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:

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Blended Cement Project with Fly Ash – Lafarge India Private Limited
Version – 03
Dated – 19 September 2006

A.2. Description of the project activity:

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Lafarge India Private Limited (hereafter referred to as Lafarge) manufactures Portland Pozzolanic Cement (PPC) under the brand name of Lafarge India. Lafarge is one of the pioneer producers of PPC blend cement in the eastern region of India. PPC is manufactured at Lafarge's Jojobera Cement Plant (JCP) and blended with fly ash as additive. In the Eastern region of the country, Lafarge enjoys a market share of 21.77% of the total production in the region[1]. In the year 2001, the management of Lafarge India unanimously decided to add fly ash in increasing quantities (to the extent allowed by Bureau of Indian Standard (BIS). This initiative was in line with Lafarge Group's[2] global guideline[3] to reduce CO_2 emissions from cement kilns. Addition of increasing quantities of fly ash was one of the options of cutting down on CO_2 emissions although at the cost of overcoming several technological and market barriers.

The manufacturing process of cement clinker is an energy-intensive process and includes pyroprcessing of limestone using coal as fossil fuel. Clinker is one of the key ingredients for cement manufacturing derived from lime stone. Clinker usage in cement is directly proportional to carbon dioxide emissions. Hence, reducing clinker using fly ash leads to greenhouse gas emission reduction.

The project entails planning, designing and producing PPC blend cement with incremental addition of additives in the form of fly ash procured from the thermal power stations[4] located adjacent to JCP. Incremental fly ash addition has effected an equivalent reduction in clinker in the PPC blend, leading to CO_2 emission reduction and other sustainable environmental benefits, directly and indirectly attributable to the project.

In respect to the contribution of the project to India's sustainable development, the following environmental, socio-economic and technical benefits are as follows:

Socio-economic well being – Clinker production is highly energy intensive. Reducing clinker production will therefore conserve energy. Given that there prevails power shortages in many parts of India, the project will augment India's overall development efforts in the utility sector and improve the availability of power in the region thus cutting down shortages. Further, the project indirectly

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[1] Source – Cement Manufacturers Association, India, New Delhi, www.cma.org – 2004.

[2] Lafarge Group

[3] In partnership with WWF.

[4] Tata Power Company Limited - 240MW coal based power plant which produces about 0.4million tons of fly ash every year.

encourages the development of waste management infrastructure and builds a reciprocal symbiosis or an industrial ecological symbiosis within the value chains of different industries namely the cement and the power sectors. Thus, the external activity of the project link two sectors of industries and encourages similar proactive action from industries to discover opportunities for economical exchange of waste products and decrease cost of waste management symbiotically.

Environmental well being – Limestone is a finite resource, and the (open cast) mining of limestone can have adverse environmental impacts. Fly ash is a by-product of electricity generation, and is a product for which disposal is difficult. Fly ash disposal is one of the major environmental concerns of the coal based thermal power plants in India. The project activity facilitates fly ash utilization and thus reduces the cost of waste handling and disposal on the part of coal fired thermal power plants. It also reduces land and air pollution at the landfills where fly ash was previously being dumped and water contamination problems arising from landfill leaching.

Replacing clinker also leads to conservation of non renewable natural resources like coal and limestone. Finally, the project will reduce emissions of greenhouse gases.

Technological well being – The CDM project will encourage other producers of cement to increasingly blend cement with additives which are waste derivatives of other industries. Further, with encouragement from CDM, the project envisages that in the future more research and development can take place to produce other types of blended cement utilizing various industrial wastes and avoiding energy intensive clinker use.

A.3. Project participants:

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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)
India (Host) Ministry of Environment & Forests, India, Government of India	Lafarge India Limited	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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Lafarge India Private Limited produces Portland Pozzolanic cement at their Jojobera Cement Plant under the brand name of Lafarge Cement PPC. The Jojobera plant is only a grinding unit and obtains clinker from other Lafarge units – Arasmeta and Sonadih, both located at the state of Chattisgarh. Due to additional additive used in the PPC blend of Lafarge produced from Jojobera plant the actual

emission reduction will be affected in the Arasmeta and Sonadih plants with respect to less clinker production. Hence, all the three units of Lafarge are included in the CDM project

A.4.1.1. Host Party(ies):

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Government of India

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

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Lafarge Jojobera - Eastern Region, Jharkhand, Singhbum district
Lafarge Arasmeta – Central Region, Chhattisgarh, Janjgri-Champa distrct
Lafarge Sonadih – Central Region, Chhattisgarh, Raipur district

A.4.1.3. City/Town/Community etc:

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Lafarge Jojobera - Jojobera
Lafarge Arasmeta – Arasmeta
Lafarge Sonadih – Sonadih

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

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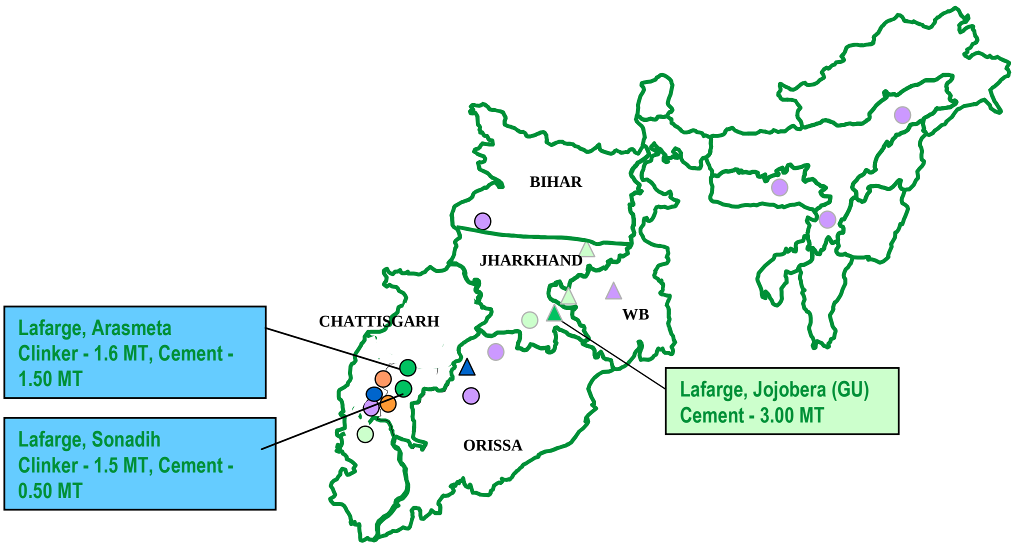
The locational details of the three cement works participating in the project are as follows:
Jojobera – Located at Singbhum district, of Jharkhand. The site is well connected by road and rail. The unit is located along National Highway Number –NH 36 and the nearest railway station in Tatanagar Junction. The geographical location of the unit is latitude of 22.47^{o}N and 32.23^{o}E longitude.

Arasmeta – Located at Janjgir-Champa district, of Chhattisgarh state. The site is connected to National Highway Number –NH 33 and the nearest railway station in Bilaspur.

