# AAC Blocks Project By Mohit Industries Limited, Gujarat, India

NXTBLOC
AUTOCLAVED AERATED CONCRETE BLOCKS

Document Prepared By Infinite Solutions

| | |
|---|---|
| **Project Title** | AAC blocks project by Mohit Industries Limited, Gujarat, India |
| **Version** | 04 |
| **Report ID** | VCS/MIL/02 |
| **Date of Issue** | 28/11/2017 |
| **Project ID** | VCS project database ID: **VCSPD1238** |
| **Monitoring Period** | 01-January-2015 to 31-August-2017 (Both days inclusive) |
| **Prepared By** | Infinite Solutions |
| **Contact** | 611, Chetak Centre Main,<br>12/2, Rabindranath Tagore Marg, South Tukoganj,<br>Indore, Madhya Pradesh 452001 |

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# 1 PROJECT DETAILS

## 1.1 Summary Description of the Implementation Status of the Project

**Summary Description:**

Mohit Industries Limited now named as Big Bloc Construction Limited (hereinafter referred to as MIL or PP) has installed an autoclaved aerated concrete (AAC) blocks manufacturing unit of capacity 300,000 m3/annum in Gujarat, India. The project activity involves setting up a new facility and is accordingly classified as a Greenfield project. The AAC blocks manufactured at the project plant uses, waste material fly ash generated from thermal power plants as the primary raw material. The AAC blocks produced replaces conventional fired (baked) clay bricks as construction material. The specific energy demand for manufacturing AAC blocks is lower as compared to conventional clay bricks.

The energy requirement for fired clay bricks manufactured in India is supplied predominantly by high carbon intensive fossil fuel sources. AAC blocks are manufactured by the autoclaving process, which is less energy intensive as compared to the thermal baking process used for manufacturing of fired clay bricks. Thus, the project activity results in lower greenhouse gas emission as compared to the conventional clay bricks manufacturing process. In terms of performance standard of AAC blocks, the AAC blocks are being manufactured in compliance with the requirements of the relevant national standard. The GHG emissions accrued from the project activity during the monitoring period 01-January-2015 to 31-August-2017 (both days inclusive) is1,22,954 tCO2e/ annum

**Implementation Status:**

The project has been implemented on 25-November-2012 and the primary technology for the AAC block manufacturing at the project plant is from **M/s Changzhou Mingjie Building Material Equipment Manufacturing Co., Ltd, China**. The blocks are manufactured, largely through mechanical processes, using cement, lime, gypsum and fly ash from thermal power plants as major raw materials along with aluminium powder (in small quantities).The batched raw materials are mixed with water and the slurry formed is fed to the moulds to set and form green cakes. The green cakes are finally cured by autoclaving with steam to form the AAC blocks. Steam is generated in coal fired boiler.

The major components of equipment installed as part of project activity are as follows:

- Raw materials storage silos
- Raw material mixer
- Hydraulically operated moulding section
- Autoclave section
- Steam boilers
- Compressed air network
- Internal transportation system

Specifications of AAC blocks manufactured under the project activity are as follows:

| Particulars | Unit | Value | Remark (if any) |
|---|---|---|---|
| Dimension of AAC blocks | Mm | 650X240X150 | As per actual production data |
| Density (dry) | kg/m3 | 551-600 | As per Lab test Report |
| Dry shrinkage (maximum) | % | 0.1 | As per Indian Standard – IS 2185 |
| Thermal conductivity | W/m-K | 0.24 | |
| Compressive strength | N/mm2 | >3.75 | |
| Fly ash | % | 72.11 | Lab test report and actual monitoring data at the plant |
| Cement | % | 18.37 | |
| Lime | % | 7.38 | |
| Gypsum | % | 2.06 | |
| Aluminium powder | % | 0.064 | |

**Commissioning Date:**

| | |
|---|---|
| **Commissioning of the Project Activity** | **25-November-2012** |

## 1.2 Sectoral Scope and Project Type

The project activity is a non AFOLU project, developed in line with UNFCCC approved CDM methodology. With reference to Appendix B to the simplified modalities and procedures for small scale CDM project activities, the project activity falls under the following category:

| | |
|---|---|
| **Type** | (iii)- Other Project Activities |
| **Scale** | Small Scale |
| **Category** | Z: Fuel switch, process improvement and energy efficiency in brick manufacture |
| **Methodology** | AMS-III.Z: Fuel Switch, process improvement and energy efficiency in brick manufacture |
| **Version** | 04 |
| **Weblink** | *http://cdm.unfccc.int/methodologies/DB/WPNWYRJ0FN59EFPA4A7N ABU0849FD3* |

## 1.3 Project Proponent

| | |
|---|---|
| Organization name | Big Bloc Construction Limited |
| Contact person | Mr. Manish Narayan Saboo |
| Title | Director |

| | |
|---|---|
| Address | A/601-B, International Trade Centre, Majura Road, Ring Road, Surat, Gujarat, 395-002, India |
| Telephone | +91 261 2463261 |
| Email | Manishsaboo84@gmail.com |

## 1.4 Other Entities Involved in the Project

| | |
|---|---|
| Organization name | Infinite Solutions |
| Role in the project | Carbon Consultant |
| Contact person | Jimmy Sah |
| Title | Head Sustainability |
| Address | 611, Chetak Centre Main, RNT Marg Indore |
| Telephone | +91 9644130430 |
| Email | jimmy@infisolutions.org |

## 1.5 Project Start Date

The start date of the project activity is 25-November-2012 which corresponds to the first production start date of the NXTBLOCK Autoclaved Aerated Concrete Block.

## 1.6 Project Crediting Period

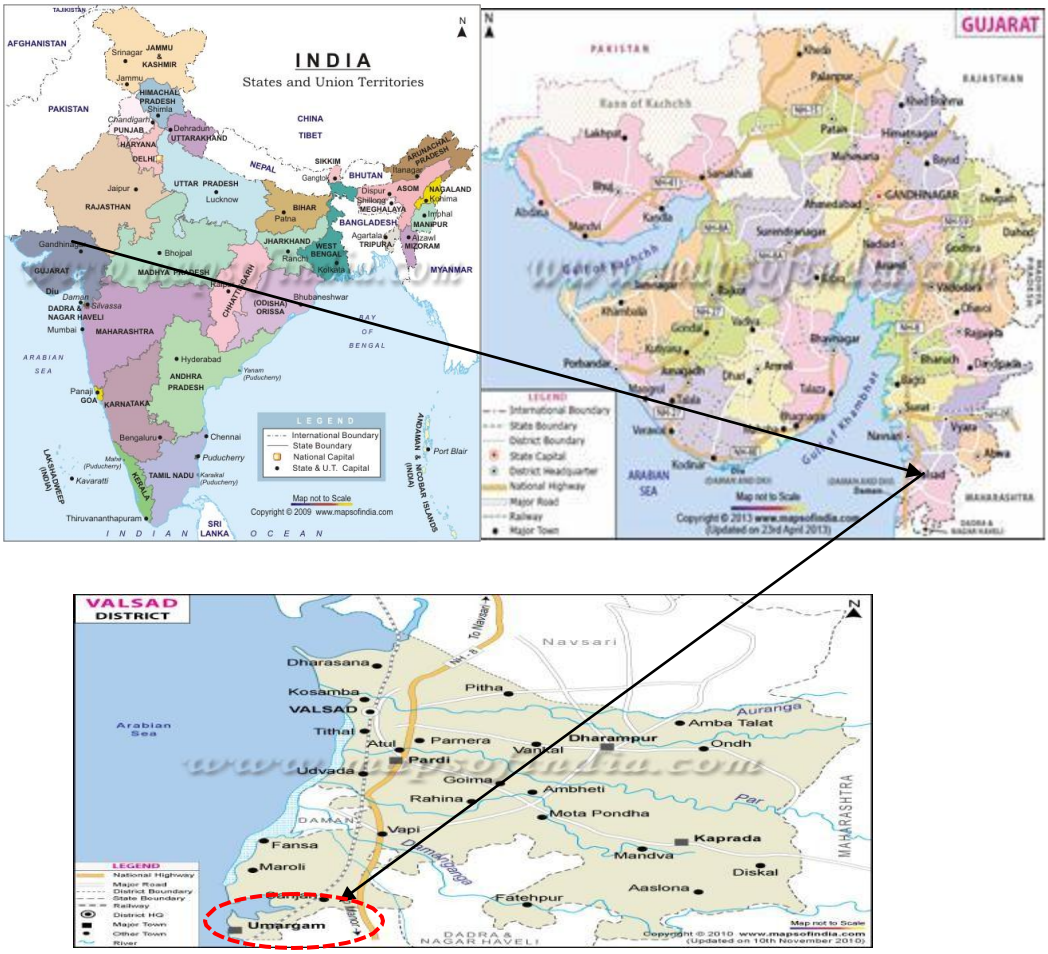
Crediting period start date: 25-November-2012

Crediting period end date: 24-November-2022

Length: 10 years 00 months

## 1.7 Project Location

| | |
|---|---|
| Country | India |
| Region | Western India |
| State | Gujarat |
| District | Valsad |
| Tehsil/Mandal | Umargaon |
| Village | Khatalwada |
| Latitude | 20.217° N |
| Longitude | 72.794°E |
| Nearest Airport | Surat |
| Nearest Railway Station | Surat |




## 1.8 Title and Reference of Methodology

The project has been developed using the following baseline and monitoring methodology approved under CDM program of UNFCCC:

| | |
|---|---|
| **Methodology** | AMS-III.Z: Fuel Switch, process improvement and energy efficiency in brick manufacture |
| **Version** | 04 |
| **Weblink** | *http://cdm.unfccc.int/methodologies/DB/WPNWYRJ0FN59EFPA4A7NABU0849FD3* |

## 1.9 Other Programs

- Emission Trading Programs and Other Binding Limits: The project activity has not participated in Emission Trading Programs and other binding limits.

