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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Title: **"Blended cement with increased blend" at Orient cement's Devapur and Jalgaon plants in India**
Version: 03
Date: 10th February 2006

A.2. Description of the project activity:

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Orient Cement (Props: Orient Paper & Industries Limited), operates two cement manufacturing units - the Devapur Unit in Andhra Pradesh and the Jalgaon Unit in Maharastra, India. The two units have been using the readily available fly ash from the thermal power plants in the region to produce PPC blend cement (Portlant Pozzolanna Cement) since 2002.

The project has been adding increasing quantities of fly ash then the prevailing practices in the region of its operation of the two plants and thus replacing equivalent quantity of clinker. Clinker consumes precious raw materials, depletes forest and produces carbon dioxide emissions that contribute to global warming. The objective of the project is to lower greenhouse gas emissions through the substitution of clinker using fly ash and contribute to a sustainable means of using fly ash in the region.

The project contributes to sustainable development in the following manner and indicates how the contributions are related to the aspects of SD set by host country:

- **Resource saving:** Limestone is a finite resource, and the (open cast) mining of limestone have adverse environmental effects. The mineral resources extraction is often accompanied by de-forestation of forested land. Reducing the need for mining of limestone saves loss of precious ecology. – ***Social and Environmental well being***
- **Disposal of fly ash:** Fly ash is a by-product of electricity generation by the thermal power plants, and is a product for which disposal is difficult in the region. – ***Social and Environmental well being***
- **Energy saving:** Clinker production is highly energy intensive. Reducing clinker production conserves energy and releases power for supply to power stressed areas. – ***Social well being***
- **Reduced environmental load:** Clinker production has associated environmental pollution impacts that would be avoided through fly ash utilization. **- *Environmental well being***; and
- **GHG reduction:** Reduce emissions of greenhouse gases primarily CO_2. **- *Social and Environmental well being***

A.3. Project participants:

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Please list project participants and Party(ies) involved and provide contact information in Annex 1. Information shall be in indicated using the following tabular format.		
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)
Ministry of Environment & Forests, India.	Orient Cement (Props: Orient Paper & Industries 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.		
Note: When the PDD is filled in support of a proposed new methodology (forms CDM-NBM and CDM-NMM), at least the host Party(ies) and any known project participant (e.g. those proposing a new methodology) shall be identified.		

Orient Cement(Props : Orient Paper & Industries Limited) will be the sole owner of the CERs generated from the project and the contact for the CDM project activity. The contact information of all project participants has been provided in Annex 1.

This project has been developed as a CDM project and expects other entities from Annex I countries to join as project participants at the later stage. The list of such participants will be provided as and when identified.

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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The Project activity has been implemented within the existing units of Orient Cement(Props : Orient Paper & Industries Limited) at Devapur in Andhra Pradesh and Jalgaon in Maharastra, India.

A.4.1.1. Host Party(ies):

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India

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

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Jalgaon Unit : Jalgaon district, Maharashtra and
Devapur Unit : Adilabad district, Mandal Kasipet, Andhra Pradesh

A.4.1.3. City/Town/Community etc:

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Jalgaon Unit : Nashirabad village and
Devapur Unit : Devapur village

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 Project activity has been implemented within the existing units of Orient Cement (Props : Orient Paper & Industries Limited) at Devapur in Andhra Pradesh and Jalgaon in Maharastra, India.

Devapur plant is located within the Kasipet Mandal in Devapur village in Andhra Pradesh. The approximate location of the unit would be 19°01’59”N latitude and 79°27’58” E longitude. The site is at

a distance of 300 km from Hyderabad, the nearest city. The nearby railway stations are Bellampally at a distance of 25 km and Mancherial around 35 km. The location of the site is depicted in the maps enclosed below. Devapur unit sources fly ash from the nearby National Thermal Power Plant (NTPC) Ramagundam which is 70 km away from the plant.

The approximate location of the Jalgaon unit would be 21°00’57”N latitude and 75°33’54”E longitude. The Orient Cement(Props : Orient Paper & Industries Limited) Jalgaon unit is located at Nashirabad Village, on National Highway 6 in Jalgaon District, Maharashtra, India. The site is at a distance of 14 km from Bhusawal and Jalgaon, the nearby cities. The nearest railway station is Bhusawal at a distance of 14 km. The location of the site is depicted in the maps enclosed below. Jalgaon unit sources fly ash from the nearby Bhusawal Thermal Power Station (BTPS) at Deepnagar which is 26 km away.

