Approved baseline methodology AM0033

"Use of non-carbonated calcium sources in the raw mix for cement processing"

Source

This baseline methodology is based on NM0123-rev "Methodology for use of non-carbonated calcium sources in the raw mix for cement processing" proposed by Lafarge Brasil, whose baseline study was prepared by Lafarge Brasil and ICF Consulting.

For more information regarding the proposal and its consideration by the Executive Board please refer to case NM0123-rev http://cdm.unfccc.int/goto/MPappmeth.

This methodology also refers to the latest version of the "Tool for the demonstration and assessment of additionality" agreed by the Executive Board and available at the UNFCCC website.[1]

Selected Approach from Paragraph 48 of the CDM Modalities and Procedures

"Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment"

Applicability

This methodology is applicable to project activities in the cement industry, to switch a part or all of the raw material used for clinker production to a non-carbonated calcium sources from limestone and clay that would otherwise continue to be used during the crediting period. The methodology is applicable to exiting plants as well as new facilities projects.

The methodology is applicable under the following conditions:

- CO_2 emissions reductions relate to CO_2 generated from decarbonisation of raw materials (typically $CaCO_3$ and $MgCO_3$) and are unrelated to the CO_2 emissions generated from fossil fuel burning;
- Raw materials (limestone and clay) used ~~as a raw material~~ for clinker production are partially or completely replaced by non-carbonated calcium sources~~, where non-carbonated raw materials availability in the region (defined as the area including at least the ten cement plants nearest to the plant of the project activity) or country is such that leakages in other uses of these non-carbonated raw materials will not occur;~~
- Type and quality of produced clinker remain the same in both baseline and project case;
- Non-carbonated raw materials are available in the region (defined as the area including at least the ten cement plants nearest to the plant of the project activity) or country is such that leakages due to displacement of other uses of these non-carbonated raw materials will not occur;
- ~~GHG emissions intensity from energy use for clinker production cannot increase with the implementation of the project activity~~

[1] Please refer to: http://cdm.unfccc.int/goto/MPappmeth

This baseline methodology shall be used in conjunction with the approved monitoring methodology AM0033 (Use of non-carbonated calcium sources in the raw mix for cement processing).

Identification of the Baseline Scenario

Two alternative scenarios ~~for non-carbonated calcium source~~ are identified:

- A continuation of current practice, i.e., a scenario in which the company continues cement production using the existing technology, fuel mix and raw materials. In case of greenfield projects, a scenario where the company uses raw materials from carbonated sources.
- Define a scenario in which traditional raw materials, limestone and clay, are partially substituted by non-carbonated calcium source. If relevant, develop different scenarios varying the degree~~s~~ of raw material switch from traditional ones. These scenarios should reflect all relevant policies and regulations.

The methodology determines the baseline scenario through one of the following analysis:
1: Selection of baseline scenario through financial analysis; or
2: Selection of baseline scenario through barrier analysis

1. Select baseline scenario through financial analysis

The following steps should be followed for baseline selection:

- Calculate the financial costs (e.g. capital and variable costs) and account cost savings due to net energy gains, if any, from project activity.
- A sensitivity analysis should be performed to assess the robustness of the selection of the most likely future scenario to reasonable variations in critical assumptions and to establish that the project is not the baseline. The financial indicator is calculated conservatively if assumptions tend to make the CDM project's indicators more attractive and the alternatives' indicators less attractive.
- The baseline scenario should take into account relevant national/local and sectoral policies and circumstances, and the proponent should demonstrate that the key factors, assumptions and parameters of the baseline scenario are conservative

2. Select baseline scenario through barriers analysis

Each non-carbonated calcium source should be assessed via the barriers analysis step of the latest version of the "Tool for the demonstration and assessment of additionality" agreed by the Executive Board and available at the UNFCCC website.

Additionality

The additionality of the project activity shall be demonstrated and assessed using the latest version of the "Tool for the demonstration and assessment of additionality" agreed by the Executive Board.