Sonadih - Located at Raipur district, Balodabazar Tehsil, Sonadih village, Chhattisgarh at 21^{o}45’ N latitude and 82^{o}14’ E longitude.



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

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The project activity is applicable to 'Category 4 – Manufacturing industries', as per the CDM sectoral scope version 02 Mar 05 (07:23) and as per approved methodology "ACM0005/ Version 03/ dated – 19th May 2006, ***"Consolidated Baseline Methodology for - Increasing the Blend in Cement Production"*** applicable to the project.

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

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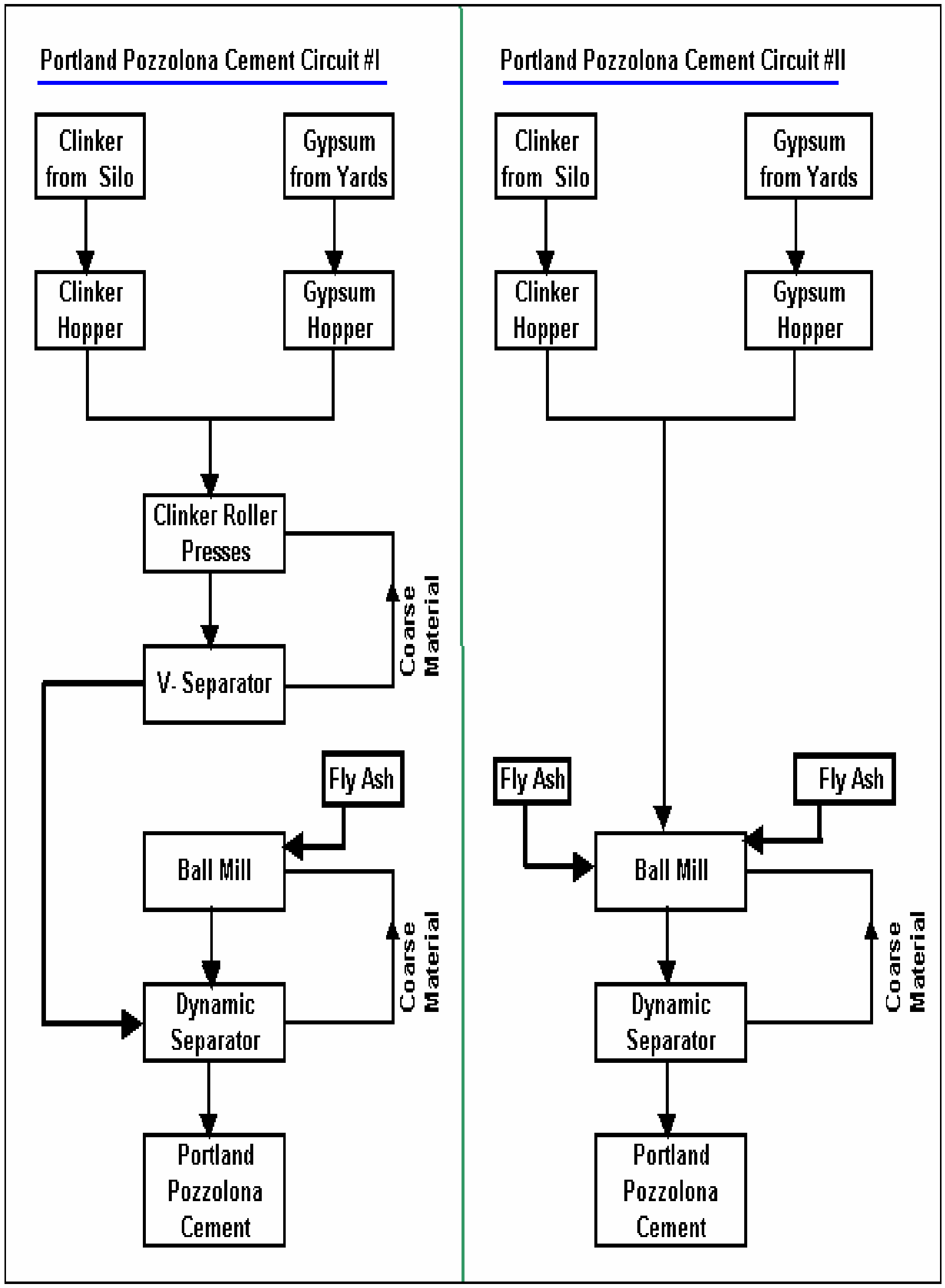
The project involves fly ash procurement from Tata Powers Company Limited (TPCL) located adjacent to the Lafarge Jojobera unit and its utilization for production of Portland Porzolanic Cement. The Lafarge Jojobera Plant proposes to add additional fly ash in an incremental manner year-wise to reduce clinker content, thus avoiding GhG emission from clinker production.

In order to meet the above objective, Lafarge had to install a new ball mill and bring in add-on technologies in their existing mill that enabled the addition of desired quantity of fly ash while maintaining quality standards as prescribed under IS specification[5].

The project activity includes following sub processes depicted in the form of line diagram:

[5] IS:1489 (Part1)-1991 - 15-35% of Fly ash in PPC



The PPC Circuit I was an existing ball mill used for PSC (slag cement) production. Additional equipment such as, OSPA V air separator, bucket elevator, air slides and solid flow meter were incorporated into the system in order to produce PPC from the existing mill. The PPC Circuit II was a greenfeild project where the whole system was established to meet the objective of producing PPC with incremental addition of fly ash.

In order to produce good quality PPC, improved clinker quality is required and the grinding process requires more stringent process control. Consequently, clinker producing units at Sonadih and Arasmeta were required to align their producing unit and be able to generate improved quality 3Ca0 SiO2 (tricalcium silicate – around 50%) grade clinker. This required additional R&D efforts at the site of clinker producing units in order to produce the required quality of clinker, considered best suitable for PPC production.

Further, the project also required to be supported by additional quality control equipment and research and development (R&D) and other installations as follows.

- Additional laboratory equipment to improve quality control of clinker and cement such as X-Ray Diffractometer (XRD) X-Ray Fluorescence Analyzer (XRF), CILAS, and PSD (particle size distribution).
- Facilities for storage, handling and proportioning of additive materials such as additional hoppers/storage, feeders, conveyors, and cement grinding aid.
- High efficiency air separators to improve fineness and particle distribution.
- Additional de-dusting systems (bag filters) for environmental control.

The dry fly ash is directly collected from the hoppers of the electrostatic precipitators of the power plant and conveyed through pneumatic conveying system run by electricity; this is the most eco-friendly method of fly ash transportation as it ensures no loss of fly ash. The fly ash in the unit is stored in covered steel silos. Aeration system is provided at the bottom of the silo to convey the fly ash through air slide from the silo to the feeding bin for accurate weighing and feeding to the mill. Bag filters are connected at the top of the fly ash silo to collect the dust in the air shooting out during fly ash unloading and feeding in the weighing bin.

