine the emission factor of the coke EFbcoke,i.

Quality of cokeb				
Composition (%)	Fixed C	Volatiles	S	P
Average 2003	85.5	1.69	0.93	0.35

Data / Parameter:	**Quality of electrode pasteb**
Data unit:	Mass fraction of each component (%m/m)
Description:	Quality of electrode paste based on elementary analyses and other relevant

	properties
Source of data used:	Supplier
Value applied:	

GREEN PASTE			
Property	Unit	Standard	Typical
Ash Content	%	<6 - 7	6.4
Volatile Matter	%	13 - 15	13.6
Fixed Carbon Content	%	> 79	79.8
Apparent Density	g/cm^3	> 1.56	1.6
Plasticity Range	%	15 - 55	24
Specific Heat	J/g°C	> 0.8	0.88
Softening Point	°C	55 – 59	Per customer
		68 – 73	
Size (Cylinders)	mm	Diameter: 400 x Length: 550	Per customer
		Diameter: 500 x Length: 550	
		Diameter: 500 x Length: 1000	
		Diameter: 600 x Length: 1000	
		Diameter: 700 x Length: 1000	
Extruder Block Size	mm	100 x 100 x 80	

PASTE BAKED @ 1000 °C			
Property	Unit	Standard	Typical
Ash Content	%	< 8	7.3
Fixed Carbon Content	%	> 90	93
Apparent Density	g/cm^3	> 1.35	1.4
Relative Density	g/cm^3	> 1.8	1.87
Total Porosity	%	> 23	24.9
Specific Electrical Resistivity	$Ohm.mm^2/m$	< 80	65.7
Thermal Shock Resistance	kW	> 12	12.5
Thermal Conductivity	W/mK	8.0 - 9.0	8.8
Specific Heat	J/g°C	> 0.7	0.75
Cold Crushing Strength	kg/cm^2	> 50	54
Bending Strength	kg/cm^2	30 - 50	46.4
Elasticity Modulus	$kg/cm^2 \times 10^4$	3.0 - 5.0	4.4
Linear Coeff. of Thermal Expansion	20 - 950 °C		Nil

Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	Green paste is bought from the supplier and put into the electrodes. As the heat increases when it goes down the electrodes, it is baked before it reaches the core of the furnace. The quality of green paste should be used for the comparison between the composition of the paste before and after the project activity.

Data / Parameter:	Quality of SiMnb
Data unit:	Text
Description:	Quality of SiMnb, based on elementary analysis and other relevant properties
Source of data used:	Project proponent
Value applied:	(see table below)
Justification of the choice of data or description of measurement methods and procedures actually applied :	The specifications of the SiMn produced will be used to compare the quality of the SiMn produced before and after the project activity.
Any comment:	

Quality of SiMnb

SiMn Specifications (Contractual elements with customer):

Element		Max (%)	Min (%)	Typical (%)
Mn	Manganese	68*	65.0	66.7
Si	Silicon	18.0	16.0	17.1
C	Carbon	2.0	-	1.6
P	Phosphorus	0.150	-	0.100
S	Sulphur	0.015	-	0.010

* Mn content of SiMn produced by furnaces 1 and 3 don't have a maximum Mn content allowed (because it is used for different applications)

Data / Parameter:	Quality of ore
Data unit:	Text
Description:	Quality of ore, based on elementary analysis and other relevant properties
Source of data used:	Project proponent
Value applied:	(see table below)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement methods are the same as the ones that will be used for the Quality of ore in the project (see section B.7.2). The value for 2003 is used to facilitate the comparison with the quality of coal at the beginning of the project activity.
Any comment:	

Quality of ore

Composition (%)	Mn	Fe	SiO2	CaO	MgO	P
Average 2003	38.2	4.4	5.0	15.1	3.6	0.017

Data / Parameter:	Quality of fluxes
Data unit:	Text
Description:	Quality of fluxes, based on elementary analysis and other relevant properties
Source of data used:	Project proponent
Value applied:	

	Quality of fluxes *Composition of Metal rich slag:* Composition (%): Mn / C / Si / Fe / CaO / MgO Average 2003: 11.7 / 0.6 / 19.8 / 0.9 / 24.3 / 4.7 *Composition of pellets:* Composition (%): MnO / SiO2 / CaO / MgO / FeO / C Average 2003: 30.8 / 28.3 / 6.0 / 8.5 / 1.9 / 7.2
Justification of the choice of data or description of measurement methods and procedures actually applied :	Measurement methods are the same as the ones that will be used for the Quality of fluxes in the project (see section B.7.2). The value for 2003 is used to facilitate the comparison with the quality of coal at the beginning of the project activity.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

1. Grid electricity emission factor

The Grid electricity emission factor ($EF_{y,offsite}$ in tCO2e/MWh) for South Africa is estimated according to ACM0002, following the procedure described in section B.6.1. Detail of data and sources used is provided in Annex 3. The following table gives the results of the calculation of Operating margin, Build margin and Combined margin (i.e. $EF_{y,offiste}$):

Table 8: Grid electricity emission factor calculations

Results	
EF	**tCO2/MWh**
OM	1.195
BM	1.248
CM	1.221

2. Onsite and offsite emission factors; baseline emissions and emission reductions per furnace

If we apply equations provided in section B.6.1 with values provided in section B.6.2 we can obtain baseline emission factors $EF_{b,onsite}$ and $EF_{b,offsite}$. To calculate project emissions (and emission reductions), we assume the following:

- $QP_{y,monitored} = QP_{historic}$
- $EF_{y,onsite} = EF_{b,onsite}$ (tCO2e/SiMn)
- $EF_{y,offiste} = EF_{b,offiste}$ (tCO2/MWh)
- $sec_{p,y} = sec_b - 0.6$ (MWh/tSiMn) i.e. savings of 0.6MWh/tSiMn in the project.

