



**CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02 - in effect as of: 1 July 2004)**

CONTENTS

- A. General description of project activity
- B. Application of a baseline methodology
- C. Duration of the project activity / Crediting period
- D. Application of a monitoring methodology and plan
- E. Estimation of GHG emissions by sources
- F. Environmental impacts
- G. Stakeholders' comments

Annexes

- Annex 1: Contact information on participants in the project activity
- Annex 2: Information regarding public funding
- Annex 3: Baseline information
- Annex 4: Monitoring plan

**SECTION A. General description of project activity****A.1 Title of the project activity:**

- Title of the project activity: “Use of blast furnace slag in the production of blended cement at Votorantim Cimentos”
- Version number of the document: 4
- Date of the document: 28/September/2006

A.2. Description of the project activity:

The purpose of the project activity is the use of blast furnace slag, an alternative raw material, as substitute of clinker in the manufacturing of cement at Votorantim Cimentos. With the substitution of clinker, greenhouse gases emissions are reduced because of the decrease of emissions in the calcination of limestone and due to the reduction of fossil fuels consumption in the kiln.

Cement is made by heating limestone with small quantities of other materials, such as clay, to 1,450°C in a kiln. The resulting hard substance, called clinker, is then ground into a powder, in cement mills, with a small amount of gypsum to make the Ordinary Portland Cement (OPC), the first produced type of cement. Other materials can be used in substitution of clinker in the grinding phase of the fabrication, producing the so-called blended cement. Blast furnace slag is one of these alternative materials, resulting in the production of the Portland Blast Furnace Slag cement (PBFS), as per methodology ACM0005.

The blast furnace slag is a residue of pig iron production similar to sand, that has properties near to clinker and that can be used, under certain conditions, as clinker substitute. In the project activity the slag is used in the grinding phase of cement production chain, i.e. slag replaces clinker in the cement mills avoiding, then, clinker production in the kilns. The implementation of the project activity started on September/2000 and continued in the following years with the installation of new mills, dryer and logistics development.

It is important to highlight that the cement industry plays a significant role in Climate Change. First because the cement manufacture is an energy intensive process, demanding large amounts of fuel and electricity in the whole process chain. In addition, the chemical process of producing clinker (calcination of limestone) produces non-renewable CO₂. These two factors results in that the cement industry is responsible for a significant portion of global man-made CO₂ emissions. It is estimated that 50% of the cement industry GHG emissions derive from the chemical process, and 40% from burning fuel. The remainder is split between electricity and transport uses.

Knowledgeable of that, back in 1999, worldwide cement industry launched the Cement Sustainability Initiative. Among other reasons, the Initiative was launched in response to international concerns about the role of the cement industry in Climate Change. The objective of the Initiative was to develop studies and to propose an agenda towards the sustainability of the cement industry. In the Climate Change chapter, the agenda proposed some important actions including: innovation in improving the energy efficiency of processes and equipment; switching to lower carbon fuels; using alternative raw materials to reduce limestone use; developing CO₂ capture and sequestration techniques; and taking advantage of market mechanisms such as emissions trading and voluntary initiatives.



Votorantim Cimentos is signatory of the Cement Industry Initiative and started to define strategies in order to meet the Initiative agenda, including the implementation of this project activity. The project activity includes six cement plants located in the Southeastern region of Brazil and will result in significant reduction in the share of clinker for cement production.

Grupo Votorantim is amongst the largest business groups in Brazil. It participates in several markets in the country, including cement, cellulose, paper, aluminum, zinc, nickel, long steel, polypropylene bioriented films, chemical specialties and orange juice. It also has an important share in the financial sector through Banco Votorantim.

In the cement, lime, mortar and concrete businesses, in Brazil and abroad, the group is represented by Votorantim Cimentos. In Brazil, Votorantim Cimentos leads both the cement market and the hydrated and industrial lime markets, and also holds a distinguished position in the mortar market. Abroad, through the operation of St. Marys, it has a 10% share of the Canadian market and about 2% of the U.S. cement market.

The project activity contributes to sustainable development in the following manners:

- Project activity contributes to the reduction of energy consumption in the cement manufacture chain and consequently to the conservation of energy resources. The increase in the use of blast furnace slag in the place of clinker reduces energy demand in cement manufacture and mining of limestone.
- The reduction of fossil fuel consumption also results in the reduction of local air pollution.
- The reduced use of clinker helps in the conservation of non-renewable reserves of limestone.
- Because less limestone is used, limestone mining activities are reduced. It results in important local environmental benefits, such as, mitigation of local air pollution, reduction of biodiversity loss, and soil and landscaping conservation at mining sites.
- Blast furnace slag is an important industrial residue that requires adequate final disposal. The use of this residue as raw material helps mitigating this problem, reducing the risks of soil and water contamination due to inadequate landfilling of slag.
- The project activity also helps mitigating Climate Change because of the significant reductions of direct and indirect greenhouse gases emissions.

Additionally, the incomes from the CDM will indirectly support and stimulate Votorantim Cimentos in keeping and improving its social and environmental programs already developed with the local community and employees at several locations. Information is available at the company website:

http://www.votorantim-cimentos.com/responsabilidade/principais_acoes.shtml

**A.3. Project participants:****Table 1 - Parties involved in the project activity**

Name of Party involved (*) ((host) indicates 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)
Brazil (host)	Votorantim Cimentos (private entity)	NO
	Ecoinvest Carbon (private entity)	

(*) 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 of requesting registration, the approval by the Party(ies) involved is required.

Note: When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM), at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.

A.4. Technical description of the project activity:**A.4.1. Location of the project activity:****A.4.1.1. Host Party(ies):**

Brazil

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

Please, refer to Table 2 in Section A.4.1.4.

A.4.1.3. City/Town/Community etc:

Please, refer to Table 2 in Section A.4.1.4.

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

The project activity encompasses six cement manufacturing plants listed in Table 2, with corresponding State and city. All of them are located in the Southeast region of the country.

Votorantim Cimentos headquarters is located at Rodovia dos Minérios, 1303 – Curitiba/PR. The detail of physical location of the plants where the project activity is developed is presented in Table 2.

Table 2 - Detail of physical location

Plant	City	State	Location
Itaú de Minas (IM)	Itaú de Minas	Minas Gerais	Rodovia MG050, Trevo km 341 – Bairro Taboca
Santa Helena (SH)	Votorantim	São Paulo	Praça Brasil, 16
Salto de Pirapora (SAL)	Salto de Pirapora	São Paulo	Fazenda Maria Paula s/n – Bairro Arado
Cubatão (CUB)	Cubatão	São Paulo	Rod. Cônego Domênico Rangoni, s/n – km 62 – Vila Parise
Volta Redonda (VR)	Volta Redonda	Rio de Janeiro	Fazenda Três Poços s/n – Distrito Industrial
Rio Negro (RN)	Cantagalo	Rio de Janeiro	Av. Senador José Ermírio de Moraes, 522 – Euclidelândia

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

The project activity pertains to Sectoral Scope 4 (Manufacturing industries).

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

Blast furnace slag is a residue of pig iron production similar to sand. It has chemical properties that allows it to be used, under certain conditions, as clinker substitute. In the project activity the slag is used in the grinding phase of cement production, replacing clinker in the cement mills, avoiding the production of clinker and resulting greenhouse gases emissions in the kilns due to calcination and fossil fuel combustion.



The project activity involved retrofitting of existing facilities and installations of new ones in the transport, preparation, storage and feeding of blast furnace slag. It includes the operation of six plants that are interconnected by an integrated logistics of slag, as represented in Figure 1.

There are three suppliers and one stockpile from where slag is provided to the plants:

- Slag Supplier 1 provides slag to IM without necessity of drying it, therefore the slag is supplied directly to the plant.
- Slag Supplier 2 provides slag to dryers located at CUB and SH plants. From dryer at CUB the slag is supplied to CUB and to SAL. From dryer at SH, slag is supplied to SAL and SH.
- Slag supplier 3 obtains slag from two sources: new slag, generated from blast furnace operation, and slag from the stockpile. Slag Supplier 3 provides slag to SH and VR dryers. SH dryer supplies SH and SAL with slag and VR supplies VR, RN, SAL and IM with slag.

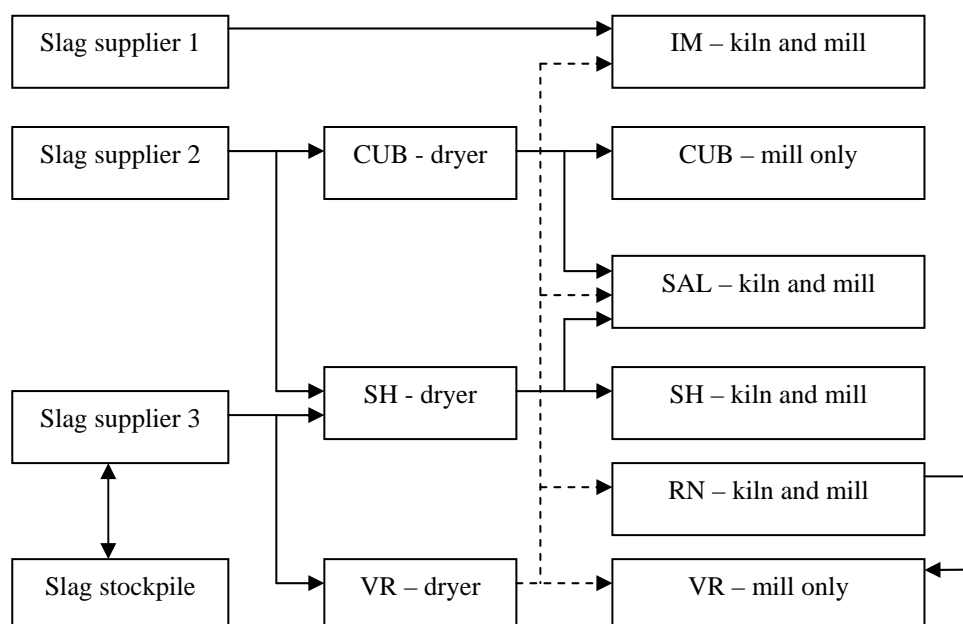


Figure 1 – Integrated logistics of blast furnace slag

After project implementation the supplying of slag, both in quantity and quality, was regularized and secured for the operation of all plants, in order to meet slag proportion use in the production of blended cement. This allowed the good results of the project activity. Before the project implementation, the supplying of slag was not controlled and plants, especially VR and CUB, used to operate with slag with less certainty of slag availability in quantity and quality.

The project activity included the following changes in the plants:

- Installation of a new dryer of slag in SH. The investment of R\$7 million was made on October/2003 and involved the installation of the dryer, field instruments and auxiliary equipment.



- Installation of two new mills in SAL, Mill#Z7 on September/2000 and Mill#Z8 on July/2003. The investment of R\$24 million, R\$12 million for each one, included the installation of the new mills, field instruments and auxiliary equipment.
- Logistics was improved and new controls had to be developed. Votorantim started to control and regularize the supplying and transport of slag and to follow-up daily slag availability and interchange between suppliers, stockpile, dryers and plants. Long term slag purchase agreements were signed between Votorantim and slag suppliers.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

The project activity is the increase of blast furnace slag share in the production of cement, resulting in the reduction of the amount of clinker per tonne of blended cement and corresponding emissions reductions. Two major components reduces greenhouse gases emissions:

- (1) Reduction of energy consumption in the production of clinker.
- (2) Reduction of CO₂ emissions derived from the calcination of limestone.

As explained before, it is estimated that these two factors results in around 90% of cement industry greenhouse gases emissions (50% of the emissions derive from the chemical process, and 40% from burning fuel).

The project activity accounts only for greenhouse gases emission reductions associated with the increased level of blending. Other measures such as energy efficiency improvements do not affect the calculations of emissions reductions.

In order to estimate emission reductions in a conservative manner and to reflect the endogenous trends in the level of blending in the region, a benchmark approach is used to calculate emission reductions. The benchmark is defined in Section B.2.

The CDM incentives helped in the implementation of the project activity. If project was not implemented, the emissions would be greater because the cement would be produced with a higher share of clinker, instead of the use of blast furnace slag. The additionality assessment conducted in Section B.3 presents with further details the additionality of the project.

There are no national and/or sectoral policies and circumstances that influence the decisions or impose obligations to the proposed project activity:

- The share of clinker and use of slag are regulated by Brazilian technical standards, as explained after in this PDD. The standards, however, allow the manufacturers to produce cement within a broad range of clinker and additives shares, from 1% to 70% of slag. This means that the use of slag is virtually not restricted nor demanded by the standards.



- Also, no sectoral policies incentive the use of slag and other additives or disincentive the use clinker. Therefore, no sectoral policies and circumstances would make the project activity preferred, rather than the baseline scenario. The only national circumstance that foments the project activity is the participation of Brazil in the Kyoto Protocol, which allows the project to benefit from the CDM incentives.

A.4.4.1. Estimated amount of emission reductions over the chosen crediting period:

The estimated amount of emissions reduction based on the forecasted blended cement production, for the first crediting period of 7 years, starting in 1/1/2001 is presented in the table below.

Table 3 - Estimated emission reductions for the first crediting period

Years	Annual estimation of emission reductions [tCO₂]
2001	184,562
2002	278,164
2003	337,193
2004	287,605
2005	256,439
2006	210,090
2007	164,543
Total estimated reductions (tonnes of CO ₂ eq)	1,718,597
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO ₂ eq)	245,514

A.4.5. Public funding of the project activity:

There is no public funding involved in the project activity.

**SECTION B. Application of a baseline methodology****B.1. Title and reference of the approved baseline methodology applied to the project activity:**

ACM0005 – “Consolidated Baseline Methodology for Increasing the Blend in Cement Production” – Version 3, 19 may 2006.

B.1.1. Justification of the choice of the methodology and why it is applicable to the project activity:

ACM0005 is applicable to projects that increase the share of additives (i.e. reduce the share of clinker) in the production of cement types beyond current practices in the country. Additives are defined as materials blended with clinker to produce blended cement types and include fly ash, gypsum, slag, etc. In the case of Votorantim Cimentos project, the increase in the share of additives and corresponding reduction in the share of clinker in the production of cement types occurs due to the use of blast furnace slag beyond current practices in the country.

The methodology is applicable to this project activity because it meets the applicability conditions:

- There is no shortage of additives related to the lack of blending materials. Project participants should demonstrate that there is no alternative allocation or use for the additional amount of additives used in the project activity.

Blast furnace slag is produced in large amounts by the steel and iron industry in the region of the project activity (São Paulo, Minas Gerais and Rio de Janeiro States) and if the slag was not used as additive in cement manufacture, it would likely be disposed in landfills. Votorantim Cimentos has long term purchase agreements with slag suppliers and the amount of slag stored in the Volta Redonda stockpile represents a strategic reserve in the case of shortage. Therefore, the shortage of slag is very unlikely and the alternative allocation for it would be landfilling.

- ACM0005 is applicable to domestically sold output of the project activity plant and excludes export of blended cement.

The production of the plants included in the project activity is sold domestically, therefore no export of blended cement is included. In the event that some part of the production is exported in the future, then, this amount shall be discounted from emissions reductions calculations.

- Adequate data are available on cement types in the market.

Two associations can provide reliable and publicly available information about the cement industry in Brazil: ABCP – Associação Brasileira de Cimento Portland (Brazilian Association of Portland Cement) and SNIC – Sindicato Nacional da Indústria do Cimento (National Association of the Cement Industry).

**B.2. Description of how the methodology is applied in the context of the project activity:**

The following steps are followed to determine emissions reductions in the context of the project activity:

Step 1 – Identification of the baseline scenario

The baseline scenario is the most plausible scenario among all realistic and credible alternative production scenarios for the relevant cement type that are consistent with current rules and regulations. Project proponents identify the baseline scenario in Section B.3 through the use of “Step 3 – Barrier Analysis” of the latest approved version of the “Tool for the determination and assessment of additionality”. Please, refer to Section B.3 for detailed analysis.

Step 2 – Additionality

The additionality of the project activity is demonstrated and assessed using the latest version of the “Tool for the demonstration and assessment of additionality”. Please, refer to Section B.3 for detailed analysis.

Step 3 – Definition of cement type

According to ACM0005, blended cement type (BC) is defined as distinct products with different uses, additives and additive to clinker ratios. In this project activity blended cement type is Portland Blast Furnace Slag cement (PBFS). This definition, however, needs to be further detailed taking into consideration two points:

- In Brazil, ABNT¹ (Associação Brasileira de Normas Técnicas – Brazilian Association of Technical Standards) defines cement types, including additives used and additive to clinker ratios, as described in Table 4.

From ABNT definition PBFS cement includes cement types CP I – S, CP II – E and CP III, because these are the ones which allows addition of blast furnace slag, in different proportions.

- The definition of blended cement type for determining a common basis for the analysis makes sense if the final use of the cement is taken into consideration. This is because the final effect of the sales increase of a certain type of cement is the substitution of an equivalent cement type, which depends on its final use.

In terms of final uses, ABCP² (Associação Brasileira de Cimento Portland – Brazilian Association of Portland Cement) indicates 21 applications for portland cements. In 13 of those applications, including the most significant ones, cement types CP I – S, CP II – E and CP III can be used interchangeably, confirming the definition PBFS in this particular project.

¹ Associação Brasileira de Normas Técnicas, ABNT. Brazilian Technical Standards Numbers 5732, 11578, 5735, 5736, 5733. Cited by ABCP, Associação Brasileira de Cimento Portland in Boletim Técnico 106 – Guia Básico de Utilização do Cimento Portland, 2002.

² Associação Brasileira de Cimento Portland, ABCP (Brazilian Association of Portland Cement). Boletim Técnico 106 – Guia Básico de Utilização do Cimento Portland, 2002. Available at www.abcp.org.br.



Table 4 – Cement types in Brazil

Type of Portland cement		Composition (% mass)			
		Clinker + Gypsum	Blast Furnace Slag	Pozzolanic Materials	Carbonatic Materials
Ordinary	CP I	100	0		
	CP I - S	99 - 95	1 - 5		
Blended	CP II - E	94 - 56	6 - 34	-	0 - 10
	CP II - Z	94 - 76	-	6 - 14	0 - 10
	CP II - F	94 - 90	-	-	6 - 10
Blast Furnace	CP III	65 - 25	35 - 70	-	0 - 5
Pozzolanic	CP IV	85 - 45	-	15 - 50	0 - 5
High Initial Resistance	CP V - ARI	100 - 95	-	-	0 - 5
Structural White Cement	CP B Estrut	100 - 75	-	-	0 - 25
Non structural White Cement	CP B	74 - 50	-	-	26 - 50

Therefore, considering the definition of cement types by ABNT and the applications by ABCP, blended cement type in this project activity is Portland Blast Furnace Slag cement (PBFS) including ABNT categories CP I – S, CP II – E and CP III.

Step 4 – Emission Reductions

Emissions reductions in year y of the project activity are calculated from equation 4, described below.