- Other Forms of Environmental Credit: The project has not availed nor it is in the process of availing any other forms of environmental credit.

- Participation under Other GHG Programs: The project activity has not participated in any other GHG program.

### 1.10 Sustainable Development

The project is not part of any nationally stated sustainable development priorities.

However, since the project is a Greenfield project generation it leads to various economic, social and technological development in the country.

Economic: The project leads to employment generation, both during construction as well as operational stage leading to overall upliftment of the economic status of the local area.

Technological: The project being a non-conventional project which leads to adoption of a new technology in the country. Such projects encourage further R&D and enhancement/viability for various other players to study and further refine the technology available.

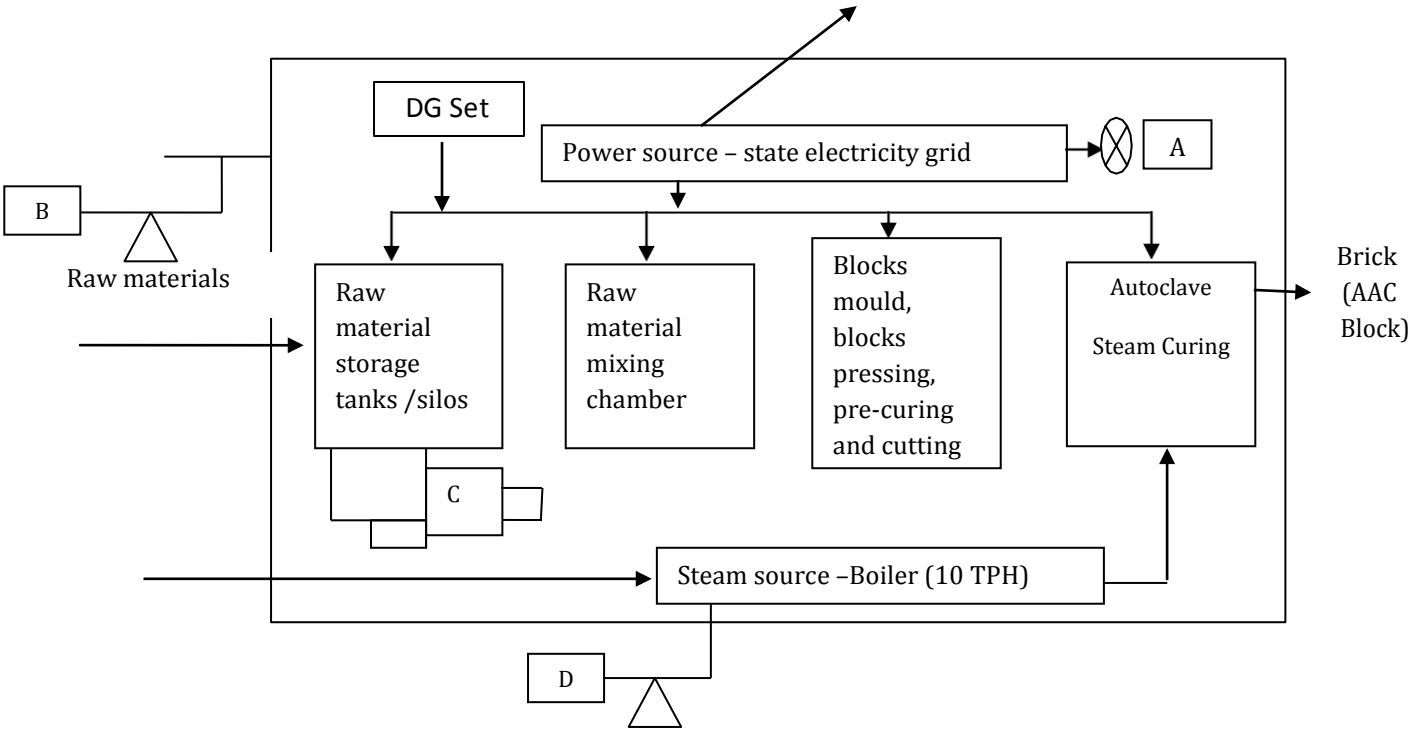
## 2 IMPLEMENTATION STATUS

### 2.1 Implementation Status of the Project Activity

The project activity has been implemented on 25-November-2012. There has not been any change in technology/equipment/ design or any other critical factor which may affect GHG emissions associated with this project activity. The major components of equipment installed as part of project activity are as follows:

- Raw materials storage silos
- Raw material mixer
- Hydraulically operated moulding section
- Autoclave section
- Steam boilers
- Compressed air network
- Internal transportation system
- Diesel Generator

A brief layout of the metering arrangement has been provided below:




**Metering Details**

| Parameter | Denotes | Instrument Details |
|---|---|---|
| $EC_{PJ,y}$ A | Quantity of electricity consumed by the project plant in year y | **Energy Meter.** |
| $RMP_{cement}$, $RMP_{flyash}$ $RMP_{gypsum}$ $RMP_{aluminium\ powder}$ $RMP_{lime}$ B | Quantity of cement, flyash, gypsum, aluminium powder & lime purchased for producing AAC blocks in the year y | **Weighbridge** |
| $RMC_{cement}$, $RMC_{flyash}$ $RMC_{gypsum}$ $RMC_{aluminium\ powder}$ $RMC_{lime}$ C | Quantity of cement, flyash, gypsum, aluminium powder & lime consumed for producing AAC blocks in the year y | **Electronic Weighbridge** |
| $FC_{coal,y}$ D | Quantity of coal combusted by the project activity boiler during the year y | **Electronic Weighbridge** |

**Consents & Clearances**

Mohit Industries Limited has taken all the requisite clearance. A list of clearances is provided below:

| Consent/Clearance Name | Date | Statutory Authority |
|---|---|---|

| | | |
|---|---|---|
| **Factory License** | 17-September-2012 | Directorate Industrial Safety & Health |
| **Clearance from District Industries Centre** | 01-August-2012 | District Industries Centre, Valsad (Govt. of Gujarat) |
| **Consent to Operate** | 18-December-2011 | Gujarat State Pollution Control Board |
| **Permission for Erection of Boiler** | 21-April-2012 | Office of Directorate of Boiler |
| **Commissioning of the project activity** | 25-November-2012 | Start date of the production of the NXTBLOC Autoclaved Aerated Concrete |

**Diesel Generator Technical Specifications**

| **Particular** | **Alternator** | **Engine** | **Energy Meter** |
|---|---|---|---|
| **Make** | Stamford | Cummins | HPL Socomec |
| **Capacity** | 500 KVA | 600 BHP | 3 X -/5 A |
| **Sr. No.** | N12E196429 | 25378061 | 1K 122653 |
| **R.P.M** | 1500 | 1500 | 1600 Imp/Kwh |
| **Voltage** | 415 V | - | 3X240 V |
| **Amp./C.T. Ratio** | 695.6 AMP | - | 800/5 Amp |
| **M.F.** | - | - | 160 |

## 2.2 Deviations

### 2.2.1 Methodology Deviations

There has not been any methodology deviation which has affected the aforesaid project activity.

### 2.2.2 Project Description Deviations

The Deviations observed in the project activity are as follows;

1. Measurement of Raw Material Consumption (using Weigh- Bridge)

The details of the weigh-bridge used for monitoring the consumption of raw material was missing in the registered VCS PD and has been added. Additionally, the calibration frequency has been set as once in a year.

2. The parameters Df,y & FRf,m has been used to compute the leakage emissions.

The purpose of monitoring of parameter "Return trip road distance between the origin and destination of freight transportation activity f" (Df,y) and "Total mass of freight transported in freight transportation activity f" (FRf,m) was given as project emission in the registered PD. However it has been changed to mention leakage emission in line to the applied methodology.

3. The project has added monitoring for the parameter of Diesel Consumption considering the usage of DG sets at site in case of emergency or grid failures. The addition of parameter is based on the conservativeness of project emission calculations.

4. Change in Meter and Accuracy class:

| | | |
|---|---|---|
| Old Energy Meter (L&T Make) | Serial No: 11490797 | Accuracy class: 0.55 for Active, 1.05 for Reactive |
| Energy Meter (L&T Make) | Serial No: 09512220 | Accuracy class: 0.5 for Active, 1.0 for Reactive |

## 2.3 Grouped Project

The project activity is not a grouped project.

## 2.4 Safeguards

### 2.4.1 No Net Harm

There are no negative environmental and/or socio-economic impacts due to the project.