The results per furnace are provided in the table below:

Table 9: Baseline emissions and emission reductions per furnace

RESULTS							
Furnace	QPhistoric (tSiMn/y)	secb (MWh/tSiMn)	EFb offiste (tCO2/tSiMn)	EFb onsite (tCO2/tSiMn)	EFb total (tCO2/tSiMn)	Average emissions at QPhistoric (tCO2/y)	ERs from elec savings at QPhistoric (tCO2/y)
1	19,441	5.02	6.12	2.29	11.14	216,574	14,243
3	19,326	5.00	6.11	2.35	11.11	214,779	14,158
5	37,767	5.42	6.62	2.75	12.04	454,830	27,668
6	20,337	5.40	6.60	2.64	12.00	244,068	14,899
7	39,396	5.58	6.81	2.66	12.39	488,224	28,862

3. Overall emissions

To compile the overall project emissions (PE) and emission reductions (ER) of the project, we sum in each year PE and ER for the furnaces that have been retrofitted in that year. As mentioned in section B.3, each furnace enters into the project boundary only once it is retrofitted. The following retrofitting schedule is used:

Table 10: Furnace retrofitting schedule

Furnace retrofitting schedule						
Furnace #		1	3	5	6	7
Date retrofit		2009	2005	2005	2008	2004
Year		*Retrofitted furnace operational?*				
1	2004-05	0	0	0	0	1
2	2005-06	0	1	1	0	1
3	2006-07	0	1	1	0	1
4	2007-08	0	1	1	0	1
5	2008-09	0	1	1	1	1
6	2009-10	1	1	1	1	1
7	2010-11	1	1	1	1	1
8	2011-12	1	1	1	1	1
9	2112-13	1	1	1	1	1
10	2013-14	1	1	1	1	1

The overall results are given in section B.6.4

4. Uncertainty of onsite emissions

The uncertainty of the onsite emissions is assessed according to ACM0038. The following uncertainties are used:

Table 11: Determination of the uncertainty of activity data and emission factors

Parameters uncertainties		
Reductant	**Uncertainty**	**Source**
Activity data		
Coal	4%	Based on 2% rated accuracy of weighfeeders (which measure the tonnes of each raw material in each batch) + other possible sources of uncertainty associated to procedures/way instruments are used
Coke	4%	Based on 2% rated accuracy of weighfeeders (which measure the tonnes of each raw material in each batch) + other possible sources of uncertainty associated to procedures/way instruments are used
Paste	10%	- Number of paste cylinders put in the electrodes is recorded accurately - Weight of each cylinder is based on weighing trucks on the weighbridge and dividing total weigh by number of cylinders. This can vary by maximum +/- 50kg compared to indications of the supplier (there are 2 sizes of cylinder: either 500kg or 700kg).
Emission factors		
Coal	6%	Based on the maximum variation of monthly measurements of coal fixed carbon (%) in a given year. This is a conservative uncertainty, as the variation of monthly measurements is not only due to uncertainties of measurement but also real variation in coal fixed carbon.
Coke	4%	Based on the maximum variation of monthly measurements of coke fixed carbon (%) in a given year. This is a conservative uncertainty, as the variation of monthly measurements is not only due to uncertainties of measurement but also real variation in coke fixed carbon.
Paste	10%	IPCC (2006) Vol3, Ch4, p4.39, Table 9

The overall uncertainty of onsite emissions is estimated to be 7.5% (see table below in the example of activity data from furnace 7).

Table 12: Overall uncertainty of onsite emissions – Example for furnace 7

Overall uncertainty of onsite emissions - Example for furnace 7				
	Coal use	**Coke use**	**Paste use**	**Total**
Onsite baseline emissions #7 1997-2003 (tCO2)	630,562	59,341	44,890	734,792
Uncertainty activity data	4.0%	4.0%	10.0%	
Uncertainty emission factors	6.0%	4.0%	10.0%	
Combined uncertainty	7.2%	5.7%	14.1%	
Combined uncertainty as % of total emissions	6.2%	0.5%	0.9%	7.5%

B.6.4 Summary of the ex-ante estimation of emission reductions:

Table 13: Ex ante estimation of overall project annual baseline and project emissions, leakage

