Monitoring Report

Indocement Blended Cement Project

UNFCCC Reference No.0526

Jakarta, 17th November 2006

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Introduction

Title of the project activity

Indocement Blended Cement Project

Date of the completion of the draft monitoring report: 17 November 2006

Purpose

The purpose of this monitoring report is to calculate the Greenhouse Gas (GHG) emission reduction achieved by manufacturing a new type of cement (herein after called "blended cement") categorized under a new Cement Standard (Indonesian standard SNI 15-7064-2004) also called PCC or Semen Portland Komposit.

This monitoring report has been prepared for "Indocement Blended Cement Project" of PT. Indocement Tunggal Prakarsa Tbk, Indonesia. 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). The monitoring period covered under this report is from 01-01-2005 until 31-10-2006 and the GHG reduction has been calculated for the period of 01-01-2005 to 31-10-2006.

Reference

The project is categorized in sectoral scope 4: Manufacturing industries

Project Design Document

"Indocement Blended Cement Project" of PT. Indocement Tunggal Prakarsa, Tbk, July 2006.

Baseline Methodology Adopted

Approved consolidated baseline methodology ACM 0005 "Consolidated Baseline Methodology for Increasing the Blend in Cement Production"

Monitoring Methodology Adopted

Approved consolidated monitoring methodology ACM 0005 "Consolidated Monitoring Methodology for increasing the Blend in Cement Production."

General Description of the project

Project Activity

The aim of the project is to manufacture and sell a new type of cement (herein after called "blended cement") categorized under a new Cement Standard (Indonesian standard SNI 15-7064-2004) (Semen Portland Komposit). This new cement type has been introduced as part of Indocement's efforts to increase the amount of various additive materials in the cement while maintaining a similar or improved cement quality compared to Ordinary Portland Cement (OPC, SNI-2049-2004 the updated SNI OPC type I standard). Blended cement is produced by increasing the proportion of additive materials such as limestone and pozzolan in the cement fine grinding process, hence reducing the clinker content of

cement. The pozzolanic materials used in Indocement's Sustainable Cement Production Project include coal fly ash and volcanic ash (trass).

The project is implemented at the three Indocement production sites located at Citeureup and Cirebon, both West Java, and Tarjun South, Kalimantan. Taken together, Indocement operates twelve cement kilns at three plants.

In this project, calcination-, fuel-, and power-related CO_2 emission reductions are achieved by lowering the clinker content per ton of cement.

The main barrier to a successful introduction of blended cement into the market is consumer aversion to this particular type of cement. A significant marketing effort by Indocement is required to overcome this prohibitive barrier.

Further information about this project is given in the PDD registered in the UNFCCC web-site on the 27th October 2006 – Indocement Blended Cement Project (revised version: post-validation site visit) May 5, 2006.

With respect to contributions to Indonesia's sustainable development, the project will deliver several environmental improvements and socio-economic benefits such as:

- *Environmental sustainability:*
    - Maintain the environmental sustainability by diversifying the natural resources in producing cement:
        - Less exploitation of limestone, clay and other additive materials in production of PCC compared to OPC results in reduction in usage of natural raw materials and therefore to an improvement insoil condition and local ecology. Use of fly-ash in cement offers an alternative solution in managing coal power plant wastes
    - The project complies with the national environmental quality standards, in terms of local air emissions, water and soil
    - The project does not disturb the genetic, species and ecosystem biodiversity due to less exploitation of raw material resulting in lower overall emissions. Moreover, the project is not located in natural conservation areas.
    - The project does not transform or modify the existing spatial planning and land-use because it takes place in the existing plant facilities and sites without involving any plant or site expansion.
    - The project ensure the health and safety conditions of their employees and local community by implementing health and safety procedures such as OHSAS 1800, implementation of risks control, and implementation of the national working safety management systems.

- *Economic sustainability*
    - The project creates new employment opportunities as more labors are required to prepare and transport the additive materials

- *Social Sustainability*
    - The project is communicated to and consulted with the local community and other related stakeholder such as the national and local government and the local leaders. These activities are conducted by:
        - Presentation and discussion with the Ministry of Environment and the Ministry of Industry and Trade
        - Presentation and discussion with Bogor, Cirebon and Kota Baru regencies
        - Consultation with the local communities (12 villages in Citereup, 6 villages in Cirebon and 10 villages in Tarjun)
        - Communication through website (www.indocement.co.id) and national newspaper
    - Throughout the consultation and the communication process, no negative responses were received. People consulted are aware of the project benefits to the local community and they give supports to the project.

- Indocement established a mechanism/procedure to address any disadvantages and complaints related to the project
- The project does not create any conflicts with the local community

- *Technical sustainability*
  - This project requires transfer of technology from the HeidelbergCement to Indocement to produce high quality clinker and cement, however does not create a dependency to a foreign technology since the know-how is transferred by building the local capacity so that the operation and technical modification are conducted locally.
  - The technology installed in this project is of a proven technology.

Project Location

Citeureup Cement Factory. The Citeureup Cement Factory is located in Citeureup, approximately 45 kilometers south of Jakarta, and 20 kilometers north of Bogor. The access to the Citeureup Cement Factory from Jakarta is through the Jagorawi toll road using the exit at the Gunung Putri toll gate. The factory is located at Mayor Oking road about 5 kilometres from the Gunung Putri toll gate.

Cirebon Cement Factory. The Cirebon Cement Factory is located in Palimanan, Cirebon Regency, West Java Province. This Factory is one of three PT Indocement's Tunggal Prakarsa production facilities. It is situated approximately 20 km west of Cirebon (or 280 km east of Jakarta) at the main (provincial) road network connecting Cirebon and Bandung/Jakarta. The access to the Factory from Jakarta is to the East through the Cikampek toll road with the exit at the Cikopo toll gate and continues through the main (provincial) road to Cirebon.

