SECTION D. Application of a monitoring methodology and plan

Revised Monitoring Plan: Version 3.1 dated 18/06/2012

D.1. Name and reference of approved monitoring methodology applied to the project activity:

>>

Title: "Consolidated Monitoring Methodology for Increasing the Blend in Cement Production"

Reference: ACM0005/ Version 02, Sectoral Scope: 4, 28th November 2005

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

>>

As discussed earlier in the baseline section B.2 all the applicability criterion of the methodology is applicable to the proposed CDM project, hence, in conjunction with the applied baseline methodology, the selected monitoring methodology has been applied to the project.

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	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	In CaO_y	In plant clinkerisation unit	t CaO	M,C	Daily	100%	Electronic	Is a part of normal day to day operation of clinkerisation unit of the plant. This is calculated as the CaO content (%) of the raw material times the raw material quantity (tonnes)
2	Out CaO_y	In plant clinkerisation unit	t CaO	M,C	Daily	100%	Electronic	Is a part of normal day to day operation of clinkerisation unit of the plant. This is calculated as the CaO content (%) of the clinker times clinker produced (tonnes)
3	In MgO_y	In plant clinkerisation unit	t MgO	M,C	Daily	100%	Electronic	Is a part of normal day to day operation of clinkerisation unit of the plant. This is calculated as the MgO content (%) of the raw material times the raw material quantity (tonnes)
4	Out MgO_y	In plant clinkerisation unit	t MgO	M,C	Daily	100%	Electronic	Is a part of normal day to day operation of clinkerisation unit of the plant. This is calculated as the MgO content (%) of the clinker times clinker produced (tonnes)
5	Quantity of limestone used in the clinkerisation unit	In plant clinkerisation unit	Kilo tonnes	M	Annually	100%	Electronic	The plant records usages of limestone for clinker production on monthly basis. For annual records same can be cross checked in annual financial accounts/ opening and closing balance of raw material used.
6	Quantity of clinker used for PPC production P_clink	In plant grinding unit	Kilo tonnes	M	Annually	100%	Electronic	The plant records usages of clinker for PPC production on monthly basis. For annual records same can be cross checked in annual financial records/ opening and closing balance of clinker.
7	FFi_,y	In plant clinkerisation unit	tonnes	M	Annually	100%	Electronic	The plant records usages of coal for clinker production on monthly basis. For annual records same can be cross checked in annual financial records/ opening and closing balance of raw material consumption

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	**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**
8	Emission factor of coal used in clinkerisation unit, EFFi	In Plant clinkerisation unit	tCO2/tonne	C	Annually	100%	Electronic	EFFi is calculated using Carbon content of coal used and default carbon oxidation factor of 0.98. Carbon content of coal used is analyzed by independent Lab.
9	PELEgrid_CLNK,y	In plant clinkerisation unit	MWh	M,C	Monthly	100%	Electronic	Total Grid electricity purchased (GE)and total self generated electricity produced(SG) as well as total electricity consumed up to clinkerisation (PELE_CLNK,y) is measured daily by dedicated meters and the same is recorded in online Energy Management System(EMS). The entire detail of measurements and metering is clearly delineated in the CDM manual. Based on the above mentioned measured data, the grid electricity up to clinkerisation is calculated as per following proportionate formula:. **PELEgrid_CLNK,y = PELE_CLNK,y x [GE/(GE+SG)].** In addition to above formula please refer the detail under ID numbers 29 , 30,and 31
10	PELEsg_CLNK,y	In plant data	MWh	M,C	Monthly	100%	Electronic	Total Grid electricity purchased (GE)and total self generated electricity produced(SG) as well as total electricity consumed up to clinkerisation (PELE_CLNK,y) is measured daily by dedicated meters and the same is recorded in online Energy Management System(EMS). The entire detail of measurements and metering is clearly delineated in the CDM manual. Based on the above mentioned measured data, the self generated electricity up to clinkerisation is calculated as per following proportionate formula:.

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	**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**
								PELEsg_CLNK,y = PELE_CLNK,y x [SG/(GE+SG)] In addition to above formula please refer the detail under ID numbers 29, 30 and 31
11	EFsg_y	In plant data	tCO2/MWh	M,C,E	Annually	100%	Electronic	Unit would record the estimated emission factor of the in-house electricity generation based on calculated total in-house net power generation and total emission due to burning of fossil fuel like HSD, FO and Coal. Total emission will be calculated using IPCC default NCV, carbon content, carbon oxidation factor, supplier's specific gravity and measured consumption quantity in case of HSD and FO and measured quantity and emission factor(EFFi) in case of coal as mentioned against serial No. 8 above. Total net power generation (ID number 28) and emission from power generation (ID number 26 & 27) is defined below.
12	ADDy Quantity of additives	In plant data	Kilo tonnes	M	Monthly	100%	Electronic	The plant records usages of fly ash for PPC production on monthly basis. For annual records same can be cross checked in annual financial records/ opening and closing balance of fly ash
13	PEcalcin,y	In plant data	tCO2/tonne of clinker	C	Annually	100%	Electronic	
14	PEfossil_fuel,y	In plant data	tCO2/tonne of clinker	C	Annually	100%	Electronic	
15	PEele_grid_CLNK,y	In plant data	tCO2/tonne of clinker	C	Annually	100%	Electronic	
16	PEele_sg_CLNK,y	In plant data	tCO2/tonne of clinker	C	Annually	100%	Electronic	
17	PEele_grid_ADD,y	In plant data	tCO2/tonne of blended cement	C	Annually	100%	Electronic	
18	PEele_sg_ADD,y	In plant data	tCO2/tonne of	C	Annually	100%	Electronic	