In the cement grinding mill, together with clinker and a small percentage of gypsum, fly ash is ground till it attains the desired blaine and homogeneous character as desired. The grinding mill is also connected to the bag filters for fugitive dust abatement. The clinker is pre ground in the roller press to save energy consumption in the grinding mill.

The technology adopted is environmentally sound and includes installation of safety equipment and ensuring safe operation. The employees have been specially trained to operate these mills and be able to add fly ash to the desired percentage at the maximum accuracy of the system.

Internal capacity building was also required to ensure a successful introduction of the new type of cement. This capacity building effort addressed PPC production, testing, quality control and marketing aspects.

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:

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The project initiative has led to incremental percentage of fly ash addition in PPC blend cement being produced at Jojobera cement plant of Lafarge India. This in turn has reduced the usage of clinker in PPC leading to avoidance of direct and indirect emissions of CO_2 associated with clinker production process. Since, JCP procures clinker from its two sister units – Aaresmeta Cement Plant (ACP) and Sonadih Cement Plant (SCP), the clinker producing units, located at Chhattisgarh; actual reduction of

CO_2 emissions have occurred at the clinker producing units. Types of emissions reduction attainable from the project are:
1. Direct on-site emissions from the calcination process of limestone at the cement kilns
2. Direct on-site emissions from the usage of fossil fuel (coal) for thermal energy to the calcinations process.
3. Direct on-site and direct off-site emissions from consumption of electricity for the clinker production.

Emission reduction is directly proportional to the tonnage of clinker reduced per tonne of PPC produced. The project is a part of voluntary initiative undertaken by the Lafarge India which is part of the international Lafarge Group. In the absence of the project activity (production of PPC with incremental addition of fly ash), the JCP unit would have produced Ordinary Portland Cement (OPC) which on an average contains 97% clinker by mass as compared to 66.84% in PPC blend presently produced by JCP. Further, OCP is more acceptable by the market in India and various governmental agencies[6] of the host country and does not face any marketing constraints. Also, OPC production does not require stringent quality control for the production of clinker and cement grinding in order to attain acceptable strength and setting time.

The Ministry of Environment and Forests (MoEF), Government of India, the nodal body responsible for the safe guard of India's environment, does not require the cement industries in the country to use a higher additive percentage in PPC production to replace an equivalent amount of clinker thereby reducing its specific energy consumption to a prescribed standard. Nor does the Department of Industries, the Bureau of Indian Standards, Cement Manufacturers Association, National Council for Building Materials or any other agency require the substitution of clinker with fly ash. There are no such regulations, planned to be in force in the near future, which would drive cement manufacturers to implement the project activity. Therefore the GHG reductions that have been achieved and would be achieved by the project activity are additional to those directed by the governmental policies and regulations and would not have happened without voluntary participation of Lafarge India with CDM consideration.

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

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Year	Annual estimation of emission reductions in tonnes of CO_2e
2001	3484
2002	34295
2003	35433
2004	48324
2005	54524
2006	43412
2007	38067

[6] Central Public Works Department (CPWD) has ban on using PPC for all government constructional activities.

2008	33218
2009	28195
2010	23156
Total estimated reductions (tonnes of CO_2e)	342108
Total number of crediting years	**10years**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**34211**

A.4.5. Public funding of the project activity:

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No public funding from parties included in Annex I was used for the project activity. The source of finance was internal accruals.

SECTION B. Application of a baseline methodology

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

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

Reference: Approved consolidated baseline methodology ACM0005/ Version 03, Sectoral Scope - 04, 19th May 2006.

Approach: Existing actual or historical emissions, as applicable

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

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According the approved methodology ACM0005, version 03, for increasing blend in cement production, the methodology is applicable to the CDM project leading to incremental use of additive in the blended cement under following conditions:

Applicability

This methodology is applicable to projects that increase the share of additives (i.e. reduce the share of clinker) in the production of cement types beyond current practices in the country.

Additives are defined as materials blended with clinker to produce blended cement types and include fly ash, gypsum, slag, etc. The methodology is applicable under the following conditions:

- There is no shortage of additives related to the lack of blending materials. Project participants should demonstrate that there is no alternative allocation or use for the additional amount of additives used in the project activity. If the surplus availability of additives is not substantiated the project emissions reductions (ERs) will be discounted as outlined below.
- This methodology is applicable to domestically sold output of the project activity plant and excludes export of blended cement.
- Adequate data are available on cement types in the market.

Explanation

The voluntary initiative undertaken by Lafarge India to reduce CO_2 emissions from clinkerisation process, has driven Lafarge JCP unit to add fly ash as additive in incremental quantities in PPC blend cement beyond the current practices in the host country, India. With increase in the share of additives i.e. clinker-substituting substances in PPC reducing the share of clinker, equivalent GHG emission reductions resulted.

- As per the report published by Technology Information Forecasting & Assessment Council (TIFAC), New Delhi, and The Energy and Resources Institute (TERI), New Delhi, on fly ash availability, its management and utilisation – **“***At present, nearly 90 million tonnes of flyash is being generated annually in India and nearly 65,000 acres of land is presently occupied by ash ponds. Nearly 73% of India’s total installed power generation capacity is thermal, of which coal based generation is nearly 90 percent (diesel, wind, gas & steam adding to about ten percent). The 85 utility thermal power stations, in addition to several captive power plants, use bituminous or sub-bituminous coal and produce large volumes of fly ash. High ash content (30-50%) of Indian coals is contributing to these large volumes of fly ash. India’s dependence on coal as a source of energy shall continue in the*

next millennium and therefore fly ash management would remain an important area of national concern.**"**

Further, the report clearly mentions the trend of fly ash utilisation in India as – **"***Utilisation of fly ash ranged between 3-5% in late eighties / early nineties. There was no large-scale concerted effort for promoting flyash utilisation. Technologies and researches were generally isolated with a little emphasis on commercialisation. Though, attempts were made for use of flyash in manufacturing bricks, cellular concrete, prefab items, cement, reclamation of low lying areas and construction of roads, the desired impact could not be achieved.***"**

The report also provides broad estimates of fly ash available in the various regions of India and its percentage utilization in different manufacturing and construction activities. **"***Broad estimates of ash production & utilization in different parts of India (Utility Thermal Power Stations) are as follows:***"**

S. No.	**Zone Name**	**FA Generation (million tonnes)**	**Utilization (million tonnes)**	**% Utilization**
1	Southern	13.5	0.8	6.0
2	Western	16.5	0.8	5.0
3	Central	18.0	2.84	15.8
4	Eastern	10.21	2.94	28.8
5	Northern	15.5	2.3	14.8
	Total (All India)	73.71	9.68	13.1
Source - TIFAC				

Fly Ash	**Installed Cap.**	**Fly Ash Available**
Sources	**MW Per Day**	**Mil.Tons P.A.**
West Bengal		
NTPC, Farakka	1600	2.1
DVC - 2 Units	980	1.26
WBSEB - 2 Units	1010	1.33
WBPDCL - 2 Units	1680	2.23
CESC - 3 Units	875	1.44
Sub Total	**6145**	**8.36**
Bihar/Jharkhand		
NTPC Kahalgaon	840	0.64
DVC - 2 Units	1555	0.88
BSEB - 4 Units	1720	0.68
TPCL	240	0.4

Sub Total	**4355**	**2.6**
Chhattisgarh		
NTPC, Korba	2100	2.95
CSEB - 3 UnitsI	1240	1.4
Jindal Power	550	0.14
Sub Total	**3890**	**4.49**
Orissa		
NTPC - 2 Units	1460	1.7
IB Valley	420	0.45
Sub Total	**1880**	**2.15**
GRAND TOTAL	**16270**	**17.6**
Source: Internal plant survey data – Lafarge JCP		

The above discussion clearly demonstrates that in India, fly ash is available in abundance. Therefore the project activity will not result in any shortage of fly ash availability in other sectors.