If the financial analysis is chosen project participants shall demonstrate that the use of non-carbonated calcium sources in the region or country is non-profitable using the net present value (NPV) analysis and explicitly state the following parameters:

- Investment requirements for raw material switching
- A discount rate appropriate to the country and sector
- Current price and projected price (variable costs) of non-carbonated calcium source;

- Revenues due to the substitution of limestone and clay by non-carbonated calcium source
- Lifetime of the project, equal to the remaining lifetime of the existing equipment(s)
- Cost savings accounting fuel consumption reduction due to energy gains of a non-occurrence of some chemical reactions that were expected in the regular way of clinker processing.

The project is additional if the NPV of the project activity is negative.
If the barriers analysis is chosen, the project participants shall demonstrate that the use of non-carbonated calcium sources in the region or country is the "first of its kind" and no project activity of this type is currently operational in the host country or region ("Region" is also defined here as the area including at least the ten cement plants nearest to the plant of the project activity.).

Project Boundary

The project boundary is defined as the clinker process where the raw material is substituted for production of clinker. Fuel and electricity used are considered outside the project boundary and are estimated in the leakage section.

Table 1: Emissions sources included or excluded from the project boundary

	Source	Gas	Included?	Justification / Explanation
Baseline	Transportation of raw materials from reserves to the plant	CO_2	Excluded	Not significant
		CH_4	Excluded	Not related
		N_2O	Excluded	Not related
	Decarbonation reaction	CO_2	Included	Main emission source
Project Activity	Transportation of raw materials from reserves to the plant	CO_2	Excluded	Not significant
		CH_4	Excluded	Not related
		N_2O	Excluded	Not related
	~~Energy required during decarbonation reaction~~	~~CO_2~~	~~Excluded~~	~~Positive effect but not directly measured.~~
		~~CH_4~~	~~Excluded~~	~~Not related~~
		~~N_2O~~	~~Excluded~~	~~Not related~~
	Decarbonation reaction	CO_2	Included	Main emission source
		CH_4	Excluded	Not related
		N_2O	Excluded	Not related

See leakage chapter for emissions sources included in leakage.

Baseline Emissions

- Reaction-based CO_2 Generation **–** the thermo chemical decomposition reaction involving decarbonation of the limestone of the raw mix (comprised of limestone and clay), producing CO_2 as an industrial process emission source ($CaCO_3 \xrightarrow{\Delta} CaO + CO_2$; i.e., the decarbonation reaction of one $CaCO_3$ molecule[2] generates one CaO molecule and one CO_2 molecule)

[2] The atomic weight of one molecule of: $CaCO_3$ is 100 (i.e., Ca atomic weight, 40 + C atomic weight, 12 + O atomic weight * 3, 48); CaO is 56 (i.e., Ca atomic weight, 40 + O atomic weight, 16); and CO_2 is 44 (i.e., C atomic weight, 12 + O atomic weight * 2, 32)

The calculation takes into account the percentage of the limestone and clay decarbonated. It takes into account that a certain amount of the limestone and clay will-become part of the clinker (CaO) and the rest will turn into CO_2.
The first step for determining the CO_2 emissions from the decarbonation reaction is to perform a lab analysis to identify the 'Loss of Ignition' (LOI)[3] of the raw mix, which quantifies the amount of CO_2 generated from one kilogram of the raw mix, based on a principle of difference in mass before and after the ignition process, corrected for moisture content. The size and frequency of sampling for this lab analysis should be statistically significant with an maximum uncertainty range of 20% at a 95% confidence level, and possible impurities in the raw mix should be monitored and reported so as to guarantee that the difference in mass can be attributed to CO_2 emissions only, or corrected otherwise.
The arithmetic mean of LOIs of the raw mix used during the year previous to project implementation (at least twelve monthly measurement campaigns) shall be used for defining the baseline emissions.

$$\mathbf{LOI = ((M_1 - M_2)/M_1)} \qquad \textbf{(1)}$$

Where:

M_1 - initial weight of dry sample in baseline scenario, kg
M_2 - residual weight of sample after heating in baseline scenario, kg
LOI – the amount of CO_2 per unit of raw mix in baseline scenario, $kgCO_2$/kg raw mix

~~Using the formulae presented above, we quantify the amount of CO_2 generated from one kilogram of the raw mix is quantified, based on the principle of difference in mass before and after the ignition process.~~

LOI is used, it is possible to determine 'coefficient raw mix/ clinker ($C_{rm/kk}$)', which defines the relation between the amounts of raw mix needed to produce a certain amount of clinker, as per the following formula:

$$C_{rm/kk} = \frac{1}{(1 - LOI)} \qquad \textbf{(2)}$$

Finally, applying the equations (1) and (2), the quantity of CO_2 emitted from decarbonation reaction per tonnes of clinker produced, is determined as follows:

$$Q_{co2} = LOI * C_{rm/kk} \qquad \textbf{(3)}$$

Where:

Q_{co2} – CO_2 emissions due to decarbonation reaction in baseline scenario, kg CO_2/kg clinker.
LOI – loss of ignition, $kgCO_2$/kg raw mix
$C_{rm/kk}$ – relation between raw mix and clinker, kg raw mix/kg clinker

For greenfield project, where samples can not be taken for establishing the baseline on the plant site as described above, one of the following approaches to determine the LOI may be chosen:

[3] LOI refers to a common and widely used method to estimate carbonate content of materials. The weight loss is measured by weighting the samples before and after heating (T > 900ºC) and is correlated to carbonated content.

Option 1: Lab analysis based on the sample obtained in the region in the baseline scenario

Under this Option, samples, to obtain the values for M_1 and M_2, are taken from the clinker production line (which may be owned by the same owner) with the highest performance in the region. The clinker production line sampled should use the same raw materials (limestone and clay) that is commonly used in the region and as in the identified baseline scenario and produces the same type and quality of clinker as done by the project activity. "Region" is defined as the area including at least the ten cement plants nearest to the plant of the project activity.

The historical information during the year previous to project implementation (previous to the proposed project implementation, at least twelve monthly measurements) shall be used if available. Alternatively, the ex post monitoring is carried out. The size and frequency of sampling for this lab analysis should be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level. Possible impurities in the raw mix should be monitored and reported so as to guarantee that the difference in mass can be attributed to CO_2 emissions only, or corrected otherwise.

The Lab analysis process is similarly conducted as described above.

Option 2: Lab analysis based on the sample obtained through authorized information

LOI is estimated as the average of LOIs from clinker production lines whose performance are among the top 5 or the top 20% and which has been put into operation most recently in the defined region. The LOI for each clinker production line is based on sampling procedure as defined above. "Region" is defined as the area including at least the ten cement plants nearest to the plant of the project activity. The properties of the clinker production lines are based on the recently published information provided by authorized or official documents.

The lab analysis shall be carried out by an or independent authorized entity. It shall be ensured that the composition of the sample of raw materials taken for each clinker production line is the same as that identified in the baseline scenario. The size and frequency of sampling for each production line should be statistically significant with a maximum uncertainty range of 20% at a 95% confidence level. Possible impurities in the raw mix should be monitored and reported so as to guarantee that the difference in mass can be attributed to CO_2 emissions only, or corrected otherwise. LOI is evaluated before the project implementation and will not be changed during the crediting period.

Project Emissions

Project emissions derive from the same source described above and use the same formulae to calculate the emissions:

Reaction-based CO_2 Generation **–** the thermo chemical decomposition reaction or decarbonation of the limestone of the raw mix (comprised of air-cooled slag, limestone and clay) produces CO_2 as an industrial process emission source ($CaCO_3 \xrightarrow{\Delta} CaO + CO_2$; i.e., the decarbonation reaction of one $CaCO_3$ molecule generates one CaO molecule and one CO_2 molecule)

Although the same basic chemical formula is used, less limestone needs to undergo decarbonation due to the replacement by non-carbonated calcium source resulting in lower CO_2 emissions.