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	**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**
			blended cement					
19	PEele_grid_BC,y	In plant data	tCO2/tonne of blended cement	C	Annually	100%	Electronic	
20	PEele_sg_BC,y	In plant data	tCO2/tonne of blended cement	C	Annually	100%	Electronic	
21	PBlend,y	In plant data	Tonne of clinker/tonne of blended cement	C	Annually	100%	Electronic	
22	PELEgrid_BC,y	In plant data	MWh	M,C	Monthly	100%	Electronic	Total Grid electricity purchased (GE)and total self generated electricity produced(SG) as well as total electricity consumed for production of blended cement (PELE_BC,y) is measured daily by dedicated meters and the same is recorded in online Energy Management System(EMS). The entire detail of measurements and metering is clearly delineated in the CDM manual. Based on the above mentioned measured data, the grid electricity for production of blended cement is calculated as per following proportionate formula:. **PELEgrid_BC,y = PELE_BC,y x [GE / (GE+SG)]**
23	PELEsg_BC,y	In plant data	MWh	M,C	Monthly	100%	Electronic	Total Grid electricity purchased (GE)and total self generated electricity produced(SG) as well as total electricity for production of blended cement (PELE_BC,y) is measured daily by dedicated meters and the same is recorded in online Energy Management System(EMS). The entire detail of measurements and

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	**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**
								metering is clearly delineated in the CDM manual. Based on the above mentioned measured data, the self generated electricityfor production of blended cement is calculated as per following proportionate formula:. **PELEsg_BC,y** = **PELE_BC,y** x [SG / (GE+SG)]
24	PELEgrid_ADD	In plant data	MWh	M	Monthly	100%	Electronic	Not Applicable ,as fly ash is not ground separately
25	PELEsg_ADDy	In plant data	MWh	M	Monthly	100%	Electronic	Not Applicable ,as fly ash is not ground separately
26	Fi ,j, y	In plant data	KL of FO, HSD and tonne of Coal	M	Monthly	100%	Electronic	HSD and FO consumption for power generation is measured through level measurement of fuel tank and consumption of coal used in power generation is measured by online coal weighing/ feeding system.
27	COEFi,j y	IPCC for HSD and FO and third party measured C% for coal	t CO2/ KL of HSD and FO and t CO2/ tonne coal	C	Annually	100%	Electronic	Fuel specific emission factor of HSD and FO is calculated using IPCC default factor of carbon content, NCV, carbon oxidation factor and supplier's specific gravity data and that of coal is calculated using third party measured C% and IPCC default carbon oxidation factor.
28	GENj,y	In plant data	MWh	M	Annually	100%	Electronic	This is total net power generated by in-house HSD and FO fired DG set and coal fired power plant. Net power generation by coal based power plant is measured and added with measured net power generated by DG sets to arrive at total net power generated in the self generation unit of the plant.
29	GE	In plant data	MWh	M	Monthly	100%	Electronic	This is total Grid power electricity entering to main bus bar and is measured by dedicated energy meters at plant main receiving substation (MRSS)from external power Grid
30	SG	In plant data	MWh	M,C	Monthly	100%	Electronic	This is total self generated electricity

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	**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**
								consumed by the plant and is measured by dedicated energy meters at plant main receiving substation (MRSS) from self generation units.
31	PELE_CLNK,y	In plant data	MWh	M,C	Monthly	100%	Electronic	Total electricity consumed up to clinkerisation (PELE_CLNK,y) is measured daily by dedicated meters and the same is recorded in online Energy Management System(EMS). Based on measured electricity consumption at different sections (Crushing, Raw Mill, Kiln) of clinkerisation, total electricity consumed up to clinkerisation is calculated.
32	PELE_BC,y	In plant data	MWh	M,C	Monthly	100%	Electronic	Total electricity consumed for production of cement in cement mill section is measured daily by dedicated meters and the same is recorded in online Energy Management system (EMS). Total electricity consumed for production of blended cement (PELE_BC,y) is calculated based on measured electricity consumption of cement mill section.
33	CLNKy	In plant data	Kilo tonnes	M,C	Annual	100%	Electronic	The daily clinker production is calculated from the proportional amount of Kiln feed (Raw meal) and the data is sum up to get the annual production. The Kiln feed will be measured and recorded in factory report.