	**Location of Orient Cement Jalgaon Unit**
	**Location of Orient Cement Devapur Unit**

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 02 - Approved consolidated baseline methodology ACM0005, "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 cement plants undertaking the CDM project activities have the following capacities:
Devapur Unit – 1.7 million tonnes per annum
Jalgaon Unit – 0.7 million tonnes per annum.

The technology involved in blending fly ash has been developed indigenously by Orient Cement (Props : Orient Paper & Industries Limited). The Research and Development at Orient Cement (Props : Orient Paper & Industries Limited) has relied on technical and other market information for increasing the blending of fly ash and on the properties of PPC. The units made a concerted effort and conducted a feasibility study for the sourcing, handling, utilizing of fly ash from the nearby thermal power plants. The research centre at Orient Cement (Props : Orient Paper & Industries Limited) uses sophisticated analyzers such as XRD, optical microscope study of clinker cement and fly ash.

The fly ash is procured from the respective thermal power plant's fly ash handling system storage silos. The fly ash is transported in 20 MT closed tankers and transported to the units where it is conveyed pneumatically to 500 MT steel silos for storage. Pneumatic handling ensures no loss of fly ash. From the silo fly ash is fed using flow control guide into the cement mill together with clinker and gypsum. Gypsum and fly ash are ground to required fineness inside the mill. Regular samples are taken and tested for fineness and quality. [1]

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 activities consist of increasing the blending of fly ash in PPC produced at the project sites. This will reduce clinker production and associated GHG emissions. As outlined in the methodology, these emissions arise from the calcination of limestone, fossil kiln fuel combustion and consumption of electrical energy for clinker and blending.

There is no mandatory requirement for the Indian cement units to use fly ash in the manufacturing process. In the absence of the CDM project, Orient Cement (Props : Orient Paper & Industries Limited) would have continued to use additional quantities of clinker to meet its market requirements. The proposed projects will take the additive blend to a level that is not common practice and which will require a number of barriers to be overcome. Birla A1 is Orient Cement 's (Props : Orient Paper & Industries Limited) flagship blended cement brand, and a considerable research, marketing, human resource and finance has been and is continued to be made to enable the increase in fly-ash blending associated with the project activity. The fly ash addition conforms to stringent BIS standards for

[1] Installation of steel silo at Jalgaon and fly ash handling system ar BTPS deepnagar , is in advance stage.

maintaining the quality and reputation of the Birla A1 brand. Significant marketing effort has been undertaken to alter adverse customer perceptions on PPC. Despite these inhibiting factors, Orient Cement (Props : Orient Paper & Industries Limited) Units took this bold initiative in adopting incremental quantities of fly ash addition that is not commonly seen in the cement sector in the region.

In the absence of the project activity, these actions would not be undertaken, and the fly ash blend of PPC produced by the Orient Cement (Props : Orient Paper & Industries Limited) cement plants would remain at the current levels. Under this (baseline) scenario, clinker production per tonne of cement and hence GHG emissions would also be higher.

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

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Years	Annual estimation of emission reductions in tonnes of CO_2e
2002-03	5665
2003-04	16746
2004-05	38633
2005-06	83918
2006-07	89084
2007-08	100998
2008-09	107366
2009-10	118886
2010-11	130352
2011-2012	140439
Total estimated reductions (tonnes of CO_2e)	832087
Total number of crediting years	**10 years**
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	**83208**

A.4.5. Public funding of the project activity:

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No public funding has been sought for the project activity. The project proponent will identify potential participants if additional funds are required in the future.

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 02, Sectoral Scope: 4
28th November 2005.

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

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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 in the methodology.
- 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.

The choice of methodology is justified in the following points :

- The projects are located in areas where there are large thermal power plants at present that are undergoing expansion. Flyash disposal poses a significant problem as it has to be landfilled. NTPC Ramagundam that supplies Devapur has expanded from 2100 MW to 2600 MW greatly increasing the availability of fly ash in the region. Jalgaon unit sources fly ash from the nearby Bhusawal Thermal Power Station (BTPS) at Deepnagar which is 26 km away and a capacity of 482.5 MW. For its various stages of phase-wise expansion, Orient Cement (Props : Orient Paper & Industries Limited) has acquired rights to use or dispose this flyash over the next 12 years. Hence there is no alternative allocation or use for the additional amount of additives used in the project activity for the foreseeable future, at least up to the end of the crediting period. Fly ash production in India is estimated at around 100 million tonnes per year, while the annual utilisation is estimated at 10 million tonnes at present.

