Monitoring Report

Mysore Cements Limited Portland Slag Cement project

for the period

(January 1, 2007 to March 31, 2008)

UNFCCC Reference No: 0711

Version 01
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SECTION 0

Project Title:	*Mysore Cements Limited Portland Slag Cement Project*
UNFCCC Reference no*:*	*0711*
Monitoring period*:*	*January 1, 2007 to March 31, 2008*
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SECTION 1

1.1 Introduction

Mysore Cements Limited is an indirect subsidiary of the Heidelberg Cement Group, one of the largest cement manufacturers in the world. The company was earlier one of the leading companies of the SK Birla group and had established its first unit at Ammasandra in 1962. The plant manufactures Portland Slag Cement (PSC). PSC is manufactured as per IS-455/1989 by intergrinding clinker, gypsum and granulated slag in suitable proportion and marketed under the brand name Birla Power and Diamond Super.

1.2 Purpose

The purpose of the project activity is to increase the share of slag in the Portland Slag Cement (PSC) production at Mysore Cements Limited (MCL). This reduces clinker use in the PSC production, thus reduces associated greenhouse gas (GHG) effect with clinker production, lowering CO_2 emissions per ton of cement production.

Manufacturing of clinker consists of grinding and pyro processing of raw materials. The reduction in clinker percentage in the blended cement results in conservation of limestone. This displaces calcinations of certain amount of limestone used for clinker production and its associated greenhouse gas (GHGs) emissions into the atmosphere. This also reduces thermal and electrical energy used in the production of clinker and its associated indirect GHGs emissions.

1.3 Project Location

The existing “slag and clinker grinding - mixing unit” is located at Ammasandra, Taluka: Turvekre, District Tumkur, state: Karnataka, India. The site is at a distance of 46 kms. from Tumkur, 125 kms from Bangalore City by road. The nearest railway station is Ammasandra, while nearest airport / airstrip is Bangalore.

1.4 Current status of the project activity

The project activity is registered with UNFCCC as CDM activity under ***"Sector 4 – Manufacturing industries"***. The UNFCCC reference number is 0711

1.5 Baseline methodology

Title: Consolidated Baseline Methodology for Increasing the Blend in Cement Production

Reference: Approved consolidated baseline methodology ACM0005 / Version 03, Sectoral Scope: 4, 19 May 2006

SECTION 2

2 Monitoring

2.1 Monitoring methodology

Title: Consolidated Baseline Methodology for Increasing the Blend in Cement Production

Reference: Approved consolidated baseline methodology ACM0005 / Version 03, Sectoral Scope: 4, 19 May 2006

2.2 Monitoring period

The monitoring of parameters is done for the baseline emissions, project emissions, and leakage calculations. Monitoring period for the project activity is chosen from 1st January 2007 to 31st March 2008. Parameters monitored during the period and their recording frequency is given in the ensuing paragraph. Data of all the relevant years have been archived for the verification purpose, and shall be kept for a minimum of two years after the crediting period.

2.3 Monitoring parameters

2.3.1 Data monitored for the Baseline Emission Calculations

ID No	Data variable	Data unit	Recording frequency	Reference
1.1	$InCaO_{BSL}$	%	Daily	Appendix-I
1.2	$OutCaO_{BSL}$	%	Daily	Appendix-I
1.3	$InMgO_{BSL}$	%	Daily	Appendix-I
1.4	$OutMgO_{BSL}$	%	Daily	Appendix-I
1.5	Quantity of clinker raw material	Kilo tonnes	Annually	Appendix-I
1.6	$CLNK_{BSL}$	Kilo tones of clinker	Annually	Appendix-I
1.7	$FF_{i\_,BSL}$	Tonnes of	Annually	Appendix-I