Equation (4)

$ER_y = [(BE_{BC,y} - PE_{BC,y}) \cdot BC_y \cdot 1000 + L_y] \cdot (1 - \alpha_y) \quad \text{tCO}_2 \quad (4)$		
$BE_{BC,y}$	Baseline emissions of CO ₂ per tonne of BC in year y of the project activity. Calculated from equation (1).	tCO ₂ /t(BC)



$PE_{BC,y}$	Project emissions of CO ₂ per tonne of BC in year y of the project activity. Calculated from equation (5).	tCO ₂ /t(BC)
BC_y	Production of blended cement in year y of the project activity. Monitored by project proponents.	kt(BC)
L_y	Leakage due to transport of additives. Calculated from equation (2.1).	tCO ₂
α_y	Proportion of additives that are not surplus. Calculated from equation (3).	Non-dimensional

Step 5 – Baseline emissions

Baseline emissions per tonne of blended cement produced are calculated from equation 1, described below:

Equation (1)

$BE_{BC,y} = [BE_{clinker} \cdot B_{Blend,y}] + BE_{ele_ADD_BC} \quad tCO_2/t(BC) \quad (1)$		
$BE_{BC,y}$	Baseline emissions per tonne of blended cement type.	tCO ₂ /t(BC)
$BE_{clinker}$	Baseline emissions per tonne of clinker in the project activity plant. Calculated from equation (1.1).	tCO ₂ /t(clinker)
$B_{Blend,y}$	Baseline benchmark of share of clinker per tonne of BC updated for year y. Defined from Benchmark Analysis.	t(clinker)/t(BC)
$BE_{ele_ADD_BC}$	Baseline electricity emissions for BC grinding and preparation of additives. Calculated from equation (1.2).	tCO ₂ /t(BC)

**Equations (1.1), (1.1.1), (1.1.2), (1.1.3) and (1.1.4)**

$BE_{clinker} = BE_{calcin} + BE_{fossil_fuel} + BE_{ele_grid_CLNK} + BE_{ele_sg_CLNK} \quad tCO_2/t(clinker) \quad (1.1)$		
BE_{calcin}	Baseline emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate. Calculated from equation (1.1.1) below:	$tCO_2/t(clinker)$
$BE_{calcin} = \frac{0.785 \cdot (OutCaO - InCaO) + 1.092 \cdot (OutMgO - InMgO)}{1000 \cdot CLNK_{BSL}} \quad tCO_2/t(clinker) \quad (1.1.1)$		
BE_{fossil_fuel}	Baseline emissions per tonne of clinker due to combustion of fossil fuels for clinker production. Calculated from equation (1.1.2) below:	$tCO_2/t(clinker)$
$BE_{fossil_fuel} = \frac{\sum (FF_{i_BSL} \cdot EFF_i)}{1000 \cdot CLNK_{BSL}} \quad tCO_2/t(clinker) \quad (1.1.2)$		
$BE_{ele_grid_CLNK}$	Baseline grid electricity emissions for clinker production per tonne of clinker. Calculated from equation (1.1.3) below:	$tCO_2/t(clinker)$
$BE_{ele_grid_CLNK} = \frac{BELE_{grid_CLNK} \cdot EF_{grid_BSL}}{1000 \cdot CLNK_{BSL}} \quad tCO_2/t(clinker) \quad (1.1.3)$		
$BE_{ele_sg_CLNK}$	Baseline emissions from self generated electricity for clinker production per tonne of clinker. Calculated from equation (1.1.4) below:	$tCO_2/t(clinker)$
$BE_{ele_sg_CLNK} = \frac{BELE_{sg_CLNK} \cdot EF_{sg_BSL}}{1000 \cdot CLNK_{BSL}} \quad tCO_2/t(clinker) \quad (1.1.4)$		

Equations (1.2), (1.2.1), (1.2.2), (1.2.3) and (1.2.4)

$BE_{ele_ADD_BC} = BE_{ele_grid_BC} + BE_{ele_sg_BC} + BE_{ele_grid_ADD} + BE_{ele_sg_ADD} \quad tCO_2/t(BC) \quad (1.2)$		
$BE_{ele_grid_BC}$	Baseline grid electricity emissions for grinding BC. Calculated from equation (1.2.1) below:	$tCO_2/t(BC)$



		$BE_{ele_grid_BC} = \frac{BELE_{grid_BC} \cdot EF_{grid_BSL}}{1000 \cdot BC_{BSL}} \quad \text{tCO}_2/\text{t(BC)} \quad (1.2.1)$
BE _{ele_sg_BC}	Baseline self generated electricity emissions for grinding BC. Calculated from equation (1.2.2) below:	tCO ₂ /t(BC)
		$BE_{ele_sg_BC} = \frac{BELE_{sg_BC} \cdot EF_{sg_BSL}}{1000 \cdot BC_{BSL}} \quad \text{tCO}_2/\text{t(BC)} \quad (1.2.2)$
BE _{ele_grid_ADD}	Baseline grid electricity emissions for preparation of additives. Calculated from equation (1.2.3) below:	tCO ₂ /t(BC)
		$BE_{ele_grid_ADD} = \frac{BELE_{grid_ADD} \cdot EF_{grid_BSL}}{1000 \cdot BC_{BSL}} \quad \text{tCO}_2/\text{t(BC)} \quad (1.2.3)$
BE _{ele_sg_ADD}	Baseline self generated electricity emissions for preparation of additives. Calculated from equation (1.2.4) below:	tCO ₂ /t(BC)
		$BE_{ele_sg_ADD} = \frac{BELE_{sg_ADD} \cdot EF_{sg_BSL}}{1000 \cdot BC_{BSL}} \quad \text{tCO}_2/\text{t(BC)} \quad (1.2.4)$

Definition of BE_{clinker}:

BE_{clinker} is primarily defined from equation (1.1). However, considering that ACM0005 is restricted to increase in percentage of blend only and not to efficiency improvements or fuel switching, the methodology states that in each year of the crediting period BE_{clinker} needs to be verified and redefined as described below:

If project emissions per tonne of clinker are less than baseline emissions in year y of the crediting period: PE_{clinker,y} < BE_{clinker}, BE_{clinker} shall be substituted by the PE_{clinker,y} in year y.

If project emissions per tonne of clinker are equal to baseline emissions in year y of the crediting period: PE_{clinker,y} = BE_{clinker}, BE_{clinker} shall be maintained as calculated by equation (1.1).

If project emissions per tonne of clinker are greater than baseline emissions in year y of the crediting period: PE_{clinker,y} > BE_{clinker}, BE_{clinker} shall be maintained as calculated by equation (1.1). In this case, there is a possibility that project activity emissions exceed the baseline emissions and the project does not get new credits for emissions reduction till the net balance for the project is positive.

PE_{clinker,y} is calculated from equation (5.1).

Definition of B_{Blend,y} from benchmark analysis:



The baseline benchmark of share of clinker per tonne of BC, $B_{Blend,y}$, is defined as the lowest value among the following:

- (i) The average (weighted by production) mass percentage of clinker for the 5 highest blend cement brands for the relevant cement type in the region; If the region comprises of less than 5 blend cement brands, the national market should be used as the default region; or
- (ii) The production weighted average mass percentage of clinker in the top 20% (in terms of share of additives) of the total production of the blended cement type in the region. If 20% falls on part capacity of a plant, that plant is included in the calculations; or
- (iii) The mass percentage of clinker in the relevant cement type produced in the proposed project activity plant before the implementation of the CDM project activity. The highest percentage of additives used over the 3 most recent years before project implementation is selected and an increasing trend of 2% in the blend is incorporated, as indicated in ACM0005.

According to ACM0005, at the renewal of the crediting period, the benchmark shall be recalculated. The basis (between the 3 options) of the benchmark may change from the option selected during the first crediting period.

In the determination of the benchmark, information obtained from SNIC³ and ABCP⁴ are used. These two external sources are reliable, verifiable and updated annually.

Only domestically sold output is considered and any export of cement produced by the project activity is excluded in the calculation of emission reductions. Actually, the plants included in the project activity produces cement for the local market only.

Project proponents choose the national market as the region for the project activity. As indicated by ACM0005, the national market is the default region to be used.

Detailed information and calculation can be found in Section E.

Monitored and fixed parameters for baseline emissions calculations

0.785	Stoichiometric emission factor for CaO. Fixed parameter defined by ACM0005..	$tCO_2/t(CaO)$
1.092	Stoichiometric emission factor for MgO. Fixed parameter defined by ACM0005.	$tCO_2/t(MgO)$
BC_{BSL}	Production of blended cement in the baseline year. Monitored by project proponents, for one year previously to project implementation, in the project site.	kt(BC)
$CLNK_{BSL}$	Production of clinker in the baseline year. Monitored by project proponents, for one year previously to project implementation, in the project site.	kt(clinker)
ADD_{BSL}	Consumption of additives in the baseline. Monitored by project proponents, for one year previously to project implementation, in the project site.	kt(slag)

³ Sindicato Nacional da Indústria do Cimento, SNIC (National Association of the Portland Cement Industry). Annual Report – 2004. Available at www.snic.com.br.

⁴ Associação Brasileira de Cimento Portland, ABCP (Brazilian Association of Portland Cement). Boletim Técnico 106 – Guia Básico de Utilização do Cimento Portland, 2002. Available at www.abcp.org.br.



InCaO	CaO content (%) of the raw material * raw material quantity. Monitored by project proponents, for one year previously to project implementation, in the project site.	t(CaO)
OutCaO	CaO content (%) of the clinker * clinker produced. Monitored by project proponents, for one year previously to project implementation, in the project site.	t(CaO)
InMgO	MgO content (%) of the raw material * raw material quantity. Monitored by project proponents, for one year previously to project implementation, in the project site.	t(MgO)
OutMgO	MgO content (%) of the clinker * clinker produced. Monitored by project proponents, for one year previously to project implementation, in the project site.	t(MgO)
FF _i _BSL	Consumption of fossil fuel of type i for clinker production in the baseline. Monitored by project proponents, for one year previously to project implementation, in the project site.	t(fuel)
BELE _{grid} _CLNK	Consumption of grid electricity for clinker production in the baseline. Monitored by project proponents, for one year previously to project implementation, in the project site.	MWh
BELE _{sg} _CLNK	Consumption of self generation of electricity for clinker production in the baseline. Monitored by project proponents, for one year previously to project implementation, at the project site.	MWh
BELE _{grid} _BC	Consumption of grid electricity for grinding BC in the baseline. Monitored by project proponents, for one year previously to project implementation, in the project site.	MWh
BELE _{sg} _BC	Consumption of self generated electricity for grinding BC in the baseline. Monitored by project proponents, for one year previously to project implementation, in the project site.	MWh
BELE _{grid} _ADD	Consumption of grid electricity for grinding additives in the baseline. Monitored by project proponents, for one year previously to project implementation, in the project site.	MWh
BELE _{sg} _ADD	Consumption of self generated electricity for grinding additives in the baseline. Monitored by project proponents, for one year previously to project implementation, in the project site.	MWh
EF _{grid} _BSL	Baseline grid electricity emission factor. Calculated according to methodology ACM0002.	tCO ₂ /MWh
EF _{sg} _BSL	Baseline self generation electricity emission factor. Calculated from equation (6).	tCO ₂ /MWh
EFF _i	Emission factor for fossil fuel i, obtained from the IPCC. Calculated from equation (7).	tCO ₂ /t(fuel)

Step 6 – Project Activity Emissions

Project activity emissions per tonne of blended cement produced are calculated from equation 5, described below:

Equation (5)

$PE_{BC,y} = [PE_{clinker,y} \cdot P_{blend,y}] + PE_{ele_ADD_BC,y} \quad tCO_2/t(BC) \quad (5)$		
PE _{BC,y}	Project emissions per tonne of blended cement type, in year y of the crediting period.	tCO ₂ /t(BC)



$PE_{clinker,y}$	Project emissions per tonne of clinker, in year y of the crediting period. Calculated from equation (5.1) in the following pages.	tCO ₂ /t(clinker)
$P_{blend,y}$	Project share of clinker per tonne of BC in year y. Monitored by project proponents, during the crediting period, in the project site. $P_{blend,y} = \frac{CLNK_y}{BC_y} \quad tCO_2/t(clinker)$	t(clinker)/t(BC)
$PE_{ele_ADD_BC,y}$	Project electricity emissions for BC grinding and preparation of additives, in year y of the crediting period. Calculated from equation (5.2) in the following pages.	tCO ₂ /t(BC)

Equations (5.1), (5.1.1), (5.1.2), (5.1.3) and (5.1.4)

$PE_{clinker,y} = PE_{calcin,y} + PE_{fossil_fuel,y} + PE_{ele_grid_CLNK,y} + PE_{ele_sg_CLNK,y} \quad tCO_2/t(clinker) \quad (5.1)$		
$PE_{calcin,y}$	Project emissions per tonne of clinker due to calcination of calcium carbonate and magnesium carbonate. Calculated from equation (5.1.1) below:	tCO ₂ /t(clinker)
$PE_{calcin,y} = \frac{0.785 \cdot (OutCaO_y - InCaO_y) + 1.092 \cdot (OutMgO_y - InMgO_y)}{1000 \cdot CLNK_y} \quad tCO_2/t(clinker) \quad (5.1.1)$		
$PE_{fossil_fuel,y}$	Project emissions per tonne of clinker due to combustion of fossil fuels for clinker production. Calculated from equation (5.1.2) below:	tCO ₂ /t(clinker)
$PE_{fossil_fuel,y} = \frac{\sum (FF_{i,y} \cdot EFF_i)}{1000 \cdot CLNK_y} \quad tCO_2/t(clinker) \quad (5.1.2)$		
$PE_{ele_grid_CLNK,y}$	Project emissions from grid electricity for clinker production per tonne of clinker. Calculated from equation (5.1.3) below:	tCO ₂ /t(clinker)
$PE_{ele_grid_CLNK,y} = \frac{PELE_{grid_CLNK,y} \cdot EF_{grid_y}}{1000 \cdot CLNK_y} \quad tCO_2/t(clinker) \quad (5.1.3)$		
$PE_{ele_sg_CLNK,y}$	Project emissions from self generated electricity for clinker production per tonne of clinker. Calculated from equation (5.1.4) below:	tCO ₂ /t(clinker)



$$PE_{ele_sg_CLNK,y} = \frac{PELE_{sg_CLNK,y} \cdot EF_{sg-y}}{1000 \cdot CLNK_y} \quad \text{tCO}_2/\text{t(clinker)} \quad (5.1.4)$$

Equations (5.2), (5.2.1), (5.2.2), (5.2.3) and (5.2.4)

$$PE_{ele_ADD_BC,y} = PE_{ele_grid_BC,y} + PE_{ele_sg_BC,y} + PE_{ele_grid_ADD,y} + PE_{ele_sg_ADD,y} \quad \text{tCO}_2/\text{t(BC)} \quad (5.2)$$

$PE_{ele_grid_BC,y}$ Project grid electricity emissions for BC grinding. Calculated from equation (5.2.1) below: $\text{tCO}_2/\text{t(BC)}$

$$PE_{ele_grid_BC,y} = \frac{PELE_{grid_BC,y} \cdot EF_{grid-y}}{BC_y} \quad \text{tCO}_2/\text{t(BC)} \quad (5.2.1)$$

$PE_{ele_sg_BC,y}$ Project self generated electricity emissions for BC grinding. Calculated from equation (5.2.2) below: $\text{tCO}_2/\text{t(BC)}$

$$PE_{ele_sg_BC,y} = \frac{PELE_{sg_BC,y} \cdot EF_{sg-y}}{BC_y} \quad \text{tCO}_2/\text{t(BC)} \quad (5.2.2)$$

$PE_{ele_grid_ADD,y}$ Project grid electricity emissions for additive preparation. Calculated from equation (5.2.3) below: $\text{tCO}_2/\text{t(BC)}$

$$PE_{ele_grid_ADD,y} = \frac{PELE_{grid_ADD,y} \cdot EF_{grid-y}}{BC_y} \quad \text{tCO}_2/\text{t(BC)} \quad (5.2.3)$$

$PE_{ele_sg_ADD,y}$ Project self generated electricity emissions for additive preparation. Calculated from equation (5.2.4) below: $\text{tCO}_2/\text{t(BC)}$

$$PE_{ele_sg_ADD,y} = \frac{PELE_{sg_ADD,y} \cdot EF_{sg-y}}{BC_y} \quad \text{tCO}_2/\text{t(BC)} \quad (5.2.4)$$

According to ACM0005, version 3, if additional additives used in the project activity needs drying, fuel combustion used in the drying process shall be accounted as an emission source. Therefore, emissions resulting for drying additional additives are accounted as project emissions.

Monitored and fixed parameters for project emissions calculations



BC_y	Production of blended cement. Monitored by project proponents, in year y of the crediting period, at the project site.	kt(BC)
$CLNK_y$	Production of clinker. Monitored by project proponents, in year y of the crediting period, at the project site.	kt(clinker)
ADD_y	Consumption of blast furnace slag. Monitored by project proponents, in year y of the crediting period, at the project site.	kt(slag)
$InCaO_y$	CaO content (%) of the raw material * raw material quantity. Monitored by project proponents, in year y of the crediting period, at the project site.	t(CaO)
$OutCaO_y$	CaO content (%) of the clinker * clinker produced. Monitored by project proponents, in year y of the crediting period, at the project site.	t(CaO)
$InMgO_y$	MgO content (%) of the raw material * raw material quantity. Monitored by project proponents, in year y of the crediting period, at the project site.	t(MgO)
$OutMgO_y$	MgO content (%) of the clinker * clinker produced. Monitored by project proponents, in year y of the crediting period, at the project site.	t(MgO)
$FF_{i,y}$	Consumption of fossil fuel of type i for clinker production. Monitored by project proponents, in year y of the crediting period, at the project site.	t(fuel)
$PELE_{grid_CLNK,y}$	Consumption of grid electricity for clinker production. Monitored by project proponents, in year y of the crediting period, at the project site.	MWh
$PELE_{sg_CLNK,y}$	Consumption of self generation of electricity for clinker production. Monitored by project proponents, in year y of the crediting period, at the project site.	MWh
$PELE_{grid_BC,y}$	Consumption of grid electricity for grinding BC. Monitored by project proponents, in year y of the crediting period, at the project site.	MWh
$PELE_{sg_BC,y}$	Consumption of self generated electricity for grinding BC. Monitored by project proponents, in year y of the crediting period, at the project site.	MWh
$PELE_{grid_ADD,y}$	Consumption of grid electricity for grinding additives. Monitored by project proponents, in year y of the crediting period, at the project site.	MWh
$PELE_{sg_ADD,y}$	Consumption of self generated electricity for grinding additives. Monitored by project proponents, in year y of the crediting period, at the project site.	MWh
$EF_{grid,y}$	Grid electricity emission factor. Calculated according to methodology ACM0002.	tCO ₂ /MWh
$EF_{sg,y}$	Project self generation electricity emission factor. Calculated from equation (6).	tCO ₂ /MWh
EFF_i	Emission factor for fossil fuel i. Calculated from equation (7).	tCO ₂ /t(fuel)

Step 7 – Leakage



Leakage 1: Emissions due to fuel use for the transport of raw materials and fuels from offsite locations to the project plant are likely to decrease due to the implementation of the project. Following ACM0005, in order to keep emissions reductions conservative, this change is not included.

Leakage 2: Emissions due to fuel use for the transport of additives from offsite locations to the project plant are likely to increase. These emissions are accounted as leakage, as per equations (2.1) and (2) below:

Equations (2.1) and (2)

$L_y = L_{add_trans} \cdot (A_{blend,y} - P_{blend,y}) \cdot BC_y \quad \text{tCO}_2 \quad (2.1)$		
$L_{add_trans} = \frac{(TF_{cons} \cdot D_{add_source} \cdot TEF)}{1000 \cdot Q_{add}} + \frac{(ELE_{conveyor_ADD} \cdot EF_{grid})}{ADD_y} \quad \text{tCO}_2/\text{t(additive)} \quad (2)$		
L_y	Leakage emissions for transport of additives.	tCO ₂
$A_{blend,y}$	Baseline benchmark share of additives per tonne of BC updated for year y.	t(slag)/t(BC)
$P_{blend,y}$	Share of additives per tonne of BC updated for year y.*	t(additive)/t(BC)
L_{add_trans}	Transport related emissions per tonne of additives. Calculated from equation (2).	tCO ₂ /t(additive)
TF_{cons}	Fuel consumption for the vehicle per kilometre. Monitored by project proponents, in year y of the crediting period, in the project site.	kg(fuel)/km
D_{add_source}	Distance between the source of additive and the project activity plant. Monitored by project proponents, in year y of the crediting period, in the project site.	km
$ELE_{conveyor_ADD}$	Annual electricity consumption for conveyor system for additives. Monitored by project proponents, in year y of the crediting period, in the project site.	MWh
Q_{add}	Quantity of additive carried in one trip per vehicle. Monitored by project proponents, in year y of the crediting period, in the project site.	t(slag)
TEF	Emission factor for transport fuel. Calculated from equation (7).	tCO ₂ /t(fuel)
EF_{grid}	Grid electricity emission factor. Calculated according to methodology ACM0002.	tCO ₂ /MWh



† - Note: The revised methodology ACM0005-Version 2 redefines $P_{blend,y}$ from share of clinker per tonne of BC to share of additives per tonne of BC. This is maintained in ACM0005-Version3. Notwithstanding, this new definition can be used only for leakage calculation, see ACM0005-Page 7-Equation 2.1. For project emissions calculations, the old definition needs to be maintained, see ACM0005-Version 3-Equation 5.