As in the baseline case, the CO_2 emission calculation takes into account the percentage of the limestone and clay decarbonated with some minor modifications due to the use of non-carbonated calcium source. It also considers the fact that a certain amount of the limestone and clay will become part of the clinker (CaO) and the rest will turn into CO_2

'Loss of Ignition' (LOI) is determined by laboratory analysis, which quantifies the amount of CO_2 generated from one kilogram of the raw mix, based on a principle of difference in mass before and after the ignition process, corrected for moisture content. Here as before, the size and frequency of sampling for this lab analysis should be statistically significant with an maximum uncertainty range of 20% at a 95% confidence level, and possible impurities in the raw mix should be monitored and reported so as to guarantee that the difference in mass can be attributed to CO_2 emissions only, or corrected otherwise.

$$LOI^* = ((M_1^* - M_2^*)/M^*_1) \quad \textbf{(4)}$$

Where:

M_1^* - initial dry weight of sample for project activity, kg
M_2^* - residual weight of sample for project activity, kg
LOI^* – the amount of CO_2 per unit of raw mix for project activity, $kgCO_2$/kg raw mix

LOI^* is used to determine 'coefficient raw mix/ clinker ($C_{rm/kk}^*$)' using the equation below:

$$C^*_{rm/kk} = \frac{1}{(1 - LOI^*)} \quad \textbf{(5)}$$

Where:

$C^*_{rm/kk}$ – amount of raw mix necessary to produce one unit of clinker, kg rawmix/kg clinker

LOI^* – the amount of CO_2 per unit of raw mix for project activity, $kgCO_2$/kg raw mix

~~For determining the~~ CO_2 emission related to project activity, ~~equations (4) and (5) are used and the quantity of CO_2 emitted from decarbonation reaction per tonnes of clinker produced during project activity is~~ are calculated, as follows:

$$Q^*_{CO2} = LOI^* * C^*_{rm/kk} \quad \textbf{(6)}$$

Where:

Q^*_{CO2} – CO_2 emissions due to decarbonation reaction during project activity, kg CO_2/kg clinker.
LOI^* – loss of ignition, $kgCO_2$/kg raw mix
$C^*_{rm/kk}$ – relation between raw mix and clinker, kg raw mix/kg clinker

When the "Loss of Ignition" (LOI) in mass is attributed to CO_2 and water, such as thermal decomposition of calcium carbide residue (CCR), project participants may choose the following approaches to determine

the LOIs. For example, the $Ca(OH)_2$, the main component of the CCR is thermally decomposed at or above 580 °C and generates water by the following chemical reaction:
$Ca(OH)_2 \rightarrow CaO + H_2O$

Option 1: Measurement of mass of trapped CO_2

Formulae (4) and (5), formula (6) can also be expressed as follows:

$$Q^*_{CO2} = LOI^* * C^*_{rm/kk} = (M_1^* - M_2^*) / M_2^* \quad \textbf{(6.1)}$$

and

$$C^*_{rm/kk} = 1/(1 - LOI^*) = M_1^* / M_2^* \quad \textbf{(5.1)}$$

During the heating process of the lab analysis, generated gas (CO_2 mixed with H_2O) is captured and CO_2 in the captured gas is measured. In this case LOI^* is calculated by following formulae:

$$LOI^* = M_{CO2}^* / M_1^* \quad \textbf{(4.1)}$$

$$C^*_{rm/kk} = M_1^* / M_2^* \quad \textbf{(5.2)}$$

$$Q^*_{CO2} = M_{CO2}^* / M_2^* \quad \textbf{(6.2)}$$

Where:

M_{CO2}^* is the mass of CO_2 measured in the captured gas (CO_2 mixed with H_2O) generated during the LOI analysis