		fuel i		
1.8	EFF_i	tCO2/tonne of fuel i	Annually	Appendix-I
1.9	$BELE_{grid\_CLNK,BSL}$	MWh	Monthly	Appendix-I
1.10	EF_{grid_BSL}	t CO2/MWh	Annually	Appendix-I
1.11	$BELE_{sg\_CLNK,BSL}$	MWh	Monthly	Appendix-I
1.12	EF_{sg_BSL}	t CO2/MWh	Monthly	Appendix-I
1.13	ADD_{BSL}Quantity of additives	Kilo tonnes	Monthly	Appendix-I
1.14	$BELE_{grid\_BC,BSL}$	MWh	Monthly	Appendix-I
1.15	$BELE_{sg\_BC,BSL}$	MWh	Monthly	Appendix-I
1.16	$BELE_{grid\_ADD}$	MWh	Monthly	Appendix-I
1.17	$BELE_{sg\_ADD,BSL}$	MWh	Monthly	Appendix-I
1.18	$F_{i\ ,j,\ BSL}$	Tonnes of fuel i	Monthly	Appendix-I
1.19	$COEF_{i,j\ BSL}$	tCO_2/tonne of fuel i	Annually	Appendix-I
1.20	$GEN_{j,BSL}$	MWh	Annually	Appendix-I
1.21	$BE_{calcin,BSL}$	t CO_2/tonne clinker	Annually	Appendix-I
1.22	$BE_{fossil\_fuel,BSL}$	t CO_2/tonne clinker	Annually	Appendix-I
1.23	$BE_{ele\_grid\_CLNK,BSL}$	t CO_2/tonne clinker	Annually	Appendix-I
1.24	$BE_{ele\_sg\_CLNK,BSL}$	t CO_2/tonne clinker	Annually	Appendix-I
1.25	$BE_{ele\_grid\_BC,BSL}$	t CO_2/tonne blended cement	Annually	Appendix-I
1.26	$BE_{ele\_sg\_BC,BSL}$	t CO_2/tonne blended cement	Annually	Appendix-I
1.27	$BE_{ele\_grid\_ADD,BSL}$	t CO_2/tonne blended cement	Annually	Appendix-I
1.28	$BE_{ele\_sg\_ADD,BSL}$	t CO_2/tonne blended	Annually	Appendix-I

		cement		
1.29	$B_{blend,y}$	Tonne of additives/tonnes of blended cement	Annually	Appendix-I

2.3.2 Data monitored for the Project Emission Calculations

ID No	Data variable	Data unit	Recording frequency	Reference
2.1	$InCaO_Y$	%	Daily	Appendix-I
2.2	$OutCaO_Y$	%	Daily	Appendix-I
2.3	$InMgO_Y$	%	Daily	Appendix-I
2.4	$OutMgO_Y$	%	Daily	Appendix-I
2.5	Quantity of clinker raw material	Kilo tonnes	Annually	Appendix-I
2.6	$CLNK_Y$	Kilo tones of clinker	Annually	Appendix-I
2.7	$FF_{i\_,Y}$	Tonnes of fuel i	Annually	Appendix-I
2.8	EFF_i	tCO2/tonne of fuel i	Annually	Appendix-I
2.9	$PELE_{grid\_CLNK,Y}$	MWh	Monthly	Appendix-I
2.10	EF_{grid_BSL}	t CO2/MWh	Annually	Appendix-I
2.11	$PELE_{sg\_CLNK,Y}$	MWh	Monthly	Appendix-I
2.12	EF_{sg_Y}	t CO2/MWh	Monthly	Appendix-I
2.13	ADD_YQuantity of additives	Kilo tonnes	Monthly	Appendix-I
2.14	$PELE_{grid\_BC,Y}$	MWh	Monthly	Appendix-I
2.15	$PELE_{sg\_BC,Y}$	MWh	Monthly	Appendix-I
2.16	$PELE_{grid\_ADD}$	MWh	Monthly	Appendix-I
2.17	$PELE_{sg\_ADD,Y}$	MWh	Monthly	Appendix-I

2.18	$F_{i,j,Y}$	Tonnes of fuel i	Monthly	Appendix-I
2.19	$COEF_{i,j\ Y}$	tCO_2/tonne of fuel i	Annually	Appendix-I
2.20	$GEN_{j,Y}$	MWh	Annually	Appendix-I
2.21	$PE_{calcin,Y}$	t CO_2/tonne clinker	Annually	Appendix-I
2.22	$PE_{fossil\_fuel,Y}$	t CO_2/tonne clinker	Annually	Appendix-I
2.23	$PE_{ele\_grid\_CLNK,Y}$	t CO_2/tonne clinker	Annually	Appendix-I
2.24	$PE_{ele\_sg\_CLNK,Y}$	t CO_2/tonne clinker	Annually	Appendix-I
2.25	$PE_{ele\_grid\_BC,Y}$	t CO_2/tonne blended cement	Annually	Appendix-I
2.26	$PE_{ele\_sg\_BC,Y}$	t CO_2/tonne blended cement	Annually	Appendix-I
2.27	$PE_{ele\_grid\_ADD,Y}$	t CO_2/tonne blended cement	Annually	Appendix-I
2.28	$PE_{ele\_sg\_ADD,Y}$	t CO_2/tonne blended cement	Annually	Appendix-I
2.29	$B_{blend,y}$	Tonne of additives/tonne of blended cement	Annually	Appendix-I

