**Orient Cement (Props: Orient Paper & Industries Limited)**

Orient Cement (Props:Orient Paper & Industries Limited)
P.O. Devapur Cement Works
District - Adilabad
Andhra Pradesh
PIN: 504218
India

# Monitoring Report

“Blended cement with increased blend” Project at Orient cement’s Devapur and Jalgaon plants in India.

UNFCCC Reference No. 0456

# Contents

# Definitions in the report:

| Abbreviations |
|---|
| PDD: Project Design Document |
| GHG: Greenhouse Gases |
| IPCC: Intergovernmental Panel on Climate Change |
| UNFCCC: The United Nations Framework Convention on Climate Change |
| XRD: x-ray diffraction |
| SD: Sustainable Development |
| $CO_2$: Carbon dioxide |
| **ER: Emission reduction** |

Chapter
1

# Introduction

## Title of the project activity:

Blended cement with increased blend" at Orient cement's Devapur and Jalgaon plants in India

**Version:** 01

**Date of completion of the Draft Monitoring report:** 27.10.06

## Purpose:

The purpose of this monitoring report is to calculate the Greenhouse Gas emission reduction achieved by the increase the share of additives (i.e. reduce the share of clinker) in the production of cement types in project for periodic verification.

This monitoring report has been prepared for "Blended cement with increased blend" Project at Orient cement's Devapur and Jalgaon plants in India. The project has been registered with UNFCCC as a CDM project activity under the Kyoto protocol. Submission of monitoring report and subsequent verification has been required mandatory by UNFCCC for issuance of Certified Emission Reductions (CERs) credits. The monitoring period covered under the report extending from 01.4.2001 to 31.03.2006 and the GHG reduction has been calculated for the period extending from 01.4.2002 to 31.03.2006.

## Reference:

The project is categorized in sectoral scope 4: Manufacturing industries.

## Project Design Document:

Blended cement with increased blend" at Orient cement's Devapur and Jalgaon plants in India, Version 03 February 10, 2006.

## Base line Methodology Adopted:

ACM0005 Version 2, 28 November, 2005 - Consolidated Methodology for Increasing the Blend in Cement Production.

## Monitoring Methodology Adopted:

Consolidated Monitoring Methodology for Increasing the Blend in Cement Production under ACM0005/ Version 03 (Sectoral Scope: 4; 19 May 2006)

## General description of the project:

### Project Activity:

Orient Cement (Props: Orient Paper & Industries Limited ), operates two cement manufacturing units - Devapur Unit in Andhra Pradesh and 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 (Portland Pozzolanna Cement) since 2001.

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 has adverse environmental effects. The mineral resources extraction is often accompanied by deforestation 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;
- GHG reduction: Reduce emissions of greenhouse gases primarily $CO_2$. - Social and Environmental Well being

## Project Location:

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 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. Devapur unit sources fly ash from the nearby National Thermal Power Plant (NTPC) Ramagundam which is 70 km away from the plant.

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. Jalgaon unit sources fly ash from the nearby Bhusawal Thermal Power Station (BTPS) at Deepnagar which is 26 km away.

## Technology employed by the project activity:

The project has been adding increasing quantities of fly ash than the prevailing practices in the region of its operation of the two plants and thus replacing equivalent quantity of clinker.

Reduction in percentage of clinker used in cement manufacturing eventually helps in reducing GHGs emissions associated with clinker manufacturing. The project activity would therefore reduce direct onsite emissions from clinkerisation and direct off-site emissions due to power generation at the thermal power plants per unit of cement produced.

## Technical description of the project

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]

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

## Project Status:

The Project has been registered with UNFCCC as CDM Project Activity under Sectoral Scope No. 4: Manufacturing industries. The project was registered on 27 Aug 06 with crediting period of 01 Apr 02 -31Mar 12 (Fixed). The UNFCCC reference number for the project activity is 0456. The DOE for the project was Det Norske Veritas Certification Ltd. (DNV).

Chapter
2

# Monitoring methodology and plan

## 1. Monitoring Methodology:

Consolidated Monitoring Methodology for Increasing the Blend in Cement Production under ACM0005/ Version 03 (Sectoral Scope: 4; 19 May 2006)

**Applicability:**
This monitoring methodology is applicable within the project boundary as defined in the registered PDD (UNFCCC Reference No. 0456)

## 2. Monitoring Period:

All the necessary parameters are monitored for both baseline emission and project emissions calculations. Monitoring period selected for baseline emissions is from 01/04/2001 to 31/03/2002 and for project emission calculations the monitoring period is considered from 01/04/2002 -31/03/2006. Parameters monitored during the period and their recording frequency and other details have been delineated below. All data has been archived for verification purpose.

