Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

TYPE III - OTHER PROJECT ACTIVITIES

Project participants shall take into account the general guidance to the methodologies, information on additionality, abbreviations and general guidance on leakage provided at http://cdm.unfccc.int/goto/SSCclar.

III.V. Decrease of coke consumption in blast furnace by installing dust/sludge recycling system in steel works

Technology/Measure:

1. This methodology comprises project activities which decrease coke consumption in a blast furnace of steel works by feeding direct reduced iron (DRI) pellet into the blast furnace. The DRI pellet is produced by dust/sludge-recycling system from dust/sludge[1] which is not currently utilized inside the works but sold outside and/or land filled;

2. The technology/measure covered by the methodology is dust/sludge-recycling system, which produces DRI pellet from dust/sludge. The system enables steel works to utilize the dust/sludge, which currently cannot be utilized inside the works. The examples of the system are Rotary Hearth Furnace (RHF), Waelz, and Primus;

3. This methodology is applicable under the condition that "Alternative Material"[2] that can be used by the "Outside User"[3] instead of the dust/sludge is abundant in the country/region demonstrated according to the following procedures:

Step 1: A list of possible Alternative Materials is prepared based on the historic and or present usage of materials by the outside user, relevant literature, and interview with experts.

Step 2: The supply situation for each type of possible Alternative Material k is assessed and the abundance of availability is demonstrated using one of the approaches below:

- Approach 1: Demonstrate that there is alternative material in the region of the project activity which is not fully utilized. For this purpose, demonstrate that the quantity of material is at least 25% larger than the quantity of dust/sludge that is being sold outside;

- Approach 2: Demonstrate that suppliers of Alternative Material in the region of the project activity are not able to sell all of their Alternative Materials. For this purpose, project participants shall demonstrate that a representative sample of suppliers of the Alternative Material in the region had a surplus of Alternative Material (e.g. at the end of the period during which Alternative Material is sold), which they could not sell and which is not utilized.

[1] Dust/sludge is material which is generated from steel making processes (e.g. coke oven, blast furnace, and converter).
[2] Alternative Material is defined as the material that can be used by the "Outside User" instead of dust/sludge after the project implementation.
[3] "Outside User" is defined as the entity which buys the dust/sludge from the steel works in the baseline.

4. This methodology is only applicable to the project activity implemented in existing steel works.

5. Measures are limited to those that result in emission reductions of less than or equal to 60 ktCO_2 equivalent annually.

Project Boundary

6. The project boundary is the physical, geographical site of the steel works where dust/sludge is generated and dust/sludge-recycling system is to be installed.

Baseline Emissions

7. The baseline scenario for the project activity is the situation where, in the absence of the project activity, no dust/sludge recycling system would be installed in the steel works and the dust/sludge, which currently cannot be utilized inside the works, would continue to be sold to outside user and/or land-filled.

8. Project participants shall apply steps 1-3 of the latest version of "Combined tool for identification of baseline scenario and demonstrate of additionality" to identify the baseline scenario. The methodology is only applicable if the identified baseline scenario is the continuation of current practice.

The plausible alternative scenarios shall include, but not limited to:

AS 1: Continuation of current practice (i.e., dust/sludge which is not currently utilized inside the works is sold to "outside users" and/or land filled)

AS 2: All the dust/sludge is recycled inside the steel works with dust/sludge recycling system (the proposed project activity undertaken without being registered as a CDM project activity)

AS 3: The dust/sludge is recycled inside the steel works without dust/sludge recycling system

9. The emission source in the baseline scenario is coke consumption in blast furnace. The project activity results in the decrease of coke consumption. The baseline emissions are determined as follows:

$$BE_y = BE_{coke,y} \quad \textbf{(1)}$$

Where:

BE_y Baseline emission in year y (tCO_2/year)

$BE_{coke,y}$ CO_2 emission associated with decreased coke consumption in the blast furnace due to the input of DRI pellet produced by the project activity in year y (tCO_2/year)

10. If the production output of the blast furnace (i.e., pig iron) generated in year y is larger than the average of historical production output of the three most recent years (excluding abnormal

years) before the implementation of the project activity, then the baseline emission shall be discounted as follows:

$$BE_y = BE_{coke,y} * \left(\frac{Q_{pig\ iron,HY}}{Q_{pig\ iron,y}} \right) \tag{2}$$

Where:

$Q_{pig\ iron,HY}$	The average quantity of pig iron production of the most recent three years (excluding abnormal years) before the implementation of the project activity (t-pig/year)
$Q_{pig\ iron,y}$	The quantity of pig iron production in year y (t-pig/year).