2.3.3 Data to be monitored for Leakage Calculations

ID No	Data variable	Data unit	Recording frequency	Reference
3.1	TF_{cons}	kg of fuel/kilometer	Annually	Appendix-I
3.2	D_{add_source}	km	Per trip	Appendix-I
3.3	TEF	kg CO_2/kg of fuel	Annually	Appendix-I
3.4	Q_{add}	Tonnes of additive /vehicle	Per trip	Appendix-I

3.5	$ELE_{conveyor\_ADD}$	MWh	Monthly	Appendix-I
3.6	EF_{grid}	Tonnes of CO_2/MWh	Annually	Appendix-I
3.7	α_y	Tonnes of additive	Annually	Appendix-I

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

The plant is operated by Company's operating personnel. The operating personnel follows the standard operating procedures (SOP) delineated for each department. The DGM (Finance) has been assigned the responsibility of the project management as also for monitoring, measurement and reporting. The deputy general managers of the relevant departments (stores, laboratory, costing and sales) are assigned with the responsibilities of archiving the respective data for pre-determined monitoring parameters as given in the monitoring plan with actual readings being taken by the Shift In-charges and Engineers. The reporting structure for the CDM project activity is available at the project site, as also the minutes of the CDM committee meetings conducted during the monitoring period..

The personnel are adequately trained and highly competent enough to carry out the necessary operations and implement the monitoring plan. Trainings are conducted, and the details of the trainings conducted during the monitoring period are available at the project site.

The QA & QC procedures are practiced and implemented in order to:

1. Secure a good consistency through planning to implementation of this CDM project and,

2. Stipulate who has responsibility for what and,

2. Avoid any misunderstanding between people and organization involved.

3. Calibration of the relevant instruments and meters

.Internal audit and Management Review conducted and their reports are available at the sites

ID number	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1.1-1.31 & 2.1-2.31	Low	These data is 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 has been used.
3.1-3.7	Medium	These data is collected at the ***purchase (stores)*** and ***costing*** department.

Calibration/Maintenance of Measuring Instruments and meters

Monitoring of parameters, which involve measurements, was done with necessary equipments according to the pre-determined intervals mentioned in the monitoring plan as per the monitoring methodology adopted for the project activity. The calibration of the monitoring equipments is done regularly. The calibration certificates for the relevant instruments and meters are available at the plant for the verification. Identified Energy Meters, which directly register electricity consumption for clinker production and cement grinding both from BESCOM and DG are calibrated once in every two years. Meter calibrations are done by External authorized agencies. If any Meter cannot be calibrated to its tolerance, it will be replaced & calibrated at the earliest by the authorized external agency. ***Meter location chart*** giving the details and location of each meter is available at the project site *(Meters which are used for monitoring the parameters of the current CDM project are highlighted in the chart) Detailed* operating, inspection and calibration procedure of weighbridge are also available at the project site.

2.3.5 Environmental Management Plan

The plant possesses the valid consent to operate from the Karnataka State pollution Control Board. Internal Environmental Audit Reports are prepared regularly and submitted to the State pollution control board and are available at the project site for verification.

The project executes the pollution control measures as part of the pollution control plan (*Environmental Management Plan). Environmental monitoring is carried out regularly

in the plant as per the predetermined frequency for all the concerned parameters. There are four ambient air monitoring stations at the cement manufacturing unit. The parameters like NO_x, CO and HC are being monitored by a MoEF approved external agency once in three months. Installations of Bag filters replacing the Electrostatic Precipitators have been implemented in the year 2006, as a pollution control measure, in order to control and maintain the emission levels below the specified standard limits

(Note: The EMP is available for verification at the project site)*

SECTION 3

GHG Emission Reductions

The project activity entails the reduction of clinker content of Portland Slag Cement (PSC) production by increasing the percentage of slag and thereby replacing the equivalent amount of clinker at MCL's cement manufacturing units at Ammasandra, Karnataka. This reduces clinker use in the PSC production, thus reduces associated greenhouse gas (GHG) effect with clinker production, lowering CO_2 emissions per ton of cement production. The formula for calculations of emission reductions is as below:

$$\mathbf{ER_{y} = \{ [BE_{BC,y} - PE_{BC,y}] * BC_{y} + L_{y} \} * (1 - \alpha_{y})}$$