## 3.1 Parameters Monitored:

### 3.1.1 Data Monitored for Baseline Emissions Calculations

| ID No. | Data variable | Source of data | Data unit | Measured (m), calculated (c) or estimated (e) | Recording frequency | Comments/ Reference (CDM Manual) |
|---|---|---|---|---|---|---|
| 1.1 | InCaOBSL | Plant records In plant clinkerisation unit | % | M,C | Daily | Is a part of normal day to day operation of clinkerisation unit of the plant. |
| 1.2 | OutCaOBSL | Plant records In plant clinkerisation unit | % | M,C | Daily | Is a part of normal day to day operation of clinkerisation unit of the plant. |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1.3 | InMgOBSL | Plant records In plant clinkerisation unit | % | M,C | Daily | Is a part of normal day to day operation of clinkerisation unit of the plant. |
| 1.4 | OutMgOBSL | Plant records In plant clinkerisation unit | % | M,C | Daily | Is a part of normal day to day operation of clinkerisation unit of the plant. |
| 1.5 | Quantity of limestone used in the clinkerisation unit in baseline | Plant records In plant clinkerisation unit | Kilo tonnes | M | Annually | 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 .. |
| 1.6 | Quantity of clinker used for PPC production CLNKBSL | Plant records in clinker grinding unit | Kilo tones of clinker | M | Annually | 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 and in published data of Cement Manufacturers Association of India. |
| 1.7 | FFi_,BSL | Plant records in clinkerisation unit | Tonnes of fuel | M | Annually | 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 |
| 1.8 | EFFi_BSL | IPCC default values for the fuels type | tCO2/tonne of fuel i | C | Annually | Calculated based on total carbon content. |
| 1.9 | BELEgrid_CLNK,BSL | Plant records in clinkerisation unit | MWh | M | Monthly | The total electricity consumed by the unit for clinker production is recorded monthly and same can be cross checked with monthly electricity bills paid. |
| 1.10 | EFgrid_BSL | In plant data | tCO2/MWh | C,E | Annually | Data on grid generation and power plant details has been sourced from State grid and central electricity authority of India |
| 1.11 | BELEsg_CLNK,BSL | In plant data | MWh | M | Monthly | Unit uses DG sets to generate electricity during power cuts or shortage from grid. |
| 1.12 | EFsg_BSL | Plant records | tCO2/MWh | M,C ,E | Annually | Unit records the estimated emission factor of the in-house electricity generation based on calculated NCV and C% of HSD used. |
| 1.13 | ADDBSL Quantity of additives added in the baseline | In plant data | Kilo tonnes | M | Monthly | 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 |
| 1.14 | BC BSL | Plant records | Kilo tines of BC | M | Annually | It is part of day to day plant operation |

| | | | | | | |
|---|---|---|---|---|---|---|
| 1.15 | BELEgrid_BC,BSL | Plant records | MWh | M | Annually | This is part of day to day operation leading to power consumption and recorded in plant records |
| 1.16 | BELEsg_BC,BSL | Plant records | MWh | M | Annually | This is part of day to day operation when there is requirement of self generation and recorded in plant record |
| 1.17 | BELEgrid_ADD | Plant records | MWh | M | Annually | This is part of day to day operation leading to power consumption and recorded in plant records |
| 1.18 | BELEsg_ADD,BSL | Plant records | MWh | M | Annually | This is part of day to day operation when there is requirement of self generation and recorded in plant record |
| 1.19 | Fi,j,BSL | Plant records | Tonnes of Fuel i | M | Annually | Part of day to day operation and recorded in the plant records |
| 1.20 | COEFi,j BSL | IPCC | tCO2/tonne of fuel i | | | Calculated using IPCC factor |
| 1.21 | GENj,BSL | Plant records | MWh | M | Annually | This is part of day to day operation when there is requirement of self generation and recorded in plant record |
| 1.22 | BEcalcin,BSL | Plant records | tCO2/tonne of clinker | C | Annually | Calculated annually based on plant records |
| 1.23 | BEfossil_fuel,BSL | Plant records | tCO2/tonne of clinker | C | Annually | Calculated annually based on plant records |
| 1.24 | BEele_grid_CLNK,BSL | Plant records | tCO2/tonne of clinker | C | Annually | Calculated annually based on plant records |
| 1.25 | BEele_sg_CLNK,BSL | Plant records | tCO2/tonne of clinker | C | Annually | Calculated annually based on plant records |
| 1.26 | BEele_grid_BC,BSL | Plant records | tCO2/tonne of blended cement | C | Annually | Calculated annually based on plant records |
| 1.27 | BEele_sg_BC,BSL | Plant records | tCO2/tonne of blended cement | C | Annually | Calculated annually based on plant records |
| 1.28 | BEele_grid_ADD,BSL | Plant records | tCO2/tonne of blended cement | C | Annually | Calculated annually based on plant records |
| 1.29 | BEele_sg_ADD,BSL | Plant records | tCO2/tonne of blended cement | C | Annually | Calculated annually based on plant records |
| 1.30 | Bblend,y | Plant records | Tonne of clinker/ tonne of blended cement | C | Annually | Calculated annually based on plant records |

### 3.1.2 Data Monitored for Project Emissions Calculations

| ID No. | Data variable | Source of data | Data unit | Measured (m), calculated © or estimated (e) | Recording frequency | Comments/ Reference (CDM Manual) |
|---|---|---|---|---|---|---|
| 2.1 | InCaOy | Plant records In plant clinkerisation unit | % | M,C | Daily | Is a part of normal day to day operation of clinkerisation unit of the plant. |
| 2.2 | OutCaOy | Plant records In plant clinkerisation unit | % | M,C | Daily | Is a part of normal day to day operation of clinkerisation unit of the plant. |
| 2.3 | InMgOy | Plant records In plant clinkerisation unit | % | M,C | Daily | Is a part of normal day to day operation of clinkerisation unit of the plant |
| 2.4 | OutMgOy | Plant records In plant clinkerisation unit | % | M,C | Daily | Is a part of normal day to day operation of clinkerisation unit of the plant. |
| 2.5 | Quantity of limestone used in the clinkerisation unit in baseline | Plant records In plant clinkerisation unit | Kilo tonnes | M | Annually | 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. |
| 2.6 | Quantity of clinker used for PPC productionCLNKy | Plant records in clinker grinding unit | Kilo tones of clinker | M | Annually | 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. |
| 2.7 | FFi_,y | Plant records in clinkerisation unit | Tonnes of fuel | M | Annually | 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 |
| 2.8 | EFFi | IPCCC default | tCO2/tonne of fuel i | ,C | Annually | Calculated based on total carbon content. |
| 2.9 | PELEgrid_CLNK,y | Plant records in clinkerisation unit | MWh | M | Monthly | The total electricity consumed by the unit for clinker production is recorded monthly and same can be cross checked with monthly electricity bills paid. |
| 2.10 | EFgrid_y | CEA | tCO2/MWh | C,E | Annually | Data on grid generation and power plant details has been sourced from State grid and central electricity authority of India |

