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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1 Title of the project activity:

Title: "Increasing the Additive Blend in cement production by Jaiprakash Associates Ltd (JAL)."

Version: Ver 1.1

Date: 5th December 2005

A.2. Description of the project activity:

The project activity is using increased level of additives to replace clinker in the manufacturing of Portland Pozzolana Cement (PPC) beyond the current levels used in Satna Cluster of India. The project activity uses fly ash from neighbouring thermal power plants (National Thermal Power Corporation-NTPC) as additive in PPC cement.

- The project activity entails developing PPC cement grades using higher levels of additives. These levels are higher than what is the common practice in the cement Industry in the region.
- Company has initiated Brand development exercise consisting of following activities:
    - Technical development of PPC grades with high fly-ash content, conducting performance tests for various applications and developing products which meet the specific needs of the application more appropriately.
    - Developing technical literature and promotion materials to create awareness and customer appreciation of such grades. Company has taken collaborative efforts with technical institutions & experts to validate use of blended cement in place of OPC.
    - Branding and promotion - conducting presentations, organizing customer meets, specialized packaging for blended grades, advertisements to help customer understand, that by use of such grades they help environmental protection.

The project activity has not undergone any major changes in manufacturing technology except some investments in handling ash/additives, classification and grinding, logistics of transporting ash etc. This project activity has been done in Rewa, Bela (Both in Madhya Pradesh, India) and Sadva Khurd (Uttar Pradesh, India) plants of Jaiprakash Associates Ltd.

Rewa and Bela plants have complete cement manufacturing processes like clinker production and then mixing and grinding of additives/flyash to produce blended cement. In Sadva Khurd plant fine flyash is blended directly with ground clinker. Ground clinker is sent to Sadva Khurd from Rewa/Bela plants in loose form, in closed tankers. Flyash is transported from nearby power plant and filtered to separate fine fly-ash. The coarse flyash is sent back to Rewa/Bela plant where it is mixed with ground Clinker, before packing.
The reduction in clinker requirement in the production of cement results in reduction of GHG emissions in the following ways –

1. Reduction in use of clinker in cement production which results in emission reduction in the following manner :

- Avoidance of electrical and thermal energy used in producing clinker and associated CO2 emissions.
- Avoidance of emission of CO2 associated with calcination of limestone in kilns

2. Reduction in emissions from reduced use of electrical energy in grinding & mixing of clinker & additives

Sustainable Development Aspects
The project activity also helps in the sustainable development of the region on following criteria -

Social well being:
It has provided new employment opportunities in operating the logistics process for transporting flyash from thermal power plants to the project site and also in flyash processing inside the cement plant.

Low clinker requirement also helps in conservation of the natural resources such as coal and limestone

Economic well being:
Reduced energy requirement leads to enhanced energy security in the region supported by reduced losses in transmission & distribution of electrical power.

Environmental well being:
i. Reducing the problems associated with handling, storage and disposal of the flyash generated in the nearby thermal power generation plants. (In normal practice fly ash is dumped in wasteland.)
ii. Reducing the air pollution caused from the flyash disposal sites near thermal power stations.
iii. Net GHG emissions reduction related with calcinations of limestone & energy use in clinker production

Technological well being:
The technology for the project activity is not new, however the project proponent has invested substantially in market-application development of blended cements with higher percentages to meet the expectations of the market.

A.3. Project participants:

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) Project participants (*) (as applicable)	Kindly indicate if the party involved wishes to be considered as project participant (yes/no)
Government of India	Jaiprakash Associates Ltd.	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

India

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

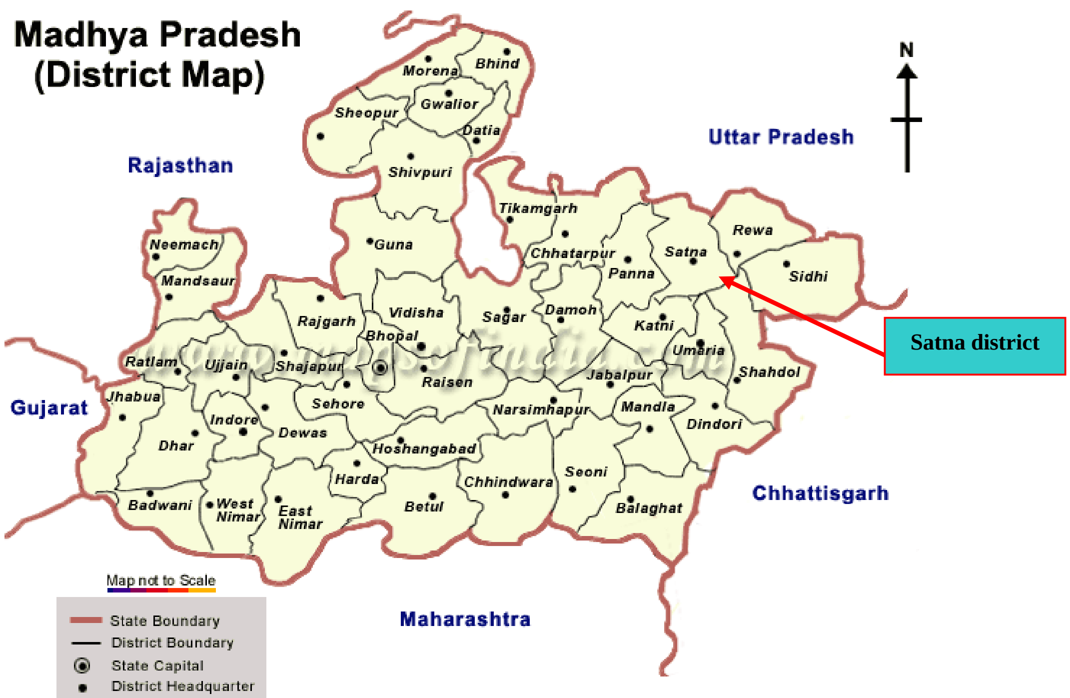
Madhya Pradesh and Uttar Pradesh

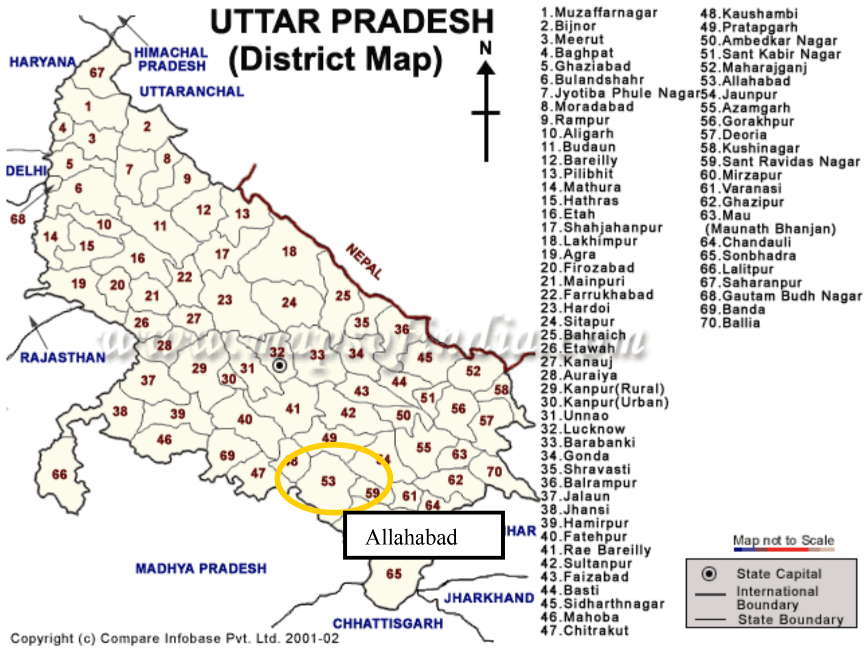
A.4.1.3. City/Town/Community etc:

Rewa District (Rewa and Bela plants) and Allahabad District (Sadva Khurd Plant)

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

The project is composed of changes in 3 plants of JAL. Two of the manufacturing plants Rewa & Bela are in Rewa district of Madhya Pradesh, India and are situated at a distance of 6 KM from each other. Sadva Khurd plant is in Allahabad district of Uttar Pradesh, India and is located at 100 KM distance from the Rewa Bela Plants





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

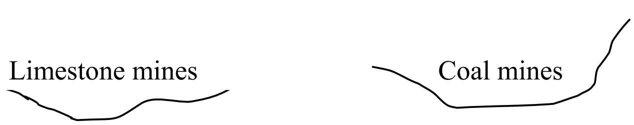
The project activity is a cement sector specific project activity. The project activity is categorized in Category 4: Manufacturing Industries.