Where:

ER_y = Emissions reductions in year y due to project activity (thousand tonnes of CO2)

$BE_{BC,y}$ = Baseline emissions per tonne of BC (t CO2/tonnes of BC)

$PE_{BC,y}$ = Project emissions per tonne of BC in year y (t CO2/tonnes of BC)

BC_y = BC production in year y (thousand tonnes)

α_y = amount (tonnes of) additive used in year y/ total additional additives used in year y

Emission reductions achieved during the monitoring period (January 2007 to March 2008) are presented in the following Table 3.1. The detailed calculations, including those of the baseline emissions, project emissions, and leakages are given at the Appendix I

Table 3.1: Emission Reductions during the period 1st January, 2007 to 31st March 2008

Period	Emission Reductions (tCO2e)
1st January 2007 to 31st March 2007	3667.09
1st April 2007 to 31st March 2008	20321.00
TOTAL EMISSION REDUCTIONS (tCO2e)	23988.09

SECTION 4

APPENDIX-I

Baseline emissions

$$BE_{BC,y} = [BE_{clinker} * B_{Blend,y}] + BE_{ele\_ADD\_BC} \text{ -----------------(1)}$$

Where:

$BE_{BC,y}$ = Baseline CO_2 emissions per tonne of blended cement type (BC) (t CO_2/tonne BC)

$BE_{clinker}$ = CO_2 emissions per tonne of clinker in the baseline in the project activity plant (t CO_2/tonne clinker) and defined below

$B_{Blend,y}$ = Baseline benchmark of share of clinker per tonne of BC updated for year y (tonne of clinker/tonne of BC)

$BE_{ele\_ADD\_BC}$ = Baseline electricity emissions for BC grinding and preparation of additives (tCO_2/tonne of BC)

Table 4.1 (Baseline emissions for the period 1st January 2007 to 31st March 2008)

Period	**$BE_{clinker}$** (tCO_2/tonne of clinker)	**B_{Blend}** (tonne of clinker/tonne of BC)	**$BE_{elec\_sg\_BC}$** self generated electricity emissions for BC grinding (tCO_2/tonne of BC)	**$BE_{BC,y}$** (tCO_2/tonne BC)
1st January 2007 to 31st March 2007	1.0824	0.60158	0.02217	0.65049
1st April 2007 to 31st March 2008	1.0255	0.59391	0.05247	0.64266

Project emissions

$$PE_{BC,y} = [PE_{clinker,y} * P_{Blend,y}] + PE_{ele\_ADD\_BC,y} \text{ ---------------------(2)}$$

Where:

$PE_{BC,y}$ = CO_2 emissions per tonne of BC in the project activity plant in year y(t CO_2/tonne BC)

$PE_{clinker,y}$ = CO_2 emissions per tonne of clinker in the project activity plant in year y (t CO2/tonne clinker) and defined below

$P_{Blend,y}$ = Share of clinker per tonne of BC in year y (tonne of clinker/tonne of BC)

$PE_{ele\_AD,D\_BC,y}$ = Electricity emissions for BC grinding and preparation of additives in year y (tCO_2/tonne of BC)

$$\mathbf{PE_{clinker,y} = PE_{calcin,y} + PE_{fossil\_fuel,y} + PE_{ele\_grid\_CLNK,y} + PE_{ele\_sg\_CLNK,y}} \text{ -------- } \mathbf{(2.1)}$$

Where:

$PE_{clinker,y}$ = Emissions of CO_2 per tonne of clinker in the project activity plant in year y (t CO_2/tonne clinker)

$PE_{calcin,y}$ = Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate in year y (t CO_2/tonne clinker)

$PE_{fossil\_fuel,y}$ = Emissions per tonne of clinker due to combustion of fossil fuels for clinker production in year y (t CO_2/tonne clinker)

$PE_{ele\_grid\_CLNK,y}$ = Grid electricity emissions for clinker production per tonne of clinker in year y (t CO_2/tonne clinker)

PEele_sg_CLNK,y = Emissions from self-generated electricity per tonne of clinker production in year y (t CO_2/tonne clinker)

$$\mathbf{PE_{calcin,y}=0.785*(OutCaOy - InCaOy)+1.092*(OutMgOy - InMgOy)/[CLNKy* 1000]} \text{ ---} \mathbf{(2.1.1)}$$

Where:

$PE_{calcin,y}$ = Emissions from the calcinations of limestone (tCO_2/tonne clinker)