Tarjun Cement Factory. The Tarjun Cement Factory is located in Tarjun Village, Kelumpang Selatan District, Kotabaru Regency, South Kalimantan Province. The plant is situated in a coastal area, approximately 280 km north of Banjarmasin, the capital city of South Kalimantan province. As an integrated operation, the cement plant operates four quarry areas – three quarries are located approximately 26 km northwest of- and one quarry is located approximately 10 km northwest of the cement plant. The nearest city to the cement plant is Batulicin, approximately 45 km southwest of the plant. The access roads are constructed to connect the quarries with the cement plant. The Cement Factory can be accessed by road transportation and river crossing from Banjarmasin. Additionally, the site can be accessed by fixed wing airplanes via Stagen Airport Kotabaru or by ship via a dedicated jetty within the cement plant complex.

Technology employed by the project activity

The proposed project produces the new blended cement with similar characteristics as the presently produced OPC. In order to meet this objective, improved clinker quality is required and the grinding process requires more stringent control. As a consequence this project must be supported by additional efforts including additional equipment and installations as well as research and development (R&D).

Additional equipment and installations:

- Facilities for production of PCC at P1 and P2 - phase 1
- Facilities for production of PCC at P1 and P2 - phase 2 (use of trass, limestone and wet fly ash)
- Additional handling system for wet fly ash, trass and limestone in cement mill P3/P4
- Installation and modification of hoppers with weighing feeders and conveyors for P 11

- Installation of additional hoppers, weighing systems and conveyors for Cirebon factory
- Additional handling system for wet fly ash, trass and limestone in cement mills P6, P7, P8

The cement plants undertaking the CDM project activities are described as follows:

Citeureup factory: With its nine kilns (P1-P8 and P11), the Citeureup cement factory is the biggest of the three factories, with a total installed capacity of about 10.4 million tons of clinker per year (MTPY). The nearly self-contained facility operates limestone and clay quarries, a 300 MW power station, and a paper sack factory (capacity about 200 million bags per year). The Citeureup cement factory produces OPC Type I, Type II, Type V, Portland Pozzolanic Cement (PPC), and oil well and white cement.

Cirebon factory: The Cirebon cement factory is a fully integrated cement factory with two kilns (P9 and P10). The total production capacity is about 2.4 MTPY of clinker. The facility operates its own limestone and clay quarries. Electricity is purchased from the national grid. The factory produces OPC Type I and PPC. (PCC introduced since 2005).

Tarjun factory: The Tarjun cement factory is a fully integrated cement factory with a single kiln (P12). The annual production capacity is about 2.4 MTPY of clinker. The cement plant operates a coal-fired power plant and port facilities. The factory produces OPC Type I. (PCC introduced since 2005).

Type of clinker: Clinker produced which is covered for this project is only clinker to produced OPC Type I, II and V, PPC and PCC. clinker for cement oil well and white cement is not covered.

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 October 2006 with crediting period of 01/01/2005 – 01/01/2014 (fixed). The UNFCCC reference number for the project activity is 0526. The DOE for the Validation of the project was Det Norske Veritas.

Monitoring Methodology and Plan

Monitoring Methodology

Approved consolidated monitoring methodology ACM 0005 "Consolidated Monitoring Methodology for increasing the Blend in Cement Production." (version 3, 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: 0526)

Monitoring Period

All the necessary parameters are monitored for both baseline emission and project emissions calculations. Monitoring period selected for baseline emissions is from 01/01/2002 to 31/12/2004 for baseline clinker to cement ratio benchmark and from 01/01/2005 to 31/10/2006 for other baseline parameters. For project emission calculations, the monitoring period is from 01/01/2002-31/12/2006. Parameters monitored during the period and their recording frequency and other details are summarized below. All data have been archived for Verification purpose.

Parameters monitored

Data monitored for Baseline emissions Calculations

ID number	Data Variable	Source of data	Symbol	Data Unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Comment/Reference
1	CaO content of the raw material for raw meal already calcined	Plant records	$InCaO_{BSL}$	%	m,c	daily	
2	CaO content of the clinker	Plant records	$OutCaO_{BSL}$	%	m,c	daily	
3	MgO content of the raw material for raw meal already calcined	Plant records	$InMgO_{BSL}$	%	m,c	daily	
4	MgO content of the clinker	Plant records	$OutMgO_{BSL}$	%	m,c	daily	
5	Clinker production	Plant records	$CLNK_{BSL}$	Kilo tonnes of clinker	m	annually	As per weigh feeder codes in ITP online system
6	Fossil fuel consumed	Plant records	FF_{i_BSL}	Tonnes of fuel i	m	annually	As per weigh feeder codes in ITP online system
7	Emission factor for fossil fuel	IPCC/plant rec	EFFi	TCO2/tonne of fuel i	c	annually	Default as per IPCC standard
8	Grid electricity for clinker production	Plant records	$BELE_{grid\_CLNK,}$	MWh	m,c	annually	Measured & calculated as per normal operation
9	Grid Emission factor	Plant records	EF_{grid_BSL}	T CO2/MWh	c	annually	ACM0002 is used to determined electricity emissions: Based on JAVA-BALI grid emission factor. Source: Decision on the meeting on determination of CDM emission factor of JAVA-MADURA-BALI (JAMALI) Grid submitted by Chevron and agreed by the