### 2.4.2 Local Stakeholder Consultation

Discussions with Local stakeholders is being carried out at periodic intervals. There are no negative comments received for the project. In line with VCS requirements the following process has been implemented to receive comments from local stakeholders as well as communicate with them at periodic intervals.

| Methods | Details | Reason for Selection |
|---|---|---|
| **Communication Book or Register** | Communication Register is maintained at Admin office at project site office.<br><br>Any comments/inputs/grievance received shall be processed in line with the procedure as described in Annex2. | The administrative office of the plant is located in the plant premises. Thus it is appropriate publicly accessible location at which local stakeholders can provide their feedback on the project. |
| **Process Book** | Any comments/inputs/grievance received shall be processed in line with the procedure as described in Annex2. | The local stakeholder shall be informed about the Communication Register during the next interaction. Further, a public notice shall be posted at the site informing the |

| | | |
|---|---|---|
| | | stakeholders about the communication procedure. |
| **Telephone access** | Mr. Tejas Dhoot, an employee of the company who is based at the project location can be contacted.<br><br>His mobile number is +91 9998449514 | For those who are unable to travel to site or are not literate, they may contact the Project Implementer via telephone.<br><br>Persons dialing this telephone number will have access to a Project representative who speaks English, Hindi and the local language, Gujarati. |
| **Internet/email access** | Mr. Tejas Dhoot<br><br>Email Id: info@nxtbloc.in tejasdhoot@hotmail.com<br><br>The comments mentioned shall be recorded in the Communication register and shall be processed in line with procedure. | Two email id of the project Implementer has been provided for the convenience of stakeholders with internet access. |
| **Company Representative** | Mr. Tejas Dhoot, an employee of the company located at project site has been assigned as the point of contact for all the local issues. | A local employee shall be available in case stakeholders have any comments. |

# 3 DATA AND PARAMETERS

## 3.1 Data and Parameters Available at Validation

| Data / Parameter | $EF_{BL}$ |
|---|---|
| Data unit | $tCO_2/m^3$ |
| Description | The annual production specific baseline emission factor. |
| Source of data | Calculated based on data taken from:<br>1. "Brick and ceramic sectors" report by Asian Institute of Technology[1]<br>2. "Energy Conservation and Pollution Control in brick kilns" report by Sameer Maithel, N Vasudevan, Lt. Col. Rakesh Joshi (Retrd.)[2]<br>3. Density of bricks taken from www.reade.com[3] |
| Value applied | 0.3993 |
| Justification of choice of data or description of | The value is a calculated value. It has been derived based on $CO_2$ emission per brick data taken from "Brick and ceramic sector report", which has been converted to $CO_2$ emission per unit volume of baseline brick with weight of each brick taken from |

[4] http://www.wbcsdcement.org/pdf/tf1_co2%20protocol%20v3.pdf

| | |
|---|---|
| measurement methods and procedures applied | "Energy conservation and Pollution Control in brick kilns" report and density of each brick from the engineering tool box. Values used are such that conservativeness of baseline emission factor is ensured. |
| Purpose of the data | This value has been used to baseline emissions |
| Comments | This value is fixed ex-*ante* |

| Data / Parameter | **$COEF_{cement}$** |
|---|---|
| Data unit | $tCO_2/kt$ |
| Description | $CO_2$ emission factor of cement production |
| Source of data | Cement Sustainability Initiative (CSI) - The Cement $CO_2$ and Energy Protocol. [4] $CO_2$ and Energy Accounting and Reporting Standard for the Cement Industry(May 2011) by WBCSD- Version 3.0 |
| Value applied | $0.638x10^3$ |
| Justification of choice of data or description of measurement methods and procedures applied | This value is a default value as per Cement Sustainability Initiative protocol and is an authentic source of data |
| Purpose of the data | Leakage emissions calculation |
| Comments | This value is fixed ex-*ante* |

| Data / Parameter | **$COEF_{aluminium}$** |
|---|---|
| Data unit | $tCO_2/kt$ |
| Description | $CO_2$ emission factor of aluminium production |
| Source of data | IPCC 2006 Report Volume 3 Chapter 1 for Soderberg Smelting Technology |
| Value applied | $1.7 \times 10^3$ |
| Justification of choice of data or description of measurement methods and procedures applied | IPCC Report is an authentic source of data. Further, for leakage emission more emission intensive of the two available technologies (Prebake and Soderberg) for aluminium production is taken for conservativeness. |
| Purpose of the data | Leakage emissions calculation |
| Comments | This value is fixed ex-*ante* |

| Data / Parameter | **$COEF_{lime}$** |
|---|---|
| Data unit | $tCO_2/kt$ |

| | |
|---|---|
| Description | $CO_2$ emission factor of lime production |
| Source of data | IPCC Guidelines 2006 for NGGI (Vol 3 Ch 2 Eqn 2.8) |
| Value applied | $0.75x10^3$ |
| Justification of choice of data or description of measurement methods and procedures applied | IPCC 2006 data is an authentic source of data |
| Purpose of the data | Leakage emissions calculation |
| Comments | This value is fixed ex-*ante* |

| Data / Parameter | **$COEF_{gypsum}$** |
|---|---|
| Data unit | -tCO2/t |
| Description | $CO_2$ emission factor of gypsum production |
| Source of data | Methodology for free allocation of emission allowances in the EU ETS post 2012[5] |
| Value applied | [6]0.01 |
| Justification of choice of data or description of measurement methods and procedures applied | EU ETS data is an authentic source of data |
| Purpose of the data | Leakage emissions calculation |
| Comments | This value is fixed ex-*ante* |

| Data / Parameter | **$EF_{CO2,f}$** |
|---|---|
| Data unit | $gCO_2$/t-km |
| Description | Default $CO_2$ emission factor for freight transportation activity f |
| Source of data | Default value as provided in the methodological tool to calculate "*Project and leakage emissions from road transportation of freight*" version 01.1.0[7] |
| Value applied | Light vehicles – 245<br>Heavy vehicles –129 |
| Justification of choice of data or description of | This is a default data as provided by UNFCCC and is an authentic source of data |

[5] http://ec.europa.eu/clima/policies/ets/cap/allocation/docs/bm_study-gypsum_en.pdf.

[6] *With reference to the source of data (Methodology for the free allocation of emission allowances in the EU ETS post 2012-Sector report for the gypsum industry), the value has been given as 0.01 tCO2/tonne*

[7] *Project and leakage emissions from transportation of freight* (*https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-12-v1.1.0.pdf* )

| | |
|---|---|
| measurement methods and procedures applied | |
| Purpose of the data | Leakage emissions calculation |
| Comments | This value is fixed ex-*ante* |

| Data / Parameter | $D_{brick}$ |
|---|---|
| Data unit | kg/m$^3$ |
| Description | Density of each baseline brick produced |
| Source of data | Density of common clay bricks taken from www.reade.com[8] |
| Value applied | 1920 |
| Justification of choice of data or description of measurement methods and procedures applied | This data has been taken from public domain (www.reade.com). |
| Purpose of the data | Baseline emissions calculation |
| Comments | The source of data is a third party publicly available source. The value can also be cross-checked from the following source http://www.simetric.co.uk/si_materials.htm |

| Data / Parameter | $W_{brick}$ |
|---|---|
| Data unit | Kg |
| Description | Weight of each baseline brick produced |
| Source of data | Section 3.0 page 3/29 of the report: "Energy Conservation and Pollution Control in brick kilns" report by Sameer Maithel, N Vasudevan, Lt. Col. Rakesh Joshi (Retrd.)[9] |
| Value applied | 3.75 |
| Justification of choice of data or description of measurement methods and procedures applied | Higher value of the range of weight provided is chosen for conservativeness. The source of data chosen is an authentic 3rd party source. |
| Purpose of the data | Baseline emissions calculation |
| Comments | http://www.reade.com/Particle_Briefings/spec_gra2.html http://www.cosmile.org/papers/brick_energyconservationpollutioncontrol.pdf Both the websites are authentic sources of data |

[8] *http://www.reade.com/Particle_Briefings/spec_gra2.html*

[9] *http://www.cosmile.org/papers/brick_energyconservationpollutioncontrol.pdf*

| Data / Parameter | $EF_{CO2,brick}$ |
|---|---|
| Data unit | $kgCO_2$/brick |
| Description | $CO_2$ emission per baseline brick produced |
| Source of data | Page # 25of the "Brick and ceramic sectors" report by Asian Institute of Technology[10] |
| Value applied | 0.78 |
| Justification of choice of data or description of measurement methods and procedures applied | Lower value of the range of $CO_2$ emission per brick provided is chosen for conservativeness. The source of data chosen is an authentic 3rd party source. |
| Purpose of the data | Baseline emissions calculation |
| Comments | Report by the "Brick and ceramic sectors" is an authentic source of data |

| Data / Parameter | $EF_{EL,plant,y}$ |
|---|---|
| Data unit | $tCO_2$/MWh |
| Description | Emission factor for electricity used in project plant in year y |
| Source of data | Tool to calculate baseline, project and/or leakage emission from electricity consumption, version no. 1 |
| Value applied | 1.3 |
| Justification of choice of data or description of measurement methods and procedures applied | Higher of the $CO_2$ emission factor for captive source (DG set) or the regional grid. Emission factor data for captive source taken from Tool to calculate baseline, project and/or leakage emission from electricity consumption, version no. 1 and emission factor of NEWNE grid taken from CEA database Version 09. |
| Purpose of the data | Project emissions calculation |
| Comments | The values have been taken from ***Tool to calculate baseline, project and/or leakage emission from electricity consumption, version no. 01[11], which is an authentic source of data.*** |

| Data / Parameter | $TDL_{plant,y}$ |
|---|---|
| Data unit | % |
| Description | Average technical transmission and distribution losses for providing electricity to project plant in year y |
| Source of data | Default value for project electricity source taken from ***Tool to calculate baseline, project and/or leakage emissions from*** |