0.785 = Stoichiometric emission factor for CaO (tCO_2/t CaO)

1.092 = Stoichiometric emission factor for MgO (tCO_2/t MgO)

InCaO,$_y$ = CaO content (%) of the raw material * raw material quantity (tonnes)

OutCaO,$_y$ = CaO content (%) of the clinker * clinker produced (tonnes)

InMgO,$_y$ = MgO content (%) of the raw material * raw material quantity (tonnes)

OutMgO,$_y$ = MgO content (%) of the clinker * clinker produced (tonnes)

Table 4.2 (Project emissions from the calcinations of limestone for the period January 2007 to March 2008)

Period	(CaO content % of the raw material)-year average	(CaO content % of the clinker)-year average	(MgO content % of the raw material)-year average	(MgO content % of the clinker)	**CLKN** (Annual clinker produced, Kilotones)	**$PE_{calcin,y}$** (Annual Emissions from the calcinations of limestone, tCO_2/tonne clinker)
1st January 2007 to 31st March 2007	0	62.88	0	5.37	47.43	0.552248
1st April 2007 to 31st March 2008	0	62.50	0	5.36	259.68	0.549156

$$PE_{fossil\_fuel,\,y} = [\sum FF_{i\_,y} * EFF_i] / CLNK_{,y} * 1000 \text{ ------------(2.1.2)}$$

Where:

$FF_{i\_,y}$ = Fossil fuel of type i consumed for clinker production in year y (tonnes of fuel i)

EFF_i = Emission factor for fossil fuel i (tCO_2/tonne of fuel)

$CLNK_y$ = Annual production of clinker in year y (kilotonnes of clinker)

Table 4.3 (Project emissions from fossil fuel consumption for the clinker production during the period January 2007 to March 2008)

Period	**Quantity of coal consumed annually FFi** (MT)	PE_{fossil_fuel} (tCO_2/tonne of clinker)
1st January 2007 to 31st March 2007	14171	0.50489
1st April 2007 to 31st March 2008	65460	0.41061

$$PE_{ele\_grid\_CLNK,y} = [PELE_{grid\_CLNK,y} * EF_{grid\_y}] / [CLNK_y * 1000] \text{ --------(2.1.3)}$$

Where:

$PELE_{grid\_CLNK,y}$ = Grid electricity for clinker production in year y (MWh)

EF_{grid_y} = Grid emission factor in year y(t CO_2/MWh)

$CLNK_y$ = Annual production of clinker in year y (kilotonnes of clinker)

Table 4.4: Project emissions from grid electricity consumption for the clinker production

Period	$PELE_{grid\_CLNK}$ (Annual grid electricity for clinker production , MWh)	EF_{grid} Grid emission factor (t CO_2/MWh)	$PE_{ele\_grid\_CLNK}$ Annual grid electricity emissions for clinker production per tonne of clinker (tCO2/tclinker)
1st January 2007 to 31st March 2007	169.16	0.85020	0.00303
1st April 2007 to 31st March 2008	4031.43	0.85197	0.01323

**Note:*

⇒ *Grid Emission factors for the monitoring period from 1st January 2007 to 31st March 2008 are taken from* **CO2 baseline database,** version 4.0, September 2008 of Central Electricity Authority (CEA), Ministry Of Power, and GOVT. OF INDIA, *and further details are given at Annex I) .*

$$PE_{elec\_sg\_CLNK,y} = [PELE_{sg\_CLNK,y} * EF_{sg\_y}] / [CLNK_y * 1000] \text{ --------------(2.1.4)}$$

Where:

$PELE_{sg\_CLNK,y}$ = Self generation of electricity for clinker production in year y (MWh)

EF_{sg_y} = Emission factor for self generated electricity in year y (t CO_2/MWh)

$CLNK_y$ = Annual production of clinker in year y (kilotonnes of clinker)

Table 4.5: Project emissions from self generated electricity consumption for clinker production

Period	**$PELE_{sg\_CLNK}$** (self generated electricity for clinker production , MWh)	**EF_{sg}** Self generated electricity emission factor (t CO_2/MWh)	**$PE_{elec\_sg\_CLNK}$** Annual emissions from self generated electricity per tonne of clinker (tCO2e/tclinker)
1st January 2007 to 31st March 2007	4916.40	0.21390	0.02217
1st April 2007 to 31st March 2008	22182.32	0.61420	0.05247