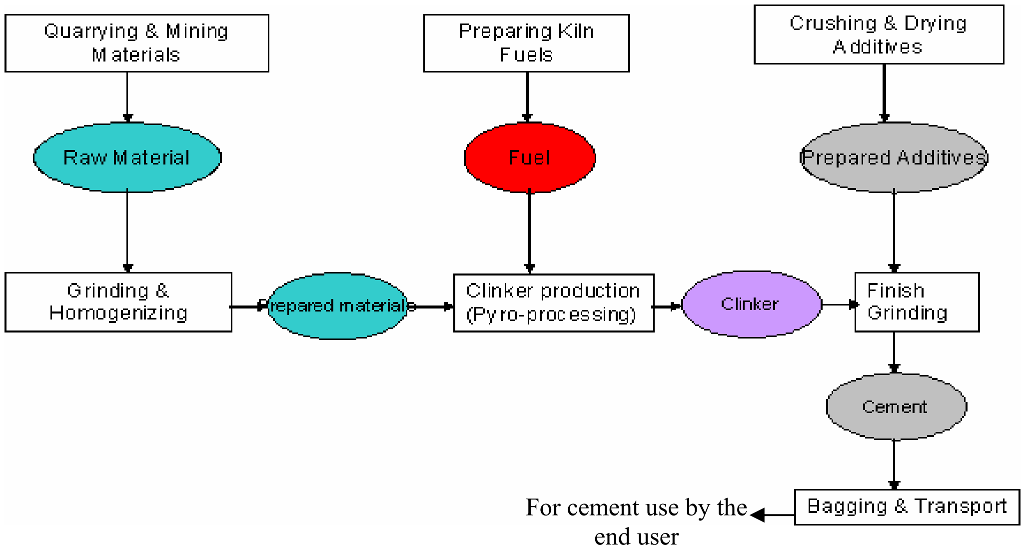
A.4.3. Technology to be employed by the project activity:

Existing blending setup was used for the project activity and no changes in manufacturing technology were done. The various stages of blended cement production are:

1. Procurement of raw materials
2. Raw Milling - Preparation of raw materials for the pyro-processing system
3. Pyro-processing – Pyro-processing raw materials to form clinker
4. Cooling & storage of clinker
5. Additive mixing & grinding
6. Packing and loading

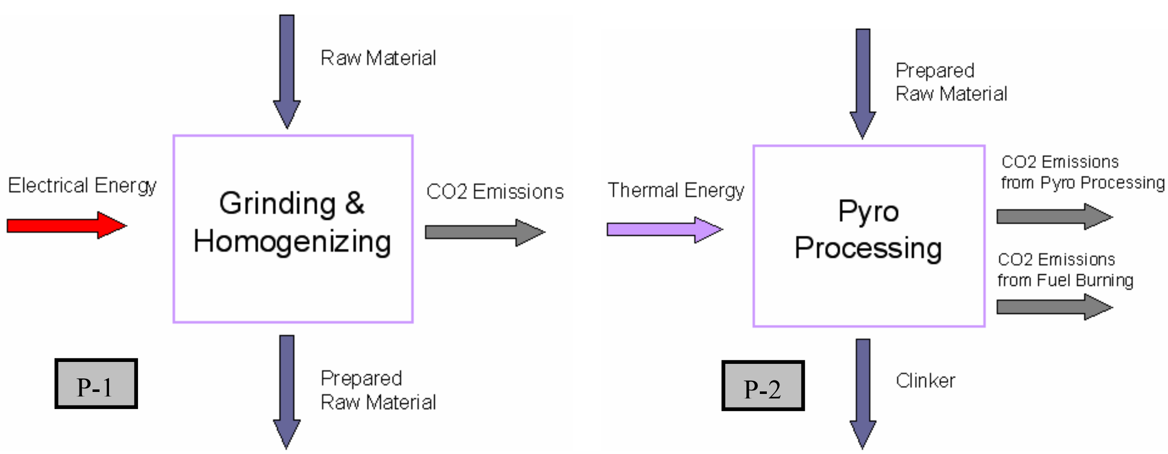
Process Diagram for Cement Manufacturing:

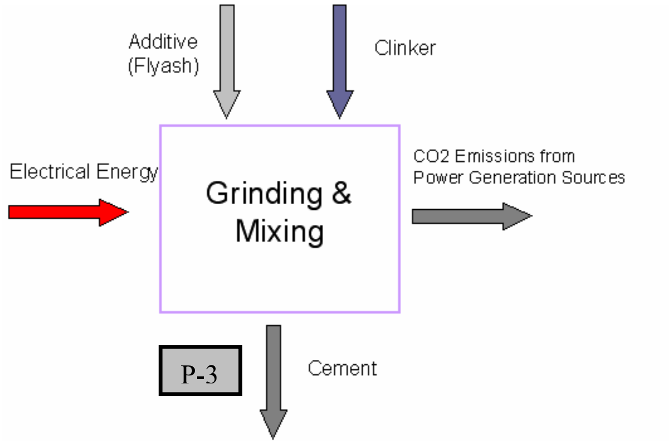




A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or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

The GHG emissions from different processes result as shown in the P1, P2 & P3 below –





The reduction in clinker requirement in the production of cement results in reduction of GHG emissions in the following ways –

1) Reduction in use of clinker in cement production which results in emission reduction through -
    a. Avoidance of electrical and thermal energy used in producing clinker and associated CO2 emissions. About 85-90% of energy used in cement production is consumed in clinker manufacturing. Hence reduction of clinker ratio in cement improves energy consumption/tonne of cement and reduces GHG emissions associated with this energy.
    b. Avoidance of emission of CO2 associated with calcination of limestone in kilns
2) Reduction in emissions from reduced use of electrical energy in grinding & mixing of clinker & additives

Markets resist cements, which use materials such as flyash /other process wastes, as they perceive the cements of such type are not as strong as OPC. There are a number of government departments which still bring out tenders requiring only OPC for major construction projects where blended cement would have easily sufficed[1].

In absence of technical development of PPC with enhanced additive use and comparable strength, and branding and promotion activities undertaken as part of project activity, the emission reduction would not have happened

There are no sectoral policies mandating increase in additive/flyash content in blended cement, thus users are free to choose cements based on their perceptions.

The estimated total reduction in tonnes of CO2 equivalent over the crediting period of 7 years = 235263 tCO2e for the first crediting period

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

Years	**Annual estimation of emission reductions in tones of CO2 e**

[1] A dossier of such tenders (number of instances where tenders invite only OPC offers) as an example of this bias is prepared by Project Proponent and can be made available.

2004-05	31646
2005-06	32279
2006-07	32924
2007-08	33583
2008-09	34254
2009-10	34940
2010-11	35638
Total estimated reductions (tonnes of CO2 e**)**	235263
Total number of crediting years	7 years (first crediting period, twice renewable)
Annual average over the crediting period of estimated reductions (tonnes of CO2e**)**	33608

A.4.5. Public funding of the project activity:

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:

Approved Methodology: ACM0005, "Consolidated Methodology for Increasing the Blend in Cement Production"

Version: 02; 28th Novemeber 2005

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

The baseline methodology applies to cement manufacturing industries that aim to increase the share of additive (Flyash in the project activity) in the production of Portland Pozzolana Cement (PPC) beyond current practices in the country (India).

The position of the CDM project activity of JAL vis-à-vis applicability conditions in the ACM 0005/Verson01 is described in the following table.

Applicability Conditions in the AM0005/Version02	**Position of the project activity vis-à-vis applicability conditions**
There is no shortage of additives to prevent leakage 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. If the surplus availability of additives is not substantiated the project emissions reductions (ERs) will be discounted.	The flyash used in the PPC is abundantly available in the region and has no alternative use. In normal situations surplus flyash is dumped in to wasteland. Documents/evidences would be made available to DOE for validation.
This methodology is applicable to domestically sold output of the project activity plant and excludes export of blended cement types.	Only domestic sale of PPC is considered in the project activity emissions reduction.
Adequate data are available on cement types in the market.	Adequate data are available in the public forum for the project activity.

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

The project activity uses the approach described in the ACM0005/Version02-"Consolidated Methodology for Increasing the Blend in Cement Production".