| | | | | | | |
|---|---|---|---|---|---|---|
| 2.11 | PELEsg_CLNK,y | Plant records | MWh | M | Monthly | Unit uses DG sets to generate electricity during power cuts or shortage from grid. |
| 2.12 | EFsg_y | Plant records | tCO2/MWh | M,C,E | Annually | Unit records the estimated emission factor of the in-house electricity generation based on calculated NCV and C% of HSD used. |
| 2.13 | ADDy Quantity of additives | In plant data | Kilo tonnes | M | Monthly | 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 |
| 2.14 | Bcy | Plant records | Kilo tines of BC | M | Annually | It is part of day to day plant operation |
| 2.15 | PELEgrid_BC,y | Plant records | MWh | M | Annually | This is part of day to day operation leading to power consumption and recorded in plant records |
| 2.16 | PELEsg_BC,y | Plant records | MWh | M | Annually | This is part of day to day operation when there is requirement of self generation and recorded in plant record |
| 2.17 | PELEgrid_ADD | Plant records | MWh | M | Annually | This is part of day to day operation leading to power consumption and recorded in plant records |
| 2.18 | PELEsg_ADD,y | Plant records | MWh | M | Annually | This is part of day to day operation when there is requirement of self generation and recorded in plant record |
| 2.19 | Fi ,j, y | Plant records | Tonnes of Fuel i | M | Annually | Part of day to day operation and recorded in the plant records |
| 2.20 | COEFi,j y | IPCC | tCO2/tonne of fuel i | | | Calculated using IPCC factor |
| 2.21 | GENj,y | Plant records | MWh | M | Annually | This is part of day to day operation when there is requirement of self generation and recorded in plant record |
| 2.22 | PEcalcin,y | Plant records | tCO2/tonne of clinker | C | Annually | Calculated annually based on plant records |
| 2.23 | PEfossil_fuel,y | Plant records | tCO2/tonne of clinker | C | Annually | Calculated annually based on plant records |
| 2.24 | PEele_grid_CLNK,y | Plant records | tCO2/tonne of clinker | C | Annually | Calculated annually based on plant records |
| 2.25 | PEele_sg_CLNK,y | Plant records | tCO2/tonne of clinker | C | Annually | Calculated annually based on plant records |
| 2.26 | PEele_grid_BC,y | Plant records | tCO2/tonne of blended cement | C | Annually | Calculated annually based on plant records |
| 2.27 | PEele_sg_BC,y | Plant records | tCO2/tonne of blended cement | C | Annually | Calculated annually based on plant records |
| 2.28 | PEele_grid_ADD,y | Plant records | tCO2/tonn | C | Annually | Calculated annually based on plant |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | e of blended cement | | | records |
| 2.29 | PEele_sg_ADD,y | Plant records | tCO2/tonne of blended cement | C | Annually | Calculated annually based on plant records |
| 2.30 | Pblend,y | Plant records | Tonne of Clinker/ tonne of blended cement | C | Annually | Calculated annually based on plant records |

## 3.1.3 Data Monitored for Leakage Emissions Calculations

| ID No. | Data variable | Source of data | Data unit | Measured (m), calculated © or estimated (e) | Recording frequency | Comment s/ Reference (CDM Manual) |
|---|---|---|---|---|---|---|
| 3.1 | TFcons | Plant records | Kg of fuel/ kilometre | C | Annually | Fuel consumption for the vehicle per kilometer taken from suppliers |
| 3.2 | Dadd_source | Plant records | Km | M | Per trip | Distance between the source of additive and the project activity plant |
| 3.3 | TEF | IPCC default values for fuel used in transportation of fly ash | Kg CO2/kg fuel used | E | Annually | Calculated based on IPCC factor |
| 3.4 | Qadd | Plant records | Tonnes additives / vehicle | M | Per trip | It is a part of day to day plant operation with regard to fly ash transportation and available in plant record. |
| 3.5 | ELEconveyor_ADD | Plant records | MWh | M | Monthly | Part of day to day operation |
| 3.6 | EFgrid | In plant data | tCO2/MWh | C | Annually | Calculated as per ACM002 |
| 3.7 | Ablend,y | Baseline calculation | tonne of additives/tonne of BC | C | Annually | Baseline benchmark share of additives per tonne of BC updated for year y |
| 3.8 | Pblend,y | Plant records | tonne of additives/tonne of BC | C | Annually | Share of additives per tonne of BC in year y |
| 3.9 | áy | Plant records | Tonne of additive | M/C | Annually | |

## 3.2 Quality Control (QC) and Quality Assurance (QA)

### Quality Management System:

The Devapur and Jalgaon plant of Orient cement is operated by Company operating personnel. The Executive Vice President has assigned the responsibility to Vice President Operation of Devapur and Asistant Vice President of Jalgaon for the project management, monitoring and reporting. They are assisted by the CDM team headed by AGM (Process).