- The entire production of PPC of the two units of Orient Cement (Props : Orient Paper & Industries Limited) is for the domestic market and there are no exports.

- Cement Manufacturers Association of India (CMA)[2] is the nodal information and database organization of cement industry in India and collects and collates information on all cement types from the market and from the manufacturers.

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[2] http://www.cmaindia.org/

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

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As suggested by the approved methodology, for barrier analysis, Step 3 of the "tool for the determination and assessment of additionality" version 2 has been used to eliminate alternatives from further consideration. The alternative baseline scenarios were:

1. **Continue to produce OPC**
2. **Produce PPC using minimum levels of additives as recommended by the BIS standard**
3. **Produce PPC using clinker percentage quantities at current blend levels practiced in the region**
4. **A switch to production of another type of cement (e.g. Portland Blast Furnace Slag Cement (PBFS))**

Given the barriers to increasing the blend of fly ash in PPC, and the continued prevalence of customer resistance to high fly-ash blended cements, there was a possibility that Orient Cement (Props : Orient Paper & Industries Limited) would have continued to manufacture OPC. However, demonstrating this is difficult and hence has been excluded from consideration. A switch to PBFS was a potential possibility. However, PBFS production is limited to areas where there is availability of slag from steel plants. Since there are no steel plant nearby to the two units of Orient Cement (Props : Orient Paper & Industries Limited) the option of switching over to PFBS can therefore also be ruled out.

Of the options 2 and 3, choosing 3 is more conservative as it is definitely a lower percentage of clinker since the standard recommends only 15% fly ash addition whereas the percentage flyash in the region was of the order of 16-32% on an average in 2001. Hence there is only one scenario i.e. the existing practice of cement production in the region (option #3) which is the realistic and credible baseline alternative to the project activity.

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%. As stated, the blend level in 2001 varied between 16% and 32% on an average. This is an optimum level that had been reached based on the clinker and fly ash quality at each plant, and taking into account the views of PPC users prevailing at that time. These levels all fall within the range specified by IS: 1489 (Part 1) and there is no requirement or need for these levels to be increased. The likely baseline scenario is the continuation of the current blend level, although in Section B.3 the project activity as a potential baseline scenario is also evaluated. The realistic and credible alternatives can therefore be restricted to two – the existing practice of cement production and the proposed project activity – and therefore the tool for demonstration of additionality is used to determine the most likely baseline scenario (see Section B.3.).

Definition of the region

"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."

The major activities of the two units of Orient Cement (Props : Orient Paper & Industries Limited) are governed from one single location, i.e Devapur. The procurement of raw material, final cement despatch and marketing operation are looked after from the corporate office located at Hyderabad, Andhra Pradesh, and the nearest city from Devapur Unit. Out of the two units, only Devapur is the integrated cement plant with highest installed capacity of 1.7 million MTA and Jalgaon operates as a grinding unit with only 0.7million MTA of installed capacity. Thus the procurements of the important raw materials such as limestone (from clinker production), coal used in clinkerisation are all monitored and governed by Devapur unit. Similarly, for all marketing operations and cement despatch schedules are drawn and governed from marketing office. Thus based on these facts of business activity, both the units have been considered as one single operation while selecting the baseline region. Both the units are approximately 380kms of radial distance apart from each other. Typically in Indian scenario, the cement market does not change drastically between this distance.

Orient Cement (Props : Orient Paper & Industries Limited) supplies more than 90% of the total production to the two states of Andhra Pradesh and Maharashtra. Thus this can be considered as baseline region to determine baseline share of clinker percentage followed by other units in the defined geographical region. There are more than 5 other plants within this region. The PPC production in the region is atleast 50 times more than that by Orient Cement (Props : Orient Paper & Industries Limited).