SN	Key Information	Information Source
1	Baseline Plants and additive content	Cement Statistics published by Cement manufacturer's association for past 5 years
2	Project activity additive contents	Plant data for all three plants
3	Captive power emission factor	Plant data regarding power generation, actual fuel consumption, fuel calorific value
4	Grid Emission Factor calculation	Western Region Electricity Board (WREB) Annual Reports, Central Electricity Authority (CEA) reports
5	Fuel emission factor	IPCC default value for each fuel type

Baseline Benchmark:

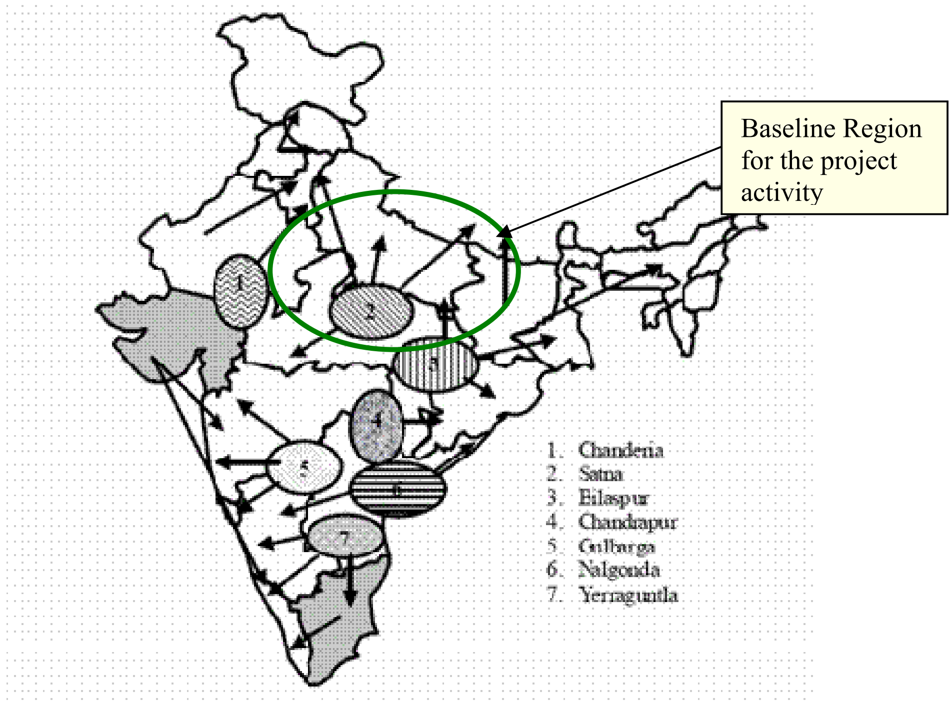
Step 1: Selecting Region:

Baseline Benchmark Region: Madhya Pradesh (Satna Cluster), State of Uttar Pradesh, Delhi, Bihar and Uttaranchal

Cement being bulk commodity, involves high freight costs for transportation. So, proximity to the market and availability of raw material & fuel are two deciding factors for choosing a plant location for a cement plant in India. This makes cement production regionalized with manufacturing units concentrated in specific locations called clusters.

As cement plants located in one particular region serve a few specific markets, and face similar economic conditions (like raw material availability, power cost, infrastructure etc) environmental conditions (Regional rules & regulation) and social conditions, Satna cluster (Rewa and Bela plants) defined by Cement Manufacturers Association (CMA) is included in the region.

Cement manufactured by JAL is supplied to Uttar Pradesh, Madhya Pradesh, Bihar, Uttaranchal, and Delhi (these states contribute to more than 94% of domestic sales). Satna cluster is in Madhya Pradesh and covers most of the plants in the state. Plants in other states mentioned above are also included in the region. This region defined for the project activity meets all applicability conditions defined in the methodology.



1. The region defined above covers more than 94% of the cement sold by JAL;
2. Includes more than 5 other plants with the required published data; and
3. The production in the region is more than four times the project activity plant's output.
4. Only domestically sold output is considered and any export of cement produced by the project activity plant are excluded in the estimation of emission reductions.

Step 2: Baseline Benchmark

In the above selected region (comprising of Madhya Pradesh (Satna Cluster), Uttar Pradesh, Delhi, Uttaranchal, and Bihar) there are 19 cement producing plants. Each operational plant is considered in the baseline benchmark analysis. Plant production data published by CMA is taken for baseline benchmark estimation. The benchmark for baseline emissions is defined as the lowest value among the following:

- The average (weighted by production) mass percentage of clinker for the 5 highest blend cement brands for the relevant cement type in the region;

Clinker percentage in top 5 blend cement brands for PPC in the region	**73.13%** (Additive content-26.87%)

- 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;

Clinker percentage in top 20% by share of additives	**72.31%** (Additive content-27.69%)

- 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.

Combined	2001-02	2002-03	2003-04
PPC	2490642	3155446	3404539
Clinker	1823355	2320791	2463004
Clinker %	73.21%	73.55%	72.34%
Additives %	26.79%	26.45%	27.66%
	Baseline Benchmark		27.66%

Clinker percentage in the project activity (Highest additives % during past three years)	**72.34%** (Additive content- 27.66%)

As per the guidelines given in ACM0005/version 2, baseline benchmark is the lowest clinker value in above three situations. Baseline benchmark is chosen as 72.31% Clinker percentage in the Blended cement. Clinker percentage is lowest in the second option (highest additive percentage in the top 20% in the region). The benchmark incorporates a trend increase, specified ex-ante, in the share of additives in blended cement type based on a minimum of an annual 2% increase in additives.

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:

In the absence of the Project Activity, additive content in the blended cement promoted by JAL would have remained same as past performance or would have reduced due to various barrier posed by market for such type of cement in the market.

Additionality of the Project Activity

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

- Increased additive content in the project activity reduces GHG emissions below in baseline emissions.

- Project Activity starts from April, 2004

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

1. *Increase in additive content in cement production*
   - Project activity is not mandatory under any National/regional or Sectoral policies. Bureau of Standards (BIS- a government body) has set a maximum limit of 35% of flyash content in PPC, but no standard percentage flyash content is prescribed. Cement demand in India is increasing rapidly and will continue to grow due to increased investment in infrastructure sector in fast growing Indian economy. This market growth has no impact on clinker cement ratio in PPC/blended cement as many government departments have banned use of blended cement in construction work. This is because of low awareness about Blended cement (It is not considered as good as OPC) and high prices.

- Until these barriers are removed or overcome by development effort, additive content in blended cement would not go up on its own.

2. *Continue with the existing additive content in cement production*
   - This is a possible scenario as evident by past few years' data that additive content in blended cement has stagnated.
3. *Further decrease in the additive content in cement production*
   - Given the increased demand in the infrastructure sector and low acceptability of blended cement, project activity might lead to decrease in additive content in blended cement[2]. The same scenario was witnessed in year 2000-01 and 2002-03 when additive content in cement has gone down each year due to many barriers.

Flyash content in blended cement is regulated by Bureau of Indian Standards (IS-1489, Part-1). As per BIS the maximum percentage of the flyash that can be accepted in PPC cement is 35%.None of the above project alternatives violate the above standard or any other existing legal and regulatory requirements.

Step 2: Barrier analysis

Technological barriers:

In India, blended cements are gaining attention only for the last few years. But flyash content in blended cement is still very low as compared to maximum percentage allowed by Bureau of Indian Standards (BIS). Main reasons prohibiting increase in flyash contents are:

- The Bureau of Indian Standards has laid down certain minimum physical and chemical specifications for all types of cement. The BIS has categorized Ordinary Portland Cement (OPC) into three categories namely, 33 Grade, 43 Grade and 53 Grade.
  - Customer buys cement based on these standards. And as PPC of similar quality/standard is not available, customers prefer using OPC grade cement only.
  - Investments are required to develop blended/PPC cement grades, which are equivalent/superior in performance to OPC grades in various applications.

- As not much efforts have been focused on ensuring good quality of flyash by power plants. It is important for cement manufacturers to develop in-house capabilities to use various types of flyash coming in for blending.

JAL are actively involved in doing R&D work on Blended cement, driven by their corporate policy of being environmentally friendly. These research works are carried out in in-house R&D facilities and with various research institutes.

Market Acceptability Barrier[3]:

There is little willingness for change from the current practice of using OPC grades to PPC grades in new application areas

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[2] The same scenario was witnessed between year 2000-01 and 2002-03 when additive content in cement has gone down each year due to many barriers faced by high additive content PPC.

[3] Necessary documents/evidences would be provided to DOE for validation

- This has primarily been because of the poor market acceptability of PPC/blended cements due to poor perceptions concerning the performance of blended cements. There is a perception that blended cement doesn't provide same strength as OPC (it has waste flyash!!!) and also it has limited usage applications.
- This perception is enhanced by purchasing practices of the government bodies like DGS&D, CPWD, NHAI, UP State Bridge Corporation Ltd and many others, which do not accept the use of blended cements. This has led to unwarranted doubts in the minds of other users concerning the quality & performance of these blended cements as well.
- Pricing of Blended cement is also an issue restricting increased flyash usage. Normally Blended cement is priced at same levels as OPC; this is due to high cost arising from high promotional and R&D investments incurred for blended cement and large transportation costs for flyash

The identified barriers apply to production of PPC/blended cements substituting OPC cement in various applications. It is quite probable that these barriers will continue to and sales of PPC will stagnate or decline if no product development and market promotion is undertaken. Hence it is clear that barriers apply to the project activity and not other scenarios and therefore the project activity satisfies the additionality logic.