ID number	Data Variable	Source of data	Symbol	Data Unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Comment/Reference
							committee, Directorate General of Electricity and Energy Utilization, Jakarta, Indonesia, Friday, 11 March 2006). This is estimated based on ACM 0002. Reference for cross checking: Directorate general electricity and energy utilization, Renewable energy division, 2006.
10	Self generation of electricity for clinker production	Plant records	$BELEs_{g\_CLNK,}$	MWh	m,c	annually	Measured & calculated as per normal operation
11	Electricity self generation emission factor	Plant records	EF_{sg_BSL}	t CO_2/MWh	m,c	annually	Measured & calculated as per normal operation
12	Blended cement (BC) production	Plant records	BC_{BSL}	Kilo tonnes of BC	m	annually	Composite of clinker, gypsum and additives
13	Grid electricity for grinding BC	Plant records	$BELE_{grid\_BC}$	MWh	c	annually	Reported by local electricity provider PLN
14	Self generation of electricity for grinding BC	Plant records	$BELE_{sg\_BC,}$	MWh	m	annually	
15	Grid electricity for grinding additives	Plant records	$BELE_{grid\_ADD}$	MWh	m	annually	
16	Self generation of electricity for grinding additives	Plant records	$BELE_{sg\_ADD,}$	MWh	m	annually	
17	Fuel consumption	Plant records	$F_{i,j,BSL}$	Tonnes of fuel i	m	annually	
18	CO2 emission coefficient of fuel	IPCC	$COEF_{i,j,BSL}$	tCO2/tonne of fuel i	c		IPCC default
19	Electricity generation	Plant records	$GEN_{i,BSL}$	MWh	m	annually	
20	Emission per ton clinker due to calcinations	Plant records	BE_{calcin}	t CO_2/tonne clinker	c	annually	
21	Emission per ton clinker due to combustion of fossil fuels for clinker production	Plant records	$BE_{fossil\_fuel,}$	t CO2/tonne clinker	c	annually	
22	Grid electricity emissions for clinker production	Plant records	$BE_{ele\_grid\_CLNK,}$	t CO2/tonne clinker	c	annually	
23	Self generated electricity emission for clinker production	Plant records	$BE_{ele\_sg\_CLNK}$	t CO2/tonne clinker	c	annually	
24	Grid electricity emissions for BC grinding	Plant records	$BE_{ele\_grid\_BC}$	t CO2/ tonne BC	c	annually	
25	Self generated electricity emission for BC grinding	Plant records	$BE_{ele\_sg\_BC}$	t CO2/ tonne BC	c	annually	
26	Grid electricity emissions for additives preparation	Plant records	$BE_{ele\_grid\_ADD}$	t CO2/ tonne BC	c	annually	
27	Self generated electricity emission for additives preparation	Plant records	$BE_{ele\_sg\_ADD,}$	t CO2/tonne BC	c	annually	
28	Share of clinker per ton of BC	Plant records	Bblend,y	t of clinker/t of BC	c	annually	Calculated from no.12

Data monitored for project emissions calculations

ID number	Data Variable	Source of data	Symbol	Data Unit	Measured (m), calcu lated (c) or estima ted (e)	Recording Frequency	Comments/Reference
1	CaO content of the raw material for raw meal already calcined	Plant records	In CaOy	%	m,c	daily	
2	CaO content of the clinker	Plant records	OutCaOy	%	m,c	daily	
3	MgO content of the raw material for raw meal already calcined	Plant records	InMgOy	%	m ,c	daily	
4	MgO content of the clinker	Plant records	Out MgOy	%	m,c	daily	
5	Clinker production	Plant records	CLNKy	Kilo tonnes of clinker	m	annually	As per weigh feeder codes in ITP online system
6	Fossil fuel consumed	Plant records	FFi_y	Tonnes of fuel i	m	annually	As per weigh feeder codes in ITP online system
7	Emission factor for fossil fuel	IPCC/plant records	EFFi	TCO2/tonne of fuel i	c	annually	Default as per IPCC standard
8	Grid electricity for clinker production	Plant records	$PELE_{gridCLNK,y}$	MWh	m,c	annually	Measured & calculated as per normal operation
9	Grid Emission factor	See comment	$EF_{grid\_y\_}$	T CO2/MWh	c	annually	ACM0002 is used to determined electricity emissions: Based on JAVA-BALI grid emission factor. Source: Decision on the meeting on determination of CDM emission factor of JAVA-MADURA-BALI (JAMALI) Grid submitted by Chevron and agreed by the committee, Directorate General of Electricity and Energy Utilization, Jakarta, Indonesia, Friday, 11 March 2006). This is estimated based on ACM 0002. Reference for cross checking: Directorate general electricity and energy utilization, Renewable energy division, 2006.
10	Self generation of electricity for clinker production	Plant records	$PELE_{sg\_CLNK,y}$	MWh	m	monthly	
11	Electricity self generation emission factor	Plant records /IPCC	EFsg_y	T CO_2/MWh	c	monthly	
12	Blended cement (BC) production	Plant records	BCy	Kilo tonnes	m	monthly	
13	Grid electricity for grinding BC	Plant records	$PELE_{grid\_BC,y}$	MWh	m	monthly	
14	Self generation of electricity for grinding BC	Plant records	$PELE_{sg\_BC,y}$	MWh	m	annually	
15	Grid electricity for grinding additives	Plant records	$PELE_{grid\_ADD}$	MWh	m	annually	
16	Self generation of electricity for grinding additives	Plant records	$PELE_{sg\_\_ADD,y}$	MWh	m	annually	
17	Fuel consumption	Plant records	Fi,j,y	Tonnes of fuel i	m	annually	