- More than 95% of the PPC blend cement produced by JCP is sold in the domestic market, within the periphery of the States of Bihar, Jharkhand, Assam, Meghalaya, Orissa and West Bengal. JCP also exports PPC to Nepal and Bangladesh, which is around 50,000 to 70,000 tonne per year. While calculating the year wise actual emissions reductions from the project, the total export quantity of PPC has been deducted from total quantity produced every year.

- Adequate data on PPC in the market are available in reports published by Cement Manufacturers Association (CMA), India.

As stated above the project activity meets all applicability criteria of the approved consolidated baseline methodology ACM0005 and justifies the appropriateness of the choice of the methodology in view of the project activity.

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

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Following steps have been applied systematically to identify project alternative(s), the appropriate baseline scenario, demonstrate project additionality, and determine estimated baseline emissions.

Step 1: Identification of Project Alternative:
In the absence of the project initiative, JCP would have either produced OPC/ PBFS cement or produced PPC with high percentage of clinker just as other units in the region tend to do. Thus the most likely and plausible baseline scenario in absence of the project would have been:

Alternative 1: Production of OPC / PBFS

JCP produces PBFS blend cement (Portland Blast Furnace Slag Cement) to the maximum capacity of 1.6 million tonne per year based on availability of slag. JCP procures blast furnace slag from Tatat Iron and

Steel Company Limited and caters to the market demand in the eastern region[7]. Since, PBFS production is restricted to slag availability and market acceptability (main constrain) almost equal to PPC, it is ruled out that in absence of the project JCP would have had gone of capacity addition to produce more slag cement and cater to the regional market.

Since PPC production depends on availability of fly ash and its characteristics, stringent quality control and R&D, production of OPC would have been a much more lucrative option for JCP as it had to invest for improvising the existing ball mill and installation of the new ball mill along with quality control equipment in order to produce PPC with incremental quantity of fly ash addition in a planned manner every year. However, that would have lead to high GhG emissions as compared to the other alternatives discussed below. However, demonstrating this is difficult and hence has been excluded from consideration..

Since OPC production does not require any additional investment to the existing infrastructure and in quality and pollution control, it is most likely that JCP plant would have produced OPC in absence of PPC. Further, since the OPC sales do not face any product and marketing constrains, it's easy to attain sales mileage and profitable financial targets, any cement unit would prefer to produce OPC.

Alternative 2: Production of PPC with low share of additives (i.e. high share of clinker) as in other manufacturing plants in the region using similar input/ raw materials and facing similar economic, market and technical circumstances

Production of fly ash based PPC in India is subject to the Bureau of Indian Standards specification IS: 1489 (Part 1). This specifies that the percentage of pozzolana material (i.e. fly ash) in PPC must fall between the ranges of 15% to 35%.

To determine the common prevailing clinker percentage of PPC in other cement manufacturing plants in the region using similar input/raw materials, and facing similar economic, market and technical circumstances.

Definition of the region

According to the consolidated approved methodology ACM0005, *"The "Region" for the benchmark calculation needs to be clearly determined and justified by project participants. The default is the national market but PPs can define a geographic region as the area where each of the following conditions are met: (i) at least 75% of project activity plant's cement production is sold (percentage of domestic sales only); (ii) includes at least 5 other plants with the required published data; and (iii) the production in the region is at least four times the project activity plant's output. 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."*

Lafarge JCP unit supplies more than 75% of the total production to the following states in the eastern region of the country, they are – Assam, Meghalaya, Bihar, Jharkhand, Orissa and West Bengal. This geographical region has markets and other plants that produce and sell their products within the region.

[7] Eastern Regional market of cement as demarcated by Cement Manufacturers Association comprises of following states: Assam, Meghalaya, Bihar, Jharkhand, Orissa, West Bengal and Chhattisgarh.

However, during the year 2000 there were only four other units in the region who and were not producing PPC in appreciable quantities and thus could be considered to be eligible for benchmarking. Therefore, the project has selected the base year as 2001, when the JCP started producing PPC in significant quantity and there are six other plants in the region also joined the same product category. All comparison has been detailed in Annex 3, under Baseline information.

Using similar input/raw materials

Since the major raw material required for production of PPC is clinker, fly ash and gypsum, the plants considered within this region generally procure raw material available within the region as crossing this geographical region would lead to additional transportation cost. Hence it is assumed that all cement plants considered for benchmarking clinker addition use almost similar type of input/ raw material for production PPC blend cement.

Facing similar economic circumstances

The cement plants in the same region will have similar economic circumstances due to similar proximities to the required quality of limestone, coal reserves, gypsum and fly ash and similar locational advantages

Facing similar market circumstances

All PPC manufacturing plants included in benchmarking caterer to the market domain of JCP and therefore face the similar market circumstances as that of the project activity hosting plant. Therefore all the cement manufacturing units producing PPC in the region as listed by CMA have been considered.

Facing similar technical circumstances

Most of the cement plants in India manufacture cement through dry process. The basic technology adopted by Indian cement industries in the dry process is similar.

It can be inferred from the above discussions that the identified cement plants in eastern region would produce PPC with similar input/ raw materials under similar market, economic and technical circumstances and would therefore be considered for estimating the common prevailing clinker percentage in the PPC produced.

According the approved methodology, benchmarking for baseline emissions within the selected *region* should be as following:

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

(ii) The production weighted average mass percentage of clinker in the top 20% (in terms of share of additives) of the total production of the blended cement type in the region; or

(iii) The mass percentage of clinker in the relevant cement type produced in the proposed project activity plant before the implementation of the CDM project activity.

Since the start of production of PPC in Jojobera, CDM was considered; the option (iii) is not applicable.

To determine (ii) and (iii) above, the approved methodology ACM005 stipulates either statistically significant random sampling or the use of reliable and up to date annual data from a reputable and verifiable source. Data on OPC, PBFS, and PPC production and on clinker production and grinding at cement plants in India is provided by the Cement Manufacturers Association of India (CMA). This data, which is from a reputable source and is verifiable, is used to derive the clinker content in PPC produced

in each region as defined above. Thus CMA data has been used to determine the percent clinker based on data on plants in the eastern region at the start of the project activity i.e. 2001.