Leakage 3: The methodology defines that another possible leakage is due to the diversion of additives from existing uses. As the slag used is surplus, it is expected that this source of leakage will not affect calculations. Notwithstanding, α_y is calculated from equation (3) below:

$$\alpha_y = \frac{x \text{ tonnes of additives in year } y \text{ not surplus}}{\text{total additional additives used in year } y} \quad (3)$$

Step 8 – Fuel and electricity emission factors

For the calculation of emissions from grid electricity (EF_{grid}) the approved consolidated baseline methodology ACM0002 is applied. Please refer to that methodology for further details.

For cement plants that self-generate electricity, the average annual emission factor of the self-generated electricity (EF_{sg}) is calculated from equation (6) below:

Equation (6) – Self-generated electricity emission factor

$EF_{sg} = \frac{\sum_{i,j} F_{i,j} \cdot COEF_{i,j}}{\sum_j GEN_j} \quad \text{tCO}_2/\text{MWh}$		
$F_{i,j}$	Amount of fuel i consumed by relevant power sources j in year y of the crediting period, monitored by project proponents at the project site.	Mass or volume units
GEN_j	Electricity generated by the source j in year y of the crediting period, monitored by project proponents at the project site.	MWh

For fuel emission factors equation (7) is applied:

Equation (7) – Fuel emission factor

$EFF = COEF = \frac{44}{12} \cdot NCV \cdot EF_C \cdot OXID \quad \text{tCO}_2/\text{t(fuel)}$		
NCV	NCV is the net calorific value (lower heating value) of fuel i, obtained from project activity information.	TJ per mass or volume units of fuel



OXID	OXID is the oxidation factor of the fuel, obtained from IPCC	Non-dimensional
EF _C	Carbon emission factor per unit of energy of the fuel i, obtained from IPCC.	tC/TJ

B.3. 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:

The additionality of the project activity is demonstrated and assessed using the “Tool for the demonstration and assessment of additionality” – Version 2.

Step 3 of the Tool is used to identify the most plausible scenario among all realistic and credible alternatives(s) to the project activity, i.e. the baseline scenario.

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

Project participants wish to have the crediting period starting prior to the registration of the project activity. For this reasons it is provided below:

- (a) Evidence that the starting date of the CDM project activity falls between 1 January 2000 and the date of the registration of a first CDM project activity

The implementation of the project activity started on September/2000 and continued in the following years with the installation of new mills, dryer and logistics development. The date represents the installation of the first new mill in SAL, Mill#Z7. Adequate evidence is available at the project site.

- (b) Evidence that the incentive from the CDM was seriously considered in the decision to proceed with the project activity.

Votorantim Cimentos is signatory of the Cement Industry Initiative and since the beginning of the Initiative the company started to define strategies in order to meet its agenda. Back in 1999 worldwide cement industry launched the Cement Sustainability Initiative. Among other reasons, the Initiative was launched in response to international concerns about the role of the cement industry in Sustainable Development and Climate Change. The objective of the Initiative was to develop studies and to propose a positive agenda towards the sustainability of the cement industry.

In the Climate Change chapter, the agenda proposed some important actions including: innovation in improving the energy efficiency of processes and equipment; switching to lower carbon fuels; using alternative raw materials to reduce limestone use; developing CO₂ capture and sequestration techniques; and taking advantage of market mechanisms such as emissions trading to meet the agenda. The implementation of this project activity is one of the efforts towards the reduction of conventional raw material and reduction of greenhouse gases emissions in the manufacturing process.



Further information on the Cement Sustainability Initiative can be found in the internet website www.wbcsdcement.org.

Step 1. Identification of alternatives to the project activity consistent with current laws and regulations

Sub-step 1a. Define alternatives to the project activity:

Realistic and credible alternative(s) are production scenarios for the relevant cement type that are consistent with current rules and regulations available to the project participants or similar project developers. They include the proposed project activity, the existing practice of cement production and practices in other manufacturing plants in the region using similar input/raw materials and facing similar economic, market and technical circumstances:

- Alternative 1: the proposed project activity not undertaken as a CDM project activity. In this scenario Votorantim Cimentos uses blast furnace slag in the production of blended cement above the benchmark level, as in the project activity.
- Alternative 2: continuation of the current situation. In this scenario Votorantim Cimentos does not change its production pattern and the use of blast furnace slag and/or other additives remains in the same level existing previously to the project implementation.
- Alternative 3: increase in additives use in some pre-defined rate. In this scenario Votorantim Cimentos increases the use of blast furnace slag and/or other additives in a pre-defined rate, lower than the project activity rate.
- Alternative 4: use of other additives different from blast furnace slag. In this scenario Votorantim Cimentos uses other additives, such as fly ash or pozzolanic materials, in the production of blended cement above the benchmark level.
- Alternative 5: development of a new product. In this scenario Votorantim Cimentos develops a new clinker-free product that replaces the ordinary Portland cement and blended cement.

Sub-step 1b. Enforcement of applicable laws and regulations:

All the alternatives are in compliance with all applicable legal and regulatory requirements.

Step 2. Investment analysis

Investment analysis is not undertaken.

Step 3. Barrier analysis

As showed below, the proposed project activity faces barriers that prevent the implementation of this type of proposed project activity; and do not prevent the implementation of at least one of the alternatives.

Sub-step 3a. Identify barriers that would prevent the implementation of type of the proposed project activity:

The following barriers would prevent the implementation of the proposed project activity:



- Barrier 1: the access to debt funding is difficult in Brazil. Despite Votorantim being a large company, it was difficult to obtain debt funding for the project activity and the company had to fund the implementation of the project activity with its own resources.
- Barrier 2: capital markets are very attractive in Brazil, especially considering the high interest rates in the country, what makes the investment in the capital markets much more attractive than funding production, specially considering the risks in this type of project. Real interest rates have been extraordinarily high since the Real plan stabilized inflation in 1994. As a consequence of the long period of inflation, the Brazilian currency experienced a strong devaluation, effectively precluding commercial banks from providing any long-term debt financing. The lack of a long-term debt market has had a severely negative direct impact on the financing of projects in Brazil.
- Barrier 3: Votorantim Cimentos had to develop substantial research effort to enable the increase in blending. Two aspects need to be highlighted: (i) adaptations in the process needed to be implemented and (ii) more stringent quality assurance and quality control procedures needed to be developed and implemented. New raw material and final product were included in the production chain with necessity of new quality tests, new controls and equipment.
- Barrier 4: development of logistics for additives supplying. The use of additives in a reliable and continuous manner required the development and control of a new supply chain in the process involving different sites and suppliers, as described in Section A.4.3
- Barrier 5: lack of infrastructure for implementation of the technology. The use of additives in a reliable and continuous manner also required that new infrastructure was installed in some of the plants involved in the project activity, as described in Section A.4.3.
- Barrier 6: despite the previous use of blended cement in the country, the perception that high additive blended cement is of inferior quality happened in the early stages of the project, when Votorantim had to introduce the new product in the market. Votorantim Cimentos had to overcome this barrier and to inform and clarify the market about the quality of the high additive blended cement.
- Barrier 7: the use of slag increases the production costs of the blended cement because it adds new steps in the production chain, its availability and quality depends on third parties, the maintenance costs increase due to difference in equipment operations, and the performance of the installation decreases (productivity decreases).

Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

Table 5 shows how barriers affect each one of the alternative scenarios identified in Step 1.

Table 5 - Effect of barriers in each alternative scenario

Alternative 1 Proposed project activity	Alternative 2 Continuation of the current situation	Alternative 3 Use of additives in lower rate	Alternative 4 Use of other additives	Alternative 5 Development of a new product



Barrier 1 Debt funding not available	Prevents implementation	Does not prevent implementation	Does not prevent implementation	Strongly prevents implementation	Strongly prevents implementation
Barrier 2 Capital markets are very attractive	Prevents implementation	Does not prevent implementation	Does not prevent implementation	Strongly prevents implementation	Strongly prevents implementation
Barrier 3 Research effort	Prevents implementation	Does not prevent implementation	Does not prevent implementation	Prevents implementation	Strongly prevents implementation
Barrier 4 Logistics for additives supplying	Prevents implementation	Does not prevent implementation	Does not prevent implementation	Strongly prevents implementation	Does not prevent implementation
Barrier 5 Lack of infrastructure	Prevents implementation	Does not prevent implementation	Does not prevent implementation	Prevents implementation	Strongly prevents implementation
Barrier 6 Market acceptability	Prevents implementation	Does not prevent implementation	Does not prevent implementation	Prevents implementation	Strongly prevents implementation
Barrier 7 Operational barriers	Prevents implementation	Does not prevent implementation	Does not prevent implementation	Prevents implementation	Strongly prevents implementation
Result of the analysis	Project alternative is prevented by identified barriers, more than Alternatives 2 and 3.	Alternative 2 is not prevented by identified barriers and remains as baseline candidate	Alternative 3 is not prevented by identified barriers and remains as baseline candidate	Barriers strongly prevents Alternative 4. It is a very unlikely scenario, especially due to the lack of other additives in the region. This alternative is eliminated from consideration	Barriers strongly prevents Alternative 5. It is a very unlikely scenario because it represents the development of a new product. This alternative is eliminated from consideration

The barrier analysis shows that:

- (i) Alternatives 4 and 5 are strongly prevented by identified barriers and for this reason are very unlikely scenarios. These alternatives are eliminated from further consideration.
- (ii) Alternatives 2 and 3 are not prevented by the barriers. For this reason they remain as possible baseline candidates. ACM0005 states that: “where more than one credible and plausible alternative remains, project participants shall, as a conservative assumption, use the



alternative baseline scenario that results in the lowest baseline emissions as the most likely baseline scenario”. Therefore, following this guidance, Alternative 3 is chosen as the baseline scenario as it results in the lowest baseline emissions due to a pre-defined increase rate in slag use.

- (iii) The project scenario (Alternative 1) remains as a possible additional scenario and Step 4 and 5 are undertaken in order to demonstrate additionality.

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

Project proponents do not have access to information about any other activity implemented previously or currently underway that is similar to the proposed project activity.

Sub-step 4b. Discuss any similar options that are occurring:

Project proponents do not have access to information about any other activity implemented previously or currently underway that is similar to the proposed project activity.

Step 5. Impact of CDM registration

The approval and registration of the project activity as a CDM activity, and the benefits and incentives derived from the project activity, will alleviate the identified barriers (Step 3) and thus enable the project activity to be undertaken for the following reasons:

- Grupo Votorantim is amongst the largest business groups in Brazil. It participates in several markets in the country, including cement, cellulose, paper, aluminium, zinc, nickel, long steel, polypropylene bioriented films, chemical specialties and orange juice. The environmental aspect of Votorantim Group's activities has always been in evidence because of the public perception of its positive and negative impacts. The registration of this project activity in the CDM will add positive value to the company, especially considering that it also operates in other countries, producing and selling goods.
- Grupo Votorantim has operations in Canada, an Annex 1 Party. The registration of this project activity in the CDM will contribute with the commitment of company's emissions reductions targets in that country.
- The registration of the project in the CDM may also result in financial benefits from the revenue obtained by selling CERs, what can help to reduce project costs.

As Step 5 is satisfied, the proposed CDM project activity is additional.

B.4. Description of how the definition of the <u>project boundary</u> related to the <u>baseline methodology</u> selected is applied to the <u>project activity</u>:

Only CO₂ is considered in the calculations because changes in CH₄ and N₂O emissions from combustion processes and calcination are considered to be negligible and excluded because the differences in the



baseline and project activity are not substantial. This assumption is conservative and in accordance with ACM0005.

The project boundary includes the cement production plant, any onsite power generation, and the power generation in the grid. Three emission sources are considered:

- Direct emissions at the cement plant due to fuel combustion for firing the kiln and on-site generation of electricity.
- Direct emissions due to calcination of limestone.
- Indirect emissions from fossil fuel combustion in power plants in the grid due to electricity use at the cement plant for: crushing and grinding the raw materials used for clinker production; driving the kiln and kiln fans; finish grinding of cement; and processing of additives.

Any transport related emissions for the delivery of additional additives will be included in the emissions related to the project activity as leakage.

Emissions reductions from transport of raw materials for clinker production are not taken into account as a conservative simplification.

B.5. Details of baseline information, including the date of completion of the baseline study and the name of person (s)/entity (ies) determining the baseline:

Date of baseline completion: 21/07/2006.

Company: Ecoinvest Carbon
Street: Rua Padre João Manoel, 222
City: São Paulo
State: SP
Postal code: 01411-000
Country: Brazil

Mr. Rodrigo Marcelo Leme
rodrigo.leme@ecoinvestcarbon.com

Phone: +55 11 3063-9068
Fax: +55 11 3063-9069

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:

01/09/2000

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

30 years, 0 months.

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:**

01/01/2001

C.2.1.2. Length of the first crediting period:

7 years, 0 months.

C.2.2. Fixed crediting period:**C.2.2.1. Starting date:**

Not applicable.

C.2.2.2. Length:

Not applicable.

**SECTION D. Application of a monitoring methodology and plan****D.1. Name and reference of approved monitoring methodology applied to the project activity:**

ACM0005 - “Consolidated Monitoring Methodology for Increasing the Blend in Cement Production” – Version 3, 19 may 2006.

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

The conditions under which the monitoring methodology is applicable are the same as that required for the application of the baseline methodology. Please, refer to Section B.1.1 for detailed analysis.

**D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario****D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:**

ID number (Please use numbers to ease cross-referencing to D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment
1. InCaO _y	CaO content of the raw material used in clinker production	Plant records	%	M, C	Daily	100%	Electronic	Will be calculated/measured as part of normal operations
2. OutCaO _y	CaO content of the clinker	Plant records	%	M, C	Daily	100%	Electronic	Will be calculated/measured as part of normal operations
3. InMgO _y	MgO content of the raw material used in clinker production	Plant records	%	M, C	Daily	100%	Electronic	Will be calculated/measured as part of normal operations
4. OutMgO _y	MgO content of the clinker	Plant records	%	M, C	Daily	100%	Electronic	Will be calculated/measured as part of normal operations
5. Raw material	Quantity of raw material for clinker production	Plant records	kilo tonnes	M	Annually	100%	Electronic	-
6. CLNK _y	Production of clinker	Plant records	kilo tonnes	M	Annually	100%	Electronic	-
7. FF _{i,y}	Consumption of fossil fuel of type i for clinker production	Project activity	tonnes	M	Annually	100%	Electronic	-
8. EFF _i	Emission factor for fossil fuel	IPCC/Plant records	tCO ₂ /tonne fuel	C/M	Annually	100%	Electronic	IPCC factors for determining CO ₂ coefficient
9. PELE _{grid, CLNK,y}	Consumption of grid	Plant records	MWh	M	Monthly	100%	Electronic	-

This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.



	electricity for clinker production							
10. $EF_{grid,y}$	Grid electricity emission factor	Follow guidance on ACM0002.	tCO ₂ /MWh	C	Annually	100%	Electronic	Follow guidance on ACM0002.
11. $PELE_{sg_CLNK,y}$	Consumption of self generation of electricity for clinker production	Plant records	MWh	M	Monthly	100%	Electronic	-
12. $EF_{sg,y}$	Emission factor for self generated electricity	Plant records/IPCC	tCO ₂ /MWh	C	Monthly	100%	Electronic	IPCC factors for determining CO ₂ coefficient
13. ADD_y	Consumption of blast furnace slag	Plant records	kilo tonnes	M	Monthly	100%	Electronic	-
14. $PELE_{grid_BC,y}$	Consumption of grid electricity for grinding BC	Plant records	MWh	M	Monthly	100%	Electronic	-
15. $PELE_{sg_BC,y}$	Consumption of self generated electricity for grinding BC	Plant records	MWh	M	Monthly	100%	Electronic	-
16. $PELE_{grid_ADD,y}$	Consumption of grid electricity for grinding additives	Plant records	MWh	M	Monthly	100%	Electronic	-
17. $PELE_{sg_ADD,y}$	Consumption of self generated electricity for grinding additives	Plant records	MWh	M	Monthly	100%	Electronic	-
18. $F_{i,j,k}$	Amount of fuel I consumed by power sources j for self generated electricity	Plant records	tonnes of fuel	M	Monthly	100%	Electronic and paper	-
19. $COEF_{i,j,k}$	CO ₂ emission coefficient of fuel i	IPCC/Plant records	tCO ₂ /tonne of fuel	C/M	Annually	100%	Electronic	-
20. $GEN_{j,k}$	Electricity generated by power source j for project self generated electricity	Plant records	MWh	M	Annually	100%	Electronic	-



21. PE _{calcin}	Emissions due to calcinations	Plant records	tCO ₂ /tonne clinker	C	Annually	100%	Electronic	-
22. PE _{fossil_fuel,y}	Emissions due to combustion of fossil fuel for clinker production	Plant records	tCO ₂ /tonne clinker	C	Annually	100%	Electronic	-
23. PE _{ele_grid_CLNK,y}	Grid electricity emission for clinker production	Plant records	tCO ₂ /tonne clinker	C	Annually	100%	Electronic	-
24. PE _{ele_sg_CLNK,y}	Self generated electricity emissions for clinker production	Plant records	tCO ₂ /tonne clinker	C	Annually	100%	Electronic	-
25. PE _{ele_grid_BC,y}	Grid electricity emissions for BC grinding	Plant records	tCO ₂ /tonne blended cement	C	Annually	100%	Electronic	-
26. PE _{ele_sg_BC,y}	Emissions from self generated electricity for BC grinding	Plant records	tCO ₂ /tonne blended cement	C	Annually	100%	Electronic	-
27. PE _{ele_grid_ADD,y}	Grid electricity emissions for additive preparation	Plant records	tCO ₂ /tonne blended cement	C	Annually	100%	Electronic	-
28. PE _{ele_sg_ADD,y}	Emissions from self generated electricity for additive preparation	Plant records	tCO ₂ /tonne blended cement	C	Annually	100%	Electronic	-
29. P _{Blend,y}	Share of clinker per tonne of BC	Plant records	tonne of clinker/tonne blended cement	C	Annually	100%	Electronic	-
30. BC _y	Production of blended cement	Plant records	kilo tonnes	M	Annually	100%	Electronic	-
31. NCV	Net calorific value of fossil fuels	Brazilian Ministry of Mines and Energy	TJ/(mass or volume units)	E	Annually	100%	Electronic	Value obtained from the Brazilian Ministry of Mines and Energy
32. OXID	Oxidation factor of fossil fuels	IPCC	Non dimensional	E	Annually	100%	Electronic	Value obtained from the IPCC

This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.



								guidelines
33. EF _C	Carbon emission factor of fossil fuels	IPCC	tC/TJ	E	Annually	100%	Electronic	Value obtained from the IPCC guidelines

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)

All formulae used to estimate project emissions were presented in Section B.2. Please, refer to this section.