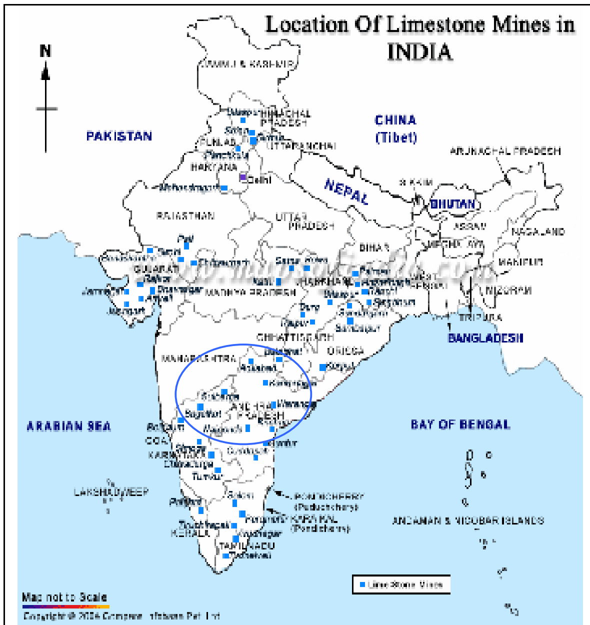
Plants	State	Type of Production Profile	OPC 000 Tonnes	PPC 000 Tonnes	PBFS 000 Tonnes	Clinker Gr 000 Tonnes	Clk in OPC 000 Tonnes	Clk in PBFS 000 Tonnes	Clk in PPC 000 Tonnes
Zuari Cement, Krishna Nagar	AP	OPC + PPC	1372.52	202.91		1489.62	1325.98		163.64
India Cement Chilamkur	AP	OPC + PPC	688.08	123.99		762.18	664.75		97.43
Raasi, Waddapally	AP	OPC + PPC	820.78	475.82		1195.3	792.95		402.35
Madras Cement, Jayantipuram	AP	OPC + PPC + Slag	181.76	488.32	297.44	671.69	175.60	150.49	345.60
ACC Ltd, Chanda	Mah	OPC + PPC	582.9	35.55		587.24	563.13		24.11

Further how the region selected is similar under several circumstances has been discussed in following sub steps.

Using similar input/raw materials

Since the major raw material required for production of PPC is clinker (more than 60% of the total weight) the plants considered within the defined region generally procures raw material (limestone) from Andhra Pradesh and Maharashtra. Further, crossing this geographical region would lead to additional

transportation cost. Hence it is assumed that all cement plants considered for benchmarking baseline share of clinker would use almost similar type of input/ raw material for production PPC blend cement.



Region – ***Andhra Pradesh and Maharashtra***

Facing similar economic circumstances
The cement plants in the defined 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 caters to the market domain of Orient Cement(Props : Orient Paper & Industries Limited) (Source- CMA, India – Inter Region Movement of Cement) and thus likely to face a similar market circumstances as that of the project activity hosting plant. All the cement manufacturing units producing PPC in the defined region as listed by CMA have been considered.

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

Thus it can be inferred from the above discussions that the defined region, i.e. Andhra Pradesh and Maharashtra, and the identified cement plants in the defined 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 at the baseline year, i.e. 2001 – 2002 of the CDM project.

Baseline emissions

The benchmark for baseline emissions is defined as the lowest value among the following:

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

To determine (ii) and (iii) above, the methodology 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 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.

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 77.88%. 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 80.56%. The CMA data is used to determine the percent clinker based on data on plants in the region at the start of the project activity i.e. 2001.

For option (iii) the mass % of clinker is 0% since the Orient Cement (Props : Orient Paper & Industries Limited) plants started adding additives and manufacturing PPC from the year 2001. This option is not considered as there was no “the relevant cement type” i.e. PPC produced prior to that year.

The lowest clinker percent is that from option (i) which is 77.88% and is considered the benchmark for the base year (2001-02).

Trend
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 is 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.

Baseline Emissions Factors
As stated under approved methodology ACM0005/ version 02,
The baseline emissions are a function of two factors:

i. the percentage of additives and the related electricity consumption; and
ii. the CO_2 emissions per tonne of clinker in the 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.

As stated in the methodology **-** “this methodology is restricted to increase in percentage of blend only and not to efficiency improvements or fuel switching, in case (i), the baseline value is substituted by the project activity value. That is, if emissions per tonne of clinker are lower during the crediting period, and then the lower value is taken for the baseline” **-** the same has been applied and will be updated in case at any of the year ‘y’ during the crediting period of the project when project emissions reduces below then the baseline performance.

The baseline emissions per tonne of clinker from calcination process in the year 2001-2002 stands to be 0.522 tCO_2/tonne clinker. The baseline emissions per tonne of clinker due to combustion of fossil fuels for clinker production are 0.206 tCO_2/tonne clinker. The baseline grid electricity emissions for clinker production per tonne of clinker are 0.033 tCO_2/tonne clinker. The baseline emissions from self generated electricity for clinker production per tonne of clinker are 0.027 tCO_2/tonne clinker. No energy is consumed in either plant for additive preparation either using grid energy or self generated energy.

The (regional) power grids or plants from which the cement plant purchases electricity and its losses are considered in determining indirect emissions. The western and southern region grid is considered whose emission factor as determined using the approved consolidated baseline methodology ACM0002 worked out to 0.988tCO2/MWh and 0.984tCO_2/MWh.