Option 2: Measurement of mass of trapped water

During the heating process of the lab analysis, water is trapped and measured, and then the trapped water is taken into account:

$$LOI^* = ((M_1^* - M_2^* - M_W^*)) / M_1^* \quad \textbf{(4.2)}$$

$$C^*_{rm/kk} = M_1^* / M_2^* \quad \textbf{(5.3)}$$

$$Q^*_{CO2} = ((M_1^* - M_2^* - M_W^*)) / M_2^* \quad \textbf{(6.3)}$$

Where:

M_W^* is the mass of water measured in the captured gas (CO_2 mixed with H_2O) generated during the LOI analysis

M_W^* may be calculated from the following formula:

$$M_W^* = M_1^* \times W_{CR} \times W_{CaOH} \times (18/74) \quad \textbf{(7)}$$

Where:

W_{CR} is the mass fraction of the CCR in the raw mix calculated based on plant operation data
W_{CaOH} is the mass fraction of Ca $(OH)_2$ in the CCR estimated using plant operation data
(18/74) is the ratio of molecular mass of H_2O and Ca $(OH)_2$

Leakage

Leakage emissions considered are CO_2 emissions from off-site transport of non-carbonated calcium source to the cement plant.

If GHG emissions intensity from energy use for clinker production increases with the implementation of the project activity, fuel consumption and electricity (from grid and self generation) consumption during the clinker process are considered as leakage emissions by the formula 8 below,

$$L_y = Q^t_{CO2} + Q_{fossil\_fuel,y} + Q_{ele\_grid\_CLINK,y} + Q_{ele\_sg\_CLINK,y} \qquad \textbf{(8)}$$

Where:

Q^t_{co2}	=	leakage from transport of non carbonated calcium source (tCO_2/yr)
$Q_{fossil\_fuel,y}$	=	leakage emission due to increase in energy use i in the year y (tCO_2e)
$Q_{ele\_grid\_CLINK,y}$	=	leakage emission due to increasse in grid electricity in the year y (tCO_2e/t clinker)
$Q_{ele\_sg\_CLINK,y}$	=	leakage emission due to increase in self generation electricity in the year y (tCO_2e/t) clinker.

Where leakage due to energy use and electricity consumption is negative, i.e. ($Q_{fossil\_fuel,y} + Q_{ele\_grid\_CLINK,y} + Q_{ele\_sg\_CLINK,y}$ y < 0), these leakages are considered as zero.

The emissions from transportation should be calculated as follows:

$$Q^t_{co_2} = \left[\left(\frac{Q_e}{q}\right) \times d_{me}\right] \times E_{co2} \Big/ 1000 \qquad \textbf{(9)}$$

Where:

Q^t_{co2}= leakage from transport of non carbonated calcium source (tCO2/yr)
Q_e= quantity of non carbonated calcium source (tonnes)
q = average truck or ship capacity (tonnes/truck or ship)
d_{me} average round-trip distance between the non-carbonated calcium source supply sites and the cement plant sites (km/truck or ship)

E_{co2}= emission factor from fuel use due to transportation (kg CO_2/km) estimated as:

Where:

$$Q_e = Q_{clinker,y} \times C_{rm/kk} \times \%_e \quad (10)$$

Where:

Q_e = quantity of non-carbonated calcium source, ton
$Q_{clinker,y}$ = quantity of clinker production in the year y (tonnes of clinker)
$C_{rm/kk}$ = Coefficient Raw mix/clinker
$\%_e$ = Percentage of non-carbonated calcium source in the raw mix', %

The leakage from the increase of fossil consumption is calculated as follows:

$$Q_{fossil\_fuel,y} = Q_{clinker,y} \times \sum_i (F_{P,i,y} - F_{b,i,y}) \times EF_{f,i,y} \quad (11)$$

Where:

~~$Q_{fossil\_fuel,y}$ = leakage emission due to energy use increase in the year y in tCO_2e.~~
$Q_{clinker,y}$ = quantity of clinker production in the year y (tonnes of clinker)
$F_{p,i,y}$ = fossil fuel of type i (coal or other fuel type "i") combusted in the project activity in the year y per unit clinker(tonnes of fuel/t clinker)
$F_{b,i,y}$ = fossil fuel of type i (coal or other fuel type "i") combusted in the baseline scenario ~~in the year y~~ per unit of clinker (tonnes of fuel/t clinker)
$EF_{f,i,y}$ = emission factor for emissions of coal or other fuel type "i" (tCO_2/tonnes of fuel).