D.2.1.3. Relevant data necessary for determining the <u>baseline</u> of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
ID number (Please use numbers to ease cross-referencing to table D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. InCaO _{BSL}	CaO content of the raw material used in clinker production in the baseline year	Plant records	%	M, C	Daily	100%	Electronic	Monitored in the year previous to project implementation
2. OutCaO _{BSL}	CaO content of the clinker in the baseline year	Plant records	%	M, C	Daily	100%	Electronic	Monitored in the year previous to project implementation
3. InMgO _{BSL}	MgO content of the raw material used in clinker production in the baseline year	Plant records	%	M, C	Daily	100%	Electronic	Monitored in the year previous to project implementation
4. OutMgO _{BSL}	MgO content of the clinker in the baseline year	Plant records	%	M, C	Daily	100%	Electronic	Monitored in the year previous to project implementation
5. Raw material	Quantity of raw material for clinker production	Plant records	kilo tonnes	M	Annually	100%	Electronic	Monitored in the year previous to project implementation



6. CLNK _{BSL}	Production of clinker in the baseline year	Plant records	kilo tonnes	M	Annually	100%	Electronic	Monitored in the year previous to project implementation
7. FF _i _{BSL}	Consumption of fossil fuel of type i for clinker production in the baseline	Plant records	tonnes	M	Annually	100%	Electronic	Monitored in the year previous to project implementation
8. EFF _i	Emission factor for fossil fuel	IPCC/Plant records	tCO ₂ /tonne fuel	C/M	Annually	100%	Electronic	IPCC factors for determining CO ₂ coefficient
9. BELE _{grid} _{CLNK} _{BSL}	Consumption of grid electricity for clinker production in the baseline	Plant records	MWh	M	Annually	100%	Electronic and paper	Monitored in the year previous to project implementation
10. EF _{grid} _{BSL}	Grid electricity emission factor	Follow guidance on ACM0002.	tCO ₂ /MWh	C	Annually	100%	Electronic	Follow guidance on ACM0002.
11. BELE _{sg} _{CLNK} _{BSL}	Consumption of self generation of electricity for clinker production in the baseline	Lant records	MWh	M	Annually	100%	Electronic	Monitored in the year previously to project implementation
12. EF _{sg} _{BSL}	Emission factor for self generated electricity	Plant records	tCO ₂ /MWh	C	Annually	100%	Electronic	IPCC factors for determining CO ₂ coefficient
13. ADD _{BSL}	Consumption of blast furnace slag in the baseline year	Plant records	kilo tonnes	M	Annually	100%	Electronic	Monitored in the year previous to project implementation
14. BELE _{grid} _{BC} _{BSL}	Consumption of grid electricity for grinding BC in the baseline	Plant records	MWh	M	Annually	100%	Electronic	Monitored in the year previous to project implementation
15. BELE _{sg} _{BC} _{BSL}	Consumption of self generated electricity for grinding BC in the baseline	Plant records	MWh	M	Annually	100%	Electronic	Monitored in the year previous to project implementation
16. BELE _{grid} _{ADD} _{BSL}	Consumption of grid electricity for grinding additives in the baseline	Plant records	MWh	M	Annually	100%	Electronic	Monitored in the year previous to project implementation

This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.



17. $BE_{LE_{sg_ADD,BSL}}$	Consumption of self generated electricity for grinding additives in the baseline	Plant records	MWh	M	Annually	100%	Electronic	Monitored in the year previous to project implementation
18. $F_{i,j,BSL}$	Amount of fuel I consumed by power sources j for self generated electricity	Plant records	tonnes of fuel	M	Annually	100%	Electronic and paper	Monitored in the year previous to project implementation
19. $COEF_{i,j,BSL}$	CO ₂ emission coefficient of fuel i	IPCC/Plant records	tCO ₂ /tonne of fuel	C/M	Annually	100%	Electronic	-
20. $GEN_{j,BSL}$	Electricity generated by power source j for project self generated electricity	Plant records	MWh	M	Annually	100%	Electronic	Monitored in the year previous to project implementation
21. $BE_{calcin,BSL}$	Emissions due to calcinations in the baseline	Plant records	tCO ₂ /tonne clinker	C	Annually	100%	Electronic	Calculated in the year previous to project implementation
22. $BE_{fossil_fuel,y,BSL}$	Emissions due to combustion of fossil fuel for clinker production in the baseline	Plant records	tCO ₂ /tonne clinker	C	Annually	100%	Electronic	Calculated in the year previous to project implementation
23. $BE_{ele_grid_CLNK,BSL}$	Grid electricity emission for clinker production in the baseline	Plant records	tCO ₂ /tonne clinker	C	Annually	100%	Electronic	Calculated in the year previous to project implementation
24. $BE_{ele_sg_CLNK,BSL}$	Self generated electricity emissions for clinker production in the baseline	Plant records	tCO ₂ /tonne clinker	C	Annually	100%	Electronic	Calculated in the year previous to project implementation
25. $BE_{ele_grid_BC,BSL}$	Grid electricity emissions for BC grinding in the baseline	Plant records	tCO ₂ /tonne blended cement	C	Annually	100%	Electronic	Calculated in the year previous to project implementation
26. $BE_{ele_sg_BCBSL}$	Emissions from self generated electricity for BC grinding in the baseline	Plant records	tCO ₂ /tonne blended cement	C	Annually	100%	Electronic	Calculated in the year previous to project implementation



27. $BE_{ele_grid_ADD,BSL}$	Grid electricity emissions for additive preparation in the baseline	Plant records	tCO ₂ /tonne blended cement	C	Annually	100%	Electronic	Calculated in the year previous to project implementation
28. $BE_{ele_sg_ADD,BSL}$	Emissions from self generated electricity for additive preparation in the baseline	Plant records	tCO ₂ /tonne blended cement	C	Annually	100%	Electronic	Calculated in the year previous to project implementation
29. $B_{blend,y}$	Share of clinker per tonne of BC in the baseline	Plant records	tonne of clinker/tonne blended cement	C	Annually	100%	Electronic	Calculated in the year previous to project implementation
29'. $A_{blend,y}$ †	Share of blast furnace slag per tonne of BC in year y	Plant records	tonne of slag/tonne of blended cement	C	Annually	100%	Electronic	This value is actually used for Leakage calculation.
30. BC_{BSL}	Production of blended cement in the baseline year	Project activity	tonnes	M	Annually	100%	Electronic	Monitored in the year previous to project implementation

† - Note: The revised methodology ACM0005-Version 2 requires that $B_{blend,y}$ (ID#29) is replaced by $A_{blend,y}$ (ID#29'). This is maintained in ACM0005-Version 3. However, $B_{blend,y}$ cannot be eliminated from monitoring because this parameter is necessary for baseline emissions calculations, see ACM0005-Version 3-Page 5-Equation 1. Additionally, $A_{blend,y}$ should be identified under Table D.2.3.1, because this parameter is used for the calculation of leakage and not baseline emissions. See ACM0005-Version 3-Page 7-Equation 2.1.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.)
--

Please, refer to section Section B.2.

**D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).****D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:**

ID number (Please use numbers to ease cross-referencing to table D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):

Not applicable.

D.2.3. Treatment of leakage in the monitoring plan**D.2.3.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity**

ID number (Please use numbers to ease cross-referencing to table D.3)	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1. TF _{cons}	Fuel consumption for the vehicles per kilometre	Plant records	kg/km	C	Annually	100%	Electronic	-
2. D _{add_source}	Distance between the source of additive and the project activity plant	Plant records	km	M	Per trip	100%	Electronic	-
3. TEF	IPCC	IPCC	kgCO ₂ /kg of	E	Annually	100%	Electronic	-

This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.



			fuel					
4. Q_{add}	Quantity of additive emission transported.	Plant records	tonnes of additive/vehicle	M	Per trip	100%	Electronic	-
5. $ELE_{conveyor_ADD}$	Electricity consumption for conveyor system for additives	Plant records	MWh	M	Monthly	100%	Electronic	-
6. EF_{grid}	Grid emissions factor	National grid/plant data	tonnes of CO_2 /MWh	C	Annually	100%	Electronic	-
7. α_y	Percentage of additives that are not surplus	Plant records	tonnes of additives	M/C	Annually	100%	Electronic	-
8. $A_{blend,y}^{\dagger}$	Baseline benchmark share of blast furnace slag per tonne of BC updated for year y	Plant records	tonne of slag/tonne of blended cement	C	Annually	100%	Electronic	-
9. $P_{blend,y}^{\dagger}$	Share of blast furnace slag per tonne of BC in year y	Plant records	tonne of slag/tonne of blended cement	C	Annually	100%	Electronic	-

\dagger - Note: The revised methodology ACM0005-Version 2 requires that $B_{blend,y}$ (ID#29) is replaced by $A_{blend,y}$ (ID#29'). This is maintained in ACM0005-Version 3. However, $B_{blend,y}$ cannot be eliminated from monitoring because this parameter is necessary for baseline emissions calculations, see ACM0005-Version 3-Page 5-Equation 1. Additionally, $A_{blend,y}$ should be identified under Table D.2.3.1, because this parameter is used for the calculation of leakage and not baseline emissions. See ACM0005-Version 3-Page 7-Equation 2.1.

D.2.3.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Please, refer to section Section B.2.

D.2.4. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

Please, refer to section Section B.2.

D.3. Quality control (QC) and quality assurance (QA) procedures are being undertaken for data monitored

This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.



Data (Indicate table and ID number e.g. 3.-1.; 3.2.)	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Table D.2.1.1 – ID numbers 1-33	Low-Medium	These data will be collected as part of normal plant level operations. QA/QC requirements consist of cross-checking these with other internal company reports. Local data and where applicable IPCC data will be used. Independent agency verification will also be used.
Table D.2.1.3 – ID numbers 1-30	Low-Medium	These data will be collected as part of normal plant level operations. QA/QC requirements consist of cross-checking these with other internal company reports. Local data and where applicable IPCC data will be used. Independent agency verification will also be used.
Table D.2.3.1 – ID numbers 1-7	Low	Round trip distance will be cross-checked with evidence of origin and map references. Truck capacity and fuel consumption data will originate from vehicle manufacturers and transporters.

D.4 Please describe the operational and management structure that the project operator will implement in order to monitor emission reductions and any leakage effects, generated by the project activity

Project operator and manager is Votorantim Cimentos S.A.. The company has maintenance and operations procedures, which include the monitoring of process variables, instruments calibration and quality control, according to company policies, engineering best practices, ISO9000 and ISO14000 certification. For this reason, no major changes in monitoring and QA/QC procedures will be required for the CDM project activity related variables and parameters.

During the implementation of the project activity, special training was required for the operation of the new dryer of slag. The new mills use the same procedures of the previous mills. New routines had to be established for the quality control of slag, they were included in the QA/QC procedures for raw materials and products. The logistics of slag did not involve a new procedure/training but resulted in new activities with transport, supply chain, logistics suppliers, storage and movement of slag inside the sites. Relevant procedures are available at the project sites, which copies were provided to the validator.

All data necessary for the monitoring of the project activity is normally monitored as part of plants operations. Therefore, there are several existing reports from which the information will be obtained, depending on the area involved. Production data is obtained from the electronic control system that automatically monitors and control plant operations. The data is kept electronically in the system, with back up available. Monthly reports are produced from these data. Transport data is obtained from the transport suppliers that transport slag.



The calculation of emissions reductions is made through a Microsoft Excel spreadsheet, which contains formulae in accordance with the methodology. The data obtained from the consolidated reports shall be introduced in the spreadsheet and emissions reductions will be calculated automatically.

All monitored data related with the project activity will be stored until two years after the end of the crediting period.



D.5 Name of person/entity determining the monitoring methodology:

Date of baseline completion: 21/07/2006.

Contact information:

Company: Ecoinvest Carbon
Street: Rua Padre João Manoel, 222
City: São Paulo
State: SP
Postal code: 01411-000
Country: Brazil

Mr. Rodrigo Marcelo Leme
rodrigo.leme@ecoinvestcarbon.com

Phone: +55 11 3063-9068
Fax: +55 11 3063-9069

**SECTION E. Estimation of GHG emissions by sources****E.1. Estimate of GHG emissions by sources:**

Detailed estimate of project emissions is presented in Annex 3.

E.2. Estimated leakage:

Detailed estimate of leakage is presented in Annex 3.

E.3. The sum of E.1 and E.2 representing the project activity emissions:

Detailed estimate of project emissions is presented in Annex 3.

E.4. Estimated anthropogenic emissions by sources of greenhouse gases of the baseline:

Detailed estimate of baseline emissions is presented in Annex 3.

E.5. Difference between E.4 and E.3 representing the emission reductions of the project activity:

Detailed estimate of emissions reductions is presented in Annex 3.

E.6. Table providing values obtained when applying formulae above:

Year	Estimation of project activity emissions [tCO ₂]*	Estimation of baseline emissions [tCO ₂]	Estimation of leakage emissions [tCO ₂]	Estimation of emissions reductions [tCO ₂]**
2001	2,902,033	3,085,286	1,309	184,562
2002	2,905,350	3,188,102	-4,588	278,164
2003	2,456,177	2,796,172	-2,801	337,193
2004	2,208,163	2,499,583	-3,815	287,605
2005	2,195,687	2,455,543	-3,417	256,439
2006	2,193,335	2,406,450	-3,026	210,090
2007	2,191,153	2,358,340	-2,643	164,543
Total	17,051,897	18,789,476	-18,981	1,718,597

* Project emissions (PE) include emissions for drying additional blast furnace slag used in the project activity.

** According to equation (4), differently from normal practice in CDM methodologies, leakage is summed and not subtracted from baseline emissions: $ER = BE - PE + LE$. Individual units of the project activity have negative ERs in specific years (SH in 2001 and IM in 2004, 2005, 2006 and 2007). Nevertheless as a whole the emission reductions of the project activity are never negative. For that reason there is no need to compensate emissions in subsequent years. Negative emission reductions from individual units are abated in the year they occur.

**Volta Redonda**

VR	2001	2002	2003	2004	2005	2006	2007
PE (tCO ₂)	100,004	99,147	86,791	85,195	85,027	84,832	84,642
BE (tCO ₂)	111,434	114,335	102,127	102,426	100,379	98,373	96,406
LE (tCO ₂)	9	-2	0	-7	-5	-4	-3
ER (tCO ₂)	11,438	15,186	15,337	17,224	15,347	13,536	11,762

Cubatão

CUB	2001	2002	2003	2004	2005	2006	2007
PE (tCO ₂)	90,913	90,134	78,901	77,450	77,297	77,120	76,947
BE (tCO ₂)	101,303	103,941	92,843	93,115	91,254	89,430	87,642
LE (tCO ₂)	8	-2	0	-6	-5	-4	-3
ER (tCO ₂)	10,399	13,805	13,943	15,658	13,952	12,306	10,692

Itaú de Minas

IM	2001	2002	2003	2004	2005	2006	2007
PE (tCO ₂)	612,554	987,186	872,648	631,537	620,932	620,807	620,807
BE (tCO ₂)	652,212	1,031,733	902,176	629,930	623,269	610,809	598,598
LE (tCO ₂)	19	21	16	11	12	13	14
ER (tCO ₂)	39,677	44,568	29,543	-1,597	2,349	-9,985	-22,195

Rio Negro

RN	2001	2002	2003	2004	2005	2006	2007
PE (tCO ₂)	345,547	268,732	161,115	192,656	192,439	192,217	191,999
BE (tCO ₂)	399,576	301,148	204,149	205,132	201,029	197,008	193,068
LE (tCO ₂)	1	0	0	-1	0	0	0
ER (tCO ₂)	54,030	32,416	43,033	12,475	8,590	4,792	1,069

Santa Helena

SH	2001	2002	2003	2004	2005	2006	2007
PE (tCO ₂)	715,654	476,401	395,522	348,159	347,755	347,193	346,642
BE (tCO ₂)	707,742	494,951	474,821	445,942	437,027	428,292	419,730
LE (tCO ₂)	-548	-4,103	-2,911	-2,440	-2,308	-2,180	-2,054
ER (tCO ₂)	-8,460	14,448	76,388	95,343	86,964	78,918	71,034

Salto de Pirapora

SAL	2001	2002	2003	2004	2005	2006	2007
PE (tCO ₂)	1,037,361	983,751	861,200	873,165	872,236	871,165	870,115
BE (tCO ₂)	1,113,019	1,141,993	1,020,056	1,023,039	1,002,585	982,539	962,895
LE (tCO ₂)	1,820	-501	92	-1,373	-1,110	-851	-599
ER (tCO ₂)	77,478	157,742	158,949	148,501	129,239	110,523	92,181

Total ER (tCO₂)	184,562	278,164	337,193	287,605	256,439	210,090	164,543
-----------------------------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------

**SECTION F. Environmental impacts****F.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

The project activity was implemented in six cement plants located in three different states. Each one of the plants has its own environmental license issued by the corresponding State environmental agency. For all cases, no special requirements, as well as no environmental impact assessments (EIA/RIMA), were requested by the environmental agencies. This is evidence that significant environmental impacts were not resultant from the project activity. The environmental licenses are available at the project sites. Copies were provided to the validator.

Regarding environmental impacts, the monitoring of environmental impacts of the project activity is made according to the requirements of the environmental agency in each State. However, as the project activity does not result in significant environmental impacts, the Agencies did not require any special or continuous monitoring. When requested by the environmental agencies, monitoring is provided. Two evidences support this fact:

- The State environmental agencies did not require the EIA/RIMA (Environmental Impact Assessment and Report) in the environmental licensing process.
- The State environmental agencies issued the environmental licenses without special requirements regarding environmental impacts mitigation and monitoring.

In addition:

- The verification of project atmospheric emissions, wastewater generation and solid residues final disposal was approved by the environmental agency as of the issuance of the license.
- Emergency plans and safety programs were developed and implemented, in accordance with Votorantim current practices and environmental legislation.

Regarding sustainable development indicators, Votorantim Cimentos has a corporate environmental performance indicator that measures the evolution of several environmental aspects in the operations of the plants, including those ones affected by the project activity.

The environmental performance indicator is called IDA (*Indicador de Desempenho Ambiental*). It encompasses energy use, water use, raw material substitution, co-processing and co-firing of alternative materials and fuels among others.

F.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:

No significant environmental impacts are due to the project activity.

**SECTION G. Stakeholders' comments****G.1. Brief description how comments by local stakeholders have been invited and compiled:**

The Brazilian Designated National Authority for the CDM requires the compulsory invitation of selected stakeholders to comment the PDD sent to validation in order to provide the letter of approval. Votorantim and Ecoinvest invited the comments from local stakeholders when validation started.

The invited local stakeholders are listed below:

- City Hall (for each city)
- Câmara de Vereadores (for each city)
- State Environmental Agency (for each state)
- Local Environmental Agency (for each city)
- Local ONG (for each city)
- State Public Attorney
- FBOMS (Representative of Brazilian Environmental ONGs)

Copies of the invitation letters and receipts (AR – *Avisos de Recebimento*) are available with project proponents.

G.2. Summary of the comments received:

So far, no comments were received from local stakeholders.

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

So far, no comments were received from local stakeholders.

Annex 1**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	Votorantim Cimentos S/A
Street/P.O.Box:	Rodovia dos Minérios, 1303
Building:	
City:	Curitiba
State/Region:	Paraná
Postfix/ZIP:	
Country:	Brazil
Telephone:	+55 41 3355 1165
FAX:	
E-Mail:	patricia.montenegro@votoran.com.br
URL:	
Represented by:	
Title:	
Salutation:	Ms.
Last Name:	Montenegro
Middle Name:	Monteiro
First Name:	Patrícia
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	



Organization:	Ecoinvest Carbon
Street/P.O.Box:	Rua Padre João Manoel, 222
Building:	
City:	São Paulo
State/Region:	SP
Postfix/ZIP:	01411-000
Country:	Brazil
Telephone:	+55 11 3063 9068
FAX:	+55 11 3063 9069
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	Mr.
Last Name:	Martins Junior
Middle Name:	de Mathias
First Name:	Carlos
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	cmm@ecoinvestcarbon.com



Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in the project activity.



Annex 3

BASELINE INFORMATION

In this annex the consolidated data for the six plants is presented.

All data is estimated and need to be verified after registration.

The benchmark analysis for B_{blend} determination and grid electricity emission factor is also presented.