18	Carbon content of the fuel used	IPCC/Plant records	COEFi,j,y	tCO2/tonne of fuel i	c		IPCC default
19	Electricity generation	Plant records	GENi,y	MWh	m	annually	
20	Emission per ton clinker due to calcinations	Plant records	$PE_{calcin,y}$	t CO_2/tonne clinker	c	annually	
21	Emission per ton clinker due to combustion of fossil fuels for clinker production	Plant records	$PE_{fossil\_fuel,y}$	t CO2/tonne clinker	c	annually	
22	Grid electricity emissions for clinker production	Plant records	$PE_{ele\_grid\_CLNK,y}$	t CO2/tonne clinker	c	annually	
23	Self generated electricity emission for clinker production	Plant records	$PE_{ele\_sg\_CLNK,y}$	t CO2/tonne clinker	c	annually	
24	Grid electricity emissions for BC grinding	Plant records	$PE_{ele\_grid\_BC,,y}$	t CO2/ tonne BC	c	annually	
25	Self generated electricity emission for BC grinding	Plant records	$PE_{ele\_sg\_BC,y}$	t CO2/ tonne BC	c	annually	
26	Grid electricity emissions for additives preparation	Plant records	$PE_{ele\_grid\_ADD,,y}$	t CO2/ tonne BC	c	annually	
27	Self generated electricity emission for additives preparation	Plant records	$PE_{ele\_sg\_ADD,y}$	t CO2/tonne BC	c	annually	
28	Share of clinker per ton of BC	Plant records	P_{blend} ?	t of clinker/t of BC	c	annually	Calculated from no.12

Data monitored for Leakage Emissions Calculations

ID number	Data Variable	Source of data	Symbol	Data Unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Comments/Reference
Truck Load							
1	Fly-ash truck load	Plant records	Qadd	Tonne of gypsum /trip	m	daily	
2	Trass truck load	Plant records	Qadd	Tonne of gypsum /trip	m	daily	
Ship Load							
Distance (D_{add_source}), overland							
3	Fly-ash carried	Plant records	D_{add_source}	Km/trip	m	per trip	
4	Trass carried	Plant records	D_{add_source}	Km/trip	m	Per trip	
Distance (D_{add_source}), overseas							
Emission factor for transport of fuel (kg CO_2/kg of fuel), TEF							
5	Emission factor for transport fuel	IPCC	TEF_{truck}	Kg CO2/kg of fuel	e	annually	
6	Emission factor for transport fuel	IPCC	TEF_{ship}	Kg CO2/kg of fuel	e	annually	
Fuel consumption for the vehicle per kilometre (kg of fuel/kilometre), TF Cons							
7	CO_2 emissions/trip for fly-ash	Plant records		Kg of CO_2/trip	c	monthly	
8	CO_2 emissions/trip for trass	Plant records		Kg of CO_2/trip	c	monthly	
9	CO_2 emissions/trip for fly-ash	Plant records		Kg of CO_2/trip	c	monthly	
10	CO_2 emissions/trip for trass	Plant records		Kg of CO_2/trip	c	monthly	

Quality Control (QC) and Quality Assurance

Quality management system

The quality management system of the CDM monitoring activities is organized and illustrated as given in Figure 1. The activity is led by the CDM Project Manager who works together with the Monitoring Plant Officer to manage and monitor all data and calculations in each factory. The responsibilities of each member of the quality management team are described hereafter.

CDM Project Manager is responsible to:

- determine, evaluate and develop CO_2 emission reduction project program,
- ensure sufficient and accurate calculations
- approval of CO_2 emission reduction report

Monitoring Plan Officer is responsible to:

- Provide calculation software program based on the approved methodology by UNFCCC.
- Prepare calculation worksheets such as daily database, Material consumption etc..
- Verify all calculations and analysis of the CO_2 emission reduction calculation result.
- report data obtained from all production sites (Citeureup, Cirebon and Tarjun)

General Manager Operation Staff is responsible to:

- Ensure correct calculations.

Monitoring Area Officer is responsible to:

- ensure CO_2 emission reduction program applied properly
- ensure facilities related in the scope of CO_2 emission reduction are sufficient and accurate
- ensure the sufficiency of data entry

Plant/Division:
Plant/Division Managers (Four Plant Managers in Citeureup + three supporting Division Managers, One in Cirebon and one in Tarjun and one Division Manager for sales) are responsible to:

- implement CO_2 emission reduction program that include executing, updating and reviewing facilities such as equipment, measuring device etc. required in the scope of CO_2 emission reduction
- develop the corrective action in case of nonconformance,
- ensure the sufficiency of data entry

Production and Supporting Department Heads are responsible to certify data and ensure on-time data submission.

Operators are responsible to conduct data entry.

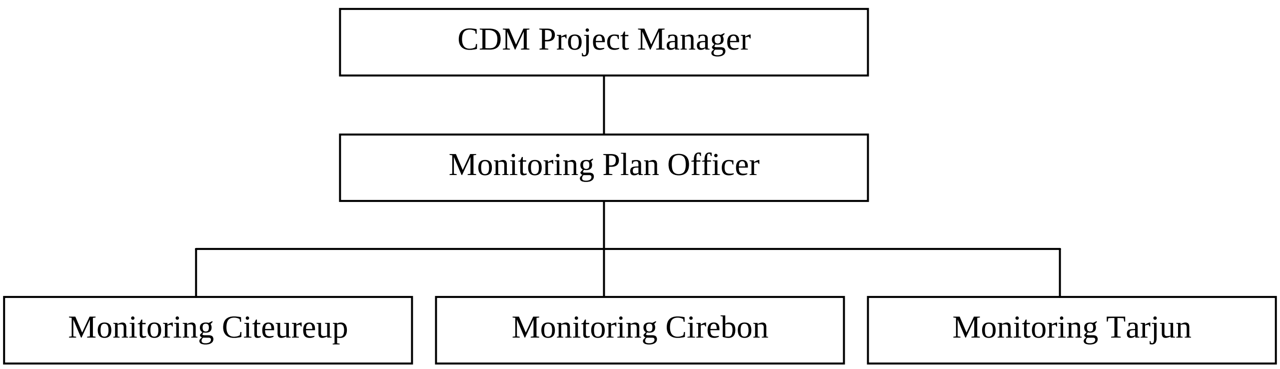

Figure 1. Quality Assurance Management system for monitorig activities Emissions Reduction Calculations Procedures (Organizational Structure)

Quality Assurance: Standard Operation Procedure for monitoring and emission reduction calculation activities

To ensure the quality assurance of data and calculation monitoring, a standard operation procedure is established and is described hereafter.