The operation, data transfer and reporting procedures are incorporated into the ISO 9001 and ISO 14001 procedure with the company.

Orient cement (Props: Orient Paper & Industries Limited) is a ISO 9001, ISO 14001 and OHSAS 18001 certified company. Hence the QA & QC procedures are equivalent to applicable National and International Standards in terms of equipment and analytical methods. Calibration of all relevant equipments are done as per existing QMS. The QA & QC procedures are set and implemented as per existing QMS system in order to:

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

- Stipulate who has responsibility for what and,
- Avoid any misunderstanding between people and organization involved.

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

| Data (Indicate table and ID number e.g. 3.-1.; 3.2.) | Uncertainty level of data (High/ Medium/ Low) | Explain QA/QC procedures planned for these data, or why such procedures are not necessary. |
|---|---|---|
| 1.I | Low | Testing as per National standards and for monitoring and calibration procedures, please refer CDM Manual |
| 1.2 | Low | Do |
| 1.3 | Low | Do |
| 1.4 | Low | Do |
| 1.5 | Low | QMS procedure is adopted for monitoring and calibration (Please refer CDM manual) |
| 1.6 | Low | QMS procedure is adopted for monitoring and calibration (Please refer CDM manual) |
| 1.7 | Low | QMS procedure is adopted for monitoring and calibration (Please refer CDM manual) |
| 1.8 | Low | Testing is done by reputed NABL research Laboratories |
| 1.9 | Low | This is a measured and calculated value and EMS procedure is adopted for monitoring and calibration (Please refer CDM manual) of values used for calculation |
| 1.10 | Low | Calculated using ACM0002 methodology |

| Data (Indicate table and ID number e.g. 3.-1.; 3.2.) | Uncertainty level of data (High/ Medium/ Low) | Explain QA/QC procedures planned for these data, or why such procedures are not necessary. |
|---|---|---|
| 1.11 | Low | This is a measured and calculated value and EMS procedure is adopted for monitoring and calibration (Please refer CDM manual) of values used for calculation |
| 1.12 | Low | This is a measured and calculated value and EMS procedure is adopted for monitoring and calibration (Please refer CDM manual) of values used for calculation |
| 1.13 | Low | QMS procedure is adopted for monitoring and calibration (Please refer CDM manual) |
| 1.14 | Low | QMS procedure is adopted for monitoring and calibration (Please refer CDM manual) |
| 1.15 | Low | This is a calculated value and EMS procedure is adopted for monitoring and calibration (Please refer CDM manual) of values used for calculation |
| 1.16 | Low | Do |
| 1.17 | Low | Do |
| 1.18 | Low | Do |
| 1.19 | Low | This is measured value and QA / QC consists of cross checking with daily company report and part of existing QMS |
| 1.20 | Low | IPCC data is used for calculation. |
| 1.21 | Low | This is measured data and QA / QC consists of cross checking with daily company report |
| 1.22 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 1.23 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 1.24 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 1.25 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 1.26 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 1.27 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 1.28 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report. |
| 1.29 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 1.30 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 2.1 | Low | Testing as per BIS standards and for monitoring and calibration procedures please CDM Manual |
| 2.2 | Low | Do |
| 2.3 | Low | Do |
| 2.4 | Low | Do |
| 2.5 | Low | QMS procedure is adopted for monitoring and calibration (Please refer CDM manual) |
| 2.6 | Low | QMS procedure is adopted for monitoring and calibration (Please refer CDM manual) |
| 2.7 | Low | QMS procedure is adopted for monitoring and calibration (Please refer CDM manual) |
| 2.8 | Low | Testing is done by reputed NABL research Laboratories |
| 2.9 | Low | This is a calculated value and EMS procedure is adopted for monitoring and calibration (Please refer CDM manual) of values used for calculation |

| Data (Indicate table and ID number e.g. 3.-1.; 3.2.) | Uncertainty level of data (High/ Medium/ Low) | Explain QA/QC procedures planned for these data, or why such procedures are not necessary. |
|---|---|---|
| 2.10 | Low | Calculated using ACM0002 methodology |
| 2.11 | Low | This is a calculated value and EMS procedure is adopted for monitoring and calibration (Please refer CDM manual) of values used for calculation |
| 2.12 | Low | This is a calculated value and EMS procedure is adopted for monitoring and calibration (Please refer CDM manual) of values used for calculation |
| 2.13 | Low | QMS procedure is adopted for monitoring and calibration (Please refer CDM manual) |
| 2.14 | Low | QMS procedure is adopted for monitoring and calibration (Please refer CDM manual) |
| 2.15 | Low | This is a calculated value and EMS procedure is adopted for monitoring and calibration (Please refer CDM manual) of values used for calculation |
| 2.16 | Low | Do |
| 2.17 | Low | Do |
| 2.18 | Low | Do |
| 2.19 | Low | This is measured value and QA / QC consists of cross checking with daily company report and part of existing QMS |
| 2.20 | Low | IPCC data is used for calculation. |
| 2.21 | Low | This is measured data and QA / QC consists of cross checking with daily company report |
| 2.22 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 2.23 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 2.24 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 2.25 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 2.26 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 2.27 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 2.28 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 2.29 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 2.30 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report |
| 3.1 | Low | The risk is mitigated by getting the duly signed data from transporters |
| 3.2 | Low | The risk is mitigated by calculating distance using Transporter guide of India |
| 3.3 | Low | IPCC default values used for transport fuel |
| 3.4 | Low | QMS procedure is adopted for monitoring and calibration |
| 3.5 | Low | The risk is mitigated by taking conservative value - the power consumption of electrical equipments are calculated by multiplying the rated capacity of motors by operating hours of the equipments |
| 3.6 | Low | Calculated using ACM0002 methodology |
| 3.7 | Low | This is a calculated value and QA / QC consists of cross checking with daily company report. |
| 3.8 | Low | This is a calculated value and QA / QC consists of cross checking with |

| Data (Indicate table and ID number e.g. 3.-1.; 3.2.) | Uncertainty level of data (High/ Medium/ Low) | Explain QA/QC procedures planned for these data, or why such procedures are not necessary. |
|---|---|---|
| | | daily company report |
| 3.9 | Low | The risk is mitigated by cross checking with published fly ash generation and consumption record for the region available in the public domain. |