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 from 15/01/2001, when the first equipment order – the fly ash handling system was placed to EEL, the equipment provider. The project has commenced commercial operation of fly ash addition from 18/12/2001. During finalization of capital investment, CDM incentive was seriously considered by the management of Orient Cement (Props : Orient Paper & Industries Limited).	
Step1a: *Identification of alternatives to the project activity consistent with current laws and regulations*	As outlined in the methodology, the available alternatives are restricted to: • Produce PPC using clinker percentage quantities at current blend levels seen in the region	
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%. Both of the above alternatives will meet	

	this requirement. 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: *Does the project face financial or economic barriers?*	Yes Project has been fully sponsored by Orient Cement (Props : Orient Paper & Industries Limited). INR 9 million was invested for the transporting storing, handling of fly ash. As there was significant market uncertainty (due to customer perceptions on PPC) at the start of the project, it was challenging to take a business risk of introducing fly ash blended cement. This challenge was significant as Orient Cement (Props : Orient Paper & Industries Limited) was experiencing severe financial crunch during the year on account of its business losses.	
Step3: *Does the project face other barriers?*	Yes **<u>Technological barriers</u>:** Orient Cement (Props: Orient Paper & Industries Limited), through this project activity was for the first time entering into the blend cement production by fly ash. Also the percentage of blend (flyash) adopted by (Props: Orient Paper & Industries Limited) was higher than the percentage of blend adopted by other plants (except one) in the region. To maintain the quality of blend cement was of the highest importance from the organizations market view point. Strict controls were required to meet quality norm of BIS and market requirement. Variation in the fly ash in respect to blains & loss on ignition percentage was the major issues and it required testing of cement at higher frequency and accuracy to ensure quality. Cement with lower quality supplied to market could have	

	resulted in damage to the brand image of Orient Cement (Props : Orient Paper & Industries Limited). To meet final quality of cement, frequent testing and close control of chemical & physical characteristic of clinker and inputs to the kiln were exercised. Close monitoring & attention from senior staff and management were exercised to maintain the above parameters. Though fly ash was available in abundance from NTPC, Ramagundam, during initial production of PPC close monitoring and interaction was necessary to get good quality of fly ash to avoid any type of adverse market reactions. During initial operation besides improving performance of new equipments the associated problems as lower production rate of mills, jamming of mills, jamming of new equipments, higher consumption of power, were suitably sorted out by the dedicated team. The necessary care was taken to maintain quality standards to meet the customer's requirements. To adhere to the quality of cement in addition to the above mentioned measures Orient Cement (Props : Orient Paper & Industries Limited **)** had to also establish additional infrastructure as mentioned below. The fly ash received by tanker is unloaded with suitable unloading system permanently and sufficient storage space had to be provided to meet variation in input quantity and also to support continuous availability of fly ash for grinding in case of gaps in supply. This needed a minimum storage capacity of 2 – 3 days. The dozing system to the feed mill had to be adequate and accurate to meet the mill requirement and minimize quality variation. The handling system also had to be fitted with adequate Pollution control facility to handle the material without creating a nuisance for the operation. The collection, transportation & storage, handling had to meet the environmental regulations in handling fly ash. Fly ash being a	

	very fine and lighter material, there was every chance of pollution in each of the activities. Alternative controls had to be made at each location from loading, transportation closed trucks / tankers, unloading in sealed container storage, withdrawal & dozing the material for blending along with cement mill feed. This required planning and investment to a large extent. BIS has issued guidelines to use designated quality of fly ash. Also quantity of fly ash has been modified for minimum of 15% and maximum 35% use. The quality had to be suitably matched with BIS quality requirement during the use of various percentage of fly ash on trial basis. Orient Cement (Props : Orient Paper & Industries Limited **)** carried out extensive in house R&D for not only manufacturing blend cement but with blend cement with higher blend percentage. Also training of the existing staff had to be carried out for blended cement production. 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 to be used. Fine fly ash is needed for the project however, from an analysis it was found that the fly ash available from NTPC is of 250 - 300 blaine as compared to other fly ash source where blaine is around 300 – 320. However, these sources are far away from the site and transporting fly ash from there is not feasible. Thus, using the fly ash available in the region could have affected the cement quality. **Institutional barriers:** Fly ash had to be transported from the nearest power plant to our unit in closed tankers. Orient Cement (Props : Orient Paper & Industries Limited) had to look for a reliable transporter with bulk tanker capable of meeting the environmental requirements on long term basis. Since the tanker was to be used exclusively for Orient Cement (Props : Orient	