11. $BE_{coke,y}$ is determined as follows:

$$BE_{coke,y} = \Delta Q_{coke,y} * NCV_{coke} * EF_{CO_2,coke} \tag{3}$$

Where:

$\Delta Q_{coke,y}$	Decreased quantity of coke consumption in the blast furnace due to the input of DRI pellet produced by the project activity in year y (t-coke/year)
NCV_{coke}	Net calorific value of coke (TJ/t-coke).
$EF_{CO_2,coke}$	CO_2 emission factor of coke (tCO_2/TJ).

12. $\Delta Q_{coke,y}$ is determined as the lower of the following:

(a) Value determined by actual measurement (see paragraph 13 for details);

(b) Value estimated (see paragraph 14 for details).

13. For the case of actual measurement $\Delta Q_{coke,y}$ is determined as below:

$$\Delta Q_{coke,y} = \left(\frac{Q_{coke,HY}}{Q_{pig\,iron,HY}} \right) * Q_{pig\,iron,y} - Q_{coke,PJ,y} \tag{4}$$

Where:

$Q_{coke,HY}$	The average quantity of coke consumption of the most recent three years,(excluding abnormal years) before the implementation of the project activity (t-coke/year)

$Q_{pig\ iron,HY}$	The average quantity of pig iron production of the most recent three years (excluding abnormal years) before the implementation of the project activity (t-pig/year)
$Q_{pig\ iron,y}$	The quantity of pig iron production in year *y* (t-pig/year)
$Q_{coke,PJ,y}$	The coke consumption in year *y* after the implementation of the project activity (t-coke/year)

14. The estimation approach determines $\Delta Q_{coke,y}$ from the following formula:

$$\Delta Q_{coke,y} = Q_{DRI,y} * DQ_{coke,y} = Q_{DRI,y} * F_{Fe\_DRI,y} * DQ_{c,y} / F_{c\_coke,y} \quad \textbf{(5)}$$

Where:

$Q_{DRI,y}$	Quantity of DRI pellet fed into the blast furnace in year *y* (t-DRI/year)
$DQ_{coke,y}$	Decreased quantity of coke consumption by feeding one ton of DRI pellet into the blast furnace in year *y* (t-coke/t-DRI)
$F_{Fe\_DRI,y}$	Fraction of metallic iron in DRI pellet produced by the project activity in year *y* (t-Fe/t-DRI)
$DQ_{c,y}$	Decreased quantity of carbon fed into the blast furnace by feeding one ton of metallic iron into the blast furnace in year *y* (t-C/t-Fe)
$F_{c\_coke,y}$	Fraction of carbon in coke fed into the blast furnace in year *y* (t-C/t-coke)

Where $DQ_{c,y}$ is determined as follows:

(a) For the *ex ante* estimation of the emission reductions, 0.3 (t-C/t -Fe) shall be used;

(b) For the *ex post* estimation of the emission reductions, $DQ_{c,y}$ is calculated from the formula below. If the calculated figure is larger than 0.3 (t-C/t -Fe), project participants shall adopt 0.3 (t-C/t-Fe) to be conservative.

$$DQ_{c,y} = \left(Q_{before,c} - Q_{after,c,y}\right) * Q_{after,pig,y} / \left(Q_{after,DRI,y} * F_{after,Fe\_DRI,y}\right) \quad \textbf{(6)}$$

Where:

$Q_{before,c}$	The quantity of carbon fed into blast furnace to produce one ton of pig iron before DRI input into the blast furnace (t-C/t-pig)
$Q_{after,c,y}$	The quantity of carbon fed into blast furnace to produce one ton of pig iron after DRI input into the blast furnace in year *y* (t-C/t-pig)
$Q_{after,pig,y}$	The amount of pig iron produced in year *y* (t-pig/year)

$Q_{after,DRI,y}$	The amount of DRI pellet fed into the blast furnace in year *y* (t-DRI/year)
$F_{after,Fe\_DRI,y}$	Fraction of metallic iron in DRI pellet fed into the blast furnace in year *y* (t-Fe/t-DRI)