Emissions Monitoring and Calculation Procedure			
Monitoring and calculation activities	**Citeureup**	**Cirebon**	**Tarjun**
Data Source and collection	Data are taken from the accounting section	Data are taken from the accounting section	Data are taken from the accounting section
	Most data are available and recorded according to ISO 9001 management system	Most data are available and recorded according to ISO 9001 management system	Most data are available and recorded according to ISO 9001 management system
	Frequency of data collection is based on Monitoring Tables given in section D of the PDD	Frequency of data collection is based on Monitoring Tables given in section D of the PDD	Frequency of data collection is based on Monitoring Tables given in section D of the PDD
	All data are reviewed and approved by Monitoring Citeureup.	All data are reviewed and approved by Monitoring Cirebon.	All data are reviewed and approved by Monitoring Tarjun
Data compilation	All data are centralized at Citeureup for data processing		
	Data from Citeureup, Cirebon and Tarjun are transmitted to Monitoring Plan Officer		
Emissions calculation	Emissions calculation is conducted on a yearly basis from data which is collected daily, monthly or annually, depending on the nature of the data. Frequency of data collection and recording is listed in section D of the monitoring section		
	All data are calculated by Monitoring Plan Officer using comprehensive excel spreadsheets		
Emissions data review and approval	Calculation is reviewed and approved by CDM project manager,		
Record Keeping	All data are recorded electronically and also kept manually in hard copy, the Monitoring Plan Officer is responsible for record keeping		

DATA ENTRY

Raw Data & Online System

A trained operator is recording the t input data for calculation of emission reductions such as quantity of alternative Materials, clinker production, etc. and pay attention to important and relevant process stages at online system.

Other data which are not available online, are recorded using forms provided by and reported to Monitoring Plan Officer.

Daily Data Base
Based on data in online system & other data General Manager Operation Staff prepare data summary into daily data base. The daily data base is verified by Monitoring Plan Officer.

Material Consumption Data
General Manager Operation Staff summarizes the verified daily data base into monthly Material consumption data. The Material consumption data are adjusted by physical check and the result is verified by Monitoring Plan Officer

Calculation BC ER
General Manager Operation Staff calculates Area CO2 emission reduction in yearly basis on the verified monthly Material consumption data.
Monitoring Plan Officer verify the Area yearly CO2 emission reduction, and back up all data related to CO2 emission reduction.

PROCESS CHANGE
In case of activities which may or would bring about significant changes in CO2 emission reductions or there is a change in methodology, the Monitoring Plan Officer shall review and determine the changes in CO2 emission reduction calculation method. The result is reported and has to be to be approved by CDM Project Manager.

INTERNAL AUDIT
An auditor will be officially assigned to check the consistency and data quality for GHG compliance. The auditor has basic knowledge on GHG emission calculations and is familiar with the cement production processes at Indocement. The auditor ensure CO2 emission reduction calculation include raw data, data entry accuracy in on-line system, daily data basis summary, fuel consumption summary, CO2 emission reduction summary and reporting – all in complience with the approved procedures & methodologies.

CORRECTIVE ACTIONS
The internal audit will identify and highlight the inconsistency of the calculation with the existing GHG reduction monitoring plan and calculation formula/algorithm. Based on this audit, corrective actions may be required prior to Verification process by an accredited CDM Designated Operation Entity

Quality control (QC) and quality assurance (QA) procedures for data monitored

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
Project emissions			
ID 1-29	Low-Medium	Yes	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.
ID 9 and 11	Medium	Yes	The source of uncertainties in the grid emission factor is the fuel composition mix of the grid. This will be updated every year to incorporate the changes in fuel composition mix. Data will be requested to DGEEU (directorate general of energy and electricity utilization). The uncertainty of the grid emission factor is about ± 10%. This will be verified regularly during the Verification process. In the absence of actual fuel emission factor for the fuel composition mix of the self generated electricity, IPCC default values will be used.
Baseline emissions			
ID 1-29	Low-Medium	Yes	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.

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
ID 9.11	Medium	Yes	The source of uncertainties in the grid emission factor is the fuel composition mix of the grid. This will be updated every year to incorporate the changes in fuel composition mix. Data will be requested to DGEEU (directorate general of energy and electricity utilization). The uncertainty of the grid emission factor is about ± 10%. This will be verified regularly during the Verification process. In the absence of actual fuel emission factor for the fuel composition mix of the self generated electricity, IPCC default value will be used.

Quality management and Environment Management System associated with CDM project activity

CDM project operation is integrated in the normal plant management structure. All monitoring equipment are installed by experts and regularly calibrated to the highest standards by project staff. The three factories where the Indocement Blended Cement project is conducted are ISO 9001 (QMS) and ISO 14001 (EMS) and OHSAS 18001 certified. All the relevant monitoring, recording, calibration are carried out in the three factories.