D.2.1.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

PEBC,y = [PEclinker,y * PBlend,y] + PEele_ADD_BC,y **(1)**

where:

PEBC,y = CO2 emissions per tonne of BC in the project activity plant in year y(tCO2/tonne BC)

PEclinker,y = CO2 emissions per tonne of clinker in the project activity plant in year y (t CO2/tonne clinker) and defined below
PBlend,y = Share of clinker per tonne of BC in year y (tonne of clinker/tonne of BC)
PEele_AD,D_BC,y = Electricity emissions for BC grinding and preparation of additives in year y (tCO2/tonne of BC)

CO2 per tonne of clinker in the project activity plant in year y is calculated as below:
PEclinker,y = PEcalcin,y + PEfossil_fuel,y + PEele_grid_CLNK,y + PEele_sg_CLNK,y (1.1)
where:
PEclinker,y = Emissions of CO2 per tonne of clinker in the project activity plant in year y (tCO2/tonne clinker)
PEcalcin,y = Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate in year y (tCO2/tonne clinker)
PEfossil_fuel,y = Emissions per tonne of clinker due to combustion of fossil fuels for clinker production in year y (t CO2/tonne clinker)
PEele_grid_CLNK,y = Grid electricity emissions for clinker production per tonne of clinker in year y (t CO2/tonne clinker)
PEele_sg_CLNK,y = Emissions from self-generated electricity per tonne of clinker production in year y (t CO2/tonne clinker)

PEcalcin,y = 0.785*(OutCaOy - InCaOy) + 1.092*(OutMgOy - InMgOy) / [CLNKy * 1000] (1.1.1)
PEcalcin,y = Emissions from the calcinations of limestone (tCO2/tonne clinker)
0.785 = Stoichiometric emission factor for CaO (tCO2/t CaO)
1.092 = Stoichiometric emission factor for MgO (tCO2/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)

PEfossil_fuel, y = [‡”FFi_,y * EFFi] /CLNK,y * 1000 (1.1.2)
where:
FFi_,y = Fossil fuel of type i consumed for clinker production in year y (tonnes of fuel i)
EFFi = Emission factor for fossil fuel i (tCO2/tonne of fuel)
CLNKy = Annual production of clinker in year y (kilotonnes of clinker)

P**Eele_grid_CLNK,y = [PELEgrid_CLNK,y * EFgrid_y] / [CLNKy* 1000] (1.1.3)**
where:
PELEgrid_CLNK,y = Grid electricity for clinker production in year y (MWh)
EFgrid_y = Grid emission factor in year y(t CO2/MWh)
CLNKy = Annual production of clinker in year y (kilotonnes of clinker)

PEelec_sg_CLNK,y = [PELEsg_CLNK ,y* EFsg_y] /[CLNKy * 1000] (1.1.4)

where:
PELEsg_CLNK,y = Self generation of electricity for clinker production in year y (MWh)
EFsg_y = Emission factor for self generated electricity in year y (t CO2/MWh)
CLNKy = Annual production of clinker in year y (kilotonnes of clinker)

PEele_ADD_BC,y = PEele_grid_BC,y + PEele_sg_BC,y **(1.2)**
where:
PEele_grid_BC = Grid electricity emissions for BC grinding in year y (tCO2/tonne of BC)
PEele_sg_BC = Emissions from self generated electricity for BC grinding in year y (tCO2/tonne of BC)

PEele_grid_BC,y = [PELEgrid_BC,y * EFgrid_BSL,y] /[BCy* 1000] **(1.2.1)**
PELEgrid_BC,y = Baseline grid electricity for grinding BC (MWh)
EFgrid_y = Grid emission factor in year y(t CO2/MWh)
BCy = Annual production of BC in year y (kilotonnes of BC)

PEelec_sg_BC,y = [PELEsg_BC,y * EFsg_y] / [BCy* 1000] **(1.2.2)**
PELEsg_BC,y = Self generated electricity for grinding BC in year y (MWh)
EFsg_y = Emission factor for self generated electricity in year y (t CO2/MWh)
BCy = Annual production of BC in year y (kilotonnes of BC)

$$\mathbf{EF_{sg,y} = \sum_{i,j} F_{i,j,y} \; X \; COEF_{i,j} / \sum_{j} GEN_{j,y}} \qquad \mathbf{(1.3)}$$

where:
$\mathbf{F_{i,j,y}}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y, j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports4to the grid,
$\mathbf{COEF_{i,j\,y}}$ is the CO2 emission coefficient of fuel i (tCO2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and
$\mathbf{GEN_{j,y}}$ is the electricity (MWh) delivered to the grid by source j.

The CO_2 emission coefficient COEFi is obtained as

$$\mathbf{COEF_{i} = NCV_{i} \; X \; EFCO_{2,i} \; X \; OXID_{i}} \qquad \mathbf{(1.3.1)}$$

where:
$\mathbf{NCV_i}$ is the net calorific value (energy content) per mass or volume unit of a fuel i,
$\mathbf{OXID_i}$ is the oxidation factor of the fuel
$\mathbf{EFCO_{2,i}}$ is the CO2 emission factor per unit of energy of the fuel i.

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

ID number	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	*In* CaO_{BSL}	*In plant clinkerisation unit*	*%*	*M,C*	*Daily*	*100%*	*Electronic*	
2	*Out* CaO_{BSL}	*In plant clinkerisation unit*	*%*	*M,C*	*Daily*	*100%*	*Electronic*	
3	*In* MgO_{BSL}	*In plant clinkerisation unit*	*%*	*M,C*	*Daily*	*100%*	*Electronic*	
4	*Out* MgO_{BSL}	*In plant clinkerisation unit*	*%*	*M,C*	*Daily*	*100%*	*Electronic*	
5	*Quantity of limestone used in the clinkerisation unit in baseline*	*In plant clinkerisation unit*	*Kilo tonnes*	*M*	*Annually*	*100%*	*Electronic*	
6	*Quantity of clinker used for PPC production in baseline B_clink*	*In plant grinding unit*	*Kilo tonnes*	*M*	*Annually*	*100%*	*Electronic*	
7	FFi,	*In plant clinkerisation unit*	*tonnes*	*M*	*Annually*	*100%*	*Electronic*	
8	EFFi_BSL	*IPCC default values for the fuels type*	*tCO2/tonne of fuel used*	*C*	*Annually*	*100%*	*Electronic*	
9	BELEgrid_CLNK, $_{BSL}$	*In plant clinkerisation unit*	*MWh*	*M*	*Monthly*	*100%*	*Electronic*	
10	EFgrid_BSL	*In plant data*	*tCO2/MWh*	*C, E*	*Annually*	*100%*	*Electronic*	
11	BELEsg_CLNK, $_{BSL}$	*In plant data*	*MWh*	*M*	*Monthly*	*100%*	*Electronic*	