[10] *http://www.faculty.ait.ac.th/visu/Prof%20Visu's%20CV/Books%20and%20research%20reports/BRICK%20AND%20CERAMIC.pdf*

[11] *http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf (Version 01, EB 39, Annex 07, Date: 16-May-2008)*

| | |
|---|---|
| | ***electricity consumption, version 01***[12] |
| Value applied | 20 |
| Justification of choice of data or description of measurement methods and procedures applied | Project emissions calculation |
| Purpose of the data | The emission factor for project emission has been selected as the default transmission and distribution losses for project emission estimation applicable to scenario CIII. Data taken from "Tool to calculate baseline, project or leakage emission from electricity consumption", which is an authentic source. |
| Comments | The values have been taken from ***Tool to calculate baseline, project and/or leakage emission from electricity consumption, version no. 01***[13], which is an authentic source of data. |

## 3.2 Data and Parameters Monitored

| | |
|---|---|
| Data / Parameter | **Compressive strength of AAC blocks** |
| Data unit | $N/mm^2$ |
| Description | Compressive strength of project blocks |
| Source of data | Laboratory test report |
| Description of measurement methods and procedures to be applied | Dry compressive strength of the project block has been tested in nationally approved laboratory. |
| Frequency of monitoring/recording | Monitoring Frequency: Once in 6 Months<br>Recording Frequency: Once in 6 Months |
| Value monitored | **Date of Test** / **Value($N/mm^2$)**<br>04-02-2015 / 3.8<br>07-09-2015 / 3.8<br>27-11-2015 / 3.65<br>19-9-2016 / 4.14<br>19-11-2016 / 3.77<br>23-03-2017 / 3.80<br>16-06-2017 / 3.81 |
| Monitoring equipment | Not Applicable as Compressive strength test was carried out in external laboratory and not at plant site. |

[12] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf *(Version 01, EB 39, Annex 07, Date: 16-May-2008)*

[13] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf *(Version 01, EB 39, Annex 07, Date: 16-May-2008)*

| | |
|---|---|
| QA/QC procedures to be applied | NABL accredited laboratory has been appointed for all the lab analysis. . |
| Purpose of the data | Baseline Emissions |
| Calculation method | This is a measured data. Hence not applicable. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | **Density of AAC blocks** |
| Data unit | kg/m$^3$ |
| Description | Density of AAC blocks |
| Source of data | Laboratory test reports |
| Description of measurement methods and procedures to be applied | Density of the project block has been tested at a nationally approved laboratory. |
| Frequency of monitoring/recording | Monitoring frequency: Once in every 6 months<br>Recording frequency: Once in every 6 months |
| Value monitored | **Date of Test** / **Value(kg/m$^3$)**<br>04-02-2015 / 569<br>07-09-2015 / 560<br>27-11-2015 / 551<br>19-9-2016 / 579.4<br>19-11-2016 / 525.8<br>23-03-2017 / 564.9<br>16-06-2017 / 596 |
| Monitoring equipment | Not Applicable. Compressive strength was carried out in external laboratory |
| QA/QC procedures to be applied | NABL accredited laboratory has been appointed for all the lab analysis. . |
| Purpose of the data | Baseline Emissions |
| Calculation method | This is a measured data. Hence not applicable. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | $P_{PJ,y}$ |
| Data unit | M$^3$ |
| Description | The annual production of the facility in year y |
| Source of data | Plant Records – production log book data |

| | |
|---|---|
| Description of measurement methods and procedures to be applied | Number of standard sized cakes being manufactured is being monitored manually. Number of cakes manufactured has been converted to volume units. |
| Frequency of monitoring/recording | Monitoring frequency:<br>Continuously Recording<br>frequency: Daily |
| Value monitored | Period: Total Production($m^3$)<br>01-Jan-2015 to 31-Dec-2015: 2,39,399<br>01-Jan-2016 to 31-Dec-2016: 2,51,334<br>01-Jan-2016 to 31-Aug-2017: 1,50,900 |
| Monitoring equipment | Number of blocks produced have been manually counted |
| QA/QC procedures to be applied | Blocks selling data and blocks stocks data can be used for verification of figures. |
| Purpose of the data | This data has been used to calculate Baseline Emission. |
| Calculation method | Production($m^3$) = (Number of cakes in kg) x (Density in kg/$m^3$) |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later |

| | |
|---|---|
| Data / Parameter | $\mathbf{FC_{coal,y}}$ |
| Data unit | kT |
| Description | Quantity of coal combusted by the project activity boiler during the year y |
| Source of data | Plant log book |
| Description of measurement methods and procedures to be applied | Coal Consumption has been measured with Electronic Weighbridge. Coal inventory has been maintained and monitored through the equation: Coal consumed = Opening Stock + Purchases – Closing Stock |
| Frequency of monitoring/recording | Monitoring Frequency: Daily<br>Recording Frequency: Daily |
| Value monitored | Period: Coal Consumption(kt)<br>01/01/2015 to 31/12/2015: 5618.74<br>01/01/2016 to 31/12/2016: 6126.72<br>01/01/2017 to 31/08/2017: 3866.46 |
| Monitoring equipment | Electronic weighbridge has been used to measure the parameter ($\mathbf{FC_{coal,y}}$). |
| QA/QC procedures to be applied | The QA/QC of the parameter has been ensured by timely calibration of the weighbridge. |
| Purpose of the data | This data has been used to calculate project emissions. |
| Calculation method | The following equation has been used to ascertain the coal consumption quantity:<br>Quantity = Opening Stock + Purchases – Closing stock |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| Data / Parameter | **$NCV_{,coal,y}$** |
|---|---|
| Data unit | TJ/kt |
| Description | Weighted average net calorific value of coal in the year y |
| Source of data | IPCC 2006 Vol 2 Chapter 1 |
| Description of measurement methods and procedures to be applied | Higher value of the uncertainty range of IPCC default values as provided in Table 1.2 Vol 2 of the 2006 IPCC Guidelines has been selected |
| Frequency of monitoring/recording | Monitoring frequency: Every update of IPCC<br>Recording frequency: Annually |
| Value monitored | 26 |
| Monitoring equipment | The value is taken from IPCC's publicly available report. |
| QA/QC procedures to be applied | IPCC data is an authentic source; hence no QA/QC was required. |
| Purpose of the data | This data has been used to calculate the project emissions due to coal consumption |
| Calculation method | Not Applicable |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later |

| Data / Parameter | **$EF_{coal,y}$** |
|---|---|
| Data unit | $tCO_2/TJ$ |
| Description | Weighted average $CO_2$ emission factor of coal in the year y |
| Source of data | Table 1.2 Vol 2 of the 2006 IPCC Guidelines |
| Description of measurement methods and procedures to be applied | Higher value of the uncertainty range of IPCC default values as provided in Table 1.4 Vol 2 of the 2006 IPCC Guidelines has been selected |
| Frequency of monitoring/recording | Monitoring frequency: Every update of IPCC<br>Recording frequency: Annually |
| Value monitored | 100 |
| Monitoring equipment | The value is taken from IPCC's publicly available report. |
| QA/QC procedures to be applied | IPCC data is an authentic source; hence no QA/QC was required. |
| Purpose of the data | Project Emissions |
| Calculation method | Not Applicable |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | **$EC_{PJ,y}$** |
| Data unit | MWh |
| Description | Quantity of electricity consumed by the project activity in year y |
| Source of data | Plant records – Electricity consumption logbook |
| Description of measurement methods and procedures to be applied | Energy meter has been used to measure the electricity consumption by the project activity. |
| Frequency of monitoring/recording | Monitoring frequency: Continuously<br>Recording frequency: Daily |
| Value monitored | Period: Electricity Consumption (MWh)<br>01/01/2015 to 31/12/2015: 1571.96<br>01/01/2016 to 31/12/2016: 1606.67<br>01/01/2017 to 31/08/2017: 1048.28 |
| Monitoring equipment | Energy Meter has been used to measure the electricity consumption in the project activity. |
| QA/QC procedures to be applied | The QA/QC of the parameter has been ensured by timely calibration of the energy meter. |
| Purpose of the data | This data has been used to determine the project emissions from electricity consumption. |
| Calculation method | Not Applicable. This is a directly measured parameter. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | **$RMP_{cement,y}$** |
| Data unit | kT |
| Description | Quantity of cement purchased for producing AAC blocks in the year y |
| Source of data | Purchase records maintained at plant |
| Description of measurement methods and procedures to be applied | Cement purchased for producing AAC blocks have been measured using weighbridge |
| Frequency of monitoring/recording | Monitoring frequency: Every purchase of raw material<br>Recording frequency: Monthly |
| Value monitored | Period: **Cement Purchased(kt)**<br>01/01/2015 to 31/12/2015: 25.961<br>01/01/2016 to 31/12/2016: 26.293<br>01/01/2017 to 31/08/2017: 18.304 |
| Monitoring equipment | Electronic Weighbridge has been used to measure the parameter. |
| QA/QC procedures to be applied | The QA/QC of the parameter has been ensured by timely calibration of the weighbridge. |