Table 4.6: Project emissions from clinker production

Period	**$PE_{clinker}$** (tCO2/tclinker)
1st January 2007 to 31st March 2007	1.0824
1st April 2007 to 31st March 2008	1.0255

$$PE_{ele\_ADD\_BC,y} = PE_{ele\_grid\_BC,y} + PE_{ele\_sg\_BC,y} + PE_{ele\_grid\_ADD,y} + PE_{ele\_sg\_ADD,y} \text{ ----------(2.2)}$$

Where:

$PE_{ele\_grid\_BC}$ = Grid electricity emissions for BC grinding in year y (tCO_2/tonne of BC)

$PE_{ele\_sg\_BC}$ = Emissions from self generated electricity for BC grinding in year y (tCO_2/tonne of BC)

$PE_{ele\_grid\_ADD}$ = Grid electricity emissions for additive preparation in year y (tCO_2/tonne of BC)

$PE_{ele\_sg\_ADD}$ = Emissions from self generated electricity additive preparation in year y (tCO_2/tonne of BC)

$$PE_{ele\_grid\_BC,y} = [\ PELE_{grid\_BC,}y * EF_{grid\_BSL,y}] / [BC_y * 1000] \text{ ----------------------(2.2.1)}$$

Where:

$PELE_{grid\_BC,y}$ = Baseline grid electricity for grinding BC (MWh)

EF_{grid_y} = Grid emission factor in year y (t CO_2/MWh)

BC_y = Annual production of BC in year y (kilotonnes of BC)

Table 4.7: Project emissions from grid electricity consumption for the blended cement production

Period	**$PELE_{grid\_BC}$** (MWh)	**EF_{grid}** (t CO_2/MWh)	**BC** Annual production of BC in year y (tonnes of BC)	**$PE_{ele\_grid\_BC}$** Grid electricity emissions for BC grinding (tCO_2/tonne of BC)
1st January 2007 to 31st March 2007	0	0.85020	66107.37	0
1st April 2007 to 31st March 2008	15465.899	0.85197	317501.58	0.041501

$$PE_{elec\_sg\_BC,y} = [PELE_{sg\_BC,y} * EF_{sg\_y}] / [BC_y * 1000] \text{ ------------------(2.2.2)}$$

Where:

$PELE_{sg\_BC,y}$ = Self generated electricity for grinding BC in year y (MWh)

EF_{sg_y} = Emission factor for self generated electricity in year y (t CO_2/MWh)

BC_y = Annual production of BC in year y (kilo tonnes of BC)

Table 4.8: Project emissions from self generated electricity consumption for the grinding of blended cement

Period	**$PELE_{sg\_BC}$** (MWh)	**EF_{sg}** (t CO_2/ MWh)	**BC** Annual production of BC in year y (tonnes of BC)	**$PE_{elec\_sg\_BC}$** self generated electricity emissions for BC grinding (tCO_2/tonne of BC)
1st January 2007 to 31st March 2007	4006.59	0.21390	66107.37	0.01296
1st April 2007 to 31st March 2008	5991.43	0.61420	317501.58	0.01159

$$PE_{ele\_grid\_ADD} = [\ PELE_{grid\_ADD} * EF_{grid\_y}] / [BC_y * 1000] \text{ -------------(2.2.3)}$$

Where:

$BELE_{grid\_ADD}$ = Baseline grid electricity for grinding additives (MWh)

EF_{grid_y} = Grid emission factor in year y(t CO_2/MWh)

BC_y = Annual production of BC in year y (kilotonnes of BC)

Table 4.9 (Project emissions from grid electricity consumption for the grinding of additives during the period January 1, 2007 to March 31, 2008)

Period	**$PELE_{grid\_ADD}$** (MWh)	**EF_{grid}** (t CO_2/ MWh)	**BC** Annual production of BC in year y (tonnes of BC)	**$PE_{ele\_grid\_ADD}$** grid electricity emissions for BC grinding tCO_2/tonne of BC)
1st January 2007 to 31st March 2007	0	0.85020	66107.37	0
1st April 2007 to 31st March 2008	0	0.85197	317501.58	0

$$PE_{elec\_sg\_ADD,y} = [PELE_{sg\_ADD,y} * EF_{sg\_y}] / [BC_y * 1000] \text{-----------}(2.2.4)$$

Where:

$PELE_{sg\_ADD,y}$ = self generation electricity for grinding additives (MWh)

EF_{sg_y} = Emission factor for self generated electricity in year y (t CO_2/MWh)