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :

12	$EFsg_{\_BSL}$	*In plant data*	*tCO2/MWh*	*M,C,E*	*Annually*	*100%*	*Electronic*	
13	ADDy Quantity of additives added in the baseline	*In plant data*	*Kilo tonnes*	*M*	Monthly	*100%*	*Electronic*	
14	BEcalcin, $_{BSL}$	*In plant data*	*tCO2/tonne of clinker*	*C*	*Annually*	*100%*	*Electronic*	
15	BEfossil_fuel, $_{BSL}$	*In plant data*	*tCO2/tonne of clinker*	*C*	*Annually*	*100%*	*Electronic*	
16	BEele_grid_CLNK, $_{BSL}$	*In plant data*	*tCO2/tonne of clinker*	*C*	*Annually*	*100%*	*Electronic*	
17	BEele_sg_CLNK, $_{BSL}$	*In plant data*	*tCO2/tonne of clinker*	*C*	*Annually*	*100%*	*Electronic*	
18	BEele_grid_BC, $_{BSL}$	*In plant data*	*tCO2/tonne of blended cement*	*C*	*Annually*	*100%*	*Electronic*	
19	BEele_sg_BC, $_{BSL}$	*In plant data*	*tCO2/tonne of blended cement*	*C*	*Annually*	*100%*	*Electronic*	
20	BBlend,y	*In plant data*	*Tonne of clinker/tonne of blended cement*	*C*	*Annually*	*100%*	*Electronic*	
21	BC BSL	*In plant data*	*(kilo tonnes of BC)*	*M/C*	*Annually*	*100%*	*Electronic*	
22	BELEgrid_BC,$_{BSL}$	*In plant data*	*MWh*	*M,C*	*Annually*	*100%*	*Electronic*	
23	BELEsg_BC,$_{BSL}$	*In plant data*	*MWh*	*M,C*	*Annually*	*100%*	*Electronic*	
24	BELEgrid_ADD	*In plant data*	*MWh*	*M*	*Annually*	*100%*	*Electronic*	
25	BELEsg_ADD,$_{BSL}$	*In plant data*	*MWh*	*M*	*Annually*	*100%*	*Electronic*	
26	Fi,j,BSL	*In plant data*	*KL of FO and HSD*	*M*	*Monthly*	*100%*	*Electronic*	
27	**$COEF_{i,j\ BSL}$**	*IPCC for carbon content, NCV and density from third party.*	*tCO2/KL of fuel i*	*C*	*Annually*	*100%*	*Electronic*	

D.2.1.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of GHGs within the project boundary and how such data will be collected and archived :								
28	$GENj_{BSL}$	*In plant data*	*MWh*	*M*	*Annually*	*100%*	*Electronic*	
29	BEele_grid_ADD,$_{BSL}$	*In plant data*	*tCO2/tonne of blended cement*	*C*	*Annually*	*100%*	*Electronic*	
30	BEele_sg_ADD,$_{BSL}$	*In plant data*	*tCO2/tonne of blended cement*	*C*	*Annually*	*100%*	*Electronic*	
31	CLNKBSL	In plant data	Kilo tonnes of clinker produced annually	M,C	Annual	100%	Electronic	The daily clinker production is calculated from the proportional amount of Kiln feed (Raw meal) and the data is sum up to get the annual production. The Kiln feed is measured and recorded in factory report.

D.2.1.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.)

>>

BEBC,y = [BEclinker * BBlend,y] + BEele_ADD_BC **(2)**

where:

BEBC,y = Baseline CO2 emissions per tonne of blended cement type (BC) (tCO2/tonne BC)

BEclinker = CO2 emissions per tonne of clinker in the baseline in the project activity plant (t CO2/tonne clinker) and defined below

BBlend,y = Baseline benchmark of share of clinker per tonne of BC updated for year y (tonne of clinker/tonne of BC)

BEele_ADD_BC = Baseline electricity emissions for BC grinding and preparation of additives (tCO2/tonne of BC)

CO_2 per tonne of clinker in the project activity plant in the baseline has been calculated as below:

BEclinker = BEcalcin + BEfossil_fuel + BEele_grid_CLNK + BEele_sg_CLNK **(2.1)**

where:

BEclinker = Baseline emissions of CO2 per tonne of clinker in the project activity plant (t CO2/tonne clinker)

BEcalcin = Baseline emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate (t CO2/tonne clinker)

BEfossil_fuel = Baseline emissions per tonne of clinker due to combustion of fossil fuels for clinker production (t CO2/tonne clinker)