Assumption:
It is assumed that the cement plant producing OPC does not require any special technological innovation and the plants in the given region would have to face similar market demand on OPC quality, hence, the proportion of clinker and gypsum addition would remain more or less similar.

For option (i) ***the average (weighted by production) mass percentage of clinker for the 5 highest blend cement brands for the relevant cement type in the region is 72.5%.*** For details refer to Annex 3 – Baseline Information of this PDD

For option (ii)*, the production weighted average mass percentage of clinker in the top 20% (in terms of share of additives) of the total production of the blended cement type in the region is 70.4%.* For details refer to Annex 3 – Baseline Information of this PDD

Option (iii) is not applicable to the project as the project is a greenfield project.

Conclusion
Since all above mentioned alternatives are legally allowed, therefore possible to execute. However, since the ACM0005 recommends considering that alternative that leads to less emissions as most plausible alternative, hence project selects "Alternative 2" as most plausible alternative that would have occurred in absence of the project. Therefore, it can be concluded that in absence of the project initiative to add fly ash with incremental quantity in a planned manner every year, JCP would have produced PPC with low share of additive (i.e. high share of clinker) as prevailing practice in the region. This is conservative.
Thus, **option (ii), which has the lowest mass percentage of clinker in cement for the region, has been selected as the benchmark baseline scenario.**

Trend of additive addition
As outlined in the methodology, the option to select a benchmark trend increase is selected. This trend is specified ex-ante, in the share of additives in blended cement type based on the minimum of an annual 2% increase in additives. There was no clear trend evident in the additive blend in the above regions, nor sufficient data to estimate such a trend. Therefore we have selected the default annual 2% increase in additives.

Step 2: Demonstration of project additionality – Refer to next section, B.3, for details on project additionality.

Step 3: Determination baseline emission
As stated under approved methodology ACM0005 version 03 (19^{th} May 2006),
The baseline emissions are a function of two factors:

- the percentage of additives and the related electricity consumption that is taken as the baseline benchmark; and
- the CO_2 emissions per tonne of clinker in the BCL project activity plants, which in turn depends on
  (a) Quantity and carbon intensity of the fuels used in clinker making;
  (b) Quantity and carbon intensity of electricity;
  (c) CO_2 emissions from calcinations.

For detailed calculations of baseline emissions in the base year 2000-2001, please refer to Annex 3 for detail Calculation of Baseline Emission Factors and Emission Reductions attainable from the project activity.

Since all grid emission factor related to the baseline and project activity requires to be calculated based on approved consolidated methodology ACM0002 version 04, grid emissions for all the three units has been determined in the following manner
JCP – located at Eastern Region, hence Eastern Regional Grid
ACP and SCP - located at Western region, hence Western Regional Grid.

As per the new directive by UNFCCC Methodology Panel for countries like India, for calculation of grid emission factor, regional grid emission factor should be determined, accordingly regional grid has been considered for calculation.

For Operating Margin emission calculation, option (e) "Average OM" has been selected as it includes all sources of electricity generation and fuel used based on actual, thus it considered to be conservative.

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:

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Steps for additionality check	**Demonstration of crossing barriers**	Conclusion
Step 0: *Preliminary screening of projects started after 1 January 2000 and before 31 December 2005*	Project started implementation in May 2001. The project has commenced additional flyash addition from this date. During finalization of capital investment, CDM incentive was seriously considered by the management of JCP.	
Step1a: *Identification of alternatives to the project activity consistent with current laws and regulations*	Already discussed in Section B.2 The most plausible alternative in absence of the project initiative would have been production of PPC with high share of clinker as other manufacturing plant in the region with using similar input/ raw material and facing similar economic, market and technical circumstances.	
Step1b: *Is the execution of the project based on legal obligation?*	No Production of fly ash based PPC in India is subject to the Bureau of Indian Standards specification IS: 1489 (Part 1). This specifies that the percentage of pozzolana material (i.e. fly ash) in PPC must fall between the ranges of 15% to 35%. The Ministry of Environment and Forests requires coal and lignite power plants subject to	

	environmental clearance conditions to submit an action plan showing how they will achieve full utilisation of fly ash. However there are no regulatory requirements on cement plants to assist in accomplishing this. From the above discussion, we conclude that both alternatives are in compliance with applicable laws and regulations.	
Step2: *Investment Analysis of the project*	No.	
Step3: *Does the project face other barriers?*	Yes Technological barriers: 1 – Quality of fly ash and streamlining of system: In order to be able to add increasing percentage of fly ash, JCP required to convince the power plants to maintain quality of fly ash, which heavily depends upon the type of coal used and operational controls of the power plant. Since, none of the above mentioned parameters are under the control of the JCP management; the project continually worked with the power plant and provided daily feed back on the fineness of the particles, loss on ignition and colour of the fly ash. The fly ash contained un-burnt coal particles in terms of loss on ignition. This was considered a negative quality constraint which had an impact on colour of cement along with floating coal particles. This was a critical parameter for production of PPC cement. The next parameter was the fineness of the fly ash which an analysis indicated a courser fly ash 250 blaine as compared to other fly ash source of power plant where blaine is around 300 – 320 m^2 / kg. This had an impact on the quantity of fly ash to be used in the cement as production quantity would be reduced with coarse fly ash. Building this team effort external to the organisation and establishing understanding and coordinating in order to utilize symbiotically the waste of another sector is commendable. Further, this is an additional effort from the unit which would not have been possible without the unit's effort to streamline to different industries	

	(manufacturing and utility). <u>2: Process improvement:</u> In order to enable the unit add more fly ash, Lafarge conducts R&D programme on a routine basis. Recently, after bringing in a few alternations in the feeding and grinding systems, the unit was able to achieve about 2% increase in fly ash addition in PPC. This is a core competency of the unit and can be demonstrated with facts and figures to the validator at time of validation. <u>3. High quality clinker:</u> The R&D efforts in the unit has established that to be able to add more % of fly ash over and above and common threshold (common practice) the unit would require high quality clinker (with Ca_3S of about 50%). Since the clinker used by JCP is being produced by Sonadih and Arasmeta unit, both producing units had to conduct separate R&D drills with the available limestones and technology in the market. This also required the clinker producing unit to selectively procure low ash containing coal for calcinations process. However, the ash content of the coal available in India is as high as 47% which is not considered good for cement. Thus, often the procurement of required quality of fuel became a constraint to the production of high quality clinker which in turn affects the percentage share of additives in PPC. <u>4. Desired Particle Size Distribution -</u> The unit has installed new laboratory equipment called Particle Size Distribution analyser in order to study the correct blaine of fly ash, clinker and gypsum that is required to produce a homogeneous blend of PPC. JCP was required to spend about INR 2.5 million to procure this equipment and separately train its personnel to handle the equipment and conduct test and suggest correct particle size of all the three ingredients. This is a continuous task and feedback is provided to the operational team at the grinding unit. Quality control efforts and regular R&D work has enablec the unit to add more fly ash in the blend which is unique in nature.	