**Benchmark Analysis – Top 20%**

Type of Portland cement		Composition (mass %)			Total Brazilian Production (tonnes)
		Clinker	Cypsum	Additives	2000
Ordinary	CP I	0.97	0.03	0.00	485,697
	CP I - S	0.96	0.03	0.01	
Blended	CP II - E	0.91	0.03	0.06	31,528,226
	CP II - Z	0.91	0.03	0.06	
	CP II - F	0.91	0.03	0.06	
Blast Furnace	CP III	0.62	0.03	0.35	2,636,005
Pozzolanic	CP IV	0.82	0.03	0.15	2,289,204
High Initial Resistance	CP V - ARI	0.97	0.03	0.00	2,600,022
Structural White Cement	CP B	0.97	0.03	0.00	19,573
Non structural White Cement	CP B	0.71	0.03	0.26	

Total production of cement types CP I, CP II and CP III in the region

tonnes 34,649,928

20% of total production in the region

tonnes 6,929,986

Top 20% - higher blends

CP III tonnes 2,636,005

CP II tonnes 4,293,981

CP I tonnes 0

Benchmark

t(clinker)/t(BC) 0.7997

**Benchmark Analysis – 5 Highest**

	Blend (mass clinker/mass cement)
CP II E	0.91
CP III	0.62

	Blended Cement Type	Blend Cement Brand	Manufacturer	Production (tonnes)
5 highest blend cement brands	CP II E	VOTORAN CP II E	VOTORANTIM	3,761,922
	CP II E	TUPI CP II E	CP CIMENTO	1,168,468
	CP II E	LIZ CP II E	SOEICOM	1,148,390
	CP III	CAUÊ CP III	CCC	998,010
	CP II E	CIMINAS CP II E	HOLCIM	993,667
	CP II E	CAMPEÃO, MONTES CLAROS CP II E	LAFARGE	741,455
	CP II E	RIBEIRÃO CP II E	CP CIMENTO	685,362
	CP II E	NASSAU CP II E	NASSAU	668,662
	CP III	VOTORAN CP III	VOTORANTIM	663,110
	CP II E	BARROSO CP II E	HOLCIM	658,654
	CP III	NASSAU CP III	NASSAU	599,940
	CP II E	ALVORADA CP II E	HOLCIM	519,849
	CP I	VOTORAN CP I	VOTORANTIM	378,127
	CP II E	ITAU CP II E	VOTORANTIM	348,948
	CP II E	BONFIM CP II E	CIMPOR	275,864
	CP III	BARROSO CP III	HOLCIM	228,776
	CP II E	CAMPEÃO CP II E	LAFARGE	167,874
	CP III	TUPI CP III	CP CIMENTO	165,116
	CP II E	MAUÁ, CAMPEÃO CP II E	LAFARGE	136,809
	CP III	PARAÍSO CP III	HOLCIM	130,182
	CP III	CIPLAN CP III	CIPLAN	79,306
	CP I	NASSAU CP I	NASSAU	59,489
	CP III	CAMPEÃO, MONTES CLAROS CP III	LAFARGE	49,836
	CP III	ITAU CP III	VOTORANTIM	46,512

Clinker (tonnes)	Benchmark (mass clinker/mass cement)
3,423,349 1,063,306 1,045,035 618,766 904,237	0.87

Grid Electricity Emission Factor

Prepared by Ecoinvest, Econergy and Ecosecurities

Source: Operador Nacional do Sistema Elétrico, Centro Nacional de Operação do Sistema, Acompanhamento Diário da Operação do SIN,
(daily reports from Jan. 1, 2002 to Dec. 31, 2004).

Emission factors for the Brazilian South-Southeast-Midwest interconnected grid				
Baseline (including imports)	EF_{OM} [tCO ₂ /MWh]	Load [MWh]	LCMR [GWh]	Imports [MWh]
2002	0.8548	275,402,896	258,720	1,607,395
2003	0.9421	288,493,929	274,649	459,586
2004	0.8763	297,879,874	284,748	1,468,275
	Total (2001-2003) =	861,776,699	818,117	3,535,256
	$EF_{OM, simple-adjusted}$ [tCO ₂ /MWh]	$EF_{BM, 2004}$	Lambda	
	0.4332	0.0962	λ_{2002}	
	Alternative weights	Default weights	0.5053	
	$w_{OM} = 0.75$	$w_{OM} = 0.5$	λ_{2003}	
	$w_{BM} = 0.25$	$w_{BM} = 0.5$	0.5312	
	EF_{CM} [tCO ₂ /MWh]	Default EF_{OM} [tCO ₂ /MWh]	λ_{2004}	
	0.3489	0.2647	0.5041	

Complete database for grid electricity emissions, including plants, fuels and generation, is available with project participants.

**SAL – Monitored data**

Plant: SAL	Blended Cement Type: CP II E, CP III											
			BASELINE			PROJECT ACTIVITY - FIRST CREDITING PERIOD						
Monitoring Data	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CLNK _{BSL} and CLNK _y	Production of clinker	kt	1,308.26	1,249.35	1,349.01	1,123.08	1,144.94	988.27	961.12	961.12	961.12	961.12
BC _{BSL} and BC _y	Production of blended cement	kt	1,818.33	1,818.33	1,847.10	2,004.68	2,098.83	1,912.97	1,957.71	1,957.71	1,957.71	1,957.71
ADD _{BSL} and ADD _y	Consumption of additives	kt	182.60	182.60	261.00	483.35	761.08	667.17	846.39	846.39	846.39	846.39
x	Quantity of additives that are not surplus	kt				0	0	0	0	0	0	0
InCaO and InCaO _y	Quantity of CaO in the raw material	t				86,910.85	88,765.81	78,868.10	72,305.87	72,305.87	72,305.87	72,305.87
	CaO content of the raw material	%				41.65	41.80	41.75	41.61	41.94	41.94	41.94
	Quantity of raw material	t				326,370.00	207,920.70	212,612.71	189,541.21	172,403.12	172,403.12	172,403.12
OutCaO and OutCaO _y	Quantity of CaO in the clinker	t				863,635.56	726,410.08	727,377.21	632,791.84	613,965.68	613,965.68	613,965.68
	CaO content of the clinker	%				64.02	64.68	63.53	64.03	63.88	63.88	63.88
InMgO and InMgO _y	Quantity of MgO in the raw material	t				7,669.70	5,031.68	4,996.40	4,681.67	4,103.19	4,103.19	4,103.19
	MgO content of the raw material	%				2.35	2.42	2.35	2.47	2.38	2.38	2.38
	Quantity of raw material	t				326,370.00	207,920.70	212,612.71	189,541.21	172,403.12	172,403.12	172,403.12
OutMgO and OutMgO _y	Quantity of MgO in the clinker	t				46,136.11	40,318.68	35,950.96	34,490.76	32,870.42	32,870.42	32,870.42
	MgO content of the clinker	%				3.42	3.59	3.14	3.49	3.42	3.42	3.42
FF _{1,BSL} and FF _{1,y}	Consumption of fossil fuel for clinker production											
FF _{1,BSL} and FF _{1,y}	Coke	t				137,990.12	137,057.44	123,908.45	108,580.54	114,580.03	114580.0313	114580.0313
FF _{2,BSL} and FF _{2,y}	Fuel Oil	t				4,806.60	1,844.00	940.75	704.99	611.40	611.395	611.395
---	---	---				---	---	---	---	---	---	---
BELE _{grid,CLNK} and PELE _{grid,CLNK,y}	Consumption of grid electricity for clinker production	MWh				364.86	378.44	372.91	373.85	394.73	394.73	394.73
BELE _{self,CLNK} and PELE _{self,CLNK,y}	Consumption of self generated electricity for clinker production	MWh				0	0	0	0	0	0	0
BELE _{grid,BC} and PELE _{grid,BC,y}	Consumption of grid electricity for grinding BC	MWh				1,144.02	1,307.87	1,751.69	1,726.19	2,374.29	2,374.29	2,374.29
BELE _{self,BC} and PELE _{self,BC,y}	Consumption of self generated electricity for grinding BC	MWh				0	0	0	0	0	0	0
BELE _{grid,ADD} and PELE _{grid,ADD,y}	Consumption of grid electricity for grinding additives	MWh				0	0	0	0	0	0	0
BELE _{self,ADD} and PELE _{self,ADD,y}	Consumption of self generated electricity for grinding additives	MWh				0	0	0	0	0	0	0
TF _{cons}	Fuel consumption in transportation											
	CUB/SAL	kg/km				0.46	0.46	0.46	0.46	0.46	0.46	0.46
	VR/SAL	kg/km				0.43	0.43	0.43	0.43	0.43	0.43	0.43
	SH/SAL	kg/km				1.85	1.85	1.85	1.85	1.85	1.85	1.85
D _{add,source}	Distance between source of additive and project plant											
	CUB/SAL	km				200	200	200	200	200	200	200
	VR/SAL	km				434	434	434	434	434	434	434
	SH/SAL	km				10	10	10	10	10	10	10
ELE _{conveyor,ADD}	Electricity consumption for additives transportation	MWh				0	0	0	0	0	0	0
Q _{add}	Quantity of additives											
	CUB/SAL	t				27	27	27	27	27	27	27
	VR/SAL	t				27	27	27	27	27	27	27
	SH/SAL	t				27	27	27	27	27	27	27
F _{ij}	Consumption of fossil fuel for self generation of electricity	t				0	0	0	0	0	0	0
GEN _j	Self generation of electricity	MWh				0	0	0	0	0	0	0

**SAL – Emission factors and project emissions**

Fixed parameter	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.785	Stoichiometric emission factor for CaO	tCO ₂ /t(CaO)			0.7850	0.7850	0.7850	0.7850	0.7850	0.7850	0.7850	0.7850
1.092	Stoichiometric emission factor for MgO	tCO ₂ /t(MgO)			1.0920	1.0920	1.0920	1.0920	1.0920	1.0920	1.0920	1.0920
EF _{C1}	Carbon emission factor for coke	tC/TJ			27.5000	27.5000	27.5000	27.5000	27.5000	27.5000	27.5000	27.5000
EF _{C2}	Carbon emission factor for fuel oil	tC/TJ			21.1000	21.1000	21.1000	21.1000	21.1000	21.1000	21.1000	21.1000
EF _{C3}	Carbon emission factor for diesel	tC/TJ			20.2000	20.2000	20.2000	20.2000	20.2000	20.2000	20.2000	20.2000
NCV ₁	Net calorific value for coke	TJ/t			0.0351	0.0351	0.0351	0.0351	0.0351	0.0351	0.0351	0.0351
NCV ₂	Net calorific value for fuel oil	TJ/t			0.0402	0.0402	0.0402	0.0402	0.0402	0.0402	0.0402	0.0402
NCV ₃	Net calorific value for diesel	TJ/t			0.0423	0.0423	0.0423	0.0423	0.0423	0.0423	0.0423	0.0423
OXID ₁	Oxidation factor of coke	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900
OXID ₂	Oxidation factor of fuel oil	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900
OXID ₃	Oxidation factor of diesel	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900

	Calculated data												
Eq.	Emission factors	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
ACM2	EF _{grid_BSL} and EF _{grid_Y}	Grid electricity emission factor (calculated per ACM0002)	tCO2/MWh			0.2647	0.2647	0.2647	0.2647	0.2647	0.2647	0.2647	0.2647
6	EF _{fg_BSL} and EF _{fg_Y}	Self generated electricity emission factor	tCO2/MWh			0	0	0	0	0	0	0	0
7	EFF ₁	CO ₂ emission factor for coke	tCO2/t(coke)			3.5066	3.5066	3.5066	3.5066	3.5066	3.5066	3.5066	3.5066
7	EFF ₂	CO ₂ emission factor for fuel oil	tCO2/t(fuel oil)			3.0753	3.0753	3.0753	3.0753	3.0753	3.0753	3.0753	3.0753
7	TEF	Transport fuel (diesel) CO ₂ emission factor	kgCO2/kg(diesel)			3.1007	3.1007	3.1007	3.1007	3.1007	3.1007	3.1007	3.1007

Calculated data													
Eq.	Project Emissions	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5.2.1	PE _{gh_grid,BC}	Project grid electricity emissions for BC grinding	tCO ₂ /t(BC)				0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003
5.2.2	PE _{gh_fg,BC,y}	Project self generated electricity emissions for BC grinding	tCO ₂ /t(BC)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.2.3	PE _{gh_grid,ADD,y}	Project grid electricity emissions for additives preparation	tCO ₂ /t(BC)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.2.4	PE _{gh_fg,ADD,y}	Project self generated electricity emissions for additives preparation	tCO ₂ /t(BC)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.2	PE _{gh_ADD,BC,y}	Project electricity emissions for BC grinding and preparation of additives	tCO ₂ /t(BC)				0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003
5.1.1	PE _{clinker,y}	Project emissions due to calcination	tCO ₂ /t(clinker)				0.4813	0.4674	0.4729	0.4751	0.4751	0.4751	0.4751
5.1.2	PE _{fuel_fuel,y}	Project emissions due to fossil fuel combustion for clinker production	tCO ₂ /t(clinker)				0.4330	0.3820	0.3875	0.4200	0.4200	0.4200	0.4200
5.1.3	PE _{gh_grid,CLINK,y}	Project emissions from grid electricity for clinker production	tCO ₂ /t(clinker)				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
5.1.4	PE _{gh_fg,CLINK,y}	Project emissions from self generated electricity for clinker production	tCO ₂ /t(clinker)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.1	PE _{clinker,y}	Project emissions per tonne of clinker	tCO ₂ /t(clinker)				0.9144	0.8495	0.8605	0.8952	0.8952	0.8952	0.8952
2.1	F _{blend,y}	Project share of clinker per tonne of BC	t(clinker)/t(BC)				0.5602	0.5455	0.5166	0.4909	0.4909	0.4909	0.4909
5	PE _{BC,y}	Project emission per tonne of blended cement	tCO ₂ /t(BC)				0.5124	0.4636	0.4448	0.4398	0.4398	0.4398	0.4398

**SAL – Baseline emissions, leakage and emission reductions**

Calculated data		Description	Unit										
Eq.	Baseline Emissions			1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1.2.1	BE _{elec_grid_BC}	Baseline grid electricity emissions for BC grinding	tCO ₂ /t(BC)			0.0002							
1.2.2	BE _{elec_sg_BC}	Baseline self generated electricity emissions for BC grinding	tCO ₂ /t(BC)			0.0000							
1.2.3	BE _{elec_grid_ADD}	Baseline grid electricity emissions for additives preparation	tCO ₂ /t(BC)			0.0000							
1.2.4	BE _{elec_sg_ADD}	Baseline self generated electricity emissions for additives preparation	tCO ₂ /t(BC)			0.0000							
1.2	BE _{elec_ADD_BC}	Baseline electricity emissions for BC grinding and preparation of additives	tCO ₂ /t(BC)			0.0002							
1.1.1	BE _{calc}	Baseline emissions due to calcination	tCO ₂ /t(clinker)			0.4546							
1.1.2	BE _{fuel_fed}	Baseline emissions due to fossil fuel combustion for clinker production	tCO ₂ /t(clinker)			0.3696							
1.1.3	BE _{elec_grid_CLNK}	Baseline emissions from grid electricity for clinker production	tCO ₂ /t(clinker)			0.0001							
1.1.4	BE _{elec_sg_CLNK}	Baseline emissions from self generated electricity for clinker production	tCO ₂ /t(clinker)			0.0000							
1.1		Baseline emissions per tonne of clinker (calculated per 1.1)	tCO ₂ /t(clinker)			0.8243							
page 8	BE _{clinker}	Baseline emissions per tonne of clinker (determined ex-post from comparison with PE _{clinker,y})	tCO ₂ /t(clinker)				0.8243	0.8243	0.8243	0.8243	0.8243	0.8243	0.8243
page 3		Baseline share of clinker per tonne of BC (market top 20%)	t(clinker)/t(BC)			0.7997							
page 3		Baseline share of clinker per tonne of BC (market 5 highest brands)	t(clinker)/t(BC)			0.8741							
page 3		Baseline share of clinker per tonne of BC (plant baseline)	t(clinker)/t(BC)	0.7195	0.6871	0.7303							
page 3	B _{blend,y}	Baseline share of clinker per tonne of BC (lowest between market and plant)	t(clinker)/t(BC)				0.6733	0.6599	0.6467	0.6337	0.6211	0.6087	0.5965
1	BE _{BC,y}	Baseline emission per tonne of blended cement	tCO ₂ /t(BC)				0.5552	0.5441	0.5332	0.5226	0.5121	0.5019	0.4918

Calculated data													
Eq.	Leakage	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
2	L _{add, trans}	Transport related emissions	tCO2/t(additive)				0.0106	0.0106	0.0106	0.0106	0.0106	0.0106	0.0106
page 7	A _{blend,y}	Baseline benchmark share of additives updated for year y	t(additive)/t(BC)				0.3267	0.3401	0.3533	0.3663	0.3789	0.3913	0.4035
page 7	P _{blend,y}	Share of additives per tonne of BC in year y	t(additive)/t(BC)				0.2411	0.3626	0.3488	0.4323	0.4323	0.4323	0.4323
2.1	L _y	Leakage for transport of additives	tCO2				1,819.66	-501.11	92.50	-1,372.85	-1,109.54	-851.50	-598.62
3	α _y	Proportion of additives that is not surplus	-				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

	Calculated data												
Eq.	Emission Reductions	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
4		Emission reductions (calculated from equation 4)	tCO ₂				77,478	157,742	158,949	148,501	129,239	110,523	92,181

**SH – Monitored data**

Plant: SH		Blended Cement Type: CP II E, CP III					BASELINE			PROJECT ACTIVITY - FIRST CREDITING PERIOD						
Monitoring Data		Description		Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007		
CLNK _{BSL} and CLNK _y		Production of clinker		kt	1,784.48	1,748.33	1,556.31	922.10	514.93	414.86	362.41	362.41	362.41	362.41		
BC _{BSL} and BC _y		Production of blended cement		kt	2,141.38	2,098.00	1,886.22	1,318.11	940.61	920.76	882.39	882.39	882.39	882.39		
ADD _{BSL} and ADD _y		Consumption of additives		kt	339.48	339.48	339.48	339.48	625.20	516.48	473.55	473.55	473.55	473.55		
x		Quantity of additives that are not surplus		kt				0	0	0	0	0	0	0		
InCaO and InCaO _y		Quantity of CaO in the raw material		t				68.08	38.11	30.53	26.98	26.98	26.98	26.98		
		CaO content of the raw material		%				41.02	41.12	40.89	41.35	41.35	41.35	41.35		
		Quantity of raw material		t				165.98	92.69	74.67	65.23	65.23	65.23	65.23		
OutCaO and OutCaO _y		Quantity of CaO in the clinker		t				587,191.14	328,270.54	264,732.04	230,088.95	230,088.95	230,088.95	230,088.95		
		CaO content of the clinker		%				63.75	63.68	63.75	63.81	63.49	63.49	63.49		
								9.86	5.61	3.01	2.55	2.13	2.13	2.13		
InMgO and InMgO _y		Quantity of MgO in the raw material		t				3.38	3.25	3.42	3.27	3.27	3.27	3.27		
		MgO content of the raw material		%				280.14	165.98	92.69	74.67	65.23	65.23	65.23		
		Quantity of raw material		t				78,126.91	43,799.59	24,974.31	19,191.54	17,779.63	17,779.63	17,779.63		
OutMgO and OutMgO _y		Quantity of MgO in the clinker		t				5.02	4.75	4.85	4.63	4.91	4.91	4.91		
		MgO content of the clinker		%												
FF _{1BSL} and FF _{1y}		Consumption of fossil fuel for clinker production														
		FF _{1BSL} and FF _{1y}		Coke	t				57,295.67	57,295.67	51,697.17	44,081.86	38,488.28	38,488.28	38,488.28	
		FF _{2BSL} and FF _{2y}		Fuel Oil	t				214.00	214.00	214.00	115.00	125.00	125.00	125.00	
...			
BELE _{grid,CLNK} and PELE _{grid,CLNK,y}		Consumption of grid electricity for clinker production		MWh				560.27	331.95	185.38	149.35	130.47	130.47	130.47		
BELE _{self,CLNK} and PELE _{self,CLNK,y}		Consumption of self generated electricity for clinker production		MWh				0	0	0	0	0	0	0		
BELE _{grid,BC} and PELE _{grid,BC,y}		Consumption of grid electricity for grinding BC		MWh				1,848.50	1,291.75	921.79	902.34	864.75	864.75	864.75		
BELE _{self,BC} and PELE _{self,BC,y}		Consumption of self generated electricity for grinding BC		MWh				0	0	0	0	0	0	0		
BELE _{grid,ADD} and PELE _{grid,ADD,y}		Consumption of grid electricity for grinding additives		MWh				0	0	0	0	0	0	0		
BELE _{self,ADD} and PELE _{self,ADD,y}		Consumption of self generated electricity for grinding additives		MWh				0	0	0	0	0	0	0		
TF _{conv}		Fuel consumption in transportation														
				CUB/SH	kg/km				0.46	0.46	0.46	0.46	0.46	0.46		
				VR/SH	kg/km				0.43	0.43	0.43	0.43	0.43	0.43		
				SAL/SH	kg/km				1.85	1.85	1.85	1.85	1.85	1.85		
D _{add,source}		Distance between source of additive and project plant														
				CUB/SH	km				190	190	190	190	190	190		
				VR/SH	km				424	424	424	424	424	424		
				SAL/SH	km				10	10	10	10	10	10		
ELE _{conveyor,ADD}		Electricity consumption for additives transportation		MWh				0	0	0	0	0	0	0		
Q _{add}		Quantity of additives														
				CUB/SH	t				27	27	27	27	27	27		
				VR/SH	t				27	27	27	27	27	27		
				SAL/SH	t				27	27	27	27	27	27		
F _{ij}		Consumption of fossil fuel for self generation of electricity		t				0	0	0	0	0	0	0		
GEN _i		Self generation of electricity		MWh				0	0	0	0	0	0	0		