GHG Calculations

In the Indocement Blended Cement Project, the increase of the additive materials resulting in lower clinker to cement ratio in the new cement type reduces GHG emissions mainly due to:

- Reduction in process CO_2-emissions due to reduced clinker in cement and consequently reduced CO2 from the calcination process

- Reduction in CO_2 emissions resulting from reduced fuel consumption in clinker burning

Formulas used for emission reduction calculations

Emission reductions

ER y = $\{[BE_{BC,y} – PE_{BC,y}]\}*BCy+Ly *(1- \alpha y)$

Where:
ER y = Emission reductions in year y due to project activity (thousand tonnes of CO_2)
$BE_{BC,y}$ = Baseline emissions per tonne of BC (t of CO_2/tonnes of BC)
$PE_{BC,y}$ = Project emissions per tonne of BC (t of CO_2/tonnes of BC)
BCy = BC production in year y (thousand tonnes)
Ly = Leakage emissions (t of CO_2)
αy = Proof of additional flyash added in the year y is surplus

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
ER y	Emission reductions in year y due to project activity	(thousand tonnes of CO_2)	-42,677	117,747
$BE_{BC,y}$	Baseline emissions per tonne of BC	(t of CO_2/tonnes of BC)	0.837	0.837
$PE_{BC,y}$	Project emissions per tonne of BC	(t of CO_2/tonnes of BC)	0.841	0.817
Ly	Leakage emissions	(t of CO_2)	-892	-1,624
y	Proof of additional flyash added in the year y is surplus	N/A	0	0

Baseline emissions

$BE_{BC,y}$ = $[BE_{clinker} * BB_{lend,y}] + BE_{ele\_ADD\_BC}$

where:

$BE_{BC,y}$ = Baseline CO2 emissions per tonne of blended cement type (BC) (tCO2/tonne BC)

$BE_{clinker}$ = CO2 emissions per tonne of clinker in the baseline in the project activity plant (t CO2/tonne clinker)[1].

$BB_{lend,y}$ = Baseline benchmark of share of clinker per tonne of BC updated for year y (tonne of clinker/tonne of BC)

$BE_{ele\_ADD\_BC}$ = Baseline electricity emissions for BC grinding and preparation of additives (tCO2/tonne of BC)

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
$BE_{BC,y}$	Baseline CO2 emissions per tonne of blended cement type (BC)	tCO2/tonne BC	0.837	0.837
$BE_{clinker}$	CO2 emissions per tonne of clinker in the baseline in the project activity plant	t CO2/tonne clinker	0.896	0.896
$BB_{lend,y}$	Baseline benchmark of share of clinker per tonne of BC updated for year y	tonne of clinker/tonne of BC	0.898	0.898
$BE_{ele\_ADD\_BC}$	Baseline electricity emissions for BC grinding and preparation of additives	tCO2/tonne of BC	0.032	0.032

Project emissions

$BE_{BC,y}$ = $[BE_{clinker} * BB_{lend,y}] + BE_{ele\_ADD\_BC}$

Where:

$PE_{BC,y}$ = CO2 emissions per tonne of BC in the project activity plant in year y(t CO2/tonne BC)

$PE_{clinker}$ = CO2 emissions per tonne of clinker in the project activity plant in year y (t CO2/tonne clinker) and defined below

$PB_{lend,y}$ = Share of clinker per tonne of BC in year y (tonne of clinker/tonne of BC)

$PE_{ele\_ADD\_BC}$ = Electricity emissions for BC grinding and preparation of additives in year y (tCO2/tonne of BC)

[1] Determination and definition of the BE clinker is given in the PDD, section E

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
$PE_{BC,y}$	CO2 emissions per tonne of blended BC in the project activity plant in year y	tCO2/tonne BC	0.841	0.817
$PE_{clinker}$	CO2 emissions per tonne of clinker in the project activity plant in year y	t CO2/tonne clinker	0.907	0.904
$PB_{lend,y}$	Share of clinker per tonne of BC in year y	tonne of clinker/tonne of BC	0.885	0.866
$PE_{ele\_ADD\_BC}$	Electricity emissions for BC grinding and preparation of additives in year y	tCO2/tonne of BC	0.037	0.034

$$PE_{clinker,y} = PE_{calcin,y} + PE_{fossil\_fuel,y} + PE_{ele\_grid\_CLNK,y} + PE_{ele\_sg\_CLNK,y}$$

where:

$PE_{clinker,y}$ = Emissions of CO2 per tonne of clinker in the project activity plant in year y (t CO2/tonne clinker)

$PE_{calcin,y}$ = Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate in year y (t CO2/tonne clinker)

$PE_{fossil\_fuel,y}$ = Emissions per tonne of clinker due to combustion of fossil fuels for clinker production in year y (t CO2/tonne clinker)

$PE_{ele\_grid\_CLNK,y}$ = Grid electricity emissions for clinker production per tonne of clinker in year y (t CO2/tonne clinker)

$PE_{ele\_sg\_CLNK,y}$ = Emissions from self-generated electricity per tonne of clinker production in year y (t CO2/tonne clinker)

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
$PE_{clinker,y}$	Emissions of CO2 per tonne of clinker in the project activity plant in year y	(t CO2/tonne clinker)	0.907	0.904

PE $_{calcin,y}$	Emissions per tonne of clinker due to calcinations of calcium carbonate and magnesium carbonate in year y	(t CO2/tonne clinker)	0.535	0.539
PE $_{fossil\_fuel,y}$	Emissions per tonne of clinker due to combustion of fossil fuels for clinker production in year y	(t CO2/tonne clinker)	0.312	0.308
PE $_{ele\_grid\_CLNK,y}$	Grid electricity emissions for clinker production per tonne of clinker in year y	(t CO2/tonne clinker)	0.023	0.024
PE $_{ele\_sg\_CLNK,y}$	Emissions from self-generated electricity per tonne of clinker production in year y	(t CO2/tonne clinker)	0.038	0.033