	4. Grinding aid- JCP has been working with the supplier to innovate grinding aid customized to the units requirement depending upon quality of clinker, fly ash and gypsum. The supplier does not produce this unique mixture for others as JCP had drawn exclusive contracts with the supplier. All relevant documents will be produced to the validator as confidential document at time of validation. 5. Market acceptability barriers: The major constraint in production of PPC cement was market response for this brand. The prime reason behind such market non-acceptability of the PPC produced is because of the fact that Indian cement market is dominated by OPC. Since the consumers have been used to high strength cements like 53+ grades, introducing the PPC cement was a great task. This required building customer awareness and clearing their doubts about Pozzolona material. This will require maintaining the quality to meet their demand. Marketing net work had to be strengthened to increase the PPC share as compared to that of competitors in the region. There is in India still a general perception that the quality of blended cements is inferior to that of OPC, and therefore that PPC with a higher fly ash blend is undesirable. PPC acceptance is in particular low in some government agencies – the Central Public Works Department has imposed a ban on the use of blended cements in bridges and other concrete works and constructions. Moreover, there still exists misconceptions that fly ash reduces cement strength and increases setting time. The a-priori assumption of customers is that a high fly ash PPC is of an inferior quality and therefore they will tend not to purchase such cement. Dissatisfaction due to blackish material leaching and floating on the surface of concrete / mortar was also a constraint that Lafarge had to overcome by providing demo as how to use and apply PPC and follow best practices in	

	constructions. All these misconceptions have resulted in a lower market share of PPC thereby discouraging the cement manufacturing units all over India to produce more PPC. In spite of all such prevailing market resistances, JCP continued the production of PPC and has applied whole-hearted efforts to further increase the additive percentage in the PPC in order to improve the GHG performance during cement production. As a part of market and technical awareness programmes, Lafarge is continuously undertaking promotional activities to convince the consumers and win their confidence on a regular basis in order to promote PPC with higher additive percentage in the consumer market. Some of these promotional activities are: ▪ Conducting dealers meet ▪ Mason meet ▪ Plant visit ▪ Distribution of printed literature ▪ Outdoor advertisement and through various media; Project has been fully sponsored by Lafarge. INR 35million was invested for installation of additional equipment in the existing ball mill and about INR 452million was invested in designing, procuring and installation of the second ball mill, specifically for PPC production with incremental addition of fly ash. Further, the unit also had to spend about INR 2.8million for procuring quality control and R&D equipments in order to produce best quality PPC and high share of fly ash. **Even though there have been many uncertainties in terms of technology of adding increasing percentage of fly ash, marketing constrains, poor acceptability of product, Lafarge India invested in the project as a voluntary initiative to improve the environment. While evaluating the cost and benefits of the project CDM incentive to be shared within the Group was seriously consider and hence it was decided to go ahead with the project expecting CDM returns to**	

	cover losses	
Step 4: ***Is the project common practice?***	No During the time of project initiation in 2001-02, no other cement units in the region was adding at the levels targeted by the JCP. (Source CMA data and estimates)	Based on additionality analysis, it is clear that project has demonstrated that it is not a business as usual case and is additional to the baseline scenario
Step 5 ***Impact of CDM registration***	This project if registered for CDM would be a boost to the adoption of fly ash addition in the Indian cement sector in the region. Successful implementation of this technology needs CDM funds to strengthen process control and cover uncertainties throughout the crediting period. Moreover, to fuel continual research and marketing efforts to enable incremental quantities of fly ash to be added requires finance and human resource. Ability to add increasing quantities of fly ash requires managing several critical factors. Hence, CDM is required both initial overcoming of barriers as well as long term investment for the sustenance of the 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 activity would reduce the GhG emissions at all stages of PPC blend cement production that includes –

- Direct emissions at the PPC producing plant due to fuel combustion for:
    - Firing the kiln (including supplemental fuels used in the precalciner);
    - Processing (including drying) of solid fuels, raw materials, and additives;
    - On-site generation of electricity (if applicable).
- 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.

Thus the project boundary includes

- PPC blend cement production at JCP

- Clinker producing units – Arasmeta Cement Plant (ACP) and Sonadih Cement Plant (SCP) in Chhattisgarh
- Power generation in the grid connected to JCP (Eastern regional grid) and ACP and SCP (Western Regional)
- Onsite captive power generation at SCP and ACP using furnace oil (FO) and high speed diesel (HSD) only at SCP
- The pneumatic conveyor pipeline system used for transporting fly ash from the power plant to the JCP

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

>>

Date of completion of baseline determination and PDD –19/ 09/ 2006

Entity determining baseline of the project: CDM Project Developer – M/s PricewaterhouseCoopers Pvt. Ltd.

Not a project participant.

Organization:	PricewaterhouseCoopers (P) Ltd.
Street/P.O.Box:	252, Veer Savarkar Marg,Shivaji Park, (Opp. Shivaji Park Maidan,Next to Mayor's Bungalow)
Building:	3rd Floor, B Wing
City:	Dadar (W), Mumbai
State/Region:	Maharastra
Postcode/ZIP:	400 028.
Country:	India
Telephone:	+ 9122 5669 1000 (Board), + 9122 5669 1302 (Direct)
FAX:	+ 9122 5654 7804 / 05
E-Mail:	
URL:	www.pwc.com
Represented by:	
Title:	Associate Director
Salutation:	Mr.
Last Name:	Ram Babu
Middle Name:	
First Name:	P
Department:	Sustainable Business Solutions
Mobile:	+91-9820135929
Direct FAX:	+91-22-24913417
Direct tel:	+91-22-56619341
Personal E-Mail:	ram.babu@in.pwc.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:

>>
The project was conceived in line with Lafarge Group's objectives to reduce CO_2 emissions from clinker production proposed in the year 2000. JCP started adding additional fly ash from the year 2001. Implementation of additional equipments in PPC Circuit #I was completed in 15th May 2001 and PPC Circuit #2 was commissioned on 1st July 2002.

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

>>
The operational lifetime of the mills is about 25years.

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:

>>
NA

C.2.1.2. Length of the first crediting period:

>>
NA

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
15/05/2001

C.2.2.2. Length:

>>
10y

SECTION D. Application of a monitoring methodology and plan

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

>>

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

Reference: Approved consolidated baseline methodology ACM0005/ Version 03, Sectoral Scope - 04, 19th May 2006.

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

>>

The approved consolidated monitoring methodology is designed to be used in conjunction with the approved consolidated baseline methodology. The applicability conditions of the monitoring methodology are identical with those for the baseline methodology. The project activity under consideration meets all the applicability conditions of the approved consolidated baseline methodology (please refer to Section B.1.1 for details).Hence it is justified to adopt the approved consolidated monitoring methodology for the project activity.