## 3.3 Quality management and Environment Management System associated with CDM project Activity:

Both the plants of the Orient cement under CDM project activity are ISO 9001 (QMS) and ISO 14001 (EMS) & OHSAS 18001 certified. All the relevant monitoring, recording, calibration are carried under both the system for different parameters and the relevant procedures are there in each plant. Internal audit is conducted at regular interval to check whether both the systems are in line with the written down procedure or not. In addition the environmental performance report is submitted to concern SPCB annually in the form of Environment statement. Both the Stack and ambient air monitoring is conducted as per the directions under consent to operate for both the plants and the monitoring reports are maintained in house. The comprehensive table detailing the source for each parameter and its monitoring procedure, frequency, recording procedure, retention time, calibration procedure and record format number etc., are listed in CDM Manual. The CDM Manual also includes various procedures for review meeting of data, procedure for non-conformance and corrective action, procedure for computer system management, procedure for training, environment monitoring etc in line with the existing QMS and the EMS.

### Calibration/Maintenance of Measuring and Analytical Instruments:

All measuring and analytical instruments are being calibrated as per the methodology ACM0005 and created as a protocol in Orients's Quality management system procedures. The maintenance methods and procedures have been incorporated as part of the ISO 9001 procedures and CDM Manual and form an integral part of the systems and procedures for the organization.

Chapter 3

# GHG Calculations

The project activity actually reduces the clinker content of Portland Pozzolanic Cement (PPC) produced by increasing the fly ash additive percent (%) and thus replaces an equivalent amount of clinker at Orient Cement manufacturing units at Devapur unit in Andhra Pradesh and the Jalgaon unit in Maharashtra. Reduction in percentage of clinker used in cement manufacturing ultimately reduces GHG emissions associated with clinker manufacturing.

Statement of GHG emission reduction in first monitoring period.

As suggested by the methodology ACM0005, version 03, 19 May, 2006, the GHG emission reduction, (ERy), achieved by the project activity for a given year is

## Formula for emission reduction calculation

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

Emission reduction achieved during monitoring period delineated in the report has been presented in the following table.

| | | 2002-2003 | 2003-2004 | 2004-2005 | 2005-2006 (Up to 31.03.06) |
|---|---|---|---|---|---|
| ERy | thousand tonnes of CO2 | 6.90791789 | 20.25138 | 40.34413 | 67.24512 |
| BEBC,y | (t CO2/tonnes of BC) | 0.70595911 | 0.702121 | 0.698283 | 0.694445 |
| PEBC,y | (t CO2/tonnes of BC) | 0.65181561 | 0.658799 | 0.637679 | 0.598206 |
| BCy | (thousand tonnes) | 129.077 | 473.339 | 675.264 | 706.937 |
| Ly | kilotonnes of CO2 | -0.08076264 | -0.25494 | -0.57951 | -0.79045 |
| αy | Ratio | 0 | 0 | 0 | 0 |

## Baseline Emissions:

BEBC,y = [BEclinker * BBlend,y] + BEele_ADD_BC ------------ (1)

where:

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

BEclinker = $CO_2$ emissions per tonne of clinker in the baseline in the project activity plant (t $CO_2$/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 (t$CO_2$/tonne of BC)

| | Description | Unit | Year 2001-2002 |
|---|---|---|---|
| BEclinker | CO2 emissions per tonne of clinker in the baseline in the project activity plant and defined below | (t CO2/tonne clinker) | 0.8675 |
| BBlend,y | Baseline benchmark of share of clinker per tonne of BC updated for year y | (tonne of clinker/tonne of BC) | 0.7788 |
| BEele_ADD_BC | Baseline electricity emissions for BC grinding and preparation of additives | (tCO2/tonne of BC) | 0.0342 |
| BEBC,y | Baseline CO2 emissions per tonne of blended cement type (BC) | tCO2/tonne BC | 0.7098 |

## Project Emissions:

PEBC,y = [PEclinker,y * PBlend,y] + PEele_ADD_BC,y --------------------------------(5)

where:

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

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

| Identification details | Description | Unit | 2002-03 | 2003-04 | 2004-05 | 2005-06 (till 31.03.06) |
|---|---|---|---|---|---|---|
| PEBC,y | CO2 emissions per tonne of BC in the project activity plant in year y | tCO2/tonne BC | 0.651815611 | 0.65879854 | 0.637679462 | 0.598205569 |
| PEclinker,y | CO2 emissions per tonne of clinker in the project activity plant in year y | (t CO2/tonne clinker) | 0.874400464 | 0.879579777 | 0.897379555 | 0.885822889 |
| PBlend,y | Share of clinker per tonne of BC in year y | (tonne of clinker/tonne of BC) | 0.709383818 | 0.714005204 | 0.676387979 | 0.644965905 |
| **PEele_AD,D_BC,y** | Electricity emissions for BC grinding and preparation of additives in year y | (tCO2/tonne of BC) | 0.031530071 | 0.030774002 | 0.030702719 | 0.026880008 |