**SH –Emission factors and project emissions**

Fixed parameter	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.785	Stoichiometric emission factor for CaO	tCO ₂ /t(CaO)			0.7850	0.7850	0.7850	0.7850	0.7850	0.7850	0.7850	0.7850
1.092	Stoichiometric emission factor for MgO	tCO ₂ /t(MgO)			1.0920	1.0920	1.0920	1.0920	1.0920	1.0920	1.0920	1.0920
EF _{C1}	Carbon emission factor for coke	tC/TJ			27.5000	27.5000	27.5000	27.5000	27.5000	27.5000	27.5000	27.5000
EF _{C2}	Carbon emission factor for fuel oil	tC/TJ			21.1000	21.1000	21.1000	21.1000	21.1000	21.1000	21.1000	21.1000
EF _{C3}	Carbon emission factor for diesel	tC/TJ			20.2000	20.2000	20.2000	20.2000	20.2000	20.2000	20.2000	20.2000
NCV ₁	Net calorific value for coke	TJ/t			0.0351	0.0351	0.0351	0.0351	0.0351	0.0351	0.0351	0.0351
NCV ₂	Net calorific value for fuel oil	TJ/t			0.0402	0.0402	0.0402	0.0402	0.0402	0.0402	0.0402	0.0402
NCV ₃	Net calorific value for diesel	TJ/t			0.0423	0.0423	0.0423	0.0423	0.0423	0.0423	0.0423	0.0423
OXID ₁	Oxidation factor of coke	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900
OXID ₂	Oxidation factor of fuel oil	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900
OXID ₃	Oxidation factor of diesel	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900

	Calculated data													
Eq.	Emission factors		Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
ACM2	EF _{grid_BSL} and EF _{grid_Y}		Grid electricity emission factor (calculated per ACM0002)	tCO2/MWh			0.2647	0.2647	0.2647	0.2647	0.2647	0.2647	0.2647	0.2647
6	EF _{fg_BSL} and EF _{fg_Y}		Self generated electricity emission factor	tCO2/MWh			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	EFF ₁		CO ₂ emission factor for coke	tCO2/t(coke)			3.5066	3.5066	3.5066	3.5066	3.5066	3.5066	3.5066	3.5066
7	EFF ₂		CO ₂ emission factor for fuel oil	tCO2/t(fuel oil)			3.0753	3.0753	3.0753	3.0753	3.0753	3.0753	3.0753	3.0753
7	TEF		Transport fuel (diesel) CO ₂ emission factor	kgCO2/kg(diesel)			3.1007	3.1007	3.1007	3.1007	3.1007	3.1007	3.1007	3.1007

Calculated data													
Eq.	Project Emissions	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5.2.1	PE _{gh_grid_BC}	Project grid electricity emissions for BC grinding	tCO ₂ /t(BC)				0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
5.2.2	PE _{gh_sg_BC,y}	Project self generated electricity emissions for BC grinding	tCO ₂ /t(BC)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.2.3	PE _{gh_grid_ADD,y}	Project grid electricity emissions for additives preparation	tCO ₂ /t(BC)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.2.4	PE _{gh_sg_ADD,y}	Project self generated electricity emissions for additives preparation	tCO ₂ /t(BC)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.2	PE _{gh_ADD_BC,y}	Project electricity emissions for BC grinding and preparation of additives	tCO ₂ /t(BC)				0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
5.1.1	PE _{calc,y}	Project emissions due to calcination	tCO ₂ /t(clinker)				0.5517	0.5533	0.5514	0.5519	0.5519	0.5519	0.5519
5.1.2	PE _{comb_fuel,y}	Project emissions due to fossil fuel combustion for clinker production	tCO ₂ /t(clinker)				0.2186	0.3533	0.3735	0.3735	0.3735	0.3735	0.3735
5.1.3	PE _{gh_grid_CLNK,y}	Project emissions from grid electricity for clinker production	tCO ₂ /t(clinker)				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
5.1.4	PE _{gh_sg_CLNK,y}	Project emissions from self generated electricity for clinker production	tCO ₂ /t(clinker)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.1	PE _{clinker,y}	Project emissions per tonne of clinker	tCO ₂ /t(clinker)				0.7704	0.9068	0.9249	0.9254	0.9254	0.9254	0.9254
2.1	P _{Blend,y}	Project share of clinker per tonne of BC	t(clinker)/t(BC)				0.6996	0.5474	0.4506	0.4107	0.4107	0.4107	0.4107
5	PE _{BC,y}	Project emission per tonne of blended cement	tCO ₂ /t(BC)				0.5392	0.4967	0.4170	0.3804	0.3804	0.3804	0.3804

**SH – Baseline emissions, leakage and emission reductions**

Calculated data		Description	Unit										
Eq.	Baseline Emissions			1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1.2.1	BE _{elec_grid_BC}	Baseline grid electricity emissions for BC grinding	tCO ₂ /t(BC)			0.0003							
1.2.2	BE _{elec_sg_BC}	Baseline self generated electricity emissions for BC grinding	tCO ₂ /t(BC)			0.0000							
1.2.3	BE _{elec_grid_ADD}	Baseline grid electricity emissions for additives preparation	tCO ₂ /t(BC)			0.0000							
1.2.4	BE _{elec_sg_ADD}	Baseline self generated electricity emissions for additives preparation	tCO ₂ /t(BC)			0.0000							
1.2	BE _{elec_ADD_BC}	Baseline electricity emissions for BC grinding and preparation of additives	tCO ₂ /t(BC)			0.0003							
1.1.1	BE _{calcin}	Baseline emissions due to calcination	tCO ₂ /t(clinker)			0.5552							
1.1.2	BE _{excl_bnd}	Baseline emissions due to fossil fuel combustion for clinker production	tCO ₂ /t(clinker)			0.1295							
1.1.3	BE _{elec_grid_CLNK}	Baseline emissions from grid electricity for clinker production	tCO ₂ /t(clinker)			0.0001							
1.1.4	BE _{elec_sg_CLNK}	Baseline emissions from self generated electricity for clinker production	tCO ₂ /t(clinker)			0.0000							
1.1		Baseline emissions per tonne of clinker (calculated per 1.1)	tCO ₂ /t(clinker)			0.6848							
page 8	BE _{clinker}	Baseline emissions per tonne of clinker (determined ex-post from comparison with PE _{clinker,y})	tCO ₂ /t(clinker)				0.6848	0.6848	0.6848	0.6848	0.6848	0.6848	0.6848
page 3		Baseline share of clinker per tonne of BC (market top 20%)	t(clinker)/t(BC)			0.7997							
page 3		Baseline share of clinker per tonne of BC (market 5 highest brands)	t(clinker)/t(BC)			0.8741							
page 3		Baseline share of clinker per tonne of BC (plant baseline)	t(clinker)/t(BC)	0.8333	0.8333	0.8251							
page 3	B _{blend,y}	Baseline share of clinker per tonne of BC (lowest between market and plant)	t(clinker)/t(BC)				0.7837	0.7680	0.7527	0.7376	0.7229	0.7084	0.6942
1	BE _{BC,y}	Baseline emission per tonne of blended cement	tCO ₂ /t(BC)				0.5369	0.5262	0.5157	0.5054	0.4953	0.4854	0.4757

Calculated data													
Eq.	Leakage	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
2	L _{add_trans}	Transport related emissions	tCO2/t(additive)				0.0101	0.0101	0.0101	0.0101	0.0101	0.0101	0.0101
page 7	A _{blend,y}	Baseline benchmark share of additives updated for year y	t(additive)/t(BC)				0.2163	0.2320	0.2473	0.2624	0.2771	0.2916	0.3058
page 7	P _{blend,y}	Share of additives per tonne of BC in year y	t(additive)/t(BC)				0.2575	0.6647	0.5609	0.5367	0.5367	0.5367	0.5367
2.1	L _y	Leakage for transport of additives	tCO2				-548.04	-4,102.86	-2,910.72	-2,439.68	-2,308.46	-2,179.86	-2,053.83
3	α _y	Proportion of additives that is not surplus	-				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

Calculated data													
Eq.	Emission Reductions	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
4		Emission reductions (calculated from equation 4)	tCO ₂				-8,460	14,448	76,388	95,343	86,964	78,918	71,034

**RN – Monitored data**

Plant: RN	Blended Cement Type: CP II E, CP III											
			BASELINE			PROJECT ACTIVITY - FIRST CREDITING PERIOD						
Monitoring Data	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CLNK _{BSL} and CLNK _y	Production of clinker	kt	640.76	694.11	549.99	397.44	314.83	180.15	240.57	240.57	240.57	240.57
BC _{BSL} and BC _y	Production of blended cement	kt	727.33	807.87	706.94	620.68	477.34	330.19	358.29	358.29	358.29	358.29
ADD _{BSL} and ADD _y	Consumption of additives	kt	53.25	61.00	74.01	131.65	116.45	90.22	110.19	110.19	110.19	110.19
x	Quantity of additives that are not surplus	kt				0	0	0	0	0	0	0
InCaO and InCaO _y	Quantity of CaO in the raw material	t				112.74	114.74	112.25	112.82	112.82	112.82	112.82
	CaO content of the raw material	%				43.92	44.70	43.73	43.95	43.95	43.95	43.95
	Quantity of raw material	t				256.70	256.70	256.70	256.70	256.70	256.70	256.70
OutCaO and OutCaO _y	Quantity of CaO in the clinker	t				261,159.80	208,073.13	118,106.34	158,750.82	158,750.82	158,750.82	158,750.82
	CaO content of the clinker	%				65.71	66.09	65.56	65.99	65.99	65.99	65.99
InMgO and InMgO _y	Quantity of MgO in the raw material	t				3.16	3.05	3.21	3.44	3.44	3.44	3.44
	MgO content of the raw material	%				1.23	1.19	1.25	1.34	1.34	1.34	1.34
	Quantity of raw material	t				256.70	256.70	256.70	256.70	256.70	256.70	256.70
OutMgO and OutMgO _y	Quantity of MgO in the clinker	t				5,365.48	4,092.83	2,558.13	3,608.52	3,608.52	3,608.52	3,608.52
	MgO content of the clinker	%				1.35	1.30	1.42	1.50	1.50	1.50	1.50
FF _{1,BSL} and FF _{1,y} FF _{1,BSL} and FF _{1,y} FF _{2,BSL} and FF _{2,y} ...	Consumption of fossil fuel for clinker production											
	Coke	t				37,297.20	28,277.00	18,005.00	18,100.00	18,100.00	18,100.00	18,100.00
	Fuel Oil	t				197.32	0.00	0.00	0.00	0.00	0.00	0.00
	...	t			
BELE _{grid,CLNK} and PELE _{grid,CLNK,y}	Consumption of grid electricity for clinker production	MWh				1.41	1.44	0.81	1.72			
BELE _{self,CLNK} and PELE _{self,CLNK,y}	Consumption of self generated electricity for clinker production	MWh				0	0	0	0	0	0	0
BELE _{grid,BC} and PELE _{grid,BC,y}	Consumption of grid electricity for grinding BC	MWh				2.36	1.83	1.31	1.41			
BELE _{self,BC} and PELE _{self,BC,y}	Consumption of self generated electricity for grinding BC	MWh				0	0	0	0	0	0	0
BELE _{grid,ADD} and PELE _{grid,ADD,y}	Consumption of grid electricity for grinding additives	MWh				0	0	0	0	0	0	0
BELE _{self,ADD} and PELE _{self,ADD,y}	Consumption of self generated electricity for grinding additives	MWh				0	0	0	0	0	0	0
TF _{cons}	Fuel consumption in transportation											
		kg/km				0.38	0.38	0.38	0.38	0.38	0.38	0.38
	---	kg/km				---	---	---	---	---	---	---
D _{add,source}	Distance between source of additive and project plant											
		km				1.2	1.2	1.2	1.2	1.2	1.2	1.2
	---	km				---	---	---	---	---	---	---
		km				---	---	---	---	---	---	---
		---				---	---	---	---	---	---	---
		---				---	---	---	---	---	---	---
ELE _{conveyor,ADD}	Electricity consumption for additives transportation	MWh				0	0	0	0	0	0	0
Q _{add}	Quantity of additives											
		t				19.5	19.5	19.5	19.5	19.5	19.5	19.5
	---	t				---	---	---	---	---	---	---
	---	t				---	---	---	---	---	---	---
F _{1,y}	Consumption of fossil fuel for self generation of electricity	t				0	0	0	0	0	0	0
GEN _y	Self generation of electricity	MWh				0	0	0	0	0	0	0

**RN – Emission factors and project emissions**

Fixed parameter	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.785	Stoichiometric emission factor for CaO	tCO ₂ /t(CaO)			0.7850	0.7850	0.7850	0.7850	0.7850	0.7850	0.7850	0.7850
1.092	Stoichiometric emission factor for MgO	tCO ₂ /t(MgO)			1.0920	1.0920	1.0920	1.0920	1.0920	1.0920	1.0920	1.0920
EF _{c1}	Carbon emission factor for coke	tC/TJ			27.5000	27.5000	27.5000	27.5000	27.5000	27.5000	27.5000	27.5000
EF _{c2}	Carbon emission factor for fuel oil	tC/TJ			21.1000	21.1000	21.1000	21.1000	21.1000	21.1000	21.1000	21.1000
EF _{c3}	Carbon emission factor for diesel	tC/TJ			20.2000	20.2000	20.2000	20.2000	20.2000	20.2000	20.2000	20.2000
NCV ₁	Net calorific value for coke	TJ/t			0.0351	0.0351	0.0351	0.0351	0.0351	0.0351	0.0351	0.0351
NCV ₂	Net calorific value for fuel oil	TJ/t			0.0402	0.0402	0.0402	0.0402	0.0402	0.0402	0.0402	0.0402
NCV ₃	Net calorific value for diesel	TJ/t			0.0423	0.0423	0.0423	0.0423	0.0423	0.0423	0.0423	0.0423
OXID ₁	Oxidation factor of coke	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900
OXID ₂	Oxidation factor of fuel oil	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900
OXID ₃	Oxidation factor of diesel	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900

	Calculated data													
Eq.	Emission factors		Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
ACM2	EF _{grid_BSL} and EF _{grid_Y}		Grid electricity emission factor (calculated per ACM0002)	tCO ₂ /MWh			0.2647	0.2647	0.2647	0.2647	0.2647	0.2647	0.2647	0.2647
6	EF _{fg_BSL} and EF _{fg_Y}		Self generated electricity emission factor	tCO ₂ /MWh			0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
7	EFF ₁		CO ₂ emission factor for coke	tCO ₂ /t(coke)			3.5066	3.5066	3.5066	3.5066	3.5066	3.5066	3.5066	3.5066
7	EFF ₂		CO ₂ emission factor for fuel oil	tCO ₂ /t(fuel oil)			3.0753	3.0753	3.0753	3.0753	3.0753	3.0753	3.0753	3.0753
7	TEF		Transport fuel (diesel) CO ₂ emission factor	kgCO ₂ /kg(diesel)			3.1007	3.1007	3.1007	3.1007	3.1007	3.1007	3.1007	3.1007

Calculated data													
Eq.	Project Emissions	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5.2.1	PE _{gh_grid,BC}	Project grid electricity emissions for BC grinding	tCO ₂ /t(BC)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.2.2	PE _{gh_fg,BC,y}	Project self generated electricity emissions for BC grinding	tCO ₂ /t(BC)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.2.3	PE _{gh_grid,ADD,y}	Project grid electricity emissions for additives preparation	tCO ₂ /t(BC)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.2.4	PE _{gh_fg,ADD,y}	Project self generated electricity emissions for additives preparation	tCO ₂ /t(BC)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.2	PE _{gh_ADD,BC,y}	Project electricity emissions for BC grinding and preparation of additives	tCO ₂ /t(BC)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.1.1	PE _{calc,y}	Project emissions due to calcination	tCO ₂ /t(clinker)				0.5303	0.5327	0.5296	0.5340	0.5340	0.5340	0.5340
5.1.2	PE _{fuel_fuel,y}	Project emissions due to fossil fuel combustion for clinker production	tCO ₂ /t(clinker)				0.3306	0.3149	0.3505	0.2638	0.2638	0.2638	0.2638
5.1.3	PE _{gh_grid_CLINK,y}	Project emissions from grid electricity for clinker production	tCO ₂ /t(clinker)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.1.4	PE _{gh_fg_CLINK,y}	Project emissions from self generated electricity for clinker production	tCO ₂ /t(clinker)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.1	PE _{clinker,y}	Project emissions per tonne of clinker	tCO ₂ /t(clinker)				0.8609	0.8477	0.8801	0.7978	0.7978	0.7978	0.7978
2.1	P _{blend,y}	Project share of clinker per tonne of BC	t(clinker)/t(BC)				0.6403	0.6596	0.5456	0.6714	0.6714	0.6714	0.6714
5	PE _{BC,y}	Project emission per tonne of blended cement	tCO ₂ /t(BC)				0.5513	0.5591	0.4802	0.5357	0.5357	0.5357	0.5357

**RN – Baseline emissions, leakage and emission reductions**

Calculated data		Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Eq.	Baseline Emissions												
1.2.1	BE _{elec_grid_BC}	Baseline grid electricity emissions for BC grinding	tCO ₂ /t(BC)			0.0000							
1.2.2	BE _{elec_sg_BC}	Baseline self generated electricity emissions for BC grinding	tCO ₂ /t(BC)			0.0000							
1.2.3	BE _{elec_grid_ADD}	Baseline grid electricity emissions for additives preparation	tCO ₂ /t(BC)			0.0000							
1.2.4	BE _{elec_sg_ADD}	Baseline self generated electricity emissions for additives preparation	tCO ₂ /t(BC)			0.0000							
1.2	BE _{elec_ADD_BC}	Baseline electricity emissions for BC grinding and preparation of additives	tCO ₂ /t(BC)			0.0000							
1.1.1	BE _{calc}	Baseline emissions due to calcination	tCO ₂ /t(clinker)			0.5334							
1.1.2	BE _{basil_fuel}	Baseline emissions due to fossil fuel combustion for clinker production	tCO ₂ /t(clinker)			0.3110							
1.1.3	BE _{elec_grid_CLNK}	Baseline emissions from grid electricity for clinker production	tCO ₂ /t(clinker)			0.0000							
1.1.4	BE _{elec_sg_CLNK}	Baseline emissions from self generated electricity for clinker production	tCO ₂ /t(clinker)			0							
1.1		Baseline emissions per tonne of clinker (calculated per 1.1)	tCO ₂ /t(clinker)			0.8444							
page 8	BE _{clinker}	Baseline emissions per tonne of clinker (determined ex-post from comparison with PE _{clinker,y})	tCO ₂ /t(clinker)				0.8444	0.8444	0.8444	0.7978	0.7978	0.7978	0.7978
page 3		Baseline share of clinker per tonne of BC (market top 20%)	t(clinker)/t(BC)			0.7997							
page 3		Baseline share of clinker per tonne of BC (market 5 highest brands)	t(clinker)/t(BC)			0.8741							
page 3		Baseline share of clinker per tonne of BC (plant baseline)	t(clinker)/t(BC)	0.8810	0.8592	0.7780							
page 3	B _{blend,y}	Baseline share of clinker per tonne of BC (lowest between market and plant)	t(clinker)/t(BC)				0.7624	0.7472	0.7322	0.7176	0.7032	0.6892	0.6754
1	BE _{BC,y}	Baseline emission per tonne of blended cement	tCO ₂ /t(BC)				0.6438	0.6309	0.6183	0.5725	0.5611	0.5499	0.5389