Step 3: Common Practice Analysis

Sub-step 3a. Analyze other activities similar to the proposed project activity:

There is no project activity similar to the proposed project activity in the system boundary. Due to various market barriers flyash content in blended cement is very low in most of the other cement plants in the system boundary (Past 5 years). The company is one of the first ones to introduce very high strength (>55 MPA) strength cement in the region.

Sub-step 3b: Discuss any similar options that are occurring

No similar kind of projects in the system boundary. Sub-steps 3a and 3b are satisfied, i.e. similar activities cannot be observed.

Step 4: Impact of CDM registration

If carbon credits from registering project activity as CDM activity are not availed to remove market barriers restricting increased flyash content in blended cement, flyash levels will stagnate or decline,. (Last three years data have been used to estimate maximum flyash content possible/reached in blended cement, this is used as baseline benchmark for the proposed project activity)

CDM registration shall help in removing barriers against project activity in following manner:

Product Related:

- Technical development of PPC grades with high fly-ash content, conducting performance tests for various applications and developing products which meet the specific needs of the application more appropriately.
    i. Buland Cement promoted by JAL is a blended cement having a 28 days compressive strength of 55 Mpa certified by IIT's Roorkee & Delhi. Buland cement today is known for its engineering quality, strength & durable construction and enjoys market leadership status in all the markets where it is being sold.
    ii. Jaypee Cement Complex is producing all popular special blends of PPC such as 'Buniyad' , and Superplus PPC – all surpassing applicable BIS standards and would shortly be introducing a Low Alkali cement also.

- Company has taken collaborative efforts with technical institutions & experts to validate use of blended cement in place of OPC. Quality testes conducted by autonomous institutions like IITs, National council for cement and building material (NCCBM); help in creating credibility of blended cement with higher flyash content in the market.

- Efforts are being made by the project proponent to amend the standards prescribed by ISI and BIS so that flyash content could be increased further.

Promotion Related:

The company invests substantial resources[4] in undertaking the following types of development activities

- Branding and promotion - conducting presentations, organizing customer meets, specialized packaging for blended grades, advertisements to help customer understand that by use of such grades they help environmental protection.

- Technical seminars for leading architects, structural engineers (technical people), decision making body. Developing technical literature and promotion materials to create awareness and customer appreciation of such grades.

- Mass campaigns like mason meets and at grass root level awareness programs through audio-visual programs. Creation of large multi-locational Technical cells to support & educate consumers on uses of cement in various types of construction.

- The blended brands would also have a 'specific discount' for promoting their use. The discount would be offered using the benefits derived from the Carbon Credits and would be annually revised in light of prices of credits prevailing in the last 1 yr. Thus the customer would enjoy part of the benefits received from the sale of Carbon Credits.

Summary:

Proposed project activity of increasing flyash content in blended cement to levels beyond what industry in currently using is thus additional project activity and is not a baseline scenario.

[4] details of financial investment made in these activities can be shared with DOE

a. Investing in R&D to ensure good product quality, development of application specific technical validation to assure clients that the cement will work, technical workshop and conferences to share the technical validation done etc

b. And by passing on the Carbon Credit benefits to the end user, (as a form of incentive) by offering price discount on blended cement to create a market for it. This will be done post registration of the CDM Project.

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

The project boundary includes the cement production plant, onsite power generation, and the power generation in the grid (if applicable).

Following emission sources are accounted for in the project activity:

- Direct emissions at the cement plant due to fuel combustion for:
    - Firing the kiln (including supplemental fuels used in the pre-calciner);
    - Processing (including drying) of solid fuels, raw materials, and additives;
    - On-site generation of electricity.
- Direct emissions due to calcination of limestone (i.e. calcium carbonate and magnesium carbonate, if present in the raw meal).
- Indirect emissions from fossil fuel combustion in power plants in the grid due to electricity use at the cement plant, including electricity consumption for:
    - Crushing and grinding the raw materials used for clinker production;
    - Driving the kiln and kiln fans;
    - Finish grinding of cement;
    - Processing of additives.

The power grid or plant from which the cement plant purchases electricity and its losses will be considered in determining indirect emissions. 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.

Gases included: CO2 only. Changes in CH4 and N2O emissions from combustion processes are considered to be negligible and excluded because the differences in the baseline and project activity are not substantial. This assumption simplifies the methodology and is conservative.

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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:

01/10/2005

Ashutosh Pandey
Emergent Ventures India Pvt. Ltd.
II C-141 Ridgewood Estate, DLF Phase IV
Gurgaon, Haryana – 122 002, India

Phone: 91-124 5102980
Mobile: 91-9312547154
Email: ashutosh@emergent-ventures.com

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/April/2004

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

25 Years

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

C.2.1. Renewable crediting period

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

01/April/2004

C.2.1.2. Length of the first crediting period:

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

C.2.2.2. Length:

SECTION D. Application of a monitoring methodology and plan

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

The project activity uses the monitoring methodology ACM0005 "Consolidated Monitoring Methodology for the Production of Blended Cement"

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

The project activity complies with the applicability criteria for the monitoring methodology ACM0005 in the following manner[5] -

1) This project activity is using increased level of flyash in production of PPC beyond the level of regional practice.
2) There is no shortage of flyash being used as additive in PPC, which is generated in thermal power plants of NTPC and is a waste with problems associated with its handling & disposal.
3) The PPC production considered for the calculation of CERs is the net PPC sold out in the domestic markets only.
4) Data on cement industry has been taken from Cement Manufacturers' Association's (CMA) annual reports.

[5] See Section B.1.1 for applicability criteria

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	$InCaO_y$	Plant records	%	M,C	Daily	100%	Electronic	Calculated as part of normal operations
2	$OutCaO_y$	Plant records	%	M,C	Daily	100%	Electronic	Calculated/measured as part of normal operations
3.	$InMgO_y$	Plant records	%	M,C	Daily	100%	Electronic	Calculated/measured as part of normal operations
4.	$OutMgO_y$	Plant records	%	M,C	Daily	100%	Electronic	Calculated/measured as part of normal operations
5.	Quantity of clinker raw material	Plant records	KT	M	Annually	100%	Electronic	
6.	$CLNK_y$	Plant records	Kilo tonnes of clinker	M	Annually	100%	Electronic	
7.	$FF_{i,y}$	Plant records	Tonnes of fuel i	M	Annually	100%	Electronic	
8.	EFE_i	IPCC/ Plant records	tCO2/tonne of fuel i	C/ M	Annually	100%	Electronic	
9.	$PELE_{grid\_CLNK,y}$	Plant records	MWh	M	monthly	100%	Electronic	
10.	EF_{grid_BSL}	See comment	tCO2/MWh	C	Annually	100%	Electronic	ACM002 used to determine electricity emissions factor for grid, see Annex 3 for details
11.	$PELE_{sg\_CLNK,y}$	Plant	MWh	M	Monthly	100%	Electronic	

		records						
12.	EF_{sg_y}	Plant records/ IPCC	tCO2/MWh	C	Monthly	100%	Electronic	All sources for captive power generation are taken to calculate the weighted average
13.	ADD_y Quantity of additives	Plant records	Kilo tones	M	Monthly	100%	Electronic	
14.	$PELE_{grid\_BC,y}$	Plant records	MWh	M	Monthly	100%	Electronic	
15.	$PELE_{sg\_BC,y}$	Plant records	MWh	M	Monthly	100%	Electronic	
16.	PELEgrid_ADD	Plant record	MWh	M	Monthly	100%	Electronic	
17.	$PELE_{sg\_ADD,y}$	Plant records	MWh	M	Monthly	100%	Electronic	
18.	$F_{i,j,y}$	Plant records	Tonnes of fuel i	M	Monthly	100%	Electronic	
19.	$COEF_{i,j,y}$	IPCC/ Plant records	tCO2/tonne of fuel i	C/M	Annually	100%	Electronic	
20.	$GEN_{j,y}$	Plant records	MWh	M	Annually	100%	Electronic	
21.	$PE_{calcin,y}$	Plant records	tCO2/ tonne clinker	C	Annually	100%	Electronic	
22.	$PE_{fossil\_fuel,y}$	Plant records	tCO2/tonne clinker	C	Annually	100%	Electronic	
23.	$PE_{ele\_grid\_CLNK,y}$	Plant records	tCO2/tonne clinker	C	Annually	100%	Electronic	
24.	$PE_{ele\_sg\_CLNK,y}$	Plant records	tCO2/tonne clinker	C	Annually	100%	Electronic	
25.	$PE_{ele\_grid\_BC,y}$	Plant records	tCO2/tonne blended cement	C	Annually	100%	Electronic	
26.	$PE_{ele\_sg\_BC,y}$	Plant	tCO2/tonne	C	Annually	100%	Electronic	

		records	blended cement					
27.	$PE_{ele\_grid\_ADD,y}$	Plant records	tCO2/tonne blended cement	C	Annually	100%	Electronic	
28.	$PE_{ele\_sg\_ADD,y}$	Plant records	tCO2/tonne blended cement	C	Annually	100%	Electronic	
29.	$P_{blend,y}$	Plant recods	Tonne of clinker/ tonne of blended cement	C	Annually	100%	Electronic	