	Paper & Industries Limited) units, suitable guarantee of minimum quantity of trips had to be ensured on a long term contract. Although the thermal power plants were disposing fly ash into ash ponds, they were reluctant to provide infrastructure for the collection of dry fly ash. **Market acceptability barriers:** The major constraint in production of PPC cement was market response for this brand. Since the consumers have been used for high strength cements like 53+ grades, introducing the PPC cement was a great task. This requires the customer with awareness and clearing their doubts about Pozzolona material. This will require maintaining the quality to meet their demand. Demonstrate the use with large data base. Marketing net work to be strengthened to increase the PPC share compared to 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 is a general perception 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. Moreover, there is the potential that the Birla A1 brand name could be negatively impacted by the blend increase.	
Step 4: ***Is the project common practice?***	No During the time of project initiation in 2001-02, only one other cement factory in the region was adding at the levels targeted by the Orient Cement (Props : Orient Paper & Industries Limited) plants.	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. In order to sustain fly ash addition, several ongoing investment need to be made. For example, Orient Cement (Props : Orient Paper & Industries Limited) has acquired rights to use or dispose flyash for Bhusawal thermal power station over the next 12 years at an investment of INR 30 million that would be made in the thermal power plant site. 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 boundary includes the cement production plant, any onsite power generation and the power generation in the grid.
Emissions from the following emission sources are accounted for:
- Direct emissions at the cement 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
- 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.

Transport related emissions from the delivery of additional additives are included in the emissions related to the project activity as leakage. Emissions reductions from transport of raw materials for clinker production have not been considered conservatively.

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 as recommended by the approved methodology. This assumption simplifies the methodology and is conservative.

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:

>>

Details baseline information attached at Annex 3.
Date of completion of baseline estimation and PDD –29 October 2005.
Entity determining the baseline: CDM Project Developer – M/s PricewaterhouseCoopers Pvt. Ltd. India, Not a project participant. Contact details as below.

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:

>>
Start date for project is 15/01/2001 when the project was conceived as a CDM project.

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

>>
Average lifetime of all equipment installed is 20 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:

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/04/2002

C.2.2.2. Length:

>>
10 years

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 Monitoring Methodology for Increasing the Blend in Cement Production"

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

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

>>

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

D.2. 1. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
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 to 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 to 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 to 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 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*	*tCO2/tonne*	*C*	*Annually*	*100%*	*Electronic*	

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
		values for the fuels type	*of fuel used*					
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	*CEA*	*tCO2/MWh*	*C, E*	*Annual*	*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*	*Unit uses DG sets to generate electricity during power cuts or shortage from grid.*
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 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_CLN K,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	PEelec_sg_CLN K,y	*In plant data*	*tCO2/tonne of clinker*	*C*	*Annually*	*100%*	*Electronic*	

D.2.1.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:								
ID number	**Data variable**	**Source of data**	**Data unit**	**Measured (m), calculated (c) or estimated (e)**	**Recording frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic/ paper)**	**Comment**
19	PEele_grid_ADD ,y	*In plant data*	*tCO2/tonne of blended cement*	C	*Annually*	*100%*	*Electronic*	
20	PEele_sg_ADD,y	*In plant data*	*tCO2/tonne of blended cement*	C	*Annually*	*100%*	*Electronic*	
21	PEele_grid_BC,y	*In plant data*	*tCO2/tonne of blended cement*	*C*	*Annually*	*100%*	*Electronic*	
22	PEele_sg_BC,y	*In plant data*	*tCO2/tonne of blended cement*	*C*	*Annually*	*100%*	*Electronic*	
23	Pblend,y	*In plant data*	*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.)

>>

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:

$$\mathbf{PEclinker,y = PEcalcin,y + PEfossil\_fuel,y + PEele\_grid\_CLNK,y + PEele\_sg\_CLNK,y} \quad \mathbf{(1.1)}$$

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)

$$\mathbf{PEcalcin,y = 0.785*(OutCaOy - InCaOy) + 1.092*(OutMgOy - InMgOy) / [CLNKy * 1000]} \quad \mathbf{(1.1.1)}$$

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)

$$\mathbf{PEfossil\_fuel, y = [\ \text{‡”}FFi\_,y * EFFi] /CLNK,y * 1000} \quad \mathbf{(1.1.2)}$$