Ex ante estimation of annual BE, PE, L and ER for all furnaces					
Year		Estimation of baseline emissions (tonnes of CO_2e)	Estimation of project activity emissions (tonnes of CO2e)	Estimation of leakage (tonnes of CO2e)	Estimation of overall emission reductions (tonnes of CO2e)
1	2004-05	373,373	344,511	0	28,862
2	2005-06	890,923	820,235	0	70,687
3	2006-07	890,923	820,235	0	70,687
4	2007-08	890,923	820,235	0	70,687
5	2008-09	1,078,713	993,127	0	85,587
6	2009-10	1,242,316	1,142,487	0	99,829
7	2010-11	1,242,316	1,142,487	0	99,829
8	2011-12	1,242,316	1,142,487	0	99,829
9	2112-13	1,242,316	1,142,487	0	99,829
10	2013-14	1,242,316	1,142,487	0	99,829
Total (tonnes of CO2e)		**10,336,434**	**9,510,777**	**0**	**825,657**

B.7 Application of the monitoring methodology and description of the monitoring plan:

B.7.1. Data and parameters monitored:

Preliminary note:
As mentioned in section B.6.3, expected emission reductions are calculated by assuming the following:

- $QP_{y,monitored} = QP_{historic}$
- $EF_{y,onsite} = EF_{b,onsite}$ (tCO2e/SiMn)
- $EF_{y,offiste} = EF_{b,offiste}$ (tCO2/MWh)
- $sec_{p,y} = sec_b - 0.6$ (MWh/tSiMn) i.e. savings of 0.6MWh/tSiMn in the project.

The value of $QP_{historic}$, $EF_{b,onsite}$, $EF_{b,offiste}$ and sec_b –are given in table 9.

This means that:

- Activity data (EC_y, $Q_{pcoal,y}$, Q_{pcoke}, Q_{ppaste}) are based on the same specific consumptions as in the baseline (except EC_y which is adjusted by the electricity savings of the project) and multiplied by $QP_{historic}$.
- Emission factors (EF_{pcoal}, EF_{pcoke}, EF_{ppaste}) are equal to the 7 year average emission factor in the baseline and Grid emission factor ($EF_{y,offsite}$) is the same as in the baseline

Data / Parameter:	QPy,monitored
Data unit:	Tonnes of SiMn/year
Description:	Quantity of SiMn production in year y during the project activity
Source of data to be used:	Project proponent
Value of data applied for the purpose of calculating expected emission reductions in section B.5	We assume that QPy,monitored = QPhistoric (see preliminary note above).

Description of measurement methods and procedures to be applied:	Data will be monitored at each tapping of the furnace by weighing metal ladles on a weighing platform. The weighing platform will be maintained and calibrated regularly in line with the manufacturer's requirements. This will ensure that the accuracy of the measurement instrument is maintained, which can be assumed to be < 2%.
QA/QC procedures to be applied:	Measured data will be cross-checked with product sales records.
Any comment:	

Data / Parameter:	**ECy**
Data unit:	MWh/year
Description:	Annual grid electricity consumption by the submerged electric arc furnace
Source of data to be used:	Project proponent
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See preliminary note above.
Description of measurement methods and procedures to be applied:	Electricity consumption will be metered continuously on individual furnaces by an electricity meter and recorded monthly. The meters will be maintained and calibrated regularly in line with the manufacturer's requirements. This will ensure that the accuracy of the measurement instrument is maintained, which can be assumed to be < 0.5%.
QA/QC procedures to be applied:	Consumption of each furnace will be cross-checked monthly with total electricity bills.
Any comment:	

Data / Parameter:	**Qpcoal,y**
Data unit:	Tonnes of coal/year
Description:	Annual consumption of coal used as reductant in the submerged electric arc furnace
Source of data to be used:	Project proponent
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See preliminary note above.
Description of measurement methods and procedures to be applied:	Coal consumption is measured in the weighfeeder each time a new batch is made (i.e. several times per shift) and recorded daily. The weighfeeder will be maintained and calibrated regularly in line with the manufacturer's requirements. This will ensure that the accuracy of the measurement instrument is maintained, which can be assumed to be < 2%.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**Qpcoke,y**
Data unit:	Tonnes of coke/year
Description:	Annual consumption of coke used as reductant in the submerged electric arc furnace
Source of data to be used:	Project proponent
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See preliminary note above.
Description of measurement methods and procedures to be applied:	Coke consumption is measured in the weighfeeder each time a new batch is made (i.e. several times per shift) and recorded daily. The weighfeeder will be maintained and calibrated regularly in line with the manufacturer's requirements. This will ensure that the accuracy of the measurement instrument is maintained, which can be assumed to be < 2%.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**Qppaste,y**
Data unit:	Tonnes of paste/year
Description:	Annual consumption of electrode paste used as electrode in the submerged electric arc furnace
Source of data to be used:	Project proponent
Value of data applied for the purpose of calculating expected emission reductions in section B.5	See preliminary note above.
Description of measurement methods and procedures to be applied:	The number of paste cylinders put into the electrode is logged each time a new cylinder is used. The average weight of each cylinder is calculated based on weighing paste trucks (arriving at the facility) on a weighbridge and dividing total weight by number of cylinders.
QA/QC procedures to be applied:	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. See section B.6.3 for the uncertainty of this parameter and its influence on the overall uncertainty of onsite emissions.
Any comment:	

Data / Parameter:	**EFpcoal,y**
Data unit:	tCO2/t coal
Description:	Emission factor applied for the coal consumed as reductant in year y
Source of data to be used:	Carbon content provided by laboratory analyses Carbon content of volatiles from IPCC (2006)