BEele_grid_CLNK = Baseline grid electricity emissions for clinker production per tonne of clinker (t CO2/tonne clinker)

BEele_sg_CLNK = Baseline emissions from self generated electricity for clinker production per tonne of clinker (t CO2/tonne clinker)

BEcalcin = [0.785*(OutCaO - InCaO) + 1.092*(OutMgO - InMgO)] / [CLNKBSL * 1000] (2.1.1)

Where:
BEcalcin = 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 = CaO content (%) of the raw material * raw material quantity (tonnes)
OutCaO = CaO content (%) of the clinker * clinker produced (tonnes)
InMgO = MgO content (%) of the raw material * raw material quantity (tonnes)
OutMgO = MgO content (%) of the clinker * clinker produced (tonnes)
CLNKBSL = Annual production of clinker in the base year (kilotonnes of clinker)

BEfossil_fuel = [∑FFi_BSL * EFFi] /[CLNKBSL * 1000] (2.1.2)

FFi_BSL = Fossil fuel of type i consumed for clinker production in the baseline (tonnes of fuel i)
EFFi = Emission factor for fossil fuel i (t CO_2/tonne of fuel)
CLNKBSL = Annual production of clinker in the base year (kilotonnes of clinker)

BEele_grid_CLNK = [BELEgrid_CLNK * EFgrid_BSL] /CLNKBSL* 1000 (2.1.3)

BELEgrid_CLNK = Baseline grid electricity for clinker production (MWh)
EFgrid_BSL = Baseline grid emission factor (tCO_2/MWh)
CLNKBSL = Annual production of clinker in the base year (kilotonnes of clinker)

BEelec_sg_CLNK = [BELEsg_CLNK * EFsg_BSL] /[CLNKBSL * 1000] (2.1.4)

BELEsg_CLNK = Baseline self generation of electricity for clinker production (MWh)
EFsg_BSL = Baseline electricity self generation emission factor (t CO_2/MWh)
CLNKBSL = Annual production of clinker in the base year (kilotonnes of clinker)

BEele_ADD_BC = BEele_grid_BC + BEele_sg_BC (2.2)

where:
BEele_grid_BC = Baseline grid electricity emissions for BC grinding (tCO_2/tonne of BC)
BEele_sg_BC = Baseline self generated electricity emissions for BC grinding (tCO_2/tonne of BC)

BEele_grid_BC = [BELEgrid_BC * EFgrid_BSL] /[BCBSL* 1000] (2.2.1)

BELEgrid_BC = Baseline grid electricity for grinding BC (MWh)
EFgrid_BSL = Baseline grid emission factor (t CO_2/MWh)

BCBSL = Annual production of BC in the base year (kilotonnes of BC)

BEelec_sg_BC = [BELEsg_BC * EFsg_BSL] / [BCBSL* 1000] **(2.2.2)**
BELEsg_BC = Baseline self generation electricity for grinding BC (MWh)
EFsg_BSL = Baseline electricity self generation emission factor (t CO2/MWh)
BCBSL = Annual production of BC in the base year (kilotonnes of BC)

$$EF_{sg,BLS} = \sum_{i,j} F_{i,j,y} \text{ X } COEF_{i,j} / \sum_{j} GEN_{j,y} \quad (2.3)$$

where:

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y, j refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports4to the grid,
$COEF_{i,j\,y}$ is the CO2 emission coefficient of fuel i (tCO2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j.

The CO_2 emission coefficient COEFi is obtained as

$$COEF_i = NCV_i \text{ X } EFCO_{2,i} \text{ X } OXID_i \quad (2.3.1)$$

where:
NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i,
$OXID_i$ is the oxidation factor of the fuel
$EFCO_{2,i}$ is the CO2 emission factor per unit of energy of the fuel i.

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

D.2.2.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

>>

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	**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	TFcons	*In plant data*	*Kg of fuel/ kilometre*	*C*	*Annually*	*100%*	*Electronic*	
2	Dadd_source	*In plant data*	*Km*	*M*	*Per trip*	*100%*	*Electronic*	

3	TEF	*IPCC default values for fuel used in transportation of fly ash*	*tonneCO2/kg fuel used*	*E*	*Annually*	*100%*	*Electronic*	*Data on grid generation and power plant details has been sourced from State grid and central electricity authority of India*
4	ELEconveyor_ADD	*In plant data*	*MWh*	*M*	*Monthly*	*100%*	*Electronic*	
5	EFgrid	*In plant data*	*t CO2/MWh*	*C*	*Annually*	*100%*	*Electronic*	*Latest published grid emission factor from CEA (Central Electricity Authority) applicable for the reporting period (ex-post) will be used for CER calculation. However if ex-ante value (0.988 tCO2/ MWh) found to be conservative to ex-post grid emission factor, ex-ante value will be used for CER calculation.*
6	Qadd	*In plant data*	*Tonne of additive/vehicle*	*M*	*Per trip*	*100%*	*Electronic*	
7	α_y	*In plant data*	*Tonne of additive*	*M/C*	*Annually*	*100%*	*Electronic*	
8	$\mathbf{A_{blend,y}}$	*In plant data*	*tonne of additives/tonne of BC*	*C*	*Annually*	*100%*	*Electronic*	*Baseline benchmark share of additives per tonne of BC updated for year. This fixed and ex-ante for respective years.*
9	$P_{blend,y}$	*In plant data*	*tonne of additives/tonne of BC*	*C*	*Annually*	*100%*	*Electronic*	*Share of additives per tonne of BC in year y is actual data calculated from PBlend y mentioned under equation 5 in page no. 8 of the applied methodology ACM 0005 version 2**

*Please note that PBlend y (Tonne of clinker/tonne of blended cement) has been represented as Pblend y against ID no. 29 in page no. 15 of the applied methodology ACM0005 version 2 as well as in our revised monitoring plan against ID no. 21 under the Table 2.1.1.1 above. This was a typographical error. As per the applied methodology PBlend,y is tonne of clinker/tonne of BC while Pblend,y is tonne of additives/tonne of BC.