| | |
|---|---|
| | Purchase data has also been used to cross verify the total raw material (cement) purchase from 3rd party sources. |
| Purpose of the data | This data has been used to calculate leakage. |
| Calculation method | This is a measured parameter. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | **$RMC_{cement,y}$** |
| Data unit | kT |
| Description | Quantity of cement consumed for producing AAC blocks in the year y |
| Source of data | Consumption records maintained at plant |
| Description of measurement methods and procedures to be applied | Cement consumed for producing AAC blocks have been measured using weighbridge |
| Frequency of monitoring/recording | Monitoring frequency: Batch-wise<br>Recording frequency: Daily |
| Value monitored | Period: **Cement Consumption(kt)**<br>25/11/2012 to 31/12/2012: 25.404<br>01/01/2013 to 31/12/2013: 30.795<br>01/01/2014 to 31/12/2014: 17.887 |
| Monitoring equipment | Electronic Weighbridge has been used to measure the parameter. |
| QA/QC procedures to be applied | The QA/QC of the parameter has been ensured by timely calibration of the weighbridge.<br>Purchase invoices have also been used to cross verify the total raw material (cement) purchase from 3rd party sources. |
| Purpose of the data | This data has been used to calculate leakage emission |
| Calculation method | This is a measured parameter. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | **$RMP_{flyash,y}$** |
| Data unit | kT |
| Description | Quantity of flyash purchased for producing AAC blocks in the year y |
| Source of data | Purchase records maintained at plant |

| | |
|---|---|
| Description of measurement methods and procedures to be applied | Flyash purchased for producing AAC blocks have been measured using weighbridge |
| Frequency of monitoring/recording | Monitoring frequency: Every purchase of raw material<br>Recording frequency: Monthly |
| Value monitored | Period: **Flyash Purchased(kt)**<br>01/01/2015 to 31/12/2015: 175.61<br>01/01/2016 to 31/12/2016: 212.52<br>01/01/2017 to 31/08/2017: 165.80 |
| Monitoring equipment | Electronic Weighbridge has been used to measure the parameter. |
| QA/QC procedures to be applied | The QA/QC of the parameter has been ensured by timely calibration of the weighbridge.<br><br>Purchase invoices have also been used to cross verify the total raw material (flyash) purchase from 3rd party sources. |
| Purpose of the data | This data has been used to calculate leakage emission |
| Calculation method | This is a measured parameter. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | **$RMC_{flyash,y}$** |
| Data unit | Kt |
| Description | Quantity of flyash consumed for producing AAC blocks in the year y |
| Source of data | Consumption records maintained at plant |
| Description of measurement methods and procedures to be applied | Flyash consumed for producing AAC blocks have been measured using weighbridge |
| Frequency of monitoring/recording | Monitoring frequency: Batch-wise<br>Recording frequency: Daily |
| Value monitored | Period: **Flyash Consumption(kt)**<br>01/01/2015 to 31/12/2015: 127.70<br>01/01/2016 to 31/12/2016: 126.77<br>01/01/2017 to 31/08/2017: 72.821 |
| Monitoring equipment | Electronic Weighbridge has been used to measure the parameter. |
| QA/QC procedures to be applied | The QA/QC of the parameter has been ensured by timely calibration of the weighbridge.<br><br>Purchase invoices have also been used to cross verify the total raw material (flyash) purchase from 3rd party sources. |
| Purpose of the data | This data has been used to calculate leakage emission |

| | |
|---|---|
| Calculation method | This is a measured parameter. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later |

| | |
|---|---|
| Data / Parameter | **$RMP_{Lime,y}$** |
| Data unit | Kt |
| Description | Quantity of Lime purchased for producing AAC blocks in the year y |
| Source of data | Purchase records maintained at plant |
| Description of measurement methods and procedures to be applied | Lime purchased for producing AAC blocks have been measured using weighbridge |
| Frequency of monitoring/recording | Monitoring frequency: Every purchase of raw material<br>Recording frequency: Monthly |
| Value monitored | **Period** \| **Lime Purchased(kt)**<br>01/01/2015 to 31/12/2015 \| 10.333<br>01/01/2016 to 31/12/2016 \| 9.965<br>01/01/2017 to 31/08/2017 \| 6.97 |
| Monitoring equipment | Electronic Weighbridge has been used to measure the parameter. |
| QA/QC procedures to be applied | The QA/QC of the parameter has been ensured by timely calibration of the weighbridge.<br>Purchase data has also been used to cross verify the total raw material (lime) purchase from 3rd party sources. |
| Purpose of the data | This data has been used to calculate leakage emission |
| Calculation method | This is a measured parameter. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | **$RMC_{Lime,y}$** |
| Data unit | Kt |
| Description | Quantity of lime consumed for producing AAC blocks in the year y |
| Source of data | Consumption records maintained at plant |
| Description of measurement methods and procedures to be applied | Lime consumed for producing AAC blocks have been measured using weighbridge |
| Frequency of monitoring/recording | Monitoring frequency: Batch-wise<br>Recording frequency: Daily |
| Value monitored | **Period** \| **Lime Consumption(kt)**<br>01/01/2015 to 31/12/2015 \| 10.797 |

| | |
|---|---|
| | 01/01/2016 to 31/12/2016: 10.300<br>01/01/2017 to 31/08/2017: 6.852 |
| Monitoring equipment | Electronic Weighbridge has been used to measure the parameter. |
| QA/QC procedures to be applied | The QA/QC of the parameter has been ensured by timely calibration of the weighbridge.<br>Purchase invoices have also been used to cross verify the total raw material (lime) purchase from 3rd party sources. |
| Purpose of the data | This data has been used to calculate leakage emission |
| Calculation method | This is a measured parameter. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | **$RMP_{gypsum,y}$** |
| Data unit | Kt |
| Description | Quantity of gypsum purchased for producing AAC blocks in the year y |
| Source of data | Purchase records maintained at plant |
| Description of measurement methods and procedures to be applied | Gypsum purchased for producing AAC blocks have been measured using weighbridge |
| Frequency of monitoring/recording | Monitoring frequency: Every Purchase of Raw Material<br>Recording frequency: Daily |
| Value monitored | **Period** / **Gypsum Purchased(kt)**<br>01/01/2015 to 31/12/2015: 1.004<br>01/01/2016 to 31/12/2016: 0<br>01/01/2017 to 31/08/2017: 0 |
| Monitoring equipment | Electronic Weighbridge has been used to measure the parameter. |
| QA/QC procedures to be applied | The QA/QC of the parameter has been ensured by timely calibration of the weighbridge.<br><br>Purchase data have also been used to cross verify the total raw material (gypsum) purchase from 3rd party sources. |
| Purpose of the data | This data has been used to calculate leakage emission |
| Calculation method | This is a measured parameter. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | **$RMC_{gypsum,y}$** |
| Data unit | Kt |

| | |
|---|---|
| Description | Quantity of gypsum consumed for producing AAC blocks in the year y |
| Source of data | Consumption records maintained at plant |
| Description of measurement methods and procedures to be applied | Quantity of Gypsum consumed for producing AAC blocks have been have been measured using weighbridge |
| Frequency of monitoring/recording | Monitoring frequency: Batch-wise<br>Recording frequency: Daily |
| Value monitored | Period: **Gypsum Consumption(kt)**<br>01/01/2015 to 31/12/2015: 1.085<br>01/01/2016 to 31/12/2016: 0.027<br>01/01/2017 to 31/08/2017: 0 |
| Monitoring equipment | Electronic Weighbridge has been used to measure the parameter. |
| QA/QC procedures to be applied | The QA/QC of the parameter has been ensured by timely calibration of the weighbridge.<br><br>Purchase invoices have also been used to cross verify the total raw material (gypsum) purchase from 3rd party sources. |
| Purpose of the data | This data has been used to calculate leakage emission |
| Calculation method | This is a measured parameter. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later |

| | |
|---|---|
| Data / Parameter | $RMP_{aluminiumpowder,y}$ |
| Data unit | Kt |
| Description | Quantity of Aluminium powder purchased for producing AAC blocks in the year y |
| Source of data | Purchase records maintained at plant |
| Description of measurement methods and procedures to be applied | Aluminium Powder purchased for producing AAC blocks have been have been measured using weighbridge |
| Frequency of monitoring/recording | Monitoring frequency: Every purchase of raw material<br>Recording frequency: Monthly |
| Value monitored | **Period** / **Aluminium Powder Purchased(kt)**<br>01/01/2015 to 31/12/2015: 0.106<br>01/01/2016 to 31/12/2016: 0.114<br>01/01/2017 to 31/08/2017: 0.077 |
| Monitoring equipment | Electronic Weighbridge has been used to measure the parameter. |