The approved consolidated monitoring methodology has been developed for monitoring the performance of the increased additive percentage in the PPC and to estimate the quantum of GhG reductions resulting from reduced process emissions, thermal energy related emissions and electrical energy related emissions due to reduction of clinker content in the PPC. The project activity would also improve its GhG performance through net clinker content reduction in PPC production and hence selection of the approved consolidated monitoring methodology to calculate the actual emissions reduction in a transparent and conservative manner resulting from the project activity is appropriate.

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
I	*In* CaO_y	*In plant clinkerisation unit*	*%*	*M,C*	*Daily*	*100%*	*Electronic*	*Is a part of normal day to day operation of clinkerisation unit of the plant.*
2	*Out* CaO_y	*In plant clinkerisation unit*	*%*	*M,C*	*Daily*	*100%*	*Electronic*	*Is a part of normal day t day operation of clinkerisation unit of the plant.*
3	*In* MgO_y	*In plant clinkerisation unit*	*%*	*M,C*	*Daily*	*100%*	*Electronic*	*Is a part of normal day t day operation of clinkerisation unit of the plant.*
4	*Out* MgO_y	*In plant clinkerisation unit*	*%*	*M,C*	*Daily*	*100%*	*Electronic*	*Is a part of normal day t day operation of clinkerisation unit of the plant.*
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 crossed checked in annual financial accounts/ balance sheet/ opening and closing balance of raw material used and investment.*
6	*Quantity of clinker used for PPC production* CLNKy	*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 crossed checked in annual financial records/ balance sheet/ opening and closing balance of clinker in published data of Cement Manufacturers Association of*

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**
								India.
7	FFi,	*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 crossed checked in annual financial records/ balance sheet/ opening and closing balance of raw material consumption*
8	EFFi	*IPCC default values for the fuels type*	*tCO2/tonne of fuel used*	*C*	*Annually*	*100%*	*Electronic*	
9	PELEgrid_CLNK,y	*In plant clinkerisation unit*	*MWh*	*M*	*Monthly*	*100%*	*Electronic*	*The total electricity consumed by the unit for clinker production is recorded monthly and same can be cross checked with monthly electricity bills paid.*
10	EFgrid_y	*Once calculated at time of PDD finalization as per latest version of ACM0002*	*tCO2/MWh*	*C, E*	*Annually*	*100%*	*Electronic*	*Data on grid generation and power plant details has been sourced from State grid and central electricity authority of India*
11	PELEsg_CLNK,y	*In plant data*	*MWh*	*M*	*Monthly*	*100%*	*Electronic*	*Captive generation through DG sets.*
12	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 NCV and C% of HSD used.*
13	*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*

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**
								annual records same can be crossed checked in annual financial records/ balance sheet/ opening and closing balance of fly ash
14	PEcalcin,y	*In plant data*	*tCO2/tonne of clinker*	*C*	*Annually*	*100%*	*Electronic*	
15	PEfossil_fuel,y	*In plant data*	*tCO2/tonne of clinker*	*C*	*Annually*	*100%*	*Electronic*	
16	PEele_grid_CLNK,y	*In plant data*	*tCO2/tonne of clinker*	*C*	*Annually*	*100%*	*Electronic*	
17	PEele_sg_CLNK,y	*In plant data*	*tCO2/tonne of clinker*	*C*	*Annually*	*100%*	*Electronic*	
18	PEele_sg_CLNK,y	*In plant data*	*tCO2/tonne of clinker*	*C*	*Annually*	*100%*	*Electronic*	
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*	
21	Operating hours of the fly ash conveying system	*In plant data*	*hours*	*M*	*Annually*	*100%*	*Electronic*	*Hours of operation to log in the daily logsheet at every shift.*

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)

PEele_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)

$$EF_{sg,y} = \sum_{i,j} F_{i,j,y} \text{ X } COEF_{i,j} / \sum_{j} GEN_{j,y} \quad \textbf{(1.3)}$$
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

$$\mathbf{COEF_i = NCV_i \text{ X } EFCO_{2,i} \text{ X } OXID_i} \quad (1.3.1)$$

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.2.1.3. 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* $CLNK_{BSL}$	*In plant grinding unit*	*Kilo tonnes*	*M*	*Annually*	*100%*	*Electronic*	
7	FFi,	*In plant clinkerisation unit*	*tonnes*	*M*	*Annually*	*100%*	*Electronic*	
8	EFFi_BLS	*IPCC default values for the fuels type*	*tCO2/tonne of fuel used*	*C*	*Annually*	*100%*	*Electronic*	
9	PELEgrid_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	PELEsg_CLNK, $_{BSL}$	*In plant data*	*MWh*	*M*	*Monthly*	*100%*	*Electronic*	
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_sg_CLNK, $_{BSL}$	*In plant data*	*tCO2/tonne of clinker*	*C*	*Annually*	*100%*	*Electronic*	
19	BEele_grid_BC, $_{BSL}$	*In plant data*	*tCO2/tonne of blended cement*	*C*	*Annually*	*100%*	*Electronic*	

20	BEele_sg_BC, *BSL*	*In plant data*	*tCO2/tonne of blended cement*	*C*	*Annually*	*100%*	*Electronic*	
21	Bblend,y	*In plant data*	*Tonne of clinker/tonne of blended cement*	*C*	*Annually*	*100%*	*Electronic*	

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 (tCO2/tonne clinker)
0.785 = Stoichiometric emission factor for CaO (tCO2/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)

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

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

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

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	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	Qadd ELEconveyor_ADD	*In plant data*	*MWh*	*M*	*Monthly*	*100%*	*Electronic*	
2	EFgrid	*In plant data*	*tcO2/MWh*	*C*	*Annually*	*100%*	*Electronic*	
3	Qadd	*In plant data*	*Tonne of additive/vehicle*	*M*	*Per trip*	*100%*	*Electronic*	
4	áy	*In plant data*	*Tonne 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.)

>>

$$L_{add\_elc} = (ELE_{conveyor\_ADD} * EF_{grid}) * 1/A_{add,y} \qquad (3)$$

where:

ELEconveyor_ADD = Electricity consumption for conveyor system for additives (MWh)

EFgrid = Grid electricity emission factor (tonnes of CO2/MWh)
Aadd = Annual consumption of additives in year y. (t of additives)

Ly = Ladd_elc * [Ablend-Pblend] * Bcy **(4)**
where:
Ly = Leakage emissions for transport of additives (tonnes of CO2)
BCy = Production of BC in year y (tonnes 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.)

>>

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

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	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. 1-21	*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 2.1.2 Id No. 1-21	*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 1-7		*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

>>

Operational and Management Structure

JCP has deputed a team of qualified quality control and cement industry experts for production of PPC blend cement. The Vice President (Jojobera Cement Plant) would be assisted by his group of service and maintenance managers to implement the monitoring plan. The management structure for this project has been 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 consolidated methodology ACM0005
- The reliability of the data monitored,
- The archiving of the data collected

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

Reliability of the data

All measurement devices are 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 are calibrated as per scheduled calibration period defined under Quality Management System ISO 9002:2000 ensuring reliability of the data recorded. 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.