Also please note that BBlend,y (tonne of clinker/tonne of BC) is the symbol used in the equation 1of page no. 5 of the applied methodology (ACM0005, version 2). Hence to align with this we have corrected the same which was mentioned as Bblend,y against sl. No. 21 of table D.2.1.3 in previous approved revised monitoring plan.

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

>>

$$L_{add\_trans} = [(TF_{cons} * D_{add\_source} * TEF) * 1/Q_{add} * 1/1000 + (ELE_{conveyor\_ADD} * EF_{grid}) * 1/ADD_y] \quad (3)$$

where:

L_{add_trans} = Transport related emissions per tonne of additives (t CO_2/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 CO_2/kg of fuel)

$ELE_{conveyor\_ADD}$ = 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. (tonnes of additives)

And leakage emissions per tonne of BC due to additional additives are determined by following formula (refer applied methodology ACM0005/Version 02 Sectoral Scope: 4 page no.: 7 and equation no. 2.1)

$$Ly = Ladd\_trans * [Ablend,y – Pblend,y] * BCy \quad (3.1)$$

where:

Ly = Leakage emissions for transport of additives (kilotonnes of CO2)

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

Ablend,y = Baseline benchmark share of additives per tonne of BC updated for year y (tonne of additives/tonne of BC)

Pblend,y = Share of additives per tonne of BC in year y (tonne of additives/tonne of BC)

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.)

>>

$$ER_y = \{ [BE_{BC,y} - PE_{BC,y}] * BC_y - L_y \} * (1 - \alpha_y) \quad (4)$$

where:

ER_y = Emissions reductions in year y due to project activity (thousand tonnes of CO_2)

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

$PE_{BC,y}$ = Project emissions per tonne of BC in year y (t CO_2/tonnes of BC)

BC_y = BC production in year y (thousand tonnes)

L_{Y} = Leakage emissions for transport of additives (kilo tonnes of CO_2)

α_y= Reduction factor

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

Data	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
In Table 2.1.1 Id No. 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. For any third party analysis, well reputed or accredited laboratory will be used.
In Table 2.1.3 Id No. 1-31	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.
In Table ID 2.3 ID numbers 1-9		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

>>

Orient Cement (Props : Orient Paper & Industries Limited) had deputed a team of qualified quality and cement industry experts to conceive, install and make operational the whole project. The Vice President (operation) would be assisted by his group of service and maintenance managers to implement the monitoring plan. The management structure for this project would be integrated with the ISO system in vogue at the plant.

Monitoring Approach

The general monitoring principles are based on:
The frequency of monitoring of the critical parameters according to the approved methodology ACM0005
The reliability of the data monitored
The archiving of the data collected

The project developer has installed adequate metering facilities within the plant premises. The measurements are monitored and controlled on a continual basis per day. The desired data is logged in log sheets by operator duly authenticated by head of plant

Reliability of the data

All measurement devices will be of digital type meters with on-line DCS (Distributed Control System) wherever practicable, having required accuracy and will be procured from reputed manufacturers. Since the reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment for reproducibility, all instruments must be calibrated once a year for ensuring reliability of the system. All instruments carry tag plates, which indicate the date of calibration and the date of next calibration. Therefore it ensures the monitoring system is highly reliable.