PEclinker,y = PEcalcin,y + PEfossil_fuel,y + PEele_grid_CLNK,y + PEele_sg_CLNK,y (5.1)

where:

PEclinker,y = Emissions of CO2 per tonne of clinker in the project activity plant in year y (t CO2/tonne clinker)

PEcalcin,y = Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate in year y (t CO2/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)

| Identification details | Description | Unit | 2002-03 | 2003-04 | 2004-05 | 2005-06 (till 31.03.06) |
|---|---|---|---|---|---|---|
| PEclinker,y | CO2 emissions per tonne of clinker in the project activity plant in year y | (t CO2/tonne clinker) | 0.874400464 | 0.879579777 | 0.897379555 | 0.885822889 |
| PEcalcin,y | Emissions from the calcinations of limestone | (t CO2/tonne clinker) | 0.5237873 | 0.524917 | 0.5248385 | 0.5249648 |
| PEfossil_fuel,y | per tonne of clinker due to combustion of fossil fuels for clinker production in year y | (t CO2/tonne clinker) | 0.286127441 | 0.289820206 | 0.306115848 | 0.294069741 |
| PEele_grid_CLNK, y | Grid electricity emissions for clinker production per tonne of clinker in year y | (t CO2/tonne clinker) | 0.059459889 | 0.062657697 | 0.061580672 | 0.06596553 |
| PEele_sg_CLNK,y | Emissions from self-generated electricity per tonne of clinker production in year y | (t CO2/tonne clinker) | 0.005025834 | 0.002184875 | 0.004844535 | 0.000822819 |

PEcalcin,y = Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate in year y (t CO2/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] (5.1.1)

where:

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)

| Identification details | Description | 2002-03 | 2003-04 | 2004-05 | 2005-06 (till 31.03.06) |
|---|---|---|---|---|---|
| PEcalcin,y | Emissions from the calcinations of limestone | 0.5237873 | 0.524917 | 0.5248385 | 0.5249648 |
| OutCaO – year average | CaO content (%) of the clinker* clinker produced (tonnes) | 958755.7307 | 1002594.118 | 1203205.131 | 1262215.536 |
| – year average | CaO content (%) of the clinker | 64.930 | 65.060 | 65.050 | 65.080 |
| InCaO – year average | CaO content (%) of the raw material * raw material quantity (tonnes) | 0 | 0 | 0 | 0 |
| – year average | CaO content (%) of the raw material | 0.000 | 0.000 | 0.000 | 0.000 |
| – year average | Quantity of Clinker raw material | 2073767.705 | 2153811.690 | 2600502.495 | 2733192.705 |
| OutMgO – year average | MgO content (%) of the clinker * clinker produced (tonnes) | 19048.1271 | 20033.39 | 24045.606 | 25019.3307 |
| – year average | MgO content (%) of the clinker | 1.29 | 1.30 | 1.30 | 1.29 |
| InMgO – year average | MgO content (%) of the raw material * raw material quantity (tonnes) | 0 | 0 | 0 | 0 |
| – year average | MgO content (%) of the raw material | 0 | 0 | 0 | 0 |
| CLNKy | Annual production of clinker in year y (Kilo Tonnes) | 1477 | 1541 | 1850 | 1939 |

PEfossil_fuel, y = [ ‡”FFi_,y * EFFi] /CLNK,y * 1000 ----------(5.1.2)

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)

| Identification details | Description | 2002-03 | 2003-04 | 2004-05 | 2005-06 (till 31.03.06) |
|---|---|---|---|---|---|
| PEfossil_fuel,y | tCO2 per tonne of clinker due to combustion of fossil fuels for clinker production in year y | 0.286127441 | 0.289820206 | 0.306115848 | 0.294069741 |
| FFi_BSL | Fossil fuel of type 1 (coal) consumed for clinker production in the baseline (tonnes of coal) | 228928.340 | 242001.040 | 306800.220 | 303252.990 |
| EFFi | Emission factor for fossil fuel 1 (t CO2/tonne of fuel) | 1.845536 | 1.845536 | 1.845536 | 1.880750667 |
| FFi_BSL | Fuel 2 (Rice husk) consumed for clinker production | 0.00 | 0.00 | 0.00 | 2451.37 |
| EFFi | Emission factor for fossil fuel 2 (t CO2/tonne of rice husk) | 0.00 | 0.00 | 0.00 | 0 |
| FFi_BSL | Fuel 3 (Saw Dust) consumed for clinker production | 0.00 | 0.00 | 0.00 | 1855.39 |
| EFFi | Emission factor for fossil fuel 3 (t CO2/tonne of Saw Dust) | 0.00 | 0.00 | 0.00 | 0 |
| CLNKy | Annual production of clinker in year y (Kilo Tonnes) | 1477 | 1541 | 1850 | 1939 |

PEele_grid_CLNK,y = [ PELEgrid_CLNK,y * EFgrid_y] / [CLNKy* 1000] (5.1.3)