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

$$PE_{BC,y} = [PE_{clinker,y} * P_{Blend,y}] + PE_{ele\_ADD\_BC,y} \quad \textbf{(1)}$$

where:
$PE_{BC,y}$ = CO_2 emissions per tonne of Blended Cement (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 CO_2/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 (tCO2/tonne of BC)

CO_2 per tonne of clinker in the project activity plant in year y is calculated as below:

$$PE_{clinker,y} = PE_{calcin,y} + PE_{fossil\_fuel,y} + PE_{ele\_grid\_CLNK,y} + PE_{ele\_sg\_CLNK,y} \quad \textbf{(1.1)}$$

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

$PE_{calcin,y} = 0.785*(OutCaO_y - InCaO_y) + 1.092*(OutMgO_y - InMgO_y) / [CLNK_y * 1000]$	**(1.1.1)**

$PE_{calcin,y}$ = 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)

$PE_{fossil\_fuel,y} = [\sum FF_{i\_,y} * EFF_i] / CLNK_{,y} * 1000$	**(1.1.2)**

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 (tCO2/tonne of fuel)
$CLNK_y$ = Annual production of clinker in year y (kilotonnes of clinker)

$PE_{ele\_grid\_CLNK,y} = [(PELE_{grid\_CLNK,y} * EF_{grid\_y}) / [CLNK_y * 1000]$	**(1.1.3)**

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)

$PE_{ele\_sg\_CLNK,y} = [\sum(PELE_{sg\_CLNK,y} * EF_{sg\_y})] / [CLNK_y * 1000]$	**(1.1.4)**

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)

$PE_{ele\_ADD\_BC,y} = PE_{ele\_grid\_BC,y} + PE_{ele\_grid\_ADD,y} + PE_{ele\_sg\_BC,y} + PE_{ele\_sg\_ADD,y}$	**(1.2)**

where:
$PE_{ele\_grid\_BC}$ = Grid electricity emissions for BC grinding in year y (tCO2/tonne of BC)
$PE_{ele\_grid\_ADD}$ = Grid electricity emissions for additive preparation in year y (tCO2/tonne of BC)
$PE_{ele\_sg\_BC}$ = Captive electricity emissions for BC grinding in year y (tCO2/tonne of BC)

$PE_{ele\_sg\_ADD}$ = Captive electricity emissions for additive preparation in year y (tCO2/tonne of BC)

$$PE_{ele\_grid\_BC,y} = [\ (PELE_{grid\_BC,y} * EF_{grid\_BSL,y})\ /[BC_y * 1000] \quad \textbf{(1.2.1)}$$

$PELE_{grid\_BC,y}$ = 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)

$$PE_{ele\_sg\_BC,y} = [\ (PELE_{sg\_BC,y} * EF_{sg\_y})]\ /[BC_y * 1000] \quad \textbf{(1.2.2)}$$

$PELE_{sg\_BC,y}$ = 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 (kilotonnes of BC)

$$PE_{ele\_grid\_ADD} = [\ (PELE_{grid\_ADD} * EF_{grid\_y})\}/[BC_y * 1000] \quad \textbf{(1.2.3)}$$

$BELE_{grid\_ADD}$ = Baseline grid electricity for grinding additives (MWh)
EF_{grid_y} = Grid emission factor in year y(t CO_2/MWh)

$$PE_{ele\_sg\_ADD} = [\ (PELE_{sg\_ADD,y} * EF_{sg\_y})]\ /[BC_y * 1000] \quad \textbf{(1.2.4)}$$

$PELE_{sg\_ADD,y}$ = Baseline self generation electricity for grinding additives (MWh)
EF_{sg_y} = Emission factor for self generated electricity in year y (t CO_2/MWh)

All fuel uses are expressed in net calorific values (NCV) or lower heating value (LHV). All units use the metric system, unless specified otherwise. In determining emission coefficients, emission factors or net calorific values in this methodology, guidance by the 2000 IPCC Good Practice Guidance should be followed where appropriate.

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 *(Please use numbers to ease cross-referencing to table*	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.3)								
1	$InCaO_{BSL}$	Plant records	%	M,C	Daily	100%	Electronic	Calculated as part of normal operations
2	$OutCaO_{BSL}$	Plant records	%	M,C	Daily	100%	Electronic	Calculated/measured as part of normal operations
3.	$InMgO_{BSL}$	Plant records	%	M,C	Daily	100%	Electronic	Calculated/measured as part of normal operations
4.	$OutMgO_{BSL}$	Plant records	%	M,C	Daily	100%	Electronic	Calculated/measured as part of normal operations
5.	Quantity of clinker raw material	Plant records	KT	M	Annually	100%	Electronic	
6.	$CLNK_{BSL}$	Plant records	Kilo tonnes of clinker	M	Annually	100%	Electronic	
7.	$FF_{i,BSL}$	Plant records	Tonnes of fuel i	M	Annually	100%	Electronic	
8.	EFE_i	IPCC/ Plant records	tCO2/tonne of fule i	C/ M	Annually	100%	Electronic	
9.	$BELE_{grid\_CLNK,BSL}$	Plant records	MWh	M	monthly	100%	Electronic	
10.	EF_{grid_BSL}	See comment	tCO2/MWh	C	Annually	100%	Electronic	ACM002 used to determine electricity emissions factor for the grid, see Annex 3 for details
11.	$BELE_{sg\_CLNK,BSL}$	Plant records	MWh	M	Monthly	100%	Electronic	
12.	EF_{sg_BSL}	Plant records/ IPCC	tCO2/MWh	C	Monthly	100%	Electronic	Based on weighted average of all the captive power generation sources
13.	ADD_{BSL} Quantity of additives	Plant records	Kilo tones	M	Monthly	100%	Electronic	
14.	$BELE_{grid\_BC,BSL}$	Plant records	MWh	M	Monthly	100%	Electronic	
15.	$BELE_{sg\_BC,BSL}$	Plant	MWh	M	Monthly	100%	Electronic	

		records						
16.	BELEgrid_ADD	Plant record	MWh	M	Monthly	100%	Electronic	
17.	$BELE_{sg\_ADD,BSL}$	Plant records	MWh	M	Monthly	100%	Electronic	
18.	$F_{i, j, BSL}$	Plant records	Tonnes of fuel i	M	Monthly	100%	Electronic	
19.	$COEF_{i,j,BSL}$	IPCC/ Plant records	tCO2/tonne of fuel i	C/M	Annually	100%	Electronic	
20.	$GEN_{j,BSL}$	Plant records	MWh	M	Annually	100%	Electronic	
21.	$BE_{calcin,BSL}$	Plant records	tCO2/ tonne clinker	C	Annually	100%	Electronic	
22.	$BE_{fossil\_fuel,BSL}$	Plant records	tCO2/tonne clinker	C	Annually	100%	Electronic	
23.	$BE_{ele\_grid\_CLNK,BSL}$	Plant records	tCO2/tonne clinker	C	Annually			
24.	$BE_{ele\_grid\_BC,BSL}$	Plant records	tCO2/tonne blended cement	C	Annually	100%	Electronic	
25.	$BE_{ele\_grid\_ADD,BSL}$	Plant records	tCO2/tonne blended cement	C	Annually	100%	Electronic	
26.	$BE_{ele\_sg\_CLNK,BSL}$	Plant records	tCO2/tonne clinker	C	Annually			
27.	$BE_{ele\_sg\_BC,BSL}$	Plant records	tCO2/tonne blended cement	C	Annually	100%	Electronic	
28.	$BE_{ele\_sg\_ADD,BSL}$	Plant records	tCO2/tonne blended cement	C	Annually	100%	Electronic	
29..	$B_{blend,y}$	Plant recods	Tonne of clinker/	C	Annually	100%	Electronic	

			tonne of blended cement					

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

$BE_{BC,y} = [BE_{clinker} * B_{Blend,y}] + BE_{ele\_ADD\_BC}$ **(2)**

where:

$BE_{BC,y}$ = Baseline CO_2 emissions per tonne of blended cement type (BC) (tCO_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 (tCO2/tonne of BC)

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

$BE_{clinker} = BE_{calcin} + BE_{fossil\_fuel} + BE_{ele\_grid\_CLNK} + BE_{ele\_sg\_CLNK}$ **(2.1)**

where:

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

BE_{calcin} = Baseline emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate (t CO_2/tonne clinker)

BE_{fossil_fuel} = Baseline emissions per tonne of clinker due to combustion of fossil fuels for clinker production (t CO_2/tonne clinker)

$BE_{ele\_grid\_CLNK}$ = Baseline grid electricity emissions for clinker production per tonne of clinker (t CO_2/tonne clinker)

$BE_{ele\_sg\_CLNK}$ = Baseline captive electricity emissions for clinker production per tonne of clinker (t CO_2/tonne clinker)

$BE_{calcin} = [0.785*(OutCaO - InCaO) + 1.092*(OutMgO - InMgO)] / [CLNK_{BSL} * 1000]$ **(2.1.1)**

BE_{calcin} = 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 = 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)

$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$BE_{fossil\_fuel} = [\sum FF_{i\_BSL} * EFF_i] / [CLNK_{BSL} * 1000]$ **(2.1.2)**

FF_{i_BSL} = Fossil fuel of type i consumed for clinker production in the baseline (tones of fuel i)
EFF_i = Emission factor for fossil fuel i (t CO_2/tonne of fuel)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$BE_{ele\_grid\_CLNK} = [(BELE_{grid\_CLNK} * EF_{grid\_BSL})] / CLNK_{BSL} * 1000$ **(2.1.3)**

$BELE_{grid\_CLNK}$ = Baseline grid electricity for clinker production (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO_2/MWh)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$BE_{ele\_sg\_CLNK} = [\sum(BELE_{sg\_CLNK} * EF_{sg\_BSL})] / CLNK_{BSL} * 1000$ **(2.1.4)**

$BELE_{sg\_CLNK}$ = Baseline self generation of electricity for clinker production (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO_2/MWh)
$CLNK_{BSL}$ = Annual production of clinker in the base year (kilotonnes of clinker)

$BE_{ele\_ADD\_BC} = BE_{ele\_grid\_sg\_BC} + BE_{ele\_grid\_sg\_ADD} + BE_{ele\_grid\_sg\_BC} + BE_{ele\_grid\_sg\_ADD}$ **(2.2)**

where:
$BE_{ele\_grid\_BC}$ = Baseline grid electricity emissions for BC grinding (tCO2/tonne of BC)
$BE_{ele\_grid\_ADD}$ = Baseline grid electricity emissions for additive preparation (tCO2/tonne of BC)
$BE_{ele\_sg\_BC}$ = Baseline captive electricity emissions for BC grinding (tCO2/tonne of BC)
$BE_{ele\_sg\_ADD}$ = Baseline captive electricity emissions for additive preparation (tCO2/tonne of BC)

$BE_{ele\_grid\_BC} = [(BELE_{grid\_BC} * EF_{grid\_BSL})] / [BC_{BSL} * 1000]$ **(2.2.1)**

$BELE_{grid\_BC}$ = Baseline grid electricity for grinding BC (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO_2/MWh)
BC_{BSL} = Annual production of BC in the base year (kilotonnes of BC)

$BE_{ele\_sg\_BC} = [\sum(BELE_{sg\_BC} * EF_{sg\_BSL})] / [BC_{BSL} * 1000]$ **(2.2.2)**

$BELE_{sg\_BC}$ = Baseline self generation electricity for grinding BC (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO_2/MWh)
BC_{BSL} = Annual production of BC in the base year (kilotonnes of BC)

$BE_{ele\_grid\_ADD} = [(BELE_{grid\_ADD} * EF_{grid\_BSL})] / [BC_{BSL} * 1000]$ **(2.2.3)**

$BELE_{grid\_ADD}$ = Baseline grid electricity for grinding additives (MWh)
EF_{grid_BSL} = Baseline grid emission factor (t CO_2/MWh)

$$BE_{ele\_sg\_ADD} = [(BELE_{sg\_ADD} * EF_{sg\_BSL})] / [BC_{BSL} * 1000] \quad \textbf{(2.2.4)}$$

$BELE_{sg\_BC}$ = Baseline self generation electricity for grinding additives (MWh)
EF_{sg_BSL} = Baseline electricity self generation emission factor (t CO_2/MWh)

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 *(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}	Plant records	Kg of fuel/kiolometer	C	Annually	100%	Electronic	
2.	D_{add_source}	Plant records	km	M	Per trip	100%	Electronic	
3.	TEF	IPCC	Kg CO2/ kg of fuel	E	Annually	100%	Electronic	
4.	Q_{add}	Plant records	Tonnes of additives/ vehicle	M	Per trip	100%	Electronic	
5.	$ELE_{conveyor\_ADD}$	Plant records	MWh	M	Monthly	100%	Electronic	
6.	EF_{grid}	National grid/plant data (if onsite generation)	Tonnes of CO2/MWh	C	Annually	100%	Electronic	
7.	α_y	Plant records	Tonnes of additive	M/C	Annually	100%	Electronic	

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

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

$ELE_{conveyor\_ADD}$ = 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)

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

$L_y = L_{add\_trans} * [A_{blend,y} – P_{blend,y}] * BC_y$	**(3.1)**

where:

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

BC_y = 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 clinker additives per tonne of BC in year y (tonne of clinker additives/tonne of BC)

Another possible leakage is due to the diversion of additives from existing uses. The PPs shall demonstrate that additional amounts of additives used are surplus. If the PPs do not substantiate x tonnes of additives are surplus, the project emissions reductions are reduced by the factor á, which is defined as:

α_y = x tonnes of additives in year y / total additional additives used in year y	**(4)**

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.)

$ER_y = \{ [BE_{BC,y} – PE_{BC,y}] * BC_y + L_y \} * (1 – \alpha_y)$	**(5)**

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)

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

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 from 1-26)	Low-medium	The data will be collected as part of normal plant level operations. QA/QC requirements consist of cross-checking these with other internal company report. Local data and where applicable IPCC data will be used. Independent agency verification will also be used.
Table D.2.1.3 (ID numbers from 1-26)	Low-medium	The data will be collected as part of normal plant level operations. QA/QC requirements consist of cross-checking these with other internal company report. Local data and where applicable IPCC data will be used. Independent agency verification will also be used.
Table D.2.3 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

A CDM champion team is constituted with participation from Production, Purchase & stores, Quality, Sales & Marketing, R&D and finance.

This team is trained about CDM concepts and are given the responsibility of collecting & maintaining data. This team will meet periodically (Proposed period of 3 months) to review CDM project activity and also to check data collected to estimate emissions reduction.

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

Ashutosh Pandey
Emergent Ventures India Pvt. Ltd.

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SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

The estimation of the emissions from the sources in project activity comprises of the emissions from the three plants namely Rewa, Bela & Sadva Khurd.

Emissions from project activity sources are calculated for the three plants in the following manner –

Parameter	Rewa	Bela	Sadva Khurd
Emissions per tonne of clinker produced (Plant Specific)	Based on the formulae described in section D.2.1.2	Based on the formulae described in section D.2.1.2	Weighted average of the clinker used from the two plants Rewa & Bela
Emissions per tonne of clinker produced (Overall)	Production weighted average of all three plants		
Electricity emissions for grinding of PPC & preparation of additives	Based on individual plant's energy consumption data. Power emission factor is the weighted average of all power sources including grid & captive sources	Based on individual plant's energy consumption data. Power emission factor is the weighted average of all power sources including grid & captive sources	Based on individual plant's energy consumption data. Power emission factor is the weighted average of all power sources including grid & captive sources
Electricity emissions for grinding of PPC & preparation of additives (Overall)	Production weighted average of all three plants		
Ratio of Clinker to PPC produced	Taken as mass production average of clinker used in the PPC produced in the 3 plants For the subsequent years in the crediting period the ratio has been considered to be decreasing such as to maintain the difference of clinker ratio in project activity & the baseline for calculation purpose. However the same be revised subject to the actual ratios every year		

		year 1	year 2	year 3	year 4	year 5	year 6	year 7
Parameter	UoM	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Emissions in the Project Activity Sources	tCO2	2361859.0	2409096.2	2457278.1	2506423.7	2556552.2	2607683.2	2659836.9

E.2. Estimated leakage:

Leakage estimation is done based on net increase in GHG emissions due to increased transportation of flyash to plant sites. Reduction in emissions due to decreased supply of coal and raw material due to project activity has not been taken to make estimation conservative in nature.