PE $_{calcin,y}$ = 0.785*(OutCaOy - InCaOy) + 1.092*(OutMgOy - InMgOy) / [CLNKy * 1000]

where:

PE $_{calcin,y}$ = Emissions from the calcinations of limestone (tCO_2/tonne clinker)
0.785 = Stoichiometric emission factor for CaO (tCO_2/t CaO)
1.092 = Stoichiometric emission factor for MgO (tCO_2/t MgO)
InCaO,y = CaO content (%) of the raw material * raw material quantity (tonnes) **(**for raw meal already calcined)
OutCaO,y = CaO content (%) of the clinker * clinker produced (tonnes)
InMgO,y = MgO content (%) of the raw material * raw material quantity (tonnes) (for raw meal already calcined)
OutMgO,y = MgO content (%) of the clinker * clinker produced (tonnes)
CLNKy = Annual production of clinker in year y (kilotonnes of clinker)

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
PE $_{calcin,y}$	Emissions from the calcinations of limestone	(tCO_2/tonne clinker)	0.535	0.539

InCaO,y	CaO content (%) of the raw material * raw material quantity (tonnes) (for raw meal already calcined)	N/A	0.114	0.061
OutCaO,y	CaO content (%) of the clinker * clinker produced (tonnes)	N/A	65.7	65.9
InMgO,y	MgO content (%) of the raw material * raw material quantity (tonnes) (for raw meal already calcined)	N/A	0.028	0.021
OutMgO,y	MgO content (%) of the clinker * clinker produced (tonnes)	N/A	1.9	2.1
CLNKy	Annual production of clinker in year y	(kilotonnes of clinker)	9,518	9,691

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

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)

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
FFi_,y	Fossil fuel of type i consumed for clinker production in year y)	(tonnes of fuel i)		
	– coal		1,299,434	1,290,560
	– Ido		24,610	19,860
	– mfo		0	0
	– natural gas		355,648	598,364
	– waste tire		6,159	3,399
	– sludge oil		0	481
	– waste oil		336	387
	– waste solvent		0	0
	– textile		0	0
	– palm shell		11,417	8,665
	– paper		208	943
	– sloop oil		0	151
	– rice husk		4,365	7,625
	– carbon fly ash			

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
	– saw dust		201 1,038	690 0
EFFi	Emission factor for fossil fuel i	(tCO2/tonne of fuel)		
	– coal		2.21	2.24
	– ido		2.72	2.74
	– mfo		0	0
	– natural gas		0.04	0.04
	– waste tire		2.39	2.37
	– sludge oil		0	1.82
	– waste oil		2.20	2.32
	– waste solvent		0	0
	– textile		0	0
	– palm shell		0	0
	– paper		0	0
	– sloop oil		0	2.52
	– rice husk		0	0
	– carbon fly ash		0.68	0.73
	– saw dust		0	0
CLNKy	Annual production of clinker in year y	(kilotonnes of clinker)	9,518	9,691

$PE_{ele\_grid\_CLNK,y}$ = [$PELE_{grid\_CLNK,y}$ * EF_{grid_y}] / [CLNKy* 1000]

Where:

$PE_{ele\_grid\_CLNK,y}$ = Grid electricity emissions for clinker production in year y (MWh)
$PELE_{grid\_CLNK,y}$ = Grid electricity for clinker production in year y (MWh)
EF_{grid_y} = Grid emission factor in year y(t CO2/MWh)
CLNKy = Annual production of clinker in year y (kilotonnes of clinker)

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
$PE_{ele\_grid\_CLNK,y}$	Grid electricity emissions for clinker production in year y	(tCO2/tonne of clinker)	0.022	0.024
$PELE_{grid\_CLNK,y}$	Grid electricity for clinker production in year y	(MWh)	277,068	311,327
EF_{grid_y}	Grid emission factor in year y	(t CO2/MWh)	0.754	0.754
CLNKy	Annual production	(kilotonnes of	9,518	9,691

	of clinker in year y	clinker)		

$PE_{ele\_ADD\_BC,y}$ = $PE_{ele\_grid\_BC,y}$ + $PE_{ele\_sg\_BC,y}$ + $PE_{ele\_grid\_ADD,y}$ + $PE_{ele\_sg\_ADD,y}$

Where:

$PE_{ele\_ADD\_BC,y}$ = Grid electricity emissions for BC grinding in year y (tCO2/tonne of BC)
$PE_{ele\_sg\_BC,y}$ = Emissions from self generated electricity for BC grinding in year y (tCO2/tonne of BC)
$PE_{ele\_grid\_ADD,y}$ = Grid electricity emissions for additive preparation in year y (tCO2/tonne of BC)
$PE_{ele\_sg\_ADD, y}$ = Emissions from self generated electricity additive preparation in year y (tCO2/tonne of BC)

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
$PE_{ele\_ADD\_BC,y}$	Grid electricity emissions for BC grinding in year y	(tCO2/tonne of BC)	0.0142	0.0160
$PE_{ele\_sg\_BC,y}$	Emissions from self generated electricity for BC grinding in year y	(tCO2/tonne of BC)	0.0230	0.0177
$PE_{ele\_grid\_ADD,y}$	Grid electricity emissions for additive preparation in year y	(tCO2/tonne of BC)	0.0000	0.0000
$PE_{ele\_sg\_ADD, y}$	Emissions from self generated electricity additive preparation in year y	(tCO2/tonne of BC)	0.0001	0.0001

$PE_{ele\_grid\_BC,y}$ = [$PELE_{grid\_BC,y}$ * $EF_{grid\_BSL,y}$] /[BCy* 1000]

Where:
$BELE_{grid\_BC,y}$ = 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)