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)

| Identification details | Description | 2002-03 | 2003-04 | 2004-05 | 2005-06 |
|---|---|---|---|---|---|
| PEele_grid_CLNK,y | Grid electricity emissions for clinker production per tonne of clinker in year y | 0.059459889 | 0.062657697 | 0.061580672 | 0.06596553 |
| BELEgrid_CLNK | Grid electricity for clinker production in year y | 88864.79 | 97730.15 | 115286.87 | 129492.938 |
| EFgrid_y | Grid emission factor in year y | 0.988 | 0.988 | 0.988 | 0.988 |
| CLNKy | Annual production of clinker in year y (Kilo Tonnes) | 1477 | 1541 | 1850 | 1939 |

PEelec_sg_CLNK,y = [PELEsg_CLNK ,y* EFsg_y] /[CLNKy * 1000] (5.1.4)

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 $CO_2$/MWh)
CLNKy = Annual production of clinker in year y (kilotonnes of clinker)

| Identification details | Description | 2002-03 | 2003-04 | 2004-05 | 2005-06 (till 31.03.06) |
|---|---|---|---|---|---|
| PEele_sg_CLNK,y | Emissions from self-generated electricity per tonne of clinker production in year y | 0.005025834 | 0.002184875 | 0.004844535 | 0.000822819 |
| PELEsg_CLNK,y | Self generation of electricity for clinker production in year y | 9649.50 | 4294.00 | 11708.18 | 2074.05 |
| EFsg_y | Emission factor for self generated electricity in year y | 0.76907038 | 0.784107407 | 0.76534097 | 0.769431348 |
| CLNKy | Annual production of clinker in year y (Kilo Tonnes) | 1477 | 1541 | 1850 | 1939 |

PEele_ADD_BC,y = PEele_grid_BC,y + PEele_sg_BC,y + PEele_grid_ADD,y + PEele_sg_ADD,y (5.2)

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_ADD = Grid electricity emissions for additive preparation in year y (tCO2/tonne of BC)

PEele_sg_ADD = Emissions from self generated electricity additive preparation in year y (tCO2/tonne of BC)

| Identification details | Description | Unit | 2002-03 | 2003-04 | 2004-05 | 2005-06 (till 31.03.06) |
|---|---|---|---|---|---|---|
| PEele_AD,D_BC, y | Electricity emissions for BC grinding and preparation of additives in year y | (tCO2/tonne of BC) | 0.031530071 | 0.030774002 | 0.030702719 | 0.026880008 |
| PEele_grid_BC,y | Grid electricity emissions for BC grinding in year y | (tCO2/tonne of | 0.028867154 | 0.029647416 | 0.02828296 | 0.026500066 |
| PEele_sg_BC,y | Emissions from self generated electricity for BC grinding in year y | (tCO2/tonne of BC) | 0.002662917 | 0.001126587 | 0.002419759 | 0.000379942 |
| PEele_grid_ADD, y | Grid electricity emissions for additive preparation in year y | (tCO2/tonne of BC) | 0 | 0 | 0 | 0 |
| PEele_sg_ADD,y | Emissions from self generated electricity additive preparation in year y | (tCO2/tonne of BC) | 0 | 0 | 0 | 0 |

PEele_grid_BC,y = [ PELEgrid_BC,y * EFgrid_BSL,y] /[BCy* 1000] (5.2.1)

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)

| Identification details | Description | Unit | 2002-03 | 2003-04 | 2004-05 | 2005-06 (till 31.03.06) |
|---|---|---|---|---|---|---|
| PEele_grid_BC,y | Grid electricity emissions for BC grinding in year y | (tCO2/tonne of BC) | 0.028867154 | 0.029647416 | 0.02828296 | 0.026500066 |
| PELEgrid_BC,y | grid electricity for grinding BC | (MWh) | | | | |
| | devapur | (MWh) | 2468.58 | 8806.89 | 10888.03 | 9837.58 |
| | jalgaon | (MWh) | 1308.06 | 5418.7712 | 8476.72308 | 9160.92252 |
| EFgrid_y | Grid emission factor in year y for SREB | (t CO2/MWh) | 0.988 | 0.988 | 0.988 | 0.988 |
| EFgrid_y | Grid emission factor in year y for Western Grid | (t CO2/MWh) | 0.984 | 0.984 | 0.984 | 0.984 |
| **Bcy** | **Annual production of BC in year y** | **(kilo tonnes of BC)** | **129** | **473** | **675** | **707** |

PEelec_sg_BC,y = [PELEsg_BC,y * EFsg_y] / [BCy* 1000] (5.2.2)

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)

| zIdentification details | Description | Unit | 2002-03 | 2003-04 | 2004-05 | 2005-06 (till 31.03.06) |
|---|---|---|---|---|---|---|
| PEele_sg_BC,y | Emissions from self generated electricity for BC grinding in year y | (tCO2/tonne of BC) | 0.002662917 | 0.001126587 | 0.002419759 | 0.000379942 |
| PELEsg_BC,y | Self generated electricity for grinding BC in year y | (MWh) | 268.054 | 386.951 | 1105.755 | 157.566 |
| EFsg_y | Emission factor for self generated electricity in year y | (t CO2/MWh) | 0.76907038 | 0.784107407 | 0.76534097 | 0.769431348 |
| **Bcy** | Annual production of BC in year y | (kilotonnes of BC) | 77 | 269 | 350 | 319 |

PEele_grid_ADD = [ PELEgrid_ADD * EFgrid_y] /[BCy* 1000] (5.2.3)