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)

$$\mathbf{PEele\_grid\_CLNK,y = [\ PELEgrid\_CLNK,y * EFgrid\_y] / [CLNKy* 1000]} \quad \mathbf{(1.1.3)}$$

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)

$$\mathbf{PEelec\_sg\_CLNK,y = [PELEsg\_CLNK\ ,y* EFsg\_y] /[CLNKy * 1000]} \quad \mathbf{(1.1.4)}$$

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)

$$EF_{sg,y} = \sum_{i,j} F_{i,j,y} \text{ X } COEF_{i,j} / \sum_{j} GEN_{j,y} \quad (1.3)$$
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
$$COEF_i = NCV_i \text{ X } EFCO_{2,i} \text{ X } OXID_i \quad (1.3.1)$$
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	BELEgrid_CLNK, $_{BSL}$	*In plant clinkerisation unit*	*MWh*	*M*	*Monthly*	*100%*	*Electronic*	
10	EFgrid_BSL	*In plant data*	*tCO2/MWh*	*C, E*	*Annually*	*100%*	*Electronic*	
11	BELEsg_CLNK, $_{BSL}$	*In plant data*	*MWh*	*M*	*Monthly*	*100%*	*Electronic*	

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

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
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	$BEelec\_sg\_CLNK,_{BSL}$	*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 (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)
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 CO2/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 (tCO2/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 CO2/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 (tCO2/tonne of BC)
BEele_sg_BC = Baseline self generated electricity emissions for BC grinding (tCO2/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 CO2/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)

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

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

The CO_2 emission coefficient COEFi is obtained as

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

where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i,

$OXID_i$ is the oxidation factor of the fuel

$EFCO_{2,i}$ is the CO2 emission factor per unit of energy of the fuel i.

D. 2.2. Option 2: Direct monitoring of emission reductions from the project activity (values should be consistent with those in section E).

D.2.2.1. Data to be collected in order to monitor emissions from the project activity, and how this data will be archived:

ID number *(Please use numbers to ease cross-referencing to table D.3)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment

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

>>

D.2.3. Treatment of leakage in the monitoring plan

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

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
1	TFcons	*In plant data*	*Kg of fuel/ kilometre*	*C*	*Annually*	*100%*	*Electronic*	
2	Dadd_source	*In plant data*	*Km*	*M*	*Per trip*	*100%*	*Electronic*	
3	TEF	*IPCC default values for fuel used in transportation of fly ash*	*tonneCO2/kg fuel used*	*E*	*Annually*	*100%*	*Electronic*	*Data on grid generation and power plant details has been sourced from State grid and central electricity authority of India*
4	Qadd ELEconveyor_ADD	*In plant data*	*MWh*	*M*	*Monthly*	*100%*	*Electronic*	
5	EFgrid	*In plant data*	*tcO2/MWh*	*C*	*Annually*	*100%*	*Electronic*	
6	Qadd	*In plant data*	*Tonne of additive/vehicle*	*M*	*Per trip*	*100%*	*Electronic*	
7	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.)

>>

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

where:

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

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

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

TEF = Emission factor for transport fuel (kg CO_2/kg of fuel)

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

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

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

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.)

>>

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

where:

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

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

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

BC_y = BC production in year y (thousand tonnes)

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

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

Monitoring Approach

The general monitoring principles are based on:

- The frequency of monitoring of the critical parameters according to the approved methodology AM0005
- The reliability of the data monitored
- The archiving of the data collected

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

Reliability of the data

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

SECTION E. Estimation of GHG emissions by sources

E.1. Estimate of GHG emissions by sources:

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The following table outlines the projected decrease in the clinker content at the cement plants carrying out the project activity over the crediting period (tonnes CO_2/tonnes BC):

2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
0.645	0.642	0.638	0.635	0.631	0.628	0.624	0.621	0.617	0.614

E.2. Estimated leakage:

>>

Leakage over the crediting period at project activity plant is estimated as follows (KtCO_2e):

2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
-0.08	-0.25	-0.55	-0.69	-0.72	-0.82	-0.85	-0.92	-0.98	-1.02

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

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The CO2 emissions per tonne of BC in the project activity plant in year y (tCO_2/tonne BC)

2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
0.60	0.61	0.58	0.57	0.53	0.53	0.53	0.53	0.53	0.53

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

>>

The CO2 emissions per tonne of BC in the baseline in year y (tCO_2/tonne BC)

2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
0.601	0.606	0.580	0.567	0.535	0.535	0.535	0.535	0.535	0.535

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

>>

The table below summarizes the baseline, project (including leakage) and emission reductions (ktCO2e).