		year 1	year 2	year 3	year 4	year 5	year 6	year 7
Parameter	UoM	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Leakage from the Project Activity	tCO2	289.3	295.1	301.0	307.0	313.1	319.4	325.8

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

		year 1	year 2	year 3	year 4	year 5	year 6	year 7
Parameter	UoM	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Total Emissions from Project Activity	tCO2	2362148.3	2409391.3	2457579.1	2506730.7	2556865.3	2608002.6	2660162.7

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

Emissions for the baseline sources are calculated for the three plants in the following manner –

Parameter	Rewa	Bela	Sadva Khurd
Emissions per tonne of clinker produced (Plant Specific)	Based on the formulae described in section D.2.1.4. In case the baseline is more than the project activity then it's been replaced by the project activity. Also the baseline specific energy consumption is considered as the average of the sp. Energy consumptions for the years 2002-03 & 2003-04	Based on the formulae described in section D.2.1.4. In case the baseline is more than the project activity then it's been replaced by the project activity Also the baseline specific energy consumption is considered as the average of the sp. Energy consumptions for the years 2002-03 & 2003-04	Weighted average of the clinker used from the two plants Rewa & Bela
Emissions per tonne of clinker produced (Overall)	Production weighted average of all three plants		
Electricity emissions for grinding of PPC & preparation of	Based on individual plant's energy consumption data.	Based on individual plant's energy consumption data.	Based on individual plant's energy consumption data.

additives	Power emission factor is the weighted average of all power sources including grid & captive sources	Power emission factor is the weighted average of all power sources including grid & captive sources	Power emission factor is the weighted average of all power sources including grid & captive sources
Electricity emissions for grinding of PPC & preparation of additives (Overall)	Production weighted average of all three plants		
Ratio of Clinker to PPC produced	Taken as mass production average of clinker used in the PPC produced in the 3 plants For subsequent years the baseline is modified by 2% every year		

		year 1	year 2	year 3	year 4	year 5	year 6	year 7
Parameter	UoM	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11
Emissions in the Baseline	tCO2	2393794.0	2441669.9	2490503.3	2540313.3	2591119.6	2642942.0	2695800.8

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

SN	Operating Years	Baseline Emissions (tCO2)	Project Activity Emissions (tCO2)	CO2 Emission Reductions (tCO2)
1.	April,04 – Mar, 05	2393794.0	2362148.3	31646
2.	April, 05 – Mar, 06	2441669.9	2409391.3	32279
3.	April, 06 – Mar, 07	2490503.3	2457579.1	32924
4.	April, 07 – Mar, 08	2540313.3	2506730.7	33583
5.	April, 08 – Mar, 09	2591119.6	2556865.3	34254
6.	April, 09 – Mar, 10	2642942.0	2608002.6	34939
7.	April, 10 – Mar, 11	2695800.8	2660162.7	35638
Total		17796142.9	17560879.986	235263

The estimated total reduction over the first crediting period of 7 years = 235263 tCO2e

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

SN	Operating Years	Baseline Emissions (tCO2)	Project Emissions in Sources (tCO2)	Leakages (tCO2)	CO2 Emission Reductions (tCO2)
1.	April,04 – Mar, 05	2393794.0	2361859.0	289.3	31646
2.	April, 05 – Mar, 06	2441669.9	2409096.2	295.1	32279
3.	April, 06 – Mar, 07	2490503.3	2457278.1	301.0	32924
4.	April, 07 – Mar, 08	2540313.3	2506423.7	307.0	33583
5.	April, 08 – Mar, 09	2591119.6	2556552.2	313.3	34254
6.	April, 09 – Mar, 10	2642942.0	2607683.2	319.4	34939
7.	April, 10 – Mar, 11	2695800.8	2659836.9	325.8	35638
Total		17796142.9	17558729.4	2150.6	235263

SECTION F. Environmental impacts

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

According to Bureau of India Standards (BIS) Fly ash content in Cement can be up to 35%, increasing fly ash content in blended cement doesn't need any Environment Impact study to be done.

Plants have conducted detailed EIA during inception stage. For the project activity of increasing blend in PPC a brief EIA was conducted.

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:

As per the Host Party regulations, no environmental impact assessment is needed for increasing use of Fly-ash content in Cement.

Based on a brief EIA done by project promoter following points were observed.

There are no negative effects envisaged on the water quality, soil, air quality, noise and health & livelihood of people in nearby areas.

There are positive environmental impacts due to proposed project activity.

- Reducing the air pollution caused from the flyash disposal sites near the thermal power stations.
- Decreasing wasteland sites used for fly ash disposal.
- Low clinker requirement shall help in conservation of the natural resources
- Lower energy requirement in the plant shall lead to low use of fossil fuel for electrical & thermal energy generation

SECTION G. Stakeholders' comments

The project activity helps in the sustainable development of the region by–

- Reducing the problems associated with handling, storage and disposal of the flyash generated in the nearby Thermal Power Generation plants. (In normal practice fly ash is dumped in wasteland.)
- Reducing the air pollution caused from the flyash disposal sites near the thermal power stations.
- Decreasing wasteland sites used for fly ash disposal.
- Reduced energy requirement leads to enhanced energy security in the region supported by reduced losses in transmission & distribution of electrical power
- Low clinker requirement shall help in conservation of the natural resources
- Providing new employment opportunities through the transportation of the flyash from thermal power plants to the project site.

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

Following are the main stakeholders for this project activity:

- **Local Community:** JAL has sent letters to District Magistrate and Panchayat to invite their comments on the project. Meetings of people from local community were invited to collect their views about the project activity. In these meetings participants were briefed about the project plan of increasing flyash in the blended cement. Participants have shown appreciation for the project, according to them these projects should be promoted by the Government as it has many socio/economic/environmental benefits for the local community.

- **Customers/Users:** JAL regularly meet its customers and take their comments/feedback. These suggestions are very helpful in developing products that suit market needs.

- **Government of India (GoI):** Company meets all requirements as decided by BIS for use of flyash content in blended cement. GoI has set a taskforce to develop industry insights for increasing use of flyash in various applications like brick building, blended cement etc. Company actively participates in such forums and proactively develops ideas for promotion of increasing use of flaysh.

- **Industry/technical Experts:** Project Participants have always taken expert's feedback and opinions while developing cement products. Buland brand of cement which has been developed as a substitute for OPC 53 (High strength) has been tested & validated by National Council for Cement & Building Materials, IIT Delhi and IIT Roorkee.

- **Power Plants:** JAL has entered into an agreement with power plant (NTPC) to utilise flyash generated during power generation. Flyash is a waste product for power project with not much commercial use, also there are problems related to disposal of flyash. Because of these reasons NTPC has shown encouragement towards flyash use in blended cement by signing an agreement with JAL.

- **Cement Manufacturers Association (CMA):** CMA is also an important stakeholder in this project. CMA as an association helps in introducing newer ideas in Indian cement industry. Discussions with CMA officials were held to understand the industry approach in increasing flyash content in cement and possible issues with the same.

G.2. Summary of the comments received:

No negative comment received.

Interactions[6] with people from local community reveal that flyash content in blended cement should be increased to maximum permissible level as it helps in sustainable development. A clear inference is that JAL should develop wide range of blended cement products and also promote these products aggressively in the market.

[6] Documentation exists for such interactions and can be shown to the validator

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

No action required as no negative comments have been received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No Public Funding Obtained.

Annex 3

BASELINE INFORMATION

TABLE 1 : Production data for JAL Plants

	Year	2000-01	2001-02	2002-03	2003-04	2004-05
Rewa	Cement Production		t/y	t/y	t/y	t/y
	OPC	820473	860716	862373	591351	500706
	PPC	1365459	1557400	1716978	1822390	2060932
	Total	2185932	2418116	2579351	2413741	2561638

	Year	2000-01	2001-02	2002-03	2003-04	2004-05
Bela	Cement Production		t/y	t/y	t/y	t/y
	OPC	946253	918369	670962	708717	1156936
	PPC	696456	887923	1112999	1129088	889376
	Total	1642709	1806292	1783961	1837805	2046312

	Year	2001-02	2002-03	2003-04	2004-05
JCGU	Cement Production	t/y	t/y	t/y	t/y
	OPC	0			
	PPC	45319	325469	453061	553056
	Total	45319	325469	453061	553056

TABLE 2: Baseline Benchmark for JAL plants

Combined	2000-01	2001-02	2002-03	2003-04	2004-05
PPC	2061915	2490642	3155446	3404539	3503364
Clinker	1484894	1823355	2320791	2463004	2498198
Clinker %	72.02%	73.21%	73.55%	72.34%	71.31%
Additives %	27.98%	26.79%	26.45%	27.66%	28.69%
		Baseline Benchmark		27.66%	
			Improvement		1.04%

TABLE 3: Electrical Energy Consumption Data

Plant	Details
Rewa	**Electricity Source-** Madhya Pradesh Grid Power, Captive Power Generation

	Fuel Used- Coal in captive thermal power plant, FO, HSD in DG set
Bela	**Electricity Source-** Madhya Pradesh Grid Power, Captive Power Generation
	Fuel Used- Coal in captive thermal power plant, FO, HSD in DG set
Sadva Khurd (JCGU)	**Electricity Source-** Captive Power Generation using DG set
	Fuel Used- FO, HSD in DG set

Grid Emission Factor for Western Grid-

Approach suggested in Approved Consolidated Methodology **ACM0002** is used to estimate grid emission factor.