The leakage from the increase of grid electricity is calculated as follows:

$$Q_{ele\_grid\_CLINK,y} = Q_{clinker,y} \times (E_{P,grid\_CLINK,y} - E_{b,grid\_CLINK,y}) \times EF_{grid\_CLINK,y} \quad (12)$$

Where:

~~$Q_{ele\_grid\_CLINK,y}$ leakage emission due to grid electricity increase in the year y in tCO_2e/t clinker~~.
$Q_{clinker,y}$ = quantity of clinker production in the year y (tonnes of clinker)
$E_{P,grid\_CLINK,y}$ = grid electricity consumption in the project activity in the year y per unit of clinker(MWh/t clinker)
$E_{b,grid\_CLINK,y}$ = grid electricity consumption in the baseline scenario ~~in the year y~~ per unit of clinker(MWh/t clinker)
$EF_{grid\_CLINK,y}$ = emission factor for emissions of grid electricity (tCO_2/MWh), which shall~~will~~ be calculated according to the latest version of ACM0002. In absence of data a conservative value of 1.3 t CO_2/mwh may be used.

The leakage from the increase of self generation electricity is calculated as follows:

$$Q_{ele\_sg\_CLINK,y} = Q_{clinker,y} \times (E_{P,sg\_CLINK,y} - E_{b,sg\_CLINK,y}) \times EF_{sg\_CLINK,y} \quad \textbf{(13)}$$

Where:

~~$Q_{ele\_sg\_CLINK,y}$~~	~~=~~	~~leakage emission due to self generation electricity increase in the year y in tCO_2e/t clinker.~~
$Q_{clinker,y}$	=	quantity of clinker production in the year y (tonnes of clinker)
$E_{P,sg\_CLINK,y}$	=	self generation electricity consumption in the project activity in the year y per unit of clinker(MWh~~t~~/t clinker)
$E_{b,sg\_CLINK,y}$	=	self generation electricity consumption in the baseline scenario ~~in the year y~~ per unit of clinker(MWh~~t~~/t clinker)
$EF_{sg\_CLINK,y}$	=	emission factor for emissions of self generation electricity (tCO_2/MWh), which will be calculated based on the operational record.

The emission factor for self generation ($EF_{sg\_CLINK,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2/MWh) of all self-generating sources in the project boundary serving the system.

$$EF_{sg\_CLINK,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} \quad \textbf{(14)}$$

Where:

$F_{i,j,y}$ = amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*,
j = *on-site* power sources,
$COEF_{i,j\,y}$ = CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and
$GEN_{j,y}$ = electricity (MWh) generated by the source *j*.

The CO_2 emission coefficient $COEF_i$ is obtained as:

$$COEF_i = NCV_i \cdot EF_{CO2,i} \quad \textbf{(15)}$$

Where:

NCV_i = net calorific value (energy content) per mass or volume unit of a fuel *i*,
$EF_{CO2,i}$ = CO2 emission factor per unit of energy of the fuel *i*.

For Greenfield projects, baseline electricity or fuel consumption per ton of clinker for baseline is estimated using one of the following options:

Option A:

Specific electricity or fuel consumption of the clinker production line (which may be owned by the same owner) with the highest performance in the region and which uses the raw materials (limestone and clay) in the baseline scenario and produces the same type and quality of clinker. “Region” is defined as the area including at least the ten cement plants nearest to the plant of the project activity.