	2002-03	2003-04	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12
Baseline emission	77.56	286.84	391.92	482.04	500.59	588.93	650.50	749.54	856.62	963.70
Project emission	83.31	303.84	431.10	539.69	590.40	690.74	758.71	869.35	987.95	1105.16
Leakage	-0.08	-0.25	-0.55	-0.69	-0.72	-0.82	-0.85	-0.92	-0.98	-1.02
Emission reduction	5.67	16.75	38.63	56.96	89.08	101.00	107.37	118.89	130.35	140.44

E.6. Table providing values obtained when applying formulae above:
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Year	Estimation of Project activity emission reductions (tonnes of CO_2 e)	Estimation of baseline emission reductions (tonnes of CO_2 e)	Estimation of leakage tonnes of CO_2 e)	Estimation of Emission reductions (tonnes of CO_2e)
2002-03	77561	83307	-81	5665
2003-04	286843	303843	-255	16746
2004-05	391922	431104	-550	38633
2005-06	455080	539691	-693	83918
2006-07	500588	590395	-723	89084
2007-08	588928	690742	-816	100998
2008-09	650497	758713	-849	107366
2009-10	749544	869348	-918	118886
2010-11	856622	987954	-980	130352
2011-2012	963700	1105163	-1024	140439
Total (tonnes of CO_2 e)	5521285	6360261	-6889	832087

SECTION F. Environmental impacts

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

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The host Party, i.e. Ministry of Environment and Forest, Government of India, does not require Environmental Impact Assessment to be conducted for cement industry projects adding fly ash to augment PPC production.

Following are the environmental benefits derived from the project:

- Resource saving : limestone is a finite resource, and the (open cast) mining of limestone may have adverse environmental effects. The mineral resources extraction is often accompanied by de-forestation of forested land. Reducing the need for mining for limestone saves loss of precious ecology.
- Disposal of fly ash : Fly ash is a by-product of electricity generation, and is a product for which disposal is difficult in the region.
- Energy saving : clinker production is highly energy intensive. Reducing clinker production conserves energy and releases power for supply to power stressed areas,
- GHG reduction : reduce emissions of greenhouse gases
- Reduced environmental load : Clinker production has attendant environmental impacts that would be avoided through fly ash substitution.

There are no transboudary impact caused by the project activity.

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:

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There are no environmental impacts considered significant by the project participants or the host Party for this CDM project.

SECTION G. Stakeholders' comments

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

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In year March, 2001 a meeting at APPCB, Hyderabad on subject of fly ash usage, was attended by Orient Cement(Props : Orient Paper & Industries Limited) executives along with other cement manufacturing units officials, AP Genco officials.
Stakeholders comments has been taken during stakeholder meeting at Orient Cement (Props : Orient Paper & Industries Limited) on 4.11.05

Meeting was attended by Mandal Revenue Officer, ZPTC member and Sarpanch along with other local members. Their queries related to environment were answered. Members were happy to note the saving in limestone and conservation of forest .They also enquired about pollution control measures adopted by Orient Cement(Props : Orient Paper & Industries Limited) for the project. Orient Cement (Props : Orient Paper & Industries Limited) executive explained about transport of fly ash in closed tanker and installation of steel silo equipped with proper dust collector.

The Orient Cement (Props : Orient Paper & Industries Limited) routinely interact with key stakeholders such as the mining department, forest department, the thermal power plants from whom the ash is sourced, customers, suppliers, the local community and its own employees through a multitude of communication mechanisms. The ISO 14001 system has established processes for external communication.

G.2. Summary of the comments received:

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Thermal power plants have been benefited by the usage of fly ash because fly ash disposal problem get reduced.
The project activity reduces the environmental impact of fly ash.
During the meeting of local stakeholder/representatives, particular point of saving of limestone and forest is appreciated.
The project in total is having positive benefit for stakeholder.

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

>>
Since there are no negative comments no action was required. Orient Cement (Props : Orient Paper & Industries Limited) has taken measures to mitigate any negative environmental effect of blending fly ash. The project provides substantial positive environmental effect through conservation of lime stone and forest.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Orient Cement (Props : Orient Paper & Industries Limited)
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Represented by:	
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Salutation:	Mr.
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding has been sought for the project activity. The project proponent will identify potential participants if additional funds are required in the future.

Annex 3

BASELINE INFORMATION

Please refer Section B of this PDD
Data source – CMA

Annex 4

MONITORING PLAN

Please refer to Section D of this PDD for details

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