Calculated data		Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Eq.	Leakage												
2	L _{add_trans}	Transport related emissions	tCO ₂ /t(additive)				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
page 7	A _{blend,y}	Baseline benchmark share of additives updated for year y	t(additive)/t(BC)				0.2376	0.2528	0.2678	0.2824	0.2968	0.3108	0.3246
page 7	P _{blend,y}	Share of additives per tonne of BC in year y	t(additive)/t(BC)				0.2121	0.2440	0.2732	0.3076	0.3076	0.3076	0.3076
2.1	L _y	Leakage for transport of additives	tCO ₂				1.15	0.31	-0.13	-0.65	-0.28	0.08	0.44
3	α _y	Proportion of additives that is not surplus	-				0	0	0	0	0	0	0

Calculated data		Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Eq.	Emission Reductions												
4		Emission reductions (calculated from equation 4)	tCO ₂				54,030	32,416	43,033	12,475	8,590	4,792	1,069

**IM – Monitored data**

Plant: IM	Blended Cement Type: CP II E, CP III												
Monitoring Data		Description	Unit	BASELINE			PROJECT ACTIVITY - FIRST CREDITING PERIOD						
				1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CLNK _{BSL} and CLNK _y		Production of clinker	kt	1,196.15	1,397.22	1,426.10	1,109.52	1,117.21	911.79	738.47	719.00	719.00	719.00
BC _{BSL} and BC _y		Production of blended cement	kt	1,374.63	1,581.60	1,676.34	1,516.15	1,523.98	1,254.36	998.61	998.61	998.61	998.61
ADD _{BSL} and ADD _y		Consumption of additives	kt	6.73			63.55	68.58	88.14	110.63	110.63	110.63	110.63
x		Quantity of additives that are not surplus	kt				0	0	0	0	0	0	0
InCaO and InCaO _y		Quantity of CaO in the raw material	t				103.86	109.02	110.24	111.46	116.59	116.59	116.59
		CaO content of the raw material	%				40.46	42.47	42.95	43.42	45.42	45.42	45.42
		Quantity of raw material	t				256.70	256.70	256.70	256.70	256.70	256.70	256.70
OutCaO and OutCaO _y		Quantity of CaO in the clinker	t	900,009.82			692,562.38	696,242.50	570,961.77	467,965.75	455,630.37	455,630.37	455,630.37
		CaO content of the clinker	%	63.11			62.42	62.32	62.62	63.37	63.37	63.37	63.37
InMgO and InMgO _y		Quantity of MgO in the raw material	t	7.03			9.16	8.86	8.55	5.60	5.60	5.60	5.60
		MgO content of the raw material	%	2.74			3.57	3.45	3.33	2.18	2.18	2.18	2.18
		Quantity of raw material	t	256.70			256.70	256.70	256.70	256.70	256.70	256.70	256.70
OutMgO and OutMgO _y		Quantity of MgO in the clinker	t	63,176.10			53,035.06	53,961.03	41,212.83	36,332.52	35,374.81	35,374.81	35,374.81
		MgO content of the clinker	%	4.43			4.78	4.83	4.52	4.92	4.92	4.92	4.92
FF _{1,BSL} and FF _{1,y}		Consumption of fossil fuel for clinker production											
FF _{1,BSL} and FF _{1,y}		Coke	t	200,370.09			108.50	105,452.22	106,607.74	62,831.47	62,831.47	62,831.47	62,831.47
FF _{2,BSL} and FF _{2,y}		Fuel Oil	t	3,094.39			2,181.34	2,983.66	1,289.70	1,289.70	1,289.70	1,289.70	1,289.70
---		Coal	t	28.50			0.00	9,148.24	1,051.84	1,051.84	1,051.84	1,051.84	1,051.84
BELE _{grid,CLNK} and PELE _{grid,CLNK,y}		Consumption of grid electricity for clinker production	MWh	423.55			329.53	331.81	270.80	219.32	213.54	213.54	213.54
BELE _{self,CLNK} and PELE _{self,CLNK,y}		Consumption of self generated electricity for clinker production	MWh	0			0	0	0	0	0	0	0
BELE _{grid,BC} and PELE _{grid,BC,y}		Consumption of grid electricity for grinding BC	MWh	1,642.81			1,485.83	1,493.50	1,229.27	978.64	978.6390397	978.6390397	978.6390397
BELE _{self,BC} and PELE _{self,BC,y}		Consumption of self generated electricity for grinding BC	MWh	0			0	0	0	0	0	0	0
BELE _{grid,ADD} and PELE _{grid,ADD,y}		Consumption of grid electricity for grinding additives	MWh	0			0	0	0	0	0	0	0
BELE _{self,ADD} and PELE _{self,ADD,y}		Consumption of self generated electricity for grinding additives	MWh	0			0	0	0	0	0	0	0
TF _{trans}		Fuel consumption in transportation											
			kg/km	0.38			0.38	0.38	0.38	0.38	0.38	0.38	0.38
		---	kg/km	---			---	---	---	---	---	---	---
		---	kg/km	---			---	---	---	---	---	---	---
D _{add,source}		Distance between source of additive and project plant											
			km	1.2			1.2	1.2	1.2	1.2	1.2	1.2	1.2
		---	km	---			---	---	---	---	---	---	---
		---	km	---			---	---	---	---	---	---	---
ELE _{conveyor,ADD}		Electricity consumption for additives transportation	MWh	0			0	0	0	0	0	0	0
Q _{add}		Quantity of additives											
			t	19.5			19.5	19.5	19.5	19.5	19.5	19.5	19.5
		---	t	---			---	---	---	---	---	---	---
		---	t	---			---	---	---	---	---	---	---
F _{ij}		Consumption of fossil fuel for self generation of electricity	t	0			0	0	0	0	0	0	0
GEN _i		Self generation of electricity	MWh	0			0	0	0	0	0	0	0

**IM – Emission factor and project emissions**

Fixed parameter	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.785	Stoichiometric emission factor for CaO	tCO ₂ /t(CaO)			0.7850	0.7850	0.7850	0.7850	0.7850	0.7850	0.7850	0.7850
1.092	Stoichiometric emission factor for MgO	tCO ₂ /t(MgO)			1.0920	1.0920	1.0920	1.0920	1.0920	1.0920	1.0920	1.0920
EF _{c1}	Carbon emission factor for coke	tC/TJ			27.5000	27.5000	27.5000	27.5000	27.5000	27.5000	27.5000	27.5000
EF _{c2}	Carbon emission factor for fuel oil	tC/TJ			21.1000	21.1000	21.1000	21.1000	21.1000	21.1000	21.1000	21.1000
EF _{c3}	Carbon emission factor for diesel	tC/TJ			20.2000	20.2000	20.2000	20.2000	20.2000	20.2000	20.2000	20.2000
NCV ₁	Net calorific value for coke	TJ/t			0.0351	0.0351	0.0351	0.0351	0.0351	0.0351	0.0351	0.0351
NCV ₂	Net calorific value for fuel oil	TJ/t			0.0402	0.0402	0.0402	0.0402	0.0402	0.0402	0.0402	0.0402
NCV ₃	Net calorific value for diesel	TJ/t			0.0423	0.0423	0.0423	0.0423	0.0423	0.0423	0.0423	0.0423
OXID ₁	Oxidation factor of coke	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900
OXID ₂	Oxidation factor of fuel oil	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900
OXID ₃	Oxidation factor of diesel	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900

	Calculated data												
Eq.	Emission factors	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
ACM2	EF _{grid_BSL} and EF _{grid_y}	Grid electricity emission factor (calculated per ACM0002)	tCO2/MWh			0.2647	0.2647	0.2647	0.2647	0.2647	0.2647	0.2647	0.2647
6	EF _{fg_BSL} and EF _{fg_y}	Self generated electricity emission factor	tCO2/MWh			0	0	0	0	0	0	0	0
7	EFF ₁	CO ₂ emission factor for coke	tCO2/t(coke)			3.5066	3.5066	3.5066	3.5066	3.5066	3.5066	3.5066	3.5066
7	EFF ₂	CO ₂ emission factor for fuel oil	tCO2/t(fuel oil)			3.0753	3.0753	3.0753	3.0753	3.0753	3.0753	3.0753	3.0753
7	TEF	Transport fuel (diesel) CO ₂ emission factor	kgCO2/kg(diesel)			3.1007	3.1007	3.1007	3.1007	3.1007	3.1007	3.1007	3.1007

Calculated data													
Eq.	Project Emissions	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5.2.1	PE _{gh_grid_BC}	Project grid electricity emissions for BC grinding	tCO2/t(BC)				0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
5.2.2	PE _{gh_fg_BC,y}	Project self generated electricity emissions for BC grinding	tCO2/t(BC)				0	0	0	0	0	0	0
5.2.3	PE _{gh_grid_ADD,y}	Project grid electricity emissions for additives preparation	tCO2/t(BC)				0	0	0	0	0	0	0
5.2.4	PE _{gh_fg_ADD,y}	Project self generated electricity emissions for additives preparation	tCO2/t(BC)				0	0	0	0	0	0	0
5.2	PE _{gh_ADD_BC,y}	Project electricity emissions for BC grinding and preparation of additives	tCO2/t(BC)				0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
5.1.1	PE _{calc,y}	Project emissions due to calcination	tCO2/t(clinker)				0.5421	0.5419	0.5408	0.5510	0.5510	0.5510	0.5510
5.1.2	PE _{ossil_fuel,y}	Project emissions due to fossil fuel combustion for clinker production	tCO2/t(clinker)				0.0064	0.3392	0.4143	0.3037	0.3119	0.3119	0.3119
5.1.3	PE _{gh_grid_CLNK,y}	Project emissions from grid electricity for clinker production	tCO2/t(clinker)				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
5.1.4	PE _{gh_fg_CLNK,y}	Project emissions from self generated electricity for clinker production	tCO2/t(clinker)				0	0	0	0	0	0	0
5.1	PE _{clinkery}	Project emissions per tonne of clinker	tCO2/t(clinker)				0.5486	0.8811	0.9552	0.8549	0.8631	0.8631	0.8631
2.1	P _{Blend,y}	Project share of clinker per tonne of BC	t(clinker)/t(BC)				0.7318	0.7331	0.7269	0.7395	0.7200	0.7200	0.7200
5	PE _{BC,y}	Project emission per tonne of blended cement	tCO2/t(BC)				0.4017	0.6462	0.6946	0.6324	0.6217	0.6217	0.6217

**IM – Baseline emissions, leakage and emission reductions**

Calculated data		Description	Unit										
Eq.	Baseline Emissions			1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1.2.1	BE _{elec_grid_BC}	Baseline grid electricity emissions for BC grinding	tCO2/t(BC)			0.0003							
1.2.2	BE _{elec_sg_BC}	Baseline self generated electricity emissions for BC grinding	tCO2/t(BC)			0							
1.2.3	BE _{elec_grid_ADD}	Baseline grid electricity emissions for additives preparation	tCO2/t(BC)			0							
1.2.4	BE _{elec_sg_ADD}	Baseline self generated electricity emissions for additives preparation	tCO2/t(BC)			0							
1.2	BE _{elec_ADD_BC}	Baseline electricity emissions for BC grinding and preparation of additives	tCO2/t(BC)			0.0003							
1.1.1	BE _{calc}	Baseline emissions due to calcination	tCO2/t(clinker)			0.5437							
1.1.2	BE _{fossil_fuel}	Baseline emissions due to fossil fuel combustion for clinker production	tCO2/t(clinker)			0.4994							
1.1.3	BE _{elec_grid_CLNK}	Baseline emissions from grid electricity for clinker production	tCO2/t(clinker)			0.0001							
1.1.4	BE _{elec_sg_CLNK}	Baseline emissions from self generated electricity for clinker production	tCO2/t(clinker)			0							
1.1		Baseline emissions per tonne of clinker (calculated per 1.1)	tCO2/t(clinker)			1.0432							
page 8	BE _{clinker}	Baseline emissions per tonne of clinker (determined ex-post from comparison with PE _{clinker,y})	tCO2/t(clinker)				0.5486	0.8811	0.9552	0.8549	0.8631	0.8631	0.8631
page 3		Baseline share of clinker per tonne of BC (market top 20%)	t(clinker)/t(BC)			0.7997							
page 3		Baseline share of clinker per tonne of BC (market 5 highest brands)	t(clinker)/t(BC)			0.8741							
page 3		Baseline share of clinker per tonne of BC (plant baseline)	t(clinker)/t(BC)	0.8702	0.8834	0.8507							
page 3	B _{blend,y}	Baseline share of clinker per tonne of BC (lowest between market and plant)	t(clinker)/t(BC)				0.7837	0.7680	0.7527	0.7376	0.7229	0.7084	0.6942
1	BE _{BC,y}	Baseline emission per tonne of blended cement	tCO2/t(BC)				0.4302	0.6770	0.7192	0.6308	0.6241	0.6117	0.5994

Calculated data													
Eq.	Leakage	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
2	L _{add_trans}	Transport related emissions	tCO ₂ /t(additive)				0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
page 7	A _{blend,y}	Baseline benchmark share of additives updated for year y	t(additive)/t(BC)				0.2163	0.2320	0.2473	0.2624	0.2771	0.2916	0.3058
page 7	P _{blend,y}	Share of additives per tonne of BC in year y	t(additive)/t(BC)				0.0419	0.0450	0.0703	0.1108	0.1108	0.1108	0.1108
2.1	L _y	Leakage for transport of additives	tCO ₂				19.17	20.66	16.11	10.98	12.05	13.09	14.12
3	α _y	Proportion of additives that is not surplus	-				0	0	0	0	0	0	0

	Calculated data												
Eq.	Emission Reductions	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
4		Emission reductions (calculated from equation 4)	tCO2				39,677	44,568	29,543	-1,597	2,349	-9,985	-22,195

**CUB – Monitored data**

Plant: CUB	Blended Cement Type: CP III											
			BASELINE			PROJECT ACTIVITY - FIRST CREDITING PERIOD						
Monitoring Data	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CLNK _{BSL} and CLNK _y	Production of clinker	kt	215.86	206.14	222.59	185.31	188.91	163.07	158.59	158.59	158.59	158.59
BC _{BSL} and BC _y	Production of blended cement	kt	300.02	300.02	304.77	330.77	346.31	315.64	323.02	323.02	323.02	323.02
ADD _{BSL} and ADD _y	Consumption of additives	kt	30.13	30.13	43.06	79.75	125.58	110.08	139.65	139.65	139.65	139.65
x	Quantity of additives that are not surplus	kt				0	0	0	0	0	0	0
InCaO and InCaO _y	Quantity of CaO in the raw material	t				14,340.29	14,646.36	13,013.24	11,930.47	11,930.47	11,930.47	11,930.47
	CaO content of the raw material	%				6.87	6.90	6.89	6.87	6.92	6.92	6.92
	Quantity of raw material	t				53,851.05	34,306.91	35,081.10	31,274.30	28,446.51	28,446.51	28,446.51
OutCaO and OutCaO _y	Quantity of CaO in the clinker	t				142,499.87	119,857.66	120,017.24	104,410.65	101,304.34	101,304.34	101,304.34
	CaO content of the clinker	%				10.56	10.67	10.48	10.56	10.54	10.54	10.54
InMgO and InMgO _y	Quantity of MgO in the raw material	t				1,265.50	830.23	824.41	772.48	677.03	677.03	677.03
	MgO content of the raw material	%				0.39	0.40	0.39	0.41	0.39	0.39	0.39
	Quantity of raw material	t				53,851.05	34,306.91	35,081.10	31,274.30	28,446.51	28,446.51	28,446.51
OutMgO and OutMgO _y	Quantity of MgO in the clinker	t				7,612.46	6,652.58	5,931.91	5,690.98	5,423.62	5,423.62	5,423.62
	MgO content of the clinker	%				0.56	0.59	0.52	0.58	0.56	0.56	0.56
FF _{1,BSL} and FF _{1,y}	Consumption of fossil fuel for clinker production					0.00	0.00	0.00	0.00	0.00	0.00	0.00
FF _{1,BSL} and FF _{1,y}	---	t				0.00	0.00	0.00	0.00	0.00	0.00	0.00
FF _{2,BSL} and FF _{2,y}	---	t				0.00	0.00	0.00	0.00	0.00	0.00	0.00
---	---	t				0.00	0.00	0.00	0.00	0.00	0.00	0.00
BELE _{grid,CLNK} and PELE _{grid,CLNK,y}	Consumption of grid electricity for clinker production	MWh				0.00	0.00	0.00	0.00	0.00	0.00	0.00
BELE _{self,CLNK} and PELE _{self,CLNK,y}	Consumption of self generated electricity for clinker production	MWh				0	0	0	0	0	0	0
BELE _{grid,BC} and PELE _{grid,BC,y}	Consumption of grid electricity for grinding BC	MWh				188.76	215.80	289.03	284.82	391.76	391.76	391.76
BELE _{self,BC} and PELE _{self,BC,y}	Consumption of self generated electricity for grinding BC	MWh				0	0	0	0	0	0	0
BELE _{grid,ADD} and PELE _{grid,ADD,y}	Consumption of grid electricity for grinding additives	MWh				0	0	0	0	0	0	0
BELE _{self,ADD} and PELE _{self,ADD,y}	Consumption of self generated electricity for grinding additives	MWh				0	0	0	0	0	0	0
TF _{cond}	Fuel consumption in transportation											
		kg/km				0.40	0.40	0.40	0.40	0.40	0.40	0.40
		kg/km				---	---	---	---	---	---	---
		kg/km				---	---	---	---	---	---	---
D _{add,source}	Distance between source of additive and project plant											
		km				5	5	5	5	5	5	5
		km				---	---	---	---	---	---	---
		km				---	---	---	---	---	---	---
ELE _{conveyer,ADD}	Electricity consumption for additives transportation	MWh				0	0	0	0	0	0	0
Q _{add}	Quantity of additives											
		t				21.5	21.5	21.5	21.5	21.5	21.5	21.5
		t				---	---	---	---	---	---	---
		t				---	---	---	---	---	---	---
F _{ij}	Consumption of fossil fuel for self generation of electricity	t				0	0	0	0	0	0	0
GEN _i	Self generation of electricity	MWh				0	0	0	0	0	0	0

**CUB – Emission factor and project emissions**

Fixed parameter	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.785	Stoichiometric emission factor for CaO	tCO ₂ /t(CaO)			0.7850	0.7850	0.7850	0.7850	0.7850	0.7850	0.7850	0.7850
1.092	Stoichiometric emission factor for MgO	tCO ₂ /t(MgO)			1.0920	1.0920	1.0920	1.0920	1.0920	1.0920	1.0920	1.0920
EF _{c1}	Carbon emission factor for coke	tC/TJ			27.5000	27.5000	27.5000	27.5000	27.5000	27.5000	27.5000	27.5000
EF _{c2}	Carbon emission factor for fuel oil	tC/TJ			21.1000	21.1000	21.1000	21.1000	21.1000	21.1000	21.1000	21.1000
EF _{c3}	Carbon emission factor for diesel	tC/TJ			20.2000	20.2000	20.2000	20.2000	20.2000	20.2000	20.2000	20.2000
NCV ₁	Net calorific value for coke	TJ/t			0.0351	0.0351	0.0351	0.0351	0.0351	0.0351	0.0351	0.0351
NCV ₂	Net calorific value for fuel oil	TJ/t			0.0402	0.0402	0.0402	0.0402	0.0402	0.0402	0.0402	0.0402
NCV ₃	Net calorific value for diesel	TJ/t			0.0423	0.0423	0.0423	0.0423	0.0423	0.0423	0.0423	0.0423
OXID ₁	Oxidation factor of coke	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900
OXID ₂	Oxidation factor of fuel oil	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900
OXID ₃	Oxidation factor of diesel	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900