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
$BELE_{grid\_BC,y}$	grid electricity for grinding BC in the project activity	MWh	184,086	181,141
$EF_{grid\_BSL,y}$	Grid emission factor in year y for Citeureup and Cirebon,	t CO2/MWh	0.754	0.754

	both are connected to JAMALI Grid			
BCy	Annual production of BC in year y	kilotonnes of BC	9,780	8,558

$PE_{elec\_sg\_BC,y}$ = [$PELE_{sg\_BC,y}$ * EF_{sg_y}] / [BCy* 1000]

Where:

$PE_{elec\_sg\_BC,y}$ = Self generated electricity for grinding BC in year y (MWh)
EF_{sg_y} = Emission factor for self generated electricity in year y (t CO_2/MWh)
BCy = Annual production of BC in year y (kilotonnes of BC)

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
$PE_{elec\_sg\_BC,y}$	Self generated electricity for grinding BC in the project activity in year y	MWh	297,678	213,098
EF_{sg_y}	Emission factor for self generated electricity in year y - Citeureup - Tarjun	t CO_2/MWh	0.744	0.735
BCy	Annual production of BC in year y	kilotonnes of BC	9,780	8,558

$PE_{ele\_grid\_ADD,\ y}$ = [$PELE_{grid\_ADD}$ * EF_{grid_y}] /[BCy* 1000]

Where:

$PELE_{grid\_ADD}$ = Grid electricity for grinding additives (MWh)
EFgrid_y = Grid emission factor in year y(t CO_2/MWh)
BCy = Annual production of BC in year y (kilotonnes of BC)

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
$PELE_{grid\_ADD}$	Grid electricity for grinding additives	MWh	333	313

EFgrid_y	Grid emission factor in year y for Citeureup and Cirebon, both are connected to JAMALI Grid	t CO2/MWh	0.754	0.754
BCy	Annual production of BC in year y	kilotonnes of BC	9,780	8.558

$PE_{elec\_sg\_ADD,y}$ = [$PELE_{sg\_ADD,y}$ * EF_{sg_y}] / [BCy* 1000]

Where:

$BELE_{sg\_ADD,y}$ = Self-generation electricity for grinding additives (MWh)
EF_{sg_y} = Emission factor for self generated electricity in year y (t CO2/MWh)
BCy = Annual production of BC in year y (kilotonnes of BC)

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
$BELE_{sg\_ADD,y}$	Self generated electricity for grinding additives in the project activity in year y	MWh	757	669
EF_{sg_y}	Emission factor for self generated electricity in year y - Citeureup - Tarjun	t CO2/MWh	0.744	0.735
BCy	Annual production of BC in year y	kilotonnes of BC	9,780	8.558

L_{add_trans} = [(TF_{cons} * D_{add_source} * TEF)* 1/Q_{add}*1/1000 + ($ELE_{conveyor\_ADD}$ * EFgrid)*1/ADDy]

where:

L_{add_trans}	= Transport related emissions per tonne of additives (t CO2/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 CO2/kg of fuel)
$ELE_{conveyor\_ADD}$	= Annual Electricity consumption for conveyor system for additives (MWh)
EFgrid	= Grid electricity emission factor (tonnes of CO2/MWh)
Q_{add}	= Quantity of additive carried in one trip per vehicle (tonnes of additive)
ADDy	= Annual consumption of additives in year y. (t of additives)

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
L_{add_trans}	Transport related emissions per tonne of additives - Limestone - Flyash - Trass - Catalys	t CO2/tonne of additive	 2.34 6.97 1.99 1.92	 2.52 8.03 2.12 1.92
TF_{cons}	Fuel consumption for the vehicle per kilometre - Limestone - Flyash - Trass - Catalys	kg of fuel/kilometre	 3.0 0.3 0.3 0.3	 3.0 0.3 0.3 0.3
D_{add_source}	Distance between the source of additive and the project activity plant - Limestone - Flyash - Trass - Catalys	km	 6.6 215.5 47.0 40.0	 7.1 228.0 50.9 40.0
TEF	Emission factor for transport fuel	kg CO2/kg of fuel	3.2	3.2
$ELE_{conveyor\_ADD}$	Annual Electricity consumption for conveyor system for additives	MWh	0	0
EFgrid	Grid electricity emission factor	tonnes of CO2/MWh	0.754	0.754
Q_{add}	Quantity of additive carried in one trip per vehicle - Limestone - Fly ash - Trass	tonnes of additive	 26.4 32.7 19.4	 26.0 31.6 20.0

	- Catalys		20.0	20.0
ADDy	Annual consumption of additives in year y - Limestone - Fly ash - Trass - Catalys	t of additives	 483,669 115,822 197,329 243	 437,713 136,451 260,457 4,408

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

Ly = L_{add_trans} * [Ablend,y – Pblend,y] * BCy

where:

Ly = Leakage emissions for transport of additives (tonnes of CO2)
BCy = Production of BC in year y (kilotonnes of BC)
Bblend,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)

	Description	Unit	Year 2005 (01/01/05-31/12/05)	Year 2006 (01/01/06-31/10/06)
Ly	Leakage emissions for transport of additives	tonnes of CO2	-223	-923
BCy	Production of BC in year y	kilotonnes of BC	9,780	8,558
Bblend,y	Baseline benchmark share of additives per tonne of BC updated for year y	tonne of additives/tonne of BC	0.102	0.104
Pblend,y	Share of additives per tonne of BC in year y	tonne of additives/tonne of BC	0.115	0.134

References

PDD: Indocement Blended Cement Project, July 2006

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CO_2 Emission Reduction Of Blended Cement Calculation Procedure, Pt. Indocement Tunggal Prakarsa, Tbk, 2006