Value of data applied for the purpose of calculating expected emission reductions in section B.5	Equal to 1997-2003 average: 2.75tCO2/ t coal See preliminary note above.
Description of measurement methods and procedures to be applied:	Coal samples are prepared at Transalloys and sent to the laboratory (at the moment from neighbouring facility at Highveld) for analysis of volatile and fix carbon content. Monthly running averages of carbon contents are used for the calculation of a monthly emission factor. This emission factor is calculated using equation 4.19, p4.33 of IPCC (2006): EQUATION 4.19 CARBON CONTENT OF FERROALLOY 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. Annual emission factor is calculated as the average of monthly emission factors and used for emission calculations.
QA/QC procedures to be applied:	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.
Any comment:	This project-specific approach is preferred to IPCC values

Data / Parameter:	**EFpcoke,y**
Data unit:	tCO2/t coke
Description:	Emission factor applied for the coke consumed as reductant in year y
Source of data to be used:	Carbon content provided by laboratory analyses Carbon content of volatiles from IPCC (2006)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Equal to 1997-2003 average: 3.13tCO2/ t coke See preliminary note above.
Description of measurement methods and procedures to be applied:	Coke samples are prepared at Transalloys and sent to the laboratory (at the moment from neighbouring facility at Highveld) for analysis of volatile and fix carbon content. Monthly running averages of carbon contents are used for the calculation of a monthly emission factor. This emission factor is calculated using equation 4.19, p4.33 of IPCC (2006):

	EQUATION 4.19 CARBON CONTENT OF FERROALLOY 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. Annual emission factor is calculated as the average of monthly emission factors and used for emission calculations.
QA/QC procedures to be applied:	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.
Any comment:	This project-specific approach is preferred to IPCC values

Data / Parameter:	**EFppaste,y**
Data unit:	tCO2/t of carbon paste
Description:	Emission factor applied for the electrode paste consumed as electrode in year y
Source of data to be used:	Supplier
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3.4 Source: IPCC (2006) Vol3, Ch4, p.4.37, Table 4.6
Description of measurement methods and procedures to be applied:	Manufacturer specifies fix carbon and volatile content, but an approximation may have to be made to estimate the carbon content of volatiles (Cv).
QA/QC procedures to be applied:	If an approximation of Cv is made, it will be cross-checked with IPCC value (which is used for EFbpaste) to ensure the value used in the project is not below it.
Any comment:	

Data / Parameter:	**Quality of coalp**
Data unit:	Mass fraction of each component (%m/m)
Description:	Quality of coal based on elementary analysis and other relevant properties
Source of data to be used:	Project proponent
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement methods and procedures to be	Fixed carbon, volatiles, S and P contents will be monitored at the start of the project activity. This will be done by lab analyses according to applicable national and international standards.

applied:	
QA/QC procedures to be applied:	Project proponent's lab analyses are preferred to supplier's data and are used to determine the emission factor of the coal EFpcoal,y.
Any comment:	

Data / Parameter:	**Quality of cokep**
Data unit:	Mass fraction of each component (%m/m)
Description:	Quality of coke based on elementary analysis and other relevant properties
Source of data to be used:	Project proponent
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement methods and procedures to be applied:	Fixed carbon, volatiles, S and P contents will be monitored at the start of the project activity. This will be done by lab analyses according to applicable national and international standards.
QA/QC procedures to be applied:	Project proponent's lab analyses are preferred to supplier's data and are used to determine the emission factor of the coal EFpcoal,y.
Any comment:	

Data / Parameter:	**Quality of electrode pastep**
Data unit:	Text
Description:	Quality of electrode paste based on elementary analyses and other relevant properties
Source of data to be used:	Supplier
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement methods and procedures to be applied:	The quality of the paste will be taken from supplier's data at the time of purchase
QA/QC procedures to be applied:	Results will be compared to factors supplied by IPCC or other suppliers
Any comment:	

Data / Parameter:	**EFy,offsite**
Data unit:	tCO2/MWh
Description:	Grid emission factor
Source of data to be	

used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	The following table gives the results of the calculation of Operating margin, Build margin and Combined margin: Table 8: Grid electricity emission factor calculations **Results** **EF** – **tCO2/MWh** OM – 1.195 BM – 1.248 CM – 1.221 The factor of 1.221tCO2/MWh will be used during the whole crediting period.
Description of measurement methods and procedures to be applied:	The Grid electricity emission factor (EFy,offsite in tCO2e/MWh) for South Africa is established ex ante according to ACM0002. Methodological choices are described in section B.6.1 and detail of the data used is provided in Annex 3.
QA/QC procedures to be applied:	Transparent data is available and referenced. For some parameters where no data is available, conservative assumptions are made.
Any comment:	

Data / Parameter:	**Quality of electrode pastep**
Data unit:	Text
Description:	Quality of electrode paste based on elementary analyses and other relevant properties
Source of data to be used:	Supplier
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement methods and procedures to be applied:	The quality of the paste will be taken from supplier's data at the time of purchase
QA/QC procedures to be applied:	Results will be compared to factors supplied by IPCC or other suppliers
Any comment:	