BC_y = Annual production of BC in year y (kilotonnes of BC)

Table 4.10: Project emissions from self generated electricity consumption for the grinding of additives

Period	**$PELE_{sg\_ADD}$** (MWh)	**EF_{sg}** (t CO_2/MWh)	**BC** Annual production of BC in year y (tonnes of BC)	**$PE_{elec\_sg\_ADD}$** grid electricity emissions for BC grinding tCO_2/tonne of BC)
1st January 2007 to 31st March 2007	0	0.21390	66107.37	0
1st April 2007 to 31st March 2008	0	0.61420	317501.58	0

***$PE_{elec\_sg\_ADD}$** *is taken as zero because in the project activity, additives are grinded with the clinker*

Table 4.11: Project emissions from BC grinding and preparation of additives

Period	**$PE_{ele\_ADD\_BC}$** (tCO_2/tonne of BC)
1st January 2007 to 31st March 2007	0.01296
1st April 2007 to 31st March 2008	0.05309

<u>Project emissions</u>

$$PE_{BC,y} = [PE_{clinker,y} * P_{Blend,y}] + PE_{ele\_ADD\_BC,y} \text{--------------------------}(2)$$

Table 4.12 (Project emissions per tonne of BC during the period January 1, 2007 to March 31, 2008)

Period	$PE_{clinker}$ (tCO_2/tonne of clinker)	P_{Blend} tonne of clinker / tonne of blended cement)	$PE_{ele\_ADD\_BC}$ (tCO_2/tonne BC)	PE_{BC} (tCO_2/tonne BC)
1st January 2007 to 31st March 2007	1.0824	0.53318	0.01296	0.59005
1st April 2007 to 31st March 2008	1.0255	0.50631	0.05309	0.57229

**P_{blend}* is share of clinker per tonne of BC produced in year y (tonne of clinker / tonne of BC) and Pblend is calculated using following formulae*

= clinker consumed in PSC / PSC production

Clinker consumed in PSC = PSC production- Gypsum consumption in PSC – Slag consumption in PSC

Leakages

$$L_{add\_trans} = [(TF_{cons} * D_{add\_source} * TEF)* 1/Q_{add}*1/1000 + (ELE_{conveyor\_ADD} * EF_{grid})* 1/ADD_Y] \text{—(3.1)}$$

Where:

L_{add_trans} = Transport related emissions per tonne of additives (t CO2/tonne of additive)

TF_{cons} = Fuel consumption for the vehicle per kilometre (kg of fuel/kilometre)

D_{add_source} = Distance between the source of additive and the project activity plant(km)

TEF = Emission factor for transport fuel (kg CO2/kg of fuel)

$ELE_{conveyor\_ADD}$ = Annual Electricity consumption for conveyor system for additives (MWh)

EF_{grid} = Grid electricity emission factor (tonnes of CO_2/MWh)

Q_{add} = Quantity of additive carried in one trip per vehicle (tonnes of additive)

ADD_Y = Annual consumption of additives in year y. (t of additives)

It may be noted that while determining the value of D_{add_source} for accounting the leakages, project proponent to be on a conservative side is considering the round trip distance of the farthest source of the additives. Further details are given at Annex II

Leakage emissions per tonne of BC due to additional additives are determined by

$\mathbf{L_y = L_{add\_trans} * [A_{blend,y} - P_{blend,y}] * BC_y}$ **----------------------(3.2)**

Where:

L_y = Leakage emissions for transport of additives (kilotonnes of CO_2)

BC_y = Production of BC in year y (kilotonnes of BC)

$A_{blend,y}$=Baseline benchmark share of additives per tonne of BC updated for year y (tonne of additives/tonne of BC)

$P_{blend,y}$ = Share of additives per tonne of BC in year y (tonne of additives/tonne of BC)

α_y = x tonnes of additives in year y / total additional additives used in year y

Another possible leakage is due to diversion of additives from existing uses. The project proponents (PPs) shall demonstrate that the additional amounts of additives used are surplus. If the PPs do not substantiate that the amount of additives, used in the project activity, are surplus, the project emission reductions are reduced by the factor α, α is defined as follows;

(α = tonnes of additive used in year y / total additional additives used in year y)

Table 4.13: Quantity of additives used

Period	**Additive (tonnes)**
1st January 2007 to 31st March 2007	28754.00
1st April 2007 to 31st March 2008	137924.00