| | |
|---|---|
| QA/QC procedures to be applied | The QA/QC of the parameter has been ensured by timely calibration of the weighbridge.<br><br>Purchase data have also been used to cross verify the total raw material (aluminium) purchase from 3rd party sources. |
| Purpose of the data | This data has been used to calculate leakage emission |
| Calculation method | This is a measured parameter. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | **$RMC_{aluminiumpowder,y}$** |
| Data unit | Kt |
| Description | Quantity of aluminium powder consumed for producing AAC blocks in the year y |
| Source of data | Consumption records maintained at plant |
| Description of measurement methods and procedures to be applied | Quantity of aluminium powder consumed for producing AAC blocks have been have been measured using weighbridge |
| Frequency of monitoring/recording | Monitoring frequency: Batch-wise<br>Recording frequency: Daily |
| Value monitored | **Period** / **Aluminium Powder Consumption(kt)**<br>01/01/2015 to 31/12/2015 — 0.109<br>01/01/2016 to 31/12/2016 — 0.120<br>01/01/2017 to 31/08/2017 — 0.072 |
| Monitoring equipment | Electronic Weighbridge has been used to measure the parameter. |
| QA/QC procedures to be applied | The QA/QC of the parameter has been ensured by timely calibration of the weighbridge.<br><br>Purchase invoices have also been used to cross verify the total raw material (aluminium powder) purchase from 3rd party sources. |
| Purpose of the data | This data has been used to calculate leakage emission |
| Calculation method | This is a measured parameter. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | **$DG_y$** |
| Data unit | Litre |

| | |
|---|---|
| Description | Quantity of Diesel consumed in the plant in the year y |
| Source of data | Consumption records maintained at plant |
| Description of measurement methods and procedures to be applied | Quantity of diesel consumed are monitored based on diesel consumed and filled in the DG set. |
| Frequency of monitoring/recording | Monitoring frequency: Batch-wise/Every time Diesel is filled in the DG set<br>Recording frequency: Monthly |
| Value monitored | **Period** / **Consumption (litre)**<br>01/01/2015 to 31/12/2015 — 23958<br>01/01/2016 to 31/12/2016 — 13437<br>01/01/2017 to 31/08/2017 — 10432 |
| Monitoring equipment | Measuring Can/Drums are used to fill Diesel |
| QA/QC procedures to be applied | Purchase invoices have also been used to cross verify the total Diesel purchase from 3rd party sources.<br>The total Diesel purchased during the monitoring period is 48000 litre while consumed is 47827 litre. The difference is due to stock maintained at site. |
| Purpose of the data | This data has been used to calculate project emission |
| Calculation method | This is a measured parameter. |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| | |
|---|---|
| Data / Parameter | $D_{f,y}$ |
| Data unit | Km |
| Description | Return trip road distance between the origin and destination of freight transportation activity f in monitoring period m |
| Source of data | Purchase records |
| Description of measurement methods and procedures to be applied | This data has been measured using online maps and purchase invoices |
| Frequency of monitoring/recording | Monitoring frequency: Whenever road trip distance changes<br>Recording frequency: Whenever road trip distance changes |
| Value monitored | **Raw Mat.** / **From** / **To** / **Roundtrip Distance**[14]<br>Cement — Surat — Umargaon — 296<br>Flyash — Dahanu — Umargaon — 60 |

[14] *http://www.distancesfrom.com*

| | | | | |
|---|---|---|---|---|
| | Lime | Nagaur | Umargaon | 1946 |
| | Gypsum | Rajkot | Umargaon | 1143 |
| | Aluminium Powder | Nagpur | Umargaon | 1658 |
| | Coal | Mundra Port | Umargaon | 1483 |
| Monitoring equipment | Purchase invoices and online maps have been used to estimate the roundtrip distances. | | | |
| QA/QC procedures to be applied | This is a third party data. | | | |
| Purpose of the data | This data has been used to calculate leakage emissions. | | | |
| Calculation method | Roundtrip road travel distances calculated from online maps. | | | |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. | | | |

| | |
|---|---|
| Data / Parameter | $\mathbf{FR_{f,m}}$ |
| Data unit | Tonne |
| Description | Total mass of freight transported in freight transportation activity f in monitoring period m |
| Source of data | Purchase records |
| Description of measurement methods and procedures to be applied | This parameter has been measured through Raw material purchase invoices. Raw materials include (cement, flyash, limestone, gypsum & aluminium powder) |
| Frequency of monitoring/recording | Monitoring frequency: Continuously<br>Recording frequency: Monthly |
| Value monitored | |
| Monitoring equipment | 3rd party purchase invoices would be used to ascertain this parameter. |

| Period | Freight Type | Total Freight Transported |
|---|---|---|
| 01/01/2015 to 31/12/2015 | Cement | 7050.62 |
| | Flyash | 175611.41 |
| | Lime | 10333.52 |
| | Gypsum | 1004 |
| | Aluminium Powder | 106.59 |
| | Coal | 7050.62 |
| 01/01/2016 to 31/12/2016 | Cement | 5601.35 |
| | Flyash | 212521.85 |
| | Lime | 9965.61 |
| | Gypsum | 0 |
| | Aluminium Powder | 114.99 |
| | Coal | 1072 |
| 01/01/2017 to 31/08/2017 | Cement | 17880.28 |
| | Flyash | 155071.89 |
| | Lime | 6438.73 |
| | Gypsum | 0 |
| | Aluminium Powder | 70.62 |
| | Coal | 695 |

| | |
|---|---|
| QA/QC procedures to be applied | The data is a 3rd party data. |
| Purpose of the data | This data would be used to calculate leakage emissions. |
| Calculation method | Not Applicable |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. |

| Data / Parameter | **The vehicle class used** |
|---|---|
| Data unit | - |
| Description | The vehicle class used for freight transportation |
| Source of data | Transportation records |
| Description of measurement methods and procedures to be applied | Vehicle type (light/heavy) used for raw material transportation has been monitored based on road challan for raw material transported during each transportation activity. |
| Frequency of monitoring/recording | Monitoring frequency: Continuously<br>Recording frequency: Every receipt of raw materials at site |
| Value monitored | From the purchase records, it has been found that the raw materials have been transported in heavy vehicles |
| Monitoring equipment | Weigh bills and UNFCCC guidelines[15] are 3rd party sources of data |
| QA/QC procedures to be applied | The data is a 3rd party data. The value has been further confirmed with the weigh bridge slip generated for raw materials inward quantity. |
| Purpose of the data | This data has been used to determine leakage Emissions |
| Calculation method | Not Applicable |
| Comments | All data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later |

Calibration details for the parameters monitored are provided separately for each equipment along with documentary evidences to the DOE. Delayed calibration is observed for 15 days for the parameter of Electricity consumption and accordingly the ER sheet has been revised.

The details for Delayed calibration are as follows;

Electricity Meter No: 09512220

[15] *Project and leakage emissions from transportation of freight (EB70, Annex23, Version 01.1.0, Tool 12)* http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-12-v1.1.0.pdf

Calibration dates: 06-06-2016 and late calibration on 30-06-2017, thus there is a delay of 24 days and accordingly delay factor considering 0.5 class meter (error factor of 1.005) has been applied for 24 day electricity consumption.

## 3.3 Monitoring Plan

The monitoring plan involves structure for:

- Monitoring, recording and archiving of all data required for calculation of *ex-post* emission reduction from the project.
- Storing documents required for emission reduction calculations.
- Conducting/arranging calibration tests for monitoring equipment
- Ensuring quality of recorded data
- Co-ordinating with consultants and verifiers to submit monitored data to APX VCS Registry for verification

The monitoring team will be structured as follows:

| Position | Report to: |
|---|---|
| Operators | Plant head |
| Supervisor Managers (Technical/Maintenance) | |
| VCS monitoring project manager | |

Detailed responsibility of each member in the monitoring team is provided below:

| # | Tasks description | Operator(s) | Supervisor | Plant Manager | VCS monitoring project manager |
|---|---|---|---|---|---|
| Monitoring activity | | | | | |
| 1 | Recording of monitored data | ✓ | ✓ | | |
| Quality Assurance & Quality Control | | | | | |
| 2 | Verification of data monitored (consistency and completeness) | | ✓ | ✓ | |
| 3 | Ensuring adequate training of staff | | | ✓ | ✓ |
| 4 | Ensuring adequate maintenance | | ✓ | ✓ | ✓ |
| | Ensuring calibration of monitoring instruments | | ✓ | ✓ | ✓ |

| | | | | | |
|---|---|---|---|---|---|
| 5 | Data archiving: ensuring adequate storage of data monitored (integrity and backup) | | | ✓ | ✓ |
| 6. | Identification of non-conformance and corrective/preventive actions and monitoring plan improvement | | | ✓ | ✓ |
| 7 | Emergency procedures | | ✓ | ✓ | |
| Calculation of GHG emission reductions and reporting | | | | | |
| 8 | Processing of data and calculation of emission reductions | | | | ✓ |
| 9 | Monitoring report: management review of monitoring report (internal audit) | | | ✓ | ✓ |

**Data Collection & Storage:**

All data has been collected in paper log books and/or online data collection system and has been converted to spreadsheet form on an annual basis. It has been ensured that raw data would be stored for a minimum of 2 years after the end of the crediting period or last verification, whichever occurs later. In case there is any inconsistency on monitored data, the period will be removed from emission reduction crediting period, unless sufficiently reliable alternative methods are available and validated by external agencies appointed to verify monitoring report submitted to VCS Board.