STEP 1: Grid Selection

As per the guidelines provided by Meth Panel during 18th meeting, Western Region Grid is selected for grid emission factor estimation. **Data about all these plants have been considered while calculating grid emission factor**. Western Region Electricity Board (WREB) annual reports and Central Electricity Authority (CEA) data is used for this purpose.

STEP 2: Calculation of the Operating Margin emission factor (EF_{OM})

There are four methods suggested by the methodology ACM0002 –

1. Simple OM
2. Simple adjusted OM
3. Dispatch Data Analysis OM
4. Average OM

Among these four options the method of **Simple OM** is adopted for the project activity as –

1. Adequate data for Dispatch Data Analysis is not available, and
2. Low cost/ must run power sources contribute less than 50% of the total grid generation in the state in average of the five most recent years. The grid is thermal power dominated; more than 70% power is supplied using thermal energy sources. Less than 30% is provided by hydro and other sources.

Generation Mix of Power Generation in Western Grid for 5 Years

Type	2000-01	2001-02	2002-03	2003-04	2004-05
Thermal	129061.01	133564.99	137299.9	136699.4	141962.0
Gas	22312.84	18375.6	22277.5	22711.3	25807.3
Total (Thermal + Gas)	**151373.9**	**151940.6**	**159577.4**	**159410.7**	**167769.2**
Wind	313.6	495.7	846.6	855.1	599.6
Hydro	7152.12	7984.3	8139.8	9391.6	10577.2
Nuclear	5902.62	6067.3	6276.9	5671.1	5099.7
Low cost/Must run	**13368.4**	**14547.3**	**15263.3**	**15917.7**	**16276.5**
Total	**164742.2**	**166487.93**	**174840.7**	**175328.4**	**184045.7**
% of Low cost/must run	**8%**	**9%**	**9%**	**9%**	**9%**

Unit Million Units
Source www.wreb.co.in

Simple OM: The Simple OM emission factor ($EF_{OM,simple}$) is calculated as the generation-weighted average emissions per electricity unit (tCO2/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants.

The vintage of data for estimating Simple OM taken is 3-year average based on the most recent statistics available. (OM for the year 2001-02, 2003-04 & 2004-05 has been considered)

Opearting Margin Estimation for Western Grid 2004-05	
OM, 2001-02	0.941
OM, 2003-04	0.932
OM, 2004-05	0.928
Average OM	**0.933**

STEP 3: Calculation of the Build Margin emission factor (EF_{BM})

Calculation of the Build Margin emission factor $EF_{BM,y\ ex\text{-}ante}$ is based on the most recent information available on the plants already built for sample group m at the time of PDD submission. The sample group m consists of the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently (This sample group is larger than group consisting of the five power plants that have been built most recently).

Build Margin Estimation for Northern Grid 2004-05	
Build Margin	**0.734**

STEP 4: Calculate the Grid Emission Factor (*EF*)

Grid Emission factor is the weighted average of the Operating Margin emission factor (EF_{OM}) and the Build Margin emission factor (EF_{BM}):

$EF = wOM \times EF_{OM} + wBM \times EF_{BM}$

Where the weights *wOM* and *wBM*, by default, are 50% (i.e., $wOM = wBM = 0.5$), and EF_{OM} and EF_{BM} are calculated as described in Steps 2 and 3 above and are expressed in tCO2/MWh. The weighted averages applied by the project participants are fixed for the entire crediting period.

Combined Margin Estimation for Western Grid 2004-05	
OM, 2001-02	0.941
OM, 2003-04	0.932
OM, 2004-05	0.928
Average OM	**0.933**
BM	0.734
Combined Margin, CM	**0.834**

Annex 4

MONITORING PLAN

The monitoring plan for the project activity comprises of measurement, estimation and calculation of data required for establishing emissions from the project activity during the crediting period. The plan charts out the methods adopted for doing so.

All the JAL plants are well equipped with the latest recording gadgets. Plants are ISO 9000 certified and have a system in place for monitoring the data on production, energy consumptions, raw material consumptions, grid power off-take etc.

The following data requires monitoring (source and frequency along with the period for which the data would be kept is described in section D of this document) -

- Data on clinker and cement production
- Data on flyash consumption
- Data on raw material consumption i.e. limestone, gypsum etc
- Data on electricity consumption area wise
- Data on fuel consumptions in the kiln; fuel type wise
- Data on captive power generation, auxiliary consumption
- Data on grid power off-take and consumption area wise
- Data on fuel consumption in captive power generation; mode wise i.e. DG set, CPP etc
- Data on limestone and clinker analysis for CaO, MgO content

All the instruments used in the monitoring of the data shall be regularly calibrated and records for calibration kept during the project activity. A plan for the calibration of the instruments shall be made and followed.

Persons shall be assigned responsibility for sections/plants for monitoring and record keeping of data.

Training of CDM team personnel:

Since there are no major changes in the production technology, extensive initial training is required. The training of the CDM team and plant personnel will be carried out on CDM principle, CDM activities, monitoring of data and record keeping through a planned schedule made in advance and a record of various training programmes undertaken would be kept for verification.

Day to day data collection and record keeping:

Plant data shall be collected on operation under the supervision of the respective Shift-in-charge and record would be kept in daily logs.

Calibration of instruments:

JAL is an ISO certified company and it has procedures well defined for the calibration of instruments. A log of calibration records is maintained. Instrumentation department in the company is responsible for the upkeep of instruments in the plant.

Maintenance of instruments and equipments used in data monitoring:

The operation department shall be responsible for the proper functioning of the equipments/ instruments and shall inform the concerned department for corrective action if found not operating as required. Corrective action shall be taken by the concerned department and a report on corrective action taken shall be maintained as done time to time along with the details of problems rectified.

Checking data for its correctness and completeness:
The CDM team would have the overall responsibility of checking data for its completeness and correctness. The data collected from daily logs is forwarded to the central lab after verification from respective departments.

Internal audits of CDM project compliance:
CDM audits shall be carried out to check the correctness of procedures and data monitored by the internal auditing team entrusted for the work. Report on internal audits done, faults found and corrective action taken shall be maintained and kept for external auditing.

Emergency preparedness:
The project activity does not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

Report generation on monitoring:
After verification of the data and due diligence on corrective ness if required an annual report on monitoring and estimations shall be maintained by the CDM team and record to this effect shall be maintained for verification.

Annex 5

Glossary

%	Percentage
BM	Build Margin
BC	Blended cement
CDM	Clean Development Mechanism
CEA	Central Electricity Authority
CER	Carbon Emission Reduction
CM	Combined Margin
CMA	Cement Manufacturers' Association
CO_2	Carbon Di Oxide
DNA	Designated National Authority
DOE	Designated Operational Entity
EIA	Environmental Impact Assessment
GHG	Green House Gases
GWh	Giga Watt Hour
IPCC	Intergovernmental Panel on Climate Change
JAL	Jaiprakash Associates Limited
Kg / kWh	Kilo Gram per Kilo Watt Hour
KP	Kyoto Protocol
kWh	Kilo Watt Hour
M	Meter
MNES	Ministry of Non-Conventional Energy Sources
MoEF	Ministry of Environment and Forests
MOP	Ministry of Power
MU	Million Units
MW	Mega Watt
NCV	Net Calorific Value
NTPC	National Thermal Power Corporation
OM	Operating Margin
OPC	Ordinary Portland Cement
PPC	Portland Pozzolana Cement
PSC	Portland Slag Cement
Rs.	Indian Rupees
T & D	Transmission and Distribution

UNFCCC	United Nations Framework Convention on Climate Change
WREB	Western Regional Electricity Board

Annex 6

References

www.cea.nic.in	Central Electricity Authority website
www.wrebgov.nic.in	Western Region Electricity Board website
www.nhpcindia.com	National Hydroelectric Corporation website
www.ntpc.co.in	National Thermal Power Corporation website
www.npcil.nic.in	Nuclear Power Corporation of India Ltd. Website
www.unfccc.int	UNFCCC website
CMA data for past 5 years	
Plant specific data of JAL	