Data / Parameter:	**Quality of SiMnp**
Data unit:	Text
Description:	Quality of SiMn
Source of data to be used:	Project proponent
Value of data applied	Not applicable

for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	A sample will be lab analysed periodically to ensure that the quality remains between pre-determined specifications for Mn, C, Si, P and S.
QA/QC procedures to be applied:	Lab analyses will be undertaken to national or international standards to ensure accuracy
Any comment:	

Data / Parameter:	**Quality of ore**
Data unit:	Text
Description:	Quality of ore
Source of data to be used:	Project proponent
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement methods and procedures to be applied:	A sample will be lab analysed at least monthly to determine the composition of the ore (e.g. contents in Mn, Fe, SiO_2, CaO)
QA/QC procedures to be applied:	Lab analyses will be undertaken to national or international standards to ensure accuracy
Any comment:	

Data / Parameter:	**Quality of fluxes**
Data unit:	Text
Description:	Quality of fluxes
Source of data to be used:	Project proponent
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Not applicable
Description of measurement methods and procedures to be applied:	A sample will be lab analysed at least monthly to determine the composition of the ore (e.g. contents in Mn, Fe, SiO_2, CaO)
QA/QC procedures to be applied:	Lab analyses will be undertaken to national or international standards to ensure accuracy

Any comment:	

B.7.2 Description of the monitoring plan:

The monitoring plan gives the actions necessary to record all the variables and factors required by methodology AM0038, version 1, 30 September 2006 (no monitoring is required for the grid emission factor calculation according to ACM0002.

The plan is based on the detailed information contained in section B.7.1 above. Most of the monitoring requirements of the methodology are in line with the kind of information routinely collected by Transalloys, so internalising the procedures should be simple and straightforward. The ISO 14001 management system implemented by Transalloys and its parent company Highveld will also help ensure that quality procedures are in place.

All data will be archived electronically, and backed up regularly. It will be kept for the full crediting period, plus two years after the end of the crediting period or the last issuance of CERs for this project activity (whichever occurs later).

Project staff will be trained regularly in order to satisfactorily fulfill their monitoring obligations. The authority and responsibility for project management, monitoring, measurement and reporting will be agreed between the project participants and formalised. Detailed procedures for calibration of monitoring equipment, maintenance of monitoring equipment and installations, and for record handling will be established.

The table below indicates the main responsibilities of the persons involved in the monitoring:

Table 14: Overview of persons responsible for implementing the monitoring plan

Task	On-site technicians	Laboratory	QC manager	CDM Programme Manager	Management (Project Developer)	EcoSecurities
Collect Data and Send samples to lab	E		R	I		

Perform lab analyses		E	R	I		
Enter data into Spreadsheet	I		E	R		
Make monitoring report				R	I	E
Archive data & reports	I		E	R		
Calibration/ Maintenance	E		R	I		

E = responsible for executing data collection
R = responsible for overseeing and assuring quality
I = to be informed

B.8 Date of completion of the application of the baseline study and monitoring methodology and the name of the responsible person(s)/entity(ies)

The baseline study and the monitoring methodology were concluded on 02/11/06. The entity determining the baseline study and the monitoring methodology and participating in the project as the Carbon Advisor is EcoSecurities Group Plc, Ireland, listed in Annex 1 of this document.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

01 October 2004

C.1.2. Expected operational lifetime of the project activity:

More than 20 years

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01 October 2004

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

The project is not subject in South Africa to requirements for an environmental impact assessment. The project is not expected to have any significant negative environmental impacts.

It will have a positive impact nationally by reducint the need for grid electricity consumption per unit manganese alloy produced. Consequently there will be a reduced demand for predominantly coal fired electricity, and mitigating the need to dedicate/build up to 30MW (+) of additional capacity to continue to supply this process alone. South Africa is projected to require significant new build in the near future. The project will predominantly reduce CO_2 emissions from the power sector, but also local pollutants such as dust and SOx.

A benefit not quantified here may be the improved efficiency of manganese extraction from the raw ore. There will also be a reduction in the amount of ore required to produce a unit of alloy product, requiring less mining, processing, transport, and energy use to provide this ore. No emissions reductions are claimed here for this benefit, but there is a positive environmental impact arising as a result.

It is not sure whether the project will lead to a reduction of coal and coke used as reductants. The impact on the environment of this component could therefore go either way.

One significant local environmental improvement will be the ability of the new furnaces to better manage dust emissions from the furnaces off gases that will allow a reduced emission to the local environment of particulates. This is even more important for furnace 5 where a new offtake system has been installed.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Not applicable

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

A stakeholders' Meeting was held in a meeting room at Transalloys plant on the 27th of October 2006, from 11h00 to 16h00. Personal invitations where send to representatives that where selected to represent the different stakeholder groups as part of the periodic open day that was established to provide ongoing information about Transalloys operations.

The stakeholder meeting was integrated in the open day to ensure a large turnout. The program consisted of:

- Presentations by several line managers explaining the different stages of the production process, followed by Q&A sessions;
- A presentation on the Transalloys energy efficiency and how it will be developed under the CDM, followed by a Q&A session;
- A tour of the plant.

Mr L. Jacobs, manager at Transalloys, introduced himself, his company, the managers that would speak and the Ecosecurities consultant that delivered the presentation on the CDM project (5-10 minutes).