BELEgrid_ADD = Baseline grid electricity for grinding additives (MWh)
EFgrid_y = Grid emission factor in year y(t CO2/MWh)
BCy = Annual production of BC in year y (kilotonnes of BC)

| Identification details | Description | Unit | 2002-03 | 2003-04 | 2004-05 | 2005-06 (till 31.03.06) |
|---|---|---|---|---|---|---|
| PEele_grid_ADD,y | Grid electricity emissions for additive preparation in year y | (tCO2/tonne of BC) | 0 | 0 | 0 | 0 |
| BELEgrid_ADD | grid electricity for grinding additives in year y | (MWh) | 0 | 0 | 0 | 0 |
| EFgrid_y | Grid emission factor in year y | (t CO2/MWh) | NA | NA | NA | NA |
| **Bcy** | Annual production of BC in year y | (kilotonnes of BC) | **129** | **473** | **675** | **707** |

PEelec_sg_ADD,y = [PELEsg_ADD,y * EFsg_y] / [BCy* 1000] (5.2.4)

PELEsg_ADD,y = Baseline self generation electricity for grinding additives (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)

| Identification details | Description | Unit | 2002-03 | 2003-04 | 2004-05 | 2005-06 (till 31.03.06) |
|---|---|---|---|---|---|---|
| PEele_sg_ADD,y | Emissions from self generated electricity additive preparation in year y | (tCO2/tonne of BC) | 0 | 0 | 0 | 0 |
| PELEsg_ADD,y | self generation electricity for grinding additives in year y | (MWh) | 0 | 0 | 0 | 0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| EFsg_y | Emission factor for self generated electricity in year y | (t CO2/MWh) | NA | NA | NA | NA |
| **Bcy** | Annual production of BC in year y | (kilotonnes of BC) | 77 | 269 | 350 | 319 |

## Leakages:

Ladd_trans = [(TFcons * Dadd_source * TEF)* 1/Qadd*1/1000 + (ELEconveyor_ADD * EFgrid)*1/ADDy] (2)
where:
Ladd_trans = Transport related emissions per tonne of additives (t CO2/tonne of additive)
TFcons = Fuel consumption for the vehicle per kilometre (kg of fuel/kilometre)
Dadd_source = Distance between the source of additive and the project activity plant (km)
TEF = Emission factor for transport fuel (kg CO2/kg of fuel)
ELEconveyor_ADD = Annual Electricity consumption for conveyor system for additives (MWh)
EFgrid = Grid electricity emission factor (tonnes of CO2/MWh)
Qadd = Quantity of additive carried in one trip per vehicle (tonnes of additive)
ADDy = Annual consumption of additives in year y. (t of additives)

| Identification details | Description | Unit | 2002-03 | 2003-04 | 2004-05 | 2005-06 |
|---|---|---|---|---|---|---|
| Ladd_trans | Transport related emissions per tonne of additives | tonne CO2/tonne of additive | 0.009628186 | 0.009628197 | 0.009628195 | 0.009628199 |
| TFcons | Fuel consumption for the vehicle per kilometre | kg fuel/km (3 km/l) | 0.2831 | 0.2831 | 0.2831 | 0.2831 |
| Dadd_source | Distance between the source of additive and the project activity plant | km | 192 | 192 | 192 | 192 |
| TEF | Emission factor for transport fuel | (kg CO2/kg of fuel) | 3.17720 | 3.17720 | 3.17720 | 3.17720 |
| ELEconveyor_ADD | Electricity consumption for conveyor system for additives | MWh | 33.9900 | 125.9900 | 205.0680 | 236.8085 |

| | | | | | | |
|---|---|---|---|---|---|---|
| EFgrid | Baseline grid emission factor of SREB | (t CO2/MWh) | 0.988 | 0.988 | 0.988 | 0.988 |
| Qadd | Quantity of additive carried in one trip per vehicle | (tonnes of additive) | 20 | 20 | 20 | 20 |
| ADDy | Annual consumption of additive | (tonnes of additives) | 33808 | 125314 | 203968 | 235537.449 |

And leakage emissions per tonne of BC due to additional additives are determined by
Ly = Ladd_trans * [Ablend,y – Pblend,y] * BCy (2.1)

where:

Ly = Leakage emissions for transport of additives (kilotonnes of CO2)
BCy = Production of BC in year y (kilotonnes of BC)
Ablend,y = Baseline benchmark share of additives per tonne of BC updated for year y (tonne of additives/tonne of BC)
Pblend,y = Share of additives per tonne of BC in year y (tonne of additives/tonne of BC)

| **Identification details** | **Description** | **Unit** | **2002-03** | **2003-04** | **2004-05** | **2005-06 (till 31.03.06)** |
|---|---|---|---|---|---|---|
| Ly | Leakage emissions for transport of additives | kilotonnes of CO2 | -0.080762645 | -0.254942042 | -0.5795077 | -0.790452708 |
| BCy | Production of BC in year y | (kilotonnes of BC) | 129 | 473 | 675 | 707 |
| Pblend,y | Share of additives per tonne of BC in year y | (tonne of additives/tonne of BC) | 0.290616182 | 0.285994796 | 0.323612021 | 0.355034095 |
| ABlend,y | Baseline benchmark share of additives per tonne of BC updated for year y | (tonne of additives/tonne of BC) | 0.225630571 | 0.230054571 | 0.234478571 | 0.238902571 |
| $\alpha_y$ | Proof of additional flyash added in the year y is surplus in the power plants | | 0 | 0 | 0 | 0 |

# References:

PDD: Blended cement with increased blend" at Orient cement's Devapur and Jalgaon plants in India, Version 03 February 10, 2006

Approved methodology: ACM0005 Version 2, 28 November, 2005 and ACM0005 Version 3, 19 May, 20065

IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories

SOPs in the plant under CDM Manual and ISO 9001 and 14001 system

Calculation excel sheets