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

>>

Date of completion of monitoring plan and PDD –19/ 09/ 2006

Entity determining monitoring plan: CDM Project Developer – M/s PricewaterhouseCoopers Pvt. Ltd.

Not project participants. Contact details given in Section B.5.

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

>>

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
PEBC,y = Project emissions per tonne of BC (tCO2/tonnes of BC)	0.651	0.614	0.602	0.587	0.571	0.565	0.561	0.564	0.564	0.564
BCy = BC production in year y (tonnes)	272985	933738	842851	950406	1154529	1000000	1000000	1000000	1000000	1000000
Project emissions (tCO2/tonnes of BC)	**177636**	**573564**	**507681**	**558039**	**659568**	**564940**	**560913**	**563580**	**563942**	**564068**

E.2. Estimated leakage:

>>

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Ly = Leakage due to fly ash transportation by pneumatic system (tCO2)	-12	-105	-101	-128	-143	-116	-102	-89	-75	-62

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

>>

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Project emissions (tCO2/tonnes of BC)	177636	573564	507681	558039	659568	564940	560913	563580	563942	564068
Ly = Leakage due to fly ash transportation by pneumatic system (tCO2)	-12	-105	-101	-128	-143	-116	-102	-89	-75	-62
Total	**178540**	**576505**	**513362**	**560866**	**662968**	**567927**	**563901**	**566567**	**566929**	**567055**

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

>>

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
BEBC,y = Baseline emissions per tonne of BC (t CO2/tonnes of BC)	0.664	0.651	0.644	0.638	0.619	0.608	0.599	0.597	0.592	0.587
BCy = BC production in year y (tonnes)	272985	933738	842851	950406	1154529	1000000	1000000	1000000	1000000	1000000
BEy = Baseline emissions (tCO2)	181133	607964	543215	606490	714234	608467	599082	596886	592212	587286

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

>>

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
ERy =Emission Reduction (tC02/yr)	3484	34295	35433	48324	54524	43412	38067	33218	28195	23156

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

>>

Year	Estimation of baseline emissions (tonnes of CO_2e)	Estimation of project activity emissions (tonnes of CO_2e)	Estimation of leakage (tonnes of CO_2e)	Estimation of emissions reductions (tonnes of CO_2e)
2001	181133	177636	-12	3484
2002	607964	573564	-105	34295
2003	543215	507681	-101	35433
2004	606490	558039	-128	48324
2005	714234	659568	-143	54524
2006	608467	564940	-116	43412

2007	599082	560913	-102	38067
2008	596886	563580	-89	33218
2009	592212	563942	-75	28195
2010	587286	564068	-62	23156
Total (tonnes of CO2e in 10 years)				**342108**

SECTION F. Environmental impacts

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

>>

The Ministry of Environment and Forests (MoEF), Government of India, under the Environment Impact Assessment Notification vide S.O. 60(E) dated 27/01/94 has listed a set of industrial activities in Schedule I of the notification which for setting up new projects or modernization/ expansion requires environmental clearance and have to conduct an Environment Impact Assessment (EIA) study.

Accordingly, Environmental Impact Study was conduct at the site to assess the environmental impact(s) of the project activity and the associated activities involved in production of PPC blend. The report does not mention any significant adverse impact likely to occur from the project activities. Detailed EIA report is available at the site and will be produced on request.

All other operational control measures that are required to be followed to avoid environmental pollution are being stringently followed and reviewed Environmental Management System of JCP certified under ISO 14001.

No transbundary impact has been identified for any activity or associated activity of the CDM project.

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:

>>

The project activity leads to several positive environmental impacts which has be separately discussed in section A.2 under project's contribution to Sustainable Development of the country.

No significant environmental impact has been reported against the project.

Project activities abide by all standards and norms prescribed by central and state pollution control board of the country. Detailed monitoring and performance records are available at the site maintained under JCP's environment management system.

SECTION G. Stakeholders' comments

>>

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

>>

The operations in Lafarge India are guided by long-term social & environmental responsibility and stakeholders' satisfaction. The group is committed to augment sustainable development and realizes that stakeholder feedback is an important pillar on which performance is based. Similarly, periodic stakeholder consultation is a part of the Sustainability process and is also carried out at the unit level.

The group has defined a process of identifying the stakeholders related to their various activities and at different stage of activities. Accordingly, for the CDM project JCP has identified the following stakeholders from whom comments on the project was invited and recorded at the unit.: **-**

1. Neighbouring community
2. Local community leaders
3. Local Govt. officials
4. Employees (including contractual labours)
5. Contractors; and
6. Fly ash providing Power Plant (Tata Power, Jojobera)

G.2. Summary of the comments received:

>>

JCP has been operating their unit since 1999 and had started producing PPC blend from 2000 onwards. Till date there has been no adverse comment or any issue raised by any of the mentioned stakeholders as above.

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

>>

The stakeholder consultation at the unit level is carried out on yearly basis.

The discussion on CDM was held on 31st August 2005.

During the meetings all respective stakeholders (internal as well as external) are called to express their opinion on the mills performance. Any issues raised by any external are also addressed during the meeting.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Lafarge India Private Limited
Street/P.O.Box:	43 Ashutosh Chaudhuri Avenue
Building:	101 B, 1st Floor Sunny Towers,
City:	Kolkata
State/Region:	West Bengal
Postfix/ZIP:	700 019
Country:	India
Telephone:	033 – 2485 6865/ 8498/ 8246/ 8847
FAX:	044 – 2485 8925/ 6855
E-Mail:	mahendar.chaudhary@in.lafarge.com
URL:	www.lafarge-india.com
Represented by:	Sr. Vice President (Manufacturing)
Title:	Chaudhary
Salutation:	Mr.
Last Name:	
Middle Name:	
First Name:	Mahendra
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No Public finding included in the project.

Annex 3

BASELINE INFORMATION

Option-I: Considering 5 highest blend cement plants in the "Region"			
Plants	**PPC Production**	**Clinker**	**Benchmark Clinker % as per Option-I**
	(MT)	**(%)**	**(%)**
Cement Plant 1	272985	68.91	**0.725**
Cement Plant 2	1210999	70.68	
Cement Plant 3	42669	72.29	
Cement Plant 4	764860	74.85	
Cement Plant 5	530820	75.18	
Total	**2291513**		

Option-II: Considering 20% (in terms of share of additives) of total production in the "Region"			
Total PPC Production in the "Region" (MT)	**676758**		
20% of Total PPC Production in the "Region"(MT)	**1483984**		
Plants	**PPC Production**	**Clinker**	**Benchmark Clinker % as per Option-II**
	(MT)	**(%)**	**(%)**
Cement Plant 1	272985.00	68.91	**0.704**
Cement Plant 2	1210999.00	70.68	
Sub-Total	**1483984.00**		

Annex 4

MONITORING PLAN

For detail monitoring plan please refer to section D of the PDD.

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