Table 4.14: Transport related emissions per ton of additives

Period	TFcons	TEF	ELEconveyor_ADD	EFgrid	Dadd_source	Qadd	Add	Ladd trans
1st January 2007 to 31st March 2007	0.286	3.09	0	0.85	1400	17	28754.00	0.0727059
1st April 2007 to 31st March 2008	0.286	3.09	0	0.85	1400	17	137924.00	0.0727059

Table 4.15: Leakage emissions due to transportation of additives

Period	Ablend	Pblend	BC (Production)	Ly
1st January 2007 to 31st March 2007	0.39842	0.53318	66107.37	-328.75
1st April 2007 to 31st March 2008	0.40609	0.50631	317501.58	-2022.36

Emission Reductions during the period January 1, 2007 to March 31, 2008

$ER_y = \{ [BE_{BC,y} – PE_{BC,y}] * BC_y + L_y \} * (1 – \alpha_y)$

Where:

ER_y = Emissions reductions in year y due to project activity (thousand tonnes of CO2)

$BE_{BC,y}$ = Baseline emissions per tonne of BC (t CO2/tonnes of BC)

$PE_{BC,y}$ = Project emissions per tonne of BC in year y (t CO2/tonnes of BC)

BC_y = BC production in year y (thousand tonnes)

Table 4.16: Baseline emissions, Project emissions and Leakage emissions

Period	$BE_{BC,y}$ Baseline emissions per tonne of BC (t CO2/tonnes of BC)	PE_{BC} Project emissions per tonne of BC (tCO_2/tonne BC)	BC (tonnes of BC)	L_y (kilotonnes of CO_2)	α (tonnes of additive used in year y / total additional additives used in year y)
1st January 2007 to 31st March 2007	0.65049	0.59005	66107.37	-328.75	0.0
1st April 2007 to 31st March 2008	0.64266	0.57229	317501.58	-2022.36	0.0

Table 4.15: Emission Reductions during the period January 1, 2007 to March 31, 2008

Period	$BE_{BC,y}$ Baseline emissions (tCO_{2e})	PE_{BC} Project emissions ($t\ CO_{2e}$)	L_y Leakage Emissions (tCO_{2e})	ER_y Emissions reductions (tCO_{2e})
1st January 2007 to 31st March 2007	43002.47	39006.63	-328.75	**3667.09**
1st April 2007 to 31st March 2008	204045.36	181702.00	-2022.36	**20321.00**
TOTAL EMISION REDUCTIONS(tCO_{2e})				**23988.09**

Annex I

The grid emission factors are taken from the CO2 baseline database, version 4.0, September 2008 of Central Electricity Authority (CEA), Ministry Of Power, and GOVT. OF INDIA.

The latest CO2 baseline database is accessible at the website: http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm. The database uses the approach of the baseline methodology ACM0002/ver07 for determining the emission factors for the different electricity grids in India.

Equations, Calculational Approach, Assumptions, Data and Calculations adopted by CEA in determining CO2 emission factors for different grid systems in India are explained in the "CO2 baseline database for the Indian Power Sector", User guide, version 4.0, September 2008; and is accessible at the above mentioned website.

In the Indian scenario, as per the latest CEA (Central Electricity Authority) database Version 4 (September 2008) the Combined Margin for the Grid Emission Factor for the years encompassing the monitoring period are as depicted in the table below.

The values of the Combined Margin (tCO2/MWh) from the mentioned CEA's CO2 database ver04 are given below:

	2006-07	2007-08
NEWNE	0.82	0.80
South	0.85	0.85
India	0.83	0.81

The Combined Margin(tCO2/MWh) (tCO2/MWh) applied for the monitoring period from January 1, 2007 to March 31, 2008, taken from the above mentioned CEA's values, are given below:

Year	**2006-07**	**2007--08**
Monitoring period	**January 1, 2007 to March 31, 2007**	**April 1, 2007 to March 31, 2008**
South	0.85	0.85

Annex II

It was found that from the transport receipts the distance between the various sources of additives and the project activity plant (Dadd_source) were

a) 680 Km (JSW, Bellary)
b) 700 Km (Kalyani, Hospet)
c) 520 Km (KISCO,Kudremukh)
d) 300 Km (VISL steel plant, Bhadravathi)
e) and 50 Km(other sources)from the project plant

Since most of the slag was coming in from JSW and Kalyani, the conservativeness of the round trip distance was examined. The project proponent to be on a conservative side considered the round trip distance of the farthest source (Kalyani) i.e 700 * 2 - 1400 Km to account for calculating the leakages