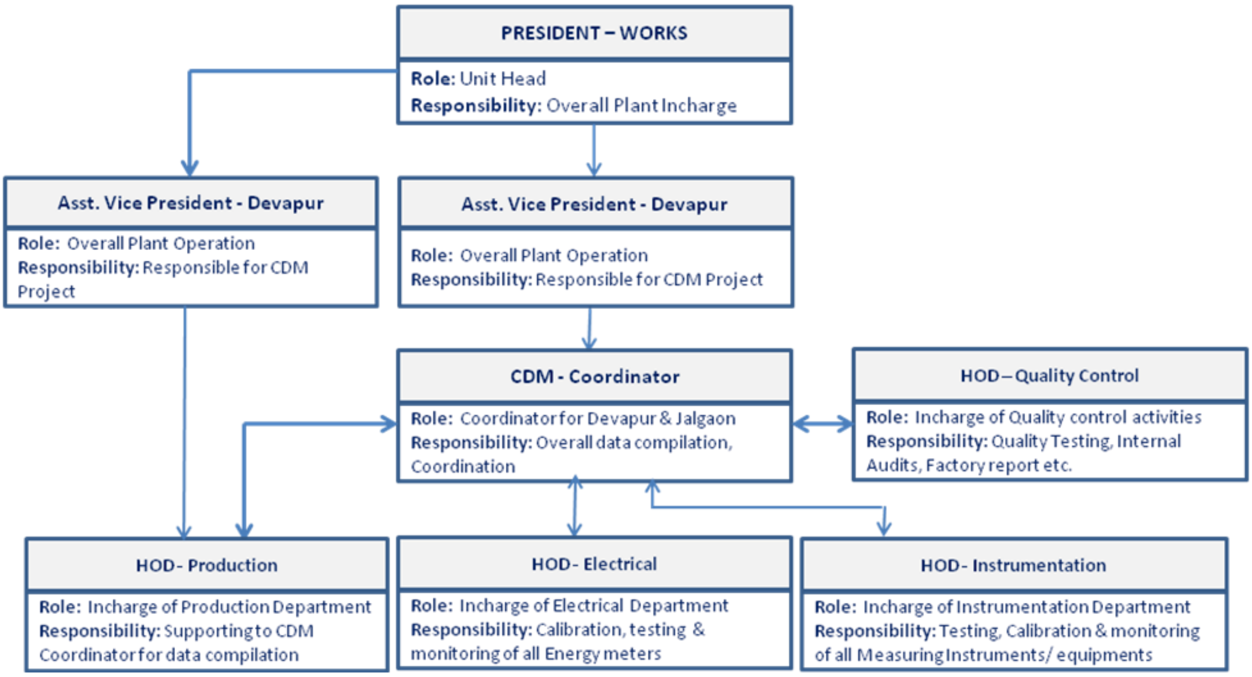
ANNEXURE -1 (BASELINE YEAR: 01/04/2001-31/03/2002)

I D No.	Baseline Emission Parameters	Applied Value	Source
1	In CaO_{BSL} (in tCaO)	0	Lab analysis report for the year 2001-02
2	Out CaO_{BSL} (in tCaO)	838342.7536	Lab analysis report for the year 2001-02
3	In MgO_{BSL} (in tMgO)	0	Lab analysis report for the year 2001-02
4	Out MgO_{BSL} (in tMgO)	16839.394	Lab analysis report for the year 2001-02
5	Quantity of limestone used in the clinkerisation unit in baseline (in KT)	1791.015	Factory report 2001-02
6	B_clink (in KT)	5.568894	Lab analysis report for the year 2001-02
7	FFi, (in MT)	199773.7 (for coal)	Lab analysis report for the year 2001-02
8	EFFi_BSL (in tCO2/tonne of coal)	1.845536 (for coal)	Calculated using total Carbon content of coal. Carbon content of coal was taken from 3rd party coal analysis report
9	BELEgrid_CLNK,$_{BSL}$ (in MWh)	43598.49	Calculated from factory report data for 2001-02
10	EFgrid_BSL (in tCO2/MWh)	0.988	Taken from CEA data for southern regional grid of India
11	BELEsg_CLNK, $_{BSL}$ (in MWh)	46806.89	Calculated based on Factory report data on in-house power generation
12	EFsg_$_{BSL}$ (in tCO2/MWh)	0.757751371	Calculated based on Fuel consumption and power generation in DG in the year 2001-02 and IPCC default value of NCV and carbon content and combustion efficiency
13	ADDy Quantity of additives added in the baseline (in KT)	1799	From Factory report of 2001-02
14	BEcalcin, $_{BSL}$ (in tCO2/tonne of clinker)	0.522248	Calculated based on CaO and MgO in and out material from Kiln and total clinker production data in 2001-02
15	BEfossil_fuel, $_{BSL}$ (in tCO2/tonne of clinker)	0.284628	Calculated based on annual production of clinker and emission factor of coal used in the kiln in 2001-02
16	BEele_grid_CLNK, $_{BSL}$ (in tCO2/tonne of clinker)	0.033254105	Calculated based on Grid electricity consumption data from plant record, grid emission factor from CEA and total clinker production data in 2001-02
17	BEele_sg_CLNK, $_{BSL}$ (in tCO2/tonne of clinker)	0.027381258	Calculated from self generation electricity consumption data, emission factor of self generated electricity and annual production of clinker in 2001-02