After the presentations by the line managers Henk Sa, Ecosecurities local representative, delivered the presentation that took the audience from the global picture down to the project at hand:

- Climate Change, GHGs and consequences;
- Answer by International Community – The Kyoto Protocol;
- The mechanisms of the Protocol;
- The Transalloys CDM project.

The presentation per se was delivered in 20-30 minutes, uninterrupted. Questions and comments were asked from the public and have been recorded in the subsequent section 2. (20-30 minutes).

After the Q&A session L. Jacobs invited the people present to join him on a tour of the plant followed by refreshment in the boardroom.

Evidence of the event is provided in Annex 5.

E.2. Summary of the comments received:

The stakeholders present (list in Annex 5) were asked to voice any question or comment that they may have about the Transalloys CDM project or the presentation in general:

1. Mr. S. van Niekerk, Managing Director of Transalloys:

   Where does the data from the graph you showed on increasing GHG levels and rising temperatures come from?

- Mr Henk Sa for EcoSecurities answered the question: Historic data on the composition of the atmosphere can be collected in several different ways. The most common method is by analyzing ice samples that where deposited thousands of years ago.

2. Mr J. Makena, from the Emahahleni Municipal Council:

   What measures have been taken to prepare countries for the effects of climate change, like flooding?

   - Mr. Makena his question was answered. The Kyoto protocol does not only aim to curb anthropogenic GHG emissions but it also aims to prepare countries for the effects of climate change via a mechanism called ‘adaptation’. For example countries that might be effected by raising sea levels are being advised to take this into account when developing their infrastructure.

3. Mr. S Zwane, Clewer Primary School:

   Was the impact of underdeveloped countries taken into consideration when the data on global warming was put to together?

   - Answer provided: Yes, that is why developing countries do not have emission reduction targets under the Kyoto protocol.

E.3. Report on how due account was taken of any comments received:

As explained in Section E.2, no comments were received specifically on the project.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Transalloys
Street/P.O.Box:	Clewer Road
Building:	
City:	Witbank
State/Region:	Mpumalanga
Postfix/ZIP:	1035
Country:	South Africa
Telephone:	013-6935021
FAX:	013-6938034
E-Mail:	louj@hiveld.co.za
URL:	
Represented by:	
Title:	Manager
Salutation:	Mr.
Last Name:	Jacob
Middle Name:	
First Name:	Lou
Department:	Transalloys
Mobile:	0827717393
Direct FAX:	013-6938034
Direct tel:	013-6935021
Personal E-Mail:	louj@hiveld.co.za

Project Annex 1 participant:

Organization:	EcoSecurities Group Plc.
Street/P.O.Box:	40 Dawson Street
Building:	
City:	Dublin
State/Region:	
Postfix/ZIP:	02
Country:	Ireland
Telephone:	+353 1613 9814
FAX:	+353 1672 4716
E-Mail:	info@ecosecurities.com
URL:	www.ecosecurities.com
Represented by:	
Title:	COO & President
Salutation:	Dr.
Last Name:	Moura Costa
Middle Name:	
First Name:	Pedro

Mobile:	
Direct FAX:	
Direct tel:	+44 1865 202 635
Personal E-Mail:	pedro@ecosecurities.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funding from Annex 1 parties.

Annex 3

BASELINE INFORMATION

Data and sources used to calculate the grid emission factor are given below:

Plant and type of fuel	OM plant? (1=y, 0=n)	BM plant? (1=y, 0=n)	Year of commission	Licensed capacity (MW)	Net energy sent out (MWh) 2002	Net energy sent out (MWh) 2003	Net energy sent out (MWh) 2004	Fuel consumption 2002	Fuel consumption 2003	Fuel consumption 2004	Unit
Grand Total				43 034	204,511,108	219,198,686	226,393,919				
Eskom generation				39 810	196,067,796	210,218,785	217,919,213				
Coal fired stations	1			35 607	181,749,299	194,046,490	203,564,592	96,460	104,370	109,508	*kt*
Arnot	1		1975 (June)	1 980	11,974,764	14,135,237	13,032,188	6,355	7,603	7,011	*kt*
Camden	1		1967 (April)	1 520							*kt*
Duvha	1		1980	3 450	23,320,444	21,384,335	25,450,613	12,377	11,502	13,691	*kt*
Grootvlei	1		1969	1 130							*kt*
Hendrina	1		1970	1 895	12,752,987	12,329,325	12,037,179	6,768	6,631	6,475	*kt*
Kendal	1		1982 (July)	3 840	26,006,905	27,820,202	27,005,053	13,803	14,963	14,527	*kt*
Komati	1		1961	891							*kt*
Kriel	1		1979	2 850	19,165,265	18,347,304	19,866,814	10,172	9,868	10,687	*kt*
Lethabo	1	1	1990 (Dec)	3 558	22,019,627	23,505,543	22,807,524	11,687	12,643	12,269	*kt*
Majuba	1	1	1996 (April)	3 843	4,600,976	10,015,560	12,539,663	2,442	5,387	6,746	*kt*
Matimba	1	1	1987	3 690	25,145,393	26,510,802	26,894,454	13,345	14,259	14,468	*kt*
Matla	1		1983 (July)	3 450	25,577,292	25,802,219	25,673,648	13,575	13,878	13,811	*kt*
Tutuka	1	1	1985 (June)	3 510	11,185,646	14,195,963	18,257,456	5,937	7,635	9,822	*kt*
Gas turbine stations	1			342	0	341	350				
Acacia	1		1976	171	0	299	305	0.00	3.55	3.62	*TJ*
PortRex	1		1976	171	0	42	45	0.00	0.50	0.53	*TJ*
Hydro power stations				661	2,356,753	777,041	777,041				
Gariep			1971	360	1,164,640	383,991	383,991	-	-	-	
Vanderkloof			1977 (March)	240	1,192,113	393,050	393,050	-	-	-	
Colleywobbles(Mbashe)				42							
First Falls				6							
Second Falls				11							
Ncora				2							
Nuclear stations				1 800	11,961,744	12,662,591	13,365,123				
Koeberg			1984 (April)	1 800	11,961,744	12,662,591	13,365,123	-	-	-	
Pumped-storage stations	1			1 400	0	2,732,322	212,107				
Drakensberg	1		1981	1 000	0	1,787,554	0	-	-	-	
Palmiet	1	1	1988	400	0	944,768	212,107	-	-	-	
Municipal generation				1 837	1,218,826	1,326,122	1,040,945				
Coal fired stations	1			1 323	1,201,006	1,038,433	1,027,337				
Athlone	1		n/a	180	76,596	76,596	10,230	38	38	5	*kt*
Kroonstad	1			30							*kt*
Swartkops	1			240							*kt*
Bloemfontein	1		n/a	103	8,233	19,444	5,931	4	10	3	*kt*
Orlando	1			300							*kt*
Rooiwal	1		n/a	300	949,078	826,217	895,000	475	413	448	*kt*
Pretoria West	1		n/a	170	167,099	116,176	116,176	84	58	58	*kt*
Gas turbine stations	1			330	7,189	3,654	2,976				
Roggebaai	1		n/a	50	2,787	2,787	1,141	31.35	31.35	12.84	*TJ*
Athlone	1		n/a	40	867	867	1,827	9.75	9.75	20.55	*TJ*
Port Elizabeth	1		n/a	40			8			0.09	*TJ*
Johannesburg	1		n/a	176	3,535			39.77			*TJ*
Pretoria West	1			24							*TJ*
Hydro power stations				4	10,632	10,632	10,632				
Lydenburg			n/a	2	6,000	6,000	6,000	-	-	-	
Ceres			n/a	1	1,082	1,082	1,082	-	-	-	
Piet Retief			n/a	1	3,550	3,550	3,550	-	-	-	
Pumped-storage stations	1			180	0	273,403	0				
Steenbras	1		n/a	180	0	273,403	0	-	-	-	
Private generation				1 387	7,224,486	7,653,779	7,433,761				
Bagasse / coal fired stations				105	259,317	259,317	192,337	*(assumed pure bagasse)*			
Tongaat-Hulett Amatikulu			n/a	12	26,781	26,781	26,781	-	-	-	
Tongaat Hulett - Darnall			n/a	12	21,704	21,704	21,704	-	-	-	
Tongaat Hulett - Felixton			n/a	32	66,510	66,510	66,510	-	-	-	
Tongaat Hulett - Maidstone Mill			n/a	29	67,397	67,397	67,397	-	-	-	
Transvaal Suiker Ltd			n/a	20	76,925	76,925	9,945	-	-	-	
Coal fired stations	1			1 279	6,950,506	7,379,448	7,226,761				
Kelvin	1		n/a	540	1,721,353	1,721,353	1,568,666	861	861	784	*kt*
Sasol Synth Fuels	1		n/a	600	4,421,074	4,738,677	4,738,677	2,211	2,369	2,369	*kt*
Sasol Chem Ind	1		n/a	139	808,079	919,418	919,418	404	460	460	*kt*
Hydro power stations				3	14,663	15,014	14,663				
Friedenheim			n/a	3	14,663	15,014	14,663	-	-	-	

Sources		
NER supply side statistics (1)		
Areas shaded: where net electricity sent out is negative, we set it to zero		
Eskom annual report 2005		
NER pers.comm 2005 (2)		
Using rated efficiencies on www.eskom.co.za (conservative):	%	*i.e Mwhprod /TJcons*
Acacia	30.30%	84.2
Port Rex	30.30%	84.2
Assuming conservative (high) efficiency:	32.00%	88.9
Calculating specific coal consumption from		
2002	0.000530731	ktcoal/MWhcoal
2003	0.000537861	ktcoal/MWhcoal
2004	0.000537952	ktcoal/MWhcoal
Assuming conservative (low) specific coal consumption	0.000500000	ktcoal/MWhcoal

Calculation of fuel emission factors

	NCV	EF	OX	=> EF	
	TJ/t fuel	tC/TJ	%	Value	*Unit*
Coal	0.02509	25.8	98.0%	2.326	*tCO2/t coal*
Gas		15.3	99.5%	55.8	*tCO2/TJ*
Source:	*1*	*2*		*Calculated*	

List of sources:
1 IPCC (1996) Table 1-2 (Value for South Africa)
2 IPCC (1996) Table 1-1

Annex 4

MONITORING INFORMATION

This information is contained in section B.7.