Calculated data													
Eq.	Emission factors	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
ACM2	EF _{grid_BSL} and EF _{grid_y}	Grid electricity emission factor (calculated per ACM0002)	tCO2/MWh			0.2647	0.2647	0.2647	0.2647	0.2647	0.2647	0.2647	0.2647
6	EF _{eg_BSL} and EF _{eg_y}	Self generated electricity emission factor	tCO2/MWh			0	0	0	0	0	0	0	0
7	EFF ₁	CO ₂ emission factor for coke	tCO2/t(coke)			3.5066	3.5066	3.5066	3.5066	3.5066	3.5066	3.5066	3.5066
7	EFF ₂	CO ₂ emission factor for fuel oil	tCO2/t(fuel oil)			3.0753	3.0753	3.0753	3.0753	3.0753	3.0753	3.0753	3.0753
7	TEF	Transport fuel (diesel) CO ₂ emission factor	kgCO2/kg(diesel)			3.1007	3.1007	3.1007	3.1007	3.1007	3.1007	3.1007	3.1007

	Calculated data												
Eq.	Project Emissions	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5.2.1	PE _{gh_grid_BC}	Project grid electricity emissions for BC grinding	tCO ₂ /t(BC)				0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003
5.2.2	PE _{gh_eg_BC_y}	Project self generated electricity emissions for BC grinding	tCO ₂ /t(BC)				0	0	0	0	0	0	0
5.2.3	PE _{gh_grid_ADD_y}	Project grid electricity emissions for additives preparation	tCO ₂ /t(BC)				0	0	0	0	0	0	0
5.2.4	PE _{gh_eg_ADD_y}	Project self generated electricity emissions for additives preparation	tCO ₂ /t(BC)				0	0	0	0	0	0	0
5.2	PE _{gh_ADD_BC_y}	Project electricity emissions for BC grinding and preparation of additives	tCO ₂ /t(BC)				0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003
5.1.1	PE _{clinker_y}	Project emissions due to calcination	tCO ₂ /t(clinker)				0.4813	0.4674	0.4729	0.4751	0.4751	0.4751	0.4751
5.1.2	PE _{ossil_fuel_y}	Project emissions due to fossil fuel combustion for clinker production	tCO ₂ /t(clinker)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.1.3	PE _{gh_grid_CLINK_y}	Project emissions from grid electricity for clinker production	tCO ₂ /t(clinker)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.1.4	PE _{gh_eg_CLINK_y}	Project emissions from self generated electricity for clinker production	tCO ₂ /t(clinker)				0	0	0	0	0	0	0
5.1	PE _{clinker_y}	Project emissions per tonne of clinker	tCO ₂ /t(clinker)				0.4813	0.4674	0.4729	0.4751	0.4751	0.4751	0.4751
2.1	PE _{blend_y}	Project share of clinker per tonne of BC	t(clinker)/t(BC)				0.5602	0.5455	0.5166	0.4909	0.4909	0.4909	0.4909
5	PE _{BC_y}	Project emission per tonne of blended cement	tCO ₂ /t(BC)				0.2698	0.2552	0.2446	0.2336	0.2336	0.2336	0.2336

**CUB – Baseline emissions, leakage and emission reductions**

Calculated data		Description	Unit										
Eq.	Baseline Emissions			1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1.2.1	BE _{elec_grid_BC}	Baseline grid electricity emissions for BC grinding	tCO ₂ /t(BC)			0.0002							
1.2.2	BE _{elec_yg_BC}	Baseline self generated electricity emissions for BC grinding	tCO ₂ /t(BC)			0							
1.2.3	BE _{elec_grid_ADD}	Baseline grid electricity emissions for additives preparation	tCO ₂ /t(BC)			0							
1.2.4	BE _{elec_yg_ADD}	Baseline self generated electricity emissions for additives preparation	tCO ₂ /t(BC)			0							
1.2	BE _{elec_ADD_BC}	Baseline electricity emissions for BC grinding and preparation of additives	tCO ₂ /t(BC)			0.0002							
1.1.1	BE _{calcin}	Baseline emissions due to calcination	tCO ₂ /t(clinker)			0.4546							
1.1.2	BE _{fuel_fed}	Baseline emissions due to fossil fuel combustion for clinker production	tCO ₂ /t(clinker)			0.0000							
1.1.3	BE _{elec_grid_CLNK}	Baseline emissions from grid electricity for clinker production	tCO ₂ /t(clinker)			0.0000							
1.1.4	BE _{elec_yg_CLNK}	Baseline emissions from self generated electricity for clinker production	tCO ₂ /t(clinker)			0							
1.1		Baseline emissions per tonne of clinker (calculated per 1.1)	tCO ₂ /t(clinker)			0.4546							
page 8	BE _{clinker}	Baseline emissions per tonne of clinker (determined ex-post from comparison with PE _{clinker,y})	tCO ₂ /t(clinker)				0.4546	0.4546	0.4546	0.4546	0.4546	0.4546	0.4546
page 3		Baseline share of clinker per tonne of BC (market top 20%)	t(clinker)/t(BC)			0.7997							
page 3		Baseline share of clinker per tonne of BC (market 5 highest brands)	t(clinker)/t(BC)			0.8741							
page 3		Baseline share of clinker per tonne of BC (plant baseline)	t(clinker)/t(BC)	0.7195	0.6871	0.7303							
page 3	B _{blend,y}	Baseline share of clinker per tonne of BC (lowest between market and plant)	t(clinker)/t(BC)				0.6733	0.6599	0.6467	0.6337	0.6211	0.6087	0.5965
1	BE _{BC,y}	Baseline emission per tonne of blended cement	tCO ₂ /t(BC)				0.3063	0.3001	0.2941	0.2883	0.2825	0.2769	0.2713

Calculated data													
Eq.	Leakage	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
2	L _{add_trans}	Transport related emissions	tCO ₂ /t(additive)				0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
page 7	A _{blend,y}	Baseline benchmark share of additives updated for year y	t(additive)/t(BC)				0.3267	0.3401	0.3533	0.3663	0.3789	0.3913	0.4035
page 7	P _{blend,y}	Share of additives per tonne of BC in year y	t(additive)/t(BC)				0.2411	0.3626	0.3488	0.4323	0.4323	0.4323	0.4323
2.1	L _y	Leakage for transport of additives	tCO ₂				8.10	-2.23	0.41	-6.11	-4.94	-3.79	-2.66
3	α _y	Proportion of additives that is not surplus	-				0	0	0	0	0	0	0

Calculated data													
Eq.	Emission Reductions	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
4		Emission reductions (calculated from equation 4)	tCO ₂				10,399	13,805	13,943	15,658	13,952	12,306	10,692

**VR – Monitored data**

Plant: VR	Blended Cement Type: CP III											
			BASELINE			PROJECT ACTIVITY - FIRST CREDITING PERIOD						
Monitoring Data	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
CLNK _{BSL} and CLNK _y	Production of clinker	kt	237.45	226.76	244.85	203.84	207.81	179.37	174.44	174.44	174.44	174.44
BC _{BSL} and BC _y	Production of blended cement	kt	330.03	330.03	335.25	363.85	380.94	347.20	355.32	355.32	355.32	355.32
ADD _{BSL} and ADD _y	Consumption of additives	kt	33.14	33.14	47.37	87.73	138.14	121.09	153.62	153.62	153.62	153.62
x	Quantity of additives that are not surplus	kt				0	0	0	0	0	0	0
InCaO and InCaO _y	Quantity of CaO in the raw material	t	24,671.86			15,774.32	16,110.99	14,314.56	13,123.52	13,123.52	13,123.52	13,123.52
	CaO content of the raw material	%	7.56			7.59	7.58	7.55	7.61	7.61	7.61	7.61
	Quantity of raw material	t	59,236.16			37,737.61	38,589.21	34,401.73	31,291.17	31,291.17	31,291.17	31,291.17
OutCaO and OutCaO _y	Quantity of CaO in the clinker	t	156,749.85			131,843.43	132,018.96	114,851.72	111,434.77	111,434.77	111,434.77	111,434.77
	CaO content of the clinker	%	11.62			11.74	11.53	11.62	11.59	11.59	11.59	11.59
InMgO and InMgO _y	Quantity of MgO in the raw material	t	1,392.05			913.25	906.85	849.72	744.73	744.73	744.73	744.73
	MgO content of the raw material	%	0.43			0.44	0.43	0.45	0.43	0.43	0.43	0.43
	Quantity of raw material	t	59,236.16			37,737.61	38,589.21	34,401.73	31,291.17	31,291.17	31,291.17	31,291.17
OutMgO and OutMgO _y	Quantity of MgO in the clinker	t	8,373.70			7,317.84	6,525.10	6,260.07	5,965.98	5,965.98	5,965.98	5,965.98
	MgO content of the clinker	%	0.62			0.65	0.57	0.63	0.62	0.62	0.62	0.62
FF _{1BSL} and FF _{1y}	Consumption of fossil fuel for clinker production	MWh	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
FF _{1BSL} and FF _{1y}	---	t	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
FF _{2BSL} and FF _{2y}	---	t	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
---	---	t	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
BELE _{grid_CLNK} and PELE _{grid_CLNKy}	Consumption of grid electricity for clinker production	MWh	0.00			0.00	0.00	0.00	0.00	0.00	0.00	0.00
BELE _{self_CLNK} and PELE _{self_CLNKy}	Consumption of self generated electricity for clinker production	MWh	0			0	0	0	0	0	0	0
BELE _{grid_BC} and PELE _{grid_BCy}	Consumption of grid electricity for grinding BC	MWh	207.64			237.38	317.93	313.30	430.93	430.93	430.93	430.93
BELE _{self_BC} and PELE _{self_BCy}	Consumption of self generated electricity for grinding BC	MWh	0			0	0	0	0	0	0	0
BELE _{grid_ADD} and PELE _{grid_ADDy}	Consumption of grid electricity for grinding additives	MWh	0			0	0	0	0	0	0	0
BELE _{self_ADD} and PELE _{self_ADDy}	Consumption of self generated electricity for grinding additives	MWh	0			0	0	0	0	0	0	0
TF _{coal}	Fuel consumption in transportation	kg/km	0.40			0.40	0.40	0.40	0.40	0.40	0.40	0.40
	---	kg/km	---			---	---	---	---	---	---	---
	---	kg/km	---			---	---	---	---	---	---	---
D _{add_source}	Distance between source of additive and project plant	km	5			5	5	5	5	5	5	5
	---	km	---			---	---	---	---	---	---	---
	---	km	---			---	---	---	---	---	---	---
ELE _{conveyor_ADD}	Electricity consumption for additives transportation	MWh	0			0	0	0	0	0	0	0
Q _{add}	Quantity of additives	t	21.5			21.5	21.5	21.5	21.5	21.5	21.5	21.5
	---	t	---			---	---	---	---	---	---	---
	---	t	---			---	---	---	---	---	---	---
F _{ij}	Consumption of fossil fuel for self generation of electricity	t	0			0	0	0	0	0	0	0
GEN _i	Self generation of electricity	MWh	0			0	0	0	0	0	0	0

**VR – Emission factor and project emissions**

Fixed parameter	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
0.785	Stoichiometric emission factor for CaO	tCO ₂ /t(CaO)			0.7850	0.7850	0.7850	0.7850	0.7850	0.7850	0.7850	0.7850
1.092	Stoichiometric emission factor for MgO	tCO ₂ /t(MgO)			1.0920	1.0920	1.0920	1.0920	1.0920	1.0920	1.0920	1.0920
EF _{C1}	Carbon emission factor for coke	tC/TJ			27.5000	27.5000	27.5000	27.5000	27.5000	27.5000	27.5000	27.5000
EF _{C2}	Carbon emission factor for fuel oil	tC/TJ			21.1000	21.1000	21.1000	21.1000	21.1000	21.1000	21.1000	21.1000
EF _{C3}	Carbon emission factor for diesel	tC/TJ			20.2000	20.2000	20.2000	20.2000	20.2000	20.2000	20.2000	20.2000
NCV ₁	Net calorific value for coke	TJ/t			0.0351	0.0351	0.0351	0.0351	0.0351	0.0351	0.0351	0.0351
NCV ₂	Net calorific value for fuel oil	TJ/t			0.0402	0.0402	0.0402	0.0402	0.0402	0.0402	0.0402	0.0402
NCV ₃	Net calorific value for diesel	TJ/t			0.0423	0.0423	0.0423	0.0423	0.0423	0.0423	0.0423	0.0423
OXID ₁	Oxidation factor of coke	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900
OXID ₂	Oxidation factor of fuel oil	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900
OXID ₃	Oxidation factor of diesel	-			0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900	0.9900

Eq.	Calculated data	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
ACM2	EF _{grid_BSL} and EF _{grid_Y}	Grid electricity emission factor (calculated per ACM0002)	tCO ₂ /MWh			0.2647	0.2647	0.2647	0.2647	0.2647	0.2647	0.2647	0.2647
6	EF _{fg_BSL} and EF _{fg_Y}	Self generated electricity emission factor	tCO ₂ /MWh			0	0	0	0	0	0	0	0
7	EFF ₁	CO ₂ emission factor for coke	tCO ₂ /t(coke)			3.5066	3.5066	3.5066	3.5066	3.5066	3.5066	3.5066	3.5066
7	EFF ₂	CO ₂ emission factor for fuel oil	tCO ₂ /t(fuel oil)			3.0753	3.0753	3.0753	3.0753	3.0753	3.0753	3.0753	3.0753
7	TEF	Transport fuel (diesel) CO ₂ emission factor	kgCO ₂ /kg(diesel)			3.1007	3.1007	3.1007	3.1007	3.1007	3.1007	3.1007	3.1007

Eq.	Calculated data	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
5.2.1	PE _{gh_grid_BC}	Project grid electricity emissions for BC grinding	tCO ₂ /t(BC)				0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003
5.2.2	PE _{gh_fg_BC_Y}	Project self generated electricity emissions for BC grinding	tCO ₂ /t(BC)				0	0	0	0	0	0	0
5.2.3	PE _{gh_grid_ADD_Y}	Project grid electricity emissions for additives preparation	tCO ₂ /t(BC)				0	0	0	0	0	0	0
5.2.4	PE _{gh_fg_ADD_Y}	Project self generated electricity emissions for additives preparation	tCO ₂ /t(BC)				0	0	0	0	0	0	0
5.2	PE _{gh_ADD_BC_Y}	Project electricity emissions for BC grinding and preparation of additives	tCO ₂ /t(BC)				0.0002	0.0002	0.0002	0.0003	0.0003	0.0003	0.0003
5.1.1	PE _{calc_Y}	Project emissions due to calcination	tCO ₂ /t(clinker)				0.4813	0.4674	0.4729	0.4751	0.4751	0.4751	0.4751
5.1.2	PE _{ossil_fuel_Y}	Project emissions due to fossil fuel combustion for clinker production	tCO ₂ /t(clinker)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.1.3	PE _{gh_grid_CLINK_Y}	Project emissions from grid electricity for clinker production	tCO ₂ /t(clinker)				0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
5.1.4	PE _{gh_fg_CLINK_Y}	Project emissions from self generated electricity for clinker production	tCO ₂ /t(clinker)				0	0	0	0	0	0	0
5.1	PE _{clinker_Y}	Project emissions per tonne of clinker	tCO ₂ /t(clinker)				0.4813	0.4674	0.4729	0.4751	0.4751	0.4751	0.4751
2.1	P _{Blend_Y}	Project share of clinker per tonne of BC	t(clinker)/t(BC)				0.5602	0.5455	0.5166	0.4909	0.4909	0.4909	0.4909
5	PE _{BC_Y}	Project emission per tonne of blended cement	tCO ₂ /t(BC)				0.2698	0.2552	0.2446	0.2336	0.2336	0.2336	0.2336

**VR – Baseline emissions, leakage and emission reductions**

Calculated data		Description	Unit										
Eq.	Baseline Emissions			1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
1.2.1	BE _{elec_grid_BC}	Baseline grid electricity emissions for BC grinding	tCO ₂ /t(BC)			0.0002							
1.2.2	BE _{elec_yg_BC}	Baseline self generated electricity emissions for BC grinding	tCO ₂ /t(BC)			0							
1.2.3	BE _{elec_grid_ADD}	Baseline grid electricity emissions for additives preparation	tCO ₂ /t(BC)			0							
1.2.4	BE _{elec_yg_ADD}	Baseline self generated electricity emissions for additives preparation	tCO ₂ /t(BC)			0							
1.2	BE _{elec_ADD_BC}	Baseline electricity emissions for BC grinding and preparation of additives	tCO ₂ /t(BC)			0.0002							
1.1.1	BE _{calcin}	Baseline emissions due to calcination	tCO ₂ /t(clinker)			0.4546							
1.1.2	BE _{fossil_fuel}	Baseline emissions due to fossil fuel combustion for clinker production	tCO ₂ /t(clinker)			0.0000							
1.1.3	BE _{elec_grid_CLNK}	Baseline emissions from grid electricity for clinker production	tCO ₂ /t(clinker)			0.0000							
1.1.4	BE _{elec_yg_CLNK}	Baseline emissions from self generated electricity for clinker production	tCO ₂ /t(clinker)			0							
1.1		Baseline emissions per tonne of clinker (calculated per 1.1)	tCO ₂ /t(clinker)			0.4546							
page 8	BE _{clinker}	Baseline emissions per tonne of clinker (determined ex-post from comparison with PE _{clinker,y})	tCO ₂ /t(clinker)				0.4546	0.4546	0.4546	0.4546	0.4546	0.4546	0.4546
page 3		Baseline share of clinker per tonne of BC (market top 20%)	t(clinker)/t(BC)			0.7997							
page 3		Baseline share of clinker per tonne of BC (market 5 highest brands)	t(clinker)/t(BC)			0.8741							
page 3		Baseline share of clinker per tonne of BC (plant baseline)	t(clinker)/t(BC)	0.7195	0.6871	0.7303							
page 3	B _{blend,y}	Baseline share of clinker per tonne of BC (lowest between market and plant)	t(clinker)/t(BC)				0.6733	0.6599	0.6467	0.6337	0.6211	0.6087	0.5965
1	BE _{BC,y}	Baseline emission per tonne of blended cement	tCO ₂ /t(BC)				0.3063	0.3001	0.2941	0.2883	0.2825	0.2769	0.2713

Calculated data													
Eq.	Leakage	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
2	L _{add_trans}	Transport related emissions	tCO ₂ /t(additive)				0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
page 7	A _{blend,y}	Baseline benchmark share of additives updated for year y	t(additive)/t(BC)				0.3267	0.3401	0.3533	0.3663	0.3789	0.3913	0.4035
page 7	P _{blend,y}	Share of additives per tonne of BC in year y	t(additive)/t(BC)				0.2411	0.3626	0.3488	0.4323	0.4323	0.4323	0.4323
2.1	L _y	Leakage for transport of additives	tCO ₂				8.91	-2.45	0.45	-6.72	-5.43	-4.17	-2.93
3	α _y	Proportion of additives that is not surplus	-				0	0	0	0	0	0	0

Calculated data													
Eq.	Emission Reductions	Description	Unit	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
4		Emission reductions (calculated from equation 4)	tCO ₂				11,438	15,186	15,337	17,224	15,347	13,536	11,762

VR – Project emissions from drying additional blast furnace slag



Project emissions due to drying (tCO ₂)							
VR	1,833	1,940	1,878	2,205	2,037	1,842	1,652
CUB	1,667	1,764	1,707	2,005	1,852	1,675	1,502
IM	3,505	2,371	1,344	0	126	0	0
RN	3,376	1,862	2,563	719	502	280	62
SH	4,940	9,238	11,569	12,537	12,134	11,572	11,021
SAL	10,101	10,688	10,348	12,151	11,223	10,151	9,102
	25,421	27,863	29,410	29,617	27,872	25,520	23,338



Annex 4

MONITORING PLAN

Monitoring data is presented in Section D.