**QA & QC Procedures followed:** All meters have been calibrated as per industry practices at regular intervals. Records of calibration certificates have been maintained for verification. The details of the calibrations have been provided below:

| Equipment | Serial Number | Accuracy Class |
|---|---|---|
| Weighbridge | 26/12-13 | III |
| Energy Meter | 09512220 | 0.5 for Active<br>1.0 for Reactive |

**Calibration Dates:** Calibration details are provided along with documentary evidences to the DOE.

**Emergency Preparedness:** In the event of emergency situations like non-functioning of equipments/instruments, the same has to be reported to Plant Head. The faulty equipment/instrument would be replaced with immediate effect. In the event of unavailability of the instrument, the emission

reductions for the concerned would not be considered and generation records for the aforesaid months would be adjusted with reference to the **GUIDELINES FOR ASSESSING COMPLIANCE WITH THE CALIBRATION FREQUENCY REQUIREMENTS**

# 4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

## 4.1 Baseline Emissions

Baseline emissions are quantified in line with paragraph 15 of the methodology ***AMS-III.Z Fuel Switch, process improvement and energy efficiency in brick manufacture (Version 04)***. as follows:

$$BE_y = EF_{BL} * P_{PJ,y}$$ ____Equation no. 1

Where:

| | | |
|---|---|---|
| $BE_y$ | $tCO_2e$ | The annual baseline emissions from fossil fuels displaced by the project activity in the year y |
| $EF_{BL}$ | $tCO_2/m^3$ | The annual production specific baseline emission factor |
| $P_{PJ,y}$ | $m^3$ | The annual net production of the facility in year y |

**For the project activity**

Annual Net Production of the facility from 01-01-2015 to 31-12-2015 =239399$m^3$
Annual Net Production of the facility from 01-01-2016 to 31-12-2016 =251334$m^3$
Annual Net Production of the facility from 01-01-2017 to 31-08-2017 =150900$m^3$
[16]Specific Baseline Emission Factor=0.3993 tCO2/$m^3$
As per Equation No.1Baseline Emissions for the aforesaid monitoring period has been calculated as:

| Period | Annual Production ($P_{PJ,y}$) | Specific Baseline EF $EF_{BL}$ | Baseline Emission $BE_y$ |
|---|---|---|---|
| | $m^3$ | $tCO_2/m^3$ | $tCO_2$ |
| 01-01-2015 to 31-12-2015 | 239399 | 0.3993 | 239399x0.3993=95,591 |
| 01-01-2016 to 31-12-2016 | 251344 | 0.3993 | 251334x0.3993=100357 |
| 01-01-2017 to 31-08-2017 | 150900 | 0.3993 | 150900x0.3993=60254 |

Baseline Emission ($BE_y$) for the monitoring period (01-Jan-2015 to 31-Aug-2017) = 2,56,202 $tCO_2e$

## 4.2 Project Emissions

Project emission sources relevant for this project are:

[16] http://www.faculty.ait.ac.th/visu/Prof%20Visu's%20CV/Books%20and%20research%20reports/BRICK%20AND%20CERAMIC.pdf

- **Project emissions from electricity consumption within the project boundary.**
- **Project emissions from coal consumption in the boiler for steam generation.**
- **Project emissions from diesel consumption in the DG set within project boundary.**

**Thus, Project Emission ($PE_y$) = $PE_{elec,y} + PE_{Coal,y} + PE_{Diesel,y}$**

- **Project emission from electricity consumption within the project boundary:**

Referring to, "***Tool to calculate baseline, project and/or leakage emission from electricity consumption, version no. 01***[17] the project emission from electricity consumption has been calculated as follows:

$$PE_{elec,y} = \sum_j EC_{PJ,j,y} * EF_{EL,j,y} * (1 + TDL_{j,y}) \quad \text{Equation 2}$$

Where:

| | | |
|---|---|---|
| $PE_{elec,y}$ | $tCO_2/yr$ | Project emissions due to electricity consumption in year y |
| $EC_{PJ,j,y}$ | MWh/yr | Quantity of electricity consumed by the project emission source j in year y |
| $FE_{EL,j,y}$ | $tCO_2/MWh$ | Emission factor for electricity generation for source j in year y |
| $TDL_{j,y}$ | % | Average technical transmission and distribution losses for providing electricity to source j in year y |

***For the project activity***

Quantity of electricity consumed by the project activity from 01-01-2015 to 31-12-2015 =1571.96MWh
Quantity of electricity consumed by the project activity from 01-01-2016 to 31-12-2016 =1606.67MWh
Quantity of electricity consumed by the project activity from 01-01-2017 to 31-08-2017 =1048.17MWh
[18]Emission factor for electricity generation for source j in year y=1.3
Average technical transmission and distribution losses for providing electricity to project=20%
As per the equation 2 as mentioned above

- **Project emissions from coal consumption in the boiler for steam generation.**

As per the tool, CO2 emission from fossil fuel combustion are calculated based on quantity of fuels combusted and the CO2 emission co-efficient of these fuels.
The applicable equation is:

$$PE_{FC,j,y} = \sum_i FC_{i,j,y} \times COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FF,y}$ | Are the CO2 emissions from fossil fuel combustion in process j during the year y (tCO2/yr) |

[17] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf (Version 01, EB 39, Annex-7, date 16-May-2008)
[18] *Tool to calculate baseline, project and/or leakage emission from electricity consumption, version no. 01(http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf(Version 01, EB 39, Annex-7, date 16-May-2008)*

| | |
|---|---|
| $FC_{i,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | Is the CO2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit) |

As per the tool, the $CO_2$ emission coefficient can be calculated using one of the options, depending on the availability of data.

- Option A: Based on the chemical composition of the fossil fuel type i
- Option B: Based on the net calorific value and the $CO_2$ emission factor of the fuel type i.

Based on availability of data, Option B has been used to calculate the $CO_2$ emission co-efficient as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where:

| | |
|---|---|
| $COEF_{i,y}$ | Is the CO2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit) |
| *NCVi*,y | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| *EFi*, *y* | Is the weighted average CO2 emission factor of fuel type i in year y (tCO2/GJ) |

**$PE_{Coal.y} = FC_{Coal.y} * COEF_{Coal.y}$** _____ **Equation 3**

***$COEF_{Coal, y} = NCV_{Coal, y} * EF_{Coal, y}$*** _____ **Equation 4**

**For the project activity**

Coal consumption for the period 01-01-2015 to 31-12-2015 = 5618.74 tonnes
Coal consumption for the period 01-01-2016 to 31-12-2016 = 6126.72 tonnes
Coal consumption for the period 01-01-2017 to 31-08-2017 = 3866.46 tonnes
Using equation 3 and equation 4

| Period | Coal Consumption | Weighted average net calorific value of coal | Weighted average CO2 emission factor of coal | Project Emissions from Coal Consumption |
|---|---|---|---|---|
| | Tonnes | TJ/kt | $tCO_2/TJ$ | $tCO_2$ |
| 01-01-2015 to 31-12-2015 | 5618.74 | 26 | 100 | 14,069 |
| 01-01-2016 to 31-12-2016 | 6126.72 | 26 | 100 | 15,930 |
| 01-01-2017 to 31-08-2017 | 3866.46 | 26 | 100 | 10,053 |

- **Project emissions from diesel consumption in the DG set within project boundary.**

As per the project emissions tool calculation, CO2 emission from fossil fuel combustion are calculated based on quantity of fuels combusted and the CO2 emission co-efficient of these fuels.
The applicable equation is:

$$PE_{FC,j,y} = \sum_{i} FC_{i,j,y} \times COEF_{i,y}$$

Where:

| | |
|---|---|
| $PE_{FF,y}$ | Are the CO2 emissions from fossil fuel combustion in process j during the year y (tCO2/yr) |
| $FC_{i,y}$ | Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr) |
| $COEF_{i,y}$ | Is the CO2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit) |

As per the tool, the $CO_2$ emission coefficient can be calculated using one of the options, depending on the availability of data.

- Option A: Based on the chemical composition of the fossil fuel type i
- Option B: Based on the net calorific value and the $CO_2$ emission factor of the fuel type i.