Option B:

Average specific electricity or fuel consumption of the clinker production lines whose performance are among the top 5 or the top 20% and which has been put into operation most recently in the defined region. “Region” is defined as the area including at least the ten cement plants nearest to the plant of the project activity. The specific electricity and fuel consumption values are investigated based on the recently published information provided by authorized or official documents.

Emission Reduction

Project life-time emission reductions = ~~Σ_{yr} (Annual Emissions Reductions)~~ **(16)**

$$= \Sigma_{yr} [(Q_{CO2} - Q^{*}_{CO2}) - L_y]$$

where:

Q_{CO2} = baseline emissions, tons

Q^{*}_{CO2} = project emissions, tons

Q^{t}_{co2} = leakage emissions, tons of CO_2

Yr = project years

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For more information regarding the proposal and its consideration by the Executive Board please refer to case NM0123-rev http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html.

Applicability

This monitoring methodology shall be used in conjunction with the approved baseline methodology AM0033 (Use of non-carbonated calcium sources in the raw mix for cement processing). The same applicability conditions as in baseline AM0033 apply.

Project Emissions Parameters

All monitored data has to be archived for 2 years following the end of the crediting period.

ID number ***(Please use numbers to ease cross-referencing to table B.7)***	**Data variable**	**Source of data**	**Data unit**	**Measured (m), calculated (c) or estimated (e)**	**Recording frequency**	**Proportion of data to be monitored**	**How will the data be archived? (electronic/ paper)**	**Comment**
1	Percentage of non-carbonated calcium source used in raw mix	*Production Report*	%	M (on-site device)	Daily	100%	Electronic (project lifetime) and Paper (5y)	Monitoring data have to be archived for 2 years following the end of the crediting period.
2	LOI of raw mix[4]	*Quality Report*	%	C (Based on formula provided)	Monthly	100%	Electronic (project lifetime) and Paper (5y)	Monitoring data have to be archived for 2 years following the end of the crediting period.
3	Production of Clinker at the Plant	*Production Report*	Ton	M (Quantity of clinker produced)	Monthly	100%	Electronic (project lifetime) and Paper (5y)	Monitoring data have to be archived for 2 years following the end of the crediting period.
4	Clinker quality	*Quality Report*	%	M	Monthly	100%	Electronic (project lifetime) and Paper (5y)	Monitoring data have to be archived for 2 years following the end of the crediting period.

[4] The size and frequency of sampling for the lab analysis for calculating LOI should be statistically significant with an maximum uncertainty range of 20% at a 95% confidence level, and possible impurities in the raw mix should be monitored and reported so as to guarantee that the difference in mass can be attributed to CO_2 emissions only, or corrected otherwise.

Baseline Emission Parameters

All monitored data has to be archived for 2 years following the end of the crediting period.

ID number *(Please use numbers to ease cross-referencing to table B.7)*	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
5	Percentage of non-carbonated calcium source used in raw mix		%	M (on-site device)	Daily	100%	Electronic (project lifetime) and Paper (5y)	Monitoring data have to be archived for 2 years following the end of the crediting period.
6	LOI of raw mix[5]		%	C (based on formula provided)	Monthly during the twelve months previous to project implementation	100%	Electronic (project lifetime) and Paper (5y)	Monitoring data have to be archived for 2 years following the end of the crediting period.

Leakage

All monitored data has to be archived for 2 years following the end of the crediting period.

[5] The size and frequency of sampling for the lab analysis for calculating LOI should be statistically significant with an maximum uncertainty range of 20% at a 95% confidence level, and possible impurities in the raw mix should be monitored and reported so as to guarantee that the difference in mass can be attributed to CO2 emissions only, or corrected otherwise.