Annex 5

STAKEHOLDER CONSULTATION

Personal invitations were sent to representatives who were selected to represent the different stakeholder groups, as part of the periodic open day that was established to provide ongoing information about Transalloys operations.

A copy of the ad to publicise the event, the list of persons invited, the actual attendance list and a photo taken during the meeting are provided in this annex.

30. OCT. 2006 49 TRANSALLOYS NO. 385

Transalloys

TRANSALLOYS

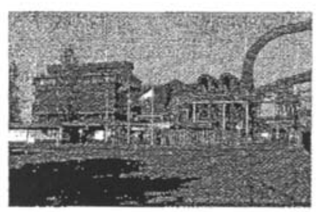
(A Division of Highveld Steel and Vanadium Corporation Limited)

Cordially invites you to attend our

Open Day

To be Held on **Friday, 27 October 2006**
at **11:00**
in the
Transalloys Administration Building

Kindly confirm your attendance on, or before the 9th October 2006 to
Mike Watson
Tel: 013 693 8119, or fax 013 659 7411, or email mikew@hiveld.co.za
Bulelwa
Tel: 013 693 8158/9 or Fax: 013 659 7411



Programme

11:00	*Welcome*	*- L. C. Jacobs, Manager, Transalloys*
11:10	*Raw Materials*	*- L. Maseko, Unit Manager*
11:20	*Silica Manganese Process*	*- D. Q. Beck, Unit Manager*
11:30	*Ferromanganese Process*	*- L. S. Kubheka, Unit Manager*
11:40	*Finished Products*	*- E. Banardo Jnr, Unit Manager*
12:00	*Baghouses*	*- M. S. Mamakoko, Electrical Engineer*
12:10	*Environmental Issues*	*- D. Nell, Engineering Manager*
12:20	*Questions & Answers*	*- L. C. Jacobs, Manager, Transalloys*
12:30 – 13:15		*- Plant Tour*
13:15 – 13:45		*- Light Finger Lunch*

OPEN DAY 27 October 2006
INVITATIONS

Organisation	Name	Contact No	Fax No	e-mail	PPE Needs	Confirmed
APOLCOM	Ms C Venter					No
	Mr W du Pisanie					No
	Mr P Ncanazo					No
Buhle Bemvelo Environmental Group	Mr M Ngobeni					Yes
	Mr Mzwakali					No
	Mr J Bembe					No
Canon Eng	Mr E Smit					Yes
	Mr. K du Plessis					Yes
Clewer Primary School	Mr S Zwane					Yes
DEAT	Mr J van Graan					No
	Mr C du Plooy					No
Eskom Customer Service	Mr D Madike					**Yes**
	Ravas Nades					**Yes**
	Alleta Nkuna					**Yes**
Emalahleni Municipal Council	Ms L Strydom					No
	Mr Mbuke					No
	Mr M Matlejoane					No
	Mr J Makena					Yes
	Mrs A Simelane					Yes
Environmental Justice Networking Forum	Mr I Mamapane					Yes
	Mr H Mashifane					No
	Mr K Bashele					No
	Mr W Mamapane					No
	Mr E Mkhwanazi					No
	Mr T Fakude					No
J & I Recycling	Mr A. Maseko					Yes
Mpumalanga Aids Environmental Forum	Mr C Markham					No
	Ms Y Masilela					No
Witbank News	Ms M Boshoff					**Yes**
Wildlife & Environment Society of SA	Mr M Suttill					No
	Mr M Ngobeni					No
Highveld Steel	Mr A. de Nysschen					No
	Dr J. Pienaar					No
	Mr J. Theiss					No
	Mr L.A. Aggenbach					Yes
	Mr S. Mafoane					No
	Ms A Diener					No
	Dr D Brooderyk					No

OPEN DAY 27 October 2006
Attendance

Organisation	Name	Contact No	Fax No	Signature
Buhle Bemvelo Environmental Group	Mr M Ngobeni	072 383 6871	013 656 3264	
Canon Eng	Mr E Smit	0824503534	0136597112	
	Mr. K du Plessis	0836601584	0136597112	
Clewer Primary School	Mr S Zwane	013 659 7537	013 659 7124	
Eco Securities	Mr H Sa			
Eskom Customer Service	Mr D Madike Ravas Nades Alleta Nkuna	013 693 3423 082 788 1498	013 693 3719	
Emahahleni Municipal Council	Mr J Makena Mrs A Simelane	013 690 6428 013 690 6234	013 690 6459 013 696 2350	
Environmental Justice Networking Forum	Mr I Mamapane	072 741 2682	013 656 2894	
J & I Recycling	Mr A. Maseko	082 445 0019		
Witbank News	Ms M Boshoff	013 656 2490	Chanel Pringle	
EMALAHLENI COUNCIL.	FANIE SITHOLE	0826347551		
HIGVELD STEEL	Ms P.N. NDLOVU	0136908880		
TRANSALLOYS	P.J. FOURIE	0827315916		
Highveld.	Erik Muller	0833002183		

Above: Henk Sa (EcoSecurities) presenting Climate Change