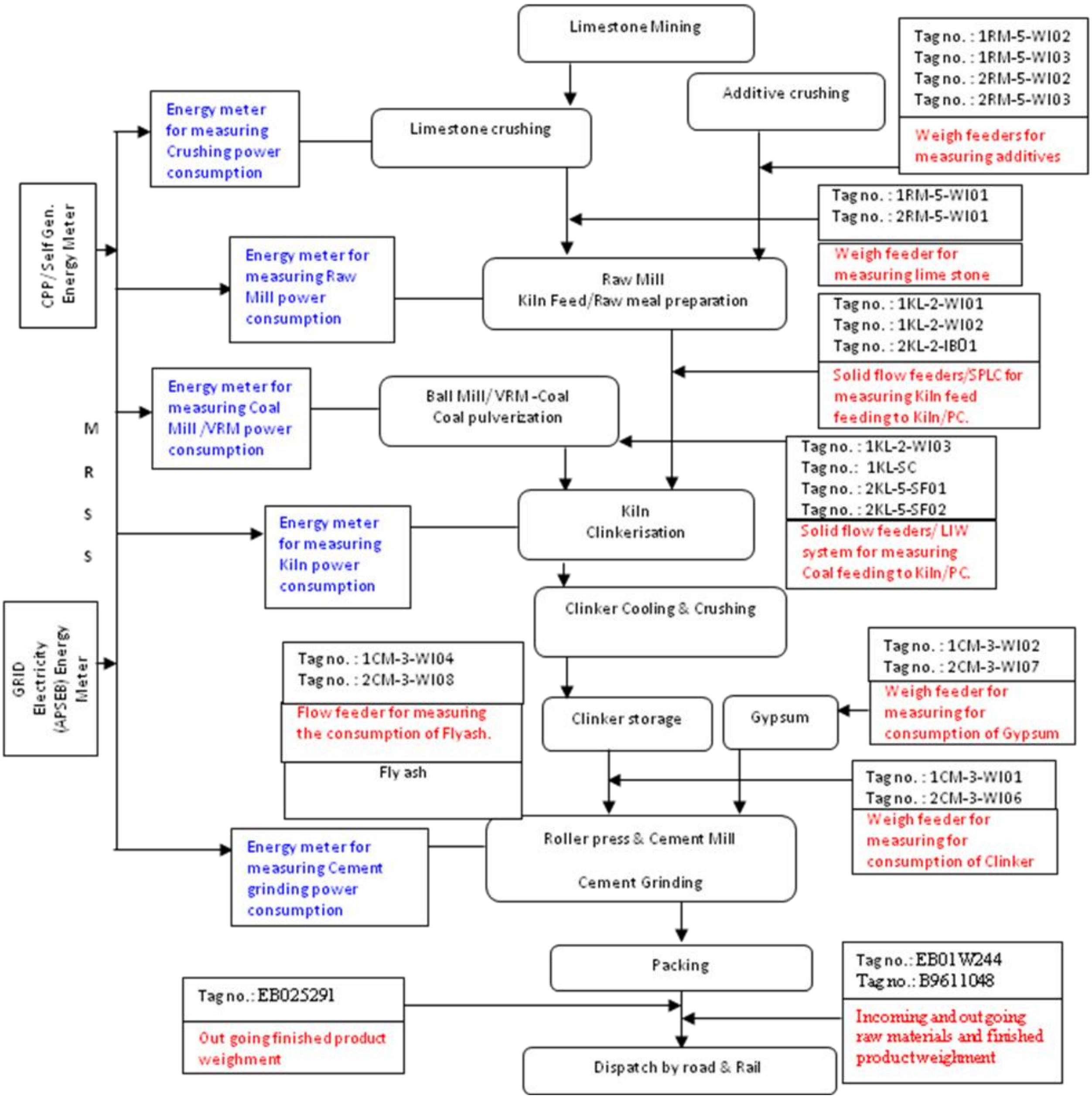
18	BEele_grid_BC, $_{BSL}$(in tCO2/tonne of blended cement)	0.0341848	Calculated from grid power consumption, grid emission factor and annual production of blended cement (BC) data in 2001-02
19	BEele_sg_BC, $_{BSL}$ (in tCO2/tonne of blended cement)	0	No self generation power was used in 2001-02 for cement grinding
20	Bblend,y (in Tonne of clinker/tonne of blended cement)	0.778793429	This is average (weighted by production) mass percentage of clinker for the 5 highest BC brands for the relevant cement type in the region. This value was validated during project validation. Please refer registered PDD page no. 11.
21	BC BSL (in KT of BC)	7.566	Total annual BC production data for 2001-02 taken from factory report.
22	BELEgrid_BC,BSL (in MWh)	261.78	Grid power consumption data for BC grinding in 2001 -02 taken Factory report.
23	BELEsg_BC,BSL (in MWh)	0	No self generated electricity was consumed for BC grinding in 2001-02.
24	BELEgrid_ADD,BSL (in MWh)	0	No grid electricity was consumed for additive preparation in 2001-02
25	BELEsg_ADD,BSL (in MWh)	0	No self generated electricity was consumed for additive preparation in 2001-02
26	Fi,j,BSL (in KL for HSD and FO)	1055.96 (for HSD) and 16431.67 (for FO)	Quantity of HSD and FO consumption for self generation power in 2001-02 and the data as per DG consumption report.
27	COEFi,j BSL (in tCO2/ KL)	2.70 (for HSD) and 2.92 (for FO)	Emission factor of HSD and FO calculated using IPCC default NCV, carbon content, carbon oxidation factor and supplier's specific gravity of respective fuel.
28	GENj,BSL (in MWh)	67082.12	Total in-house power generated in 2001-02 and available in factory report.
29	BEele_grid_ADD,BSL (in tCO2/ tonne of BC)	0	No grid electricity was consumed for additive preparation and hence no emission in 2001-02 for additive preparation due to grid power consumption.
30	BEele_sg_ADD,BSL (in tCO2/ tonne of BC)	0	No self generated electricity was consumed for additive preparation and hence no emission in 2001-02 for additive preparation due to self generated electricity consumption.
31	Annual production of clinker in the base year (kilotonnes of clinker) CLNKBSL (in KT)	1295.338	Lab analysis report for the year 2001-02

ANNEXURE – 2 – ROLES & RESPONSIBILITIES

ORGANISATION STRUCTURE



ANNEXURE – 3 LINE DIAGAM ALONGWITH MONITORING POINTS- DEVAPUR



APSEB: Andhra Pradesh State Electricity Board
MRSS: Main receiving Sub Station

ANNEXURE – 3A LINE DIAGAM ALONGWITH MONITORING POINTS- JALGAON