Based on availability of data, Option B has been used to calculate the $CO_2$ emission co-efficient as follows:

$$COEF_{i,y} = NCV_{i,y} \times EF_{CO2,i,y}$$

Where:

| | |
|---|---|
| $COEF_{i,y}$ | Is the CO2 emission coefficient of fuel type i in year y (tCO2/mass or volume unit) |
| *NCVi*,y | Is the weighted average net calorific value of the fuel type i in year y (GJ/mass or volume unit) |
| *EFi, y* | Is the weighted average CO2 emission factor of fuel type i in year y (tCO2/GJ) |

**$PE_{Diesel.y}$ = $DG_y$*$COEF_{Diesel.y}$*Density of Diesel** _____ **Equation 5**

***$COEF_{Diesel}$, y = $NCV_{Diesel}$, y * $EF_{Diesel}$, y*** _____ **Equation 6**

| | | |
|---|---|---|
| $PE_{Diesel.y}$ | $tCO_2/yr$ | Project emissions due to Diesel consumption in year y |
| DGy | TJ/Gg | Quantity of Diesel consumed by the project emission source j in year y |
| $COEF_{Diesel,y}$ | tCO2e/ TJ | Emission factor for Diesel generation for source j in year y |
| Density of Diesel | KG/litres | Density of Diesel |

**For the project activity**

Diesel consumption for the period 01-01-2015 to 31-12-2015 = 23,958 Litres
Diesel consumption for the period 01-01-2016 to 31-12-2016 = 13,437 Litres
Diesel consumption for the period 01-01-2017 to 31-08-2017 = 10,432 Litres
Using equation 5 and equation 6

| Period | Diesel Consumption | Weighted average net calorific value of Diesel | Weighted average CO2 emission factor of Diesel | Project Emissions from Diesel Consumption |
|---|---|---|---|---|
| | Litres | TJ/Gg | $tCO_2/TJ$ | $tCO_2$ |
| 01-01-2015 to 31-12-2015 | 23,958 | 43 | 74.1 | 68 |
| 01-01-2016 to 31-12-2016 | 13,437 | 43 | 74.1 | 39 |
| 01-01-2017 to 31-08-2017 | 10,432 | 43 | 74.1 | 30 |

**Total Project Emissions (PEy) for the monitoring period (01-01-2015 to 31-08- 2017) has been tabulated below:**

| Period | Project Emissions from electricity consumption within the project boundary | Project Emissions from Coal Consumption | Project Emissions from Diesel Consumption | Total Project Emissions from the Project Activity |
|---|---|---|---|---|
| | $tCO_2$ | $tCO_2$ | $tCO_2$ | $tCO_2$ |
| 01-01-2015 to 31-12-2015 | 2,453 | 14,609 | 68 | 17,130 |
| 01-01-2016 to 31-12-2016 | 2,507 | 15,930 | 39 | 18,476 |
| 01-01-2017 to 31-08-2017 | 1,636 | 10,053 | 30 | 11,719 |

## 4.3 Leakage

Leakage emission sources relevant for this project are:

- **Leakage emissions due to raw material production**
- **Leakage emission due to raw material transportation**

- **Leakage emissions due to raw material production**

Leakage emission due to raw material production has been calculated based on the formula:

$$LE_{rm,prod,y} = RMC_{cement,y} * COEF_{cement} + RMC_{lime,y} * COEF_{lime} + RMC_{gypsum,y} * COEF_{gypsum} + RMC_{aluminium,y} * COEF_{aluminium}$$ Equation 7

| | | |
|---|---|---|
| $LE_{rm,prod,y}$ | $tCO_2$ | Leakage emission from raw material production in the year y |
| $RMC_{cement,y}$ | kt | Quantity of cement consumed for producing AAC blocks in the year y |
| $COEF_{cement}$ | $tCO_2/kt$ | $CO_2$ emission factor of cement production |
| $RMC_{lime,y}$ | kt | Quantity of lime consumed for producing AAC blocks in the year y |
| $COEF_{lime}$ | $tCO_2/kt$ | $CO_2$ emission factor of lime production |
| $RMC_{gypsum,y}$ | kt | Quantity of gypsum consumed for producing AAC blocks in the year y |
| $COEF_{gypsum}$ | $tCO_2/kt$ | $CO_2$ emission factor of gypsum production |

| | | |
|---|---|---|
| $RMC_{aluminium,y}$ | kt | Quantity of aluminium powder consumed for producing AAC blocks in the year y |
| $COEF_{aluminium}$ | $tCO_2/kt$ | $CO_2$ emission factor of aluminium production |

Where:

**For the project activity:**

| Period | Freight Type | Raw Material consumed | Specific GHG Emissions | Leakage Emissions from Raw Material Production |
|---|---|---|---|---|
| 01-01-2015 to 31-12-2015 | **Raw Material** | **Tonnes** | **$tCO_2$/tonne of raw material** | **$tCO_2$** |
| | **Cement** | 25404.07 | 0.638 | **16,208** |
| | **Flyash** | 127709.47 | 0 | **0** |
| | **Lime** | 10797.43 | 0.75 | **8,099** |
| | **Gypsum** | 1085.17 | 0.01 | **11** |
| | **Al.Powder** | 109.96 | 1.7 | **187** |
| | **Coal** | 5618.74 | 0 | **0** |
| 01-01-2016 to 31-12-2016 | **Cement** | 30795.21 | 0.638 | **19,647** |
| | **Flyash** | 126776.34 | 0 | **0** |
| | **Lime** | 10300.67 | 0.75 | **7,725** |
| | **Gypsum** | 27.42 | 0.01 | **0.27** |
| | **Al. Powder** | 120.81 | 1.7 | **205** |
| | **Coal** | 6126.72 | 0 | **0** |
| 01-01-2017 to 31-08-2017 | **Cement** | 17887.12 | 0.638 | **11412** |
| | **Flyash** | 72821.14 | 0 | **0** |
| | **Lime** | 6851.93 | 0.75 | **5139** |
| | **Gypsum** | 0.00 | 0.01 | **0** |
| | **Al.Powder** | 72.00 | 1.7 | **123** |
| | **Coal** | 3866.46 | 0 | **0** |

- **Leakage emissions due to raw material transportation**

Leakage emission due to raw material transportation has been calculated based on the formula

Where:

$$LE_{rm,trans,y} = \sum_{f} D_{f,y} * FR_{f,y} * EF_{CO2,f} * 10^{-6}$$ _____Equation 8

**For the project activity**

| | | |
|---|---|---|
| $LE_{rm,trans,y}$ | $tCO_2$ | Leakage emission from road transportation of freight in monitoring period m |
| $D_{f,y}$ | km | Return trip road distance between the origin and destination of freight transportation activity f in monitoring period m |
| $FR_{f,m}$ | tonne | Total mass of freight transported in freight transportation activity f in monitoring period m |
| $EF_{CO2,f}$ | $gCO_2$/t-km | Default $CO_2$ emission factor for freight transportation activity f |
| F | | Freight transportation activities conducted in the project activity in monitoring period m |

| Period | Freight Type | Raw Material Transported | Total Roundtrip distance | Default $CO_2$ Emission Factor for Freight Transportation activity | Leakage Emissions from Raw Material Transportation |
|---|---|---|---|---|---|
| | **Raw Material** | **Tonnes** | **kms** | **$gCO_2$/t-km** | **$tCO_2$** |
| **01-01-2015 to 31-12-2015** | **Cement** | 25961.81 | 296 | 129 | 992 |
| | **Flyash** | 175611.41 | 60 | 129 | 1360 |
| | **Lime** | 10333.52 | 1946 | 129 | 2595 |
| | **Gypsum** | 1004.00 | 1143 | 129 | 149 |
| | **Al.Powder** | 106.59 | 1672 | 129 | 23 |
| | **Coal** | 7050.62 | 1483 | 129 | 1349 |
| **01-01-2016 to 31-12-2016** | **Cement** | 26293.91 | 296 | 129 | 1005 |
| | **Flyash** | 212521.85 | 60 | 129 | 1645 |
| | **Lime** | 9965.61 | 1946 | 129 | 2502 |
| | **Gypsum** | 0.00 | 1143 | 129 | 0 |
| | **Al. Powder** | 114.99 | 1672 | 129 | 25 |
| | **Coal** | 5601.35 | 1483 | 129 | 1072 |
| **01-Jan-2017 to 31 Aug-2017** | **Cement** | 18304.09 | 296 | 129 | 699 |
| | **Flyash** | 155071.89 | 60 | 129 | 1284 |
| | **Lime** | 6438.73 | 1946 | 129 | 1751 |
| | **Gypsum** | 0.00 | 1143 | 129 | 0 |
| | **Al.Powder** | 70.62 | 1672 | 129 | 17 |
| | **Coal** | 3628.5 | 1483 | 129 | 695 |

**Total Leakage Emissions (LEy) for the monitoring has been tabulated below:**

| Period | Leakage Emissions from Raw Material Production | Leakage Emissions from Raw Material Transportation | Total Leakage Emissions from the Project Activity |
|---|---|---|---|
| | $tCO_2$ | $tCO_2$ | $tCO_2$ |
| 1/1/2015 to 31/12/2015 | 24505 | 6468 | 30973 |

| | | | |
|---|---|---|---|
| 01/01/2016 to 31/12/2016 | 27581 | 6249 | 33830 |
| 01/01/2017 to 31/8/2017 | 16674 | 4446 | 21120 |

## 4.4 Net GHG Emission Reductions and Removals

| Period | Baseline emissions or removals ($tCO_2e$) | Project emissions or removals ($tCO_2e$) | Leakage emissions ($tCO_2e$) | Net GHG emission reductions or removals ($tCO_2e$) |
|---|---|---|---|---|
| **01/01/2015 to 31/12/2015** | 95,591 | 17,130 | 30,973 | 47,488 |
| **01/01/2016 to 31/12/2016** | 1,00,357 | 18,476 | 33,830 | 48,051 |
| **01/01/2017 to 31/08/2017** | 60,254 | 11,719 | 21,120 | 27,415 |
| **Total** | **2,56,202** | **47,325** | **85,923** | **1,22,954** |