ID number *(Please use numbers to ease cross-referencing to table B.7)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
7	Quantity of non-carbonated calcium transported	-	tonnes	C	Monthly	100%	Electronic (project lifetime) and Paper (5y)	Monitoring data have to be archived for 2 years following the end of the crediting period.
8	Truck capacity	-	Tonnes /truck	C	Monthly	100%	Electronic (project lifetime) and Paper (5y)	-
9	Distance	-	Km/truck	C	Monthly	100%	Electronic (project lifetime) and Paper (5y)	In certain cases other means of transportation which require other formulas be used iod.
10	Emission factors	-	Kg CO_2eq per km	C	Monthly	100%	Electronic (project lifetime) and Paper (5y)	
11	Fossil fuel consumption in the project activity.		tonnes fuel/t clinker	C	Monthly	100%	Electronic (project lifetime) and Paper (5y)	
12	Fossil fuel consumption in the baseline scenario.		tonnes fuel/t clinker	C	Once /monthly	100%	Electronic (project lifetime) and Paper (5y)	based on historic data for existing plants or monitored ex post for new facilities
13	Average net calorific value		TJ/t or TJ/m^3	C	Once	100%	Electronic (project lifetime) and Paper (5y)	Default value and no change

ID number *(Please use numbers to ease cross-referencing to table B.7)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
14	Grid electricity consumption in the project activity		MWh/t clinker	C	Monthly	100%	Electronic (project lifetime) and Paper (5y)	
15	Grid electricity consumption in the baseline scenario		MWh/t clinker	C	Once	100%	Electronic (project lifetime) and Paper (5y)	based on historic data for existing plants or monitored ex post for new facilities
16	Emission factor of grid electricity		tCO_2eq per MWh	C	Yearly	100%	Electronic (project lifetime) and Paper (5y)	According to ACM0002
17	Self generation electricity consumption in the project activity		MWh/t clinker	C	Monthly	100%	Electronic (project lifetime) and Paper (5y)	
18	Self generation electricity consumption in the baseline scenario		MWh/t clinker	C	Once	100%	Electronic (project lifetime) and Paper (5y)	based on historic data for existing plants or monitored ex post for new facilities
19	Emission factor of Self generation electricity		tCO_2eq per MWh	C	Yearly	100%	Electronic (project lifetime) and Paper (5y)	According to operational data

ID number *(Please use numbers to ease cross-referencing to table B.7)*	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
20	$F_{i,j,y}$	Plant records	Tonnes of fuel i	M	Monthly	100%	Electronic	
21	$COEF_{i,j\ y}$	IPCC/ Plant records	tCO2/tonne of fuel i	C/M	Annually	100%	Electronic	
22	$GEN_{j,y}$	Plant records	MWh	M	Annually	100%	Electronic	

Where leakage due to energy fuel and electricity consumption is negative ($Q_{fossil\_fuel,y} + Q_{ele\_grid\_CLINK,y} + Q_{ele\_sg\_CLINK,y}$ y < 0), project participants should assume it equals 0.

Quality Control (QC) and Quality Assurance (QA) Procedures

Data	Uncertainty Level of Data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary
1	low	Accuracy of the balance used, following ISO9000 standards
2	low	Accuracy of the balance, following ISO9000 standards
3	low	Accuracy of the balance used, following the ISO9000 standards
4	low	X-rays diffraction, microscopy
5	low	Accuracy of the balance used, following ISO9000 standards
6	low	Accuracy of the balance, following ISO9000 standards
7	low	Accuracy of the balance used, following ISO9000 standards
8	low	Accuracy of the balance used, following ISO9000 standards
9	low	Accuracy of the balance used, following ISO9000 standards
10	low	Literature data should be used
11	low	Accuracy of the balance used, following ISO9000 standards
12	low	Accuracy of the balance used, following ISO9000 standards
13	low	Literature data should be used
14	low	Accuracy of the meter used, following ISO9000 standards
15	low	Accuracy of the meter used, following ISO9000 standards
16	low	Literature data should be used
17	low	Accuracy of the balance used, following ISO9000 standards
18	low	Accuracy of the balance used, following ISO9000 standards
19	low	Literature data should be used
20, 21, 22	Low-Medium	These data will be collected as part of normal plant level operations. QA/QC requirements consist of cross –checking these with other internal company reports. Local data and where applicable IPCC data will be used. Independent agency verification will also be used.