Project activity emissions

15. The emission sources in the project activity consist of CO_2 emission from electricity and fuel consumption by dust/sludge recycling system. In case the project activity utilizes the dust/sludge that would have been landfilled in the absence of the project activity, CO_2 emission from the carbon contained in the dust/sludge should also be included in the project emission calculations.

$$PE_y = PE_{ele,y} + PE_{fuel,y} + PE_{DS,y} \quad \textbf{(7)}$$

Where:

PE_y	Project emission in year *y* (tCO_2/year)
$PE_{ele,y}$	CO_2 emission associated with electricity consumption by dust/sludge recycling system (tCO_2/year)
$PE_{fuel,y}$	CO_2 emission associated with fuel consumption by dust/sludge recycling system (tCO_2/year)
$PE_{DS,y}$	CO_2 emission associated with the carbon contained in the dust/sludge which would have been landfilled in the absence of the project activity (tCO_2/year)

16. $PE_{ele,y}$ is calculated based on the latest version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".

17. $PE_{fuel,y}$ is calculated from the following methods:

(a) If the fuel used by the dust/sludge recycling system is fossil fuel, the latest version of "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" is used to determine the CO_2 emissions;

(b) If the fuel used by the dust/sludge recycling system is off gas generated from the steel making process such as coke oven gas (COG) and blast furnace gas (BFG), the CO_2 emission is determined as follows:

(i) In case the dust/sludge recycling system uses the off gas which would not be used for any purpose but be flared in the absence of the project activity, $PE_{fuel,y}$ is zero;

(ii) In case the dust/sludge recycling system uses the off gas, which would be used by other steel making processes as a fuel in the absence of the project activity.[4] $PE_{fuel,y}$ is calculated as follows:

$$PE_{fuel,y} = Q_{OG,y} * NCV_{OG} * EF_{CO2,FF} \quad \textbf{(8)}$$

Where:

$Q_{OG,y}$	Quantity of the off gas consumed by the dust/sludge recycling system in year *y* (Nm^3/year)
NCV_{OG}	Net calorific value of the off gas consumed by the dust/sludge recycling system (TJ/Nm^3)
$EF_{CO2,FF,y}$	CO_2 emission factor of the fossil fuel that would be used (instead of the off gas) by the other steel making processes which currently use the off gas as a fuel in year *y* (tCO_2/TJ)

18. $PE_{DS,y}$ is calculated from the formula below:

$$PE_{DS,y} = Q_{DS,LF,y} * CC_{DS} * 44/12 \quad \textbf{(9)}$$

Where:

$Q_{DS,LF,y}$	Quantity of the dust/sludge which would be landfilled in the absence of the project activity in year *y* on a dry weight basis (t-dry-ds /year). This is calculated based on the procedure described in the paragraph 19
CC_{DS}	Carbon content of the dust/sludge which would be landfilled in the absence of the project activity on a dry weight basis (t-C/t-dry-ds). This should be determined as the average of the carbon content of the dust/sludge which was landfilled for the most recent three years prior to the implementation of the project activity

19. $Q_{DS,LF,y}$ is determined conservatively as the maximum of the two values below under 19(a) and 19(b):

(a) The average of the historical annual quantity of the dust/sludge which was landfilled for the most recent three years prior to the implementation of the project activity;

$$Q_{DS,LF,y} = \left(Q_{DS,LF,n} + Q_{DS,LF,n-1} + Q_{DS,LF,n-2}\right)/3 \quad \textbf{(10)}$$

[4] It is assumed here that the consumption of the off gas by the project activity results in increased fossil fuel consumption by existing steel making process which currently uses the off gas as a fuel.

Where:

$Q_{DS,LF,n}$ Historical annual quantity of the dust/sludge which was landfilled in year *n* on a dry weight basis (t-dry-ds /year)

n Year prior to the implementation of the project activity

(b) The total dust/sludge generated from the steel works in year y multiplied with the average historical fraction of dust/sludge, which was landfilled for the most recent three years prior to the implementation of the project activity.

$$Q_{DS,LF,y} = Q_{DS,total,y} * \left(Q_{DS,LF,n} / Q_{DS,total,n} + Q_{DS,LF,n-1} / Q_{DS,total,n-1} + Q_{DS,LF,n-2} / Q_{DS,total,n-2}\right)/3 \quad \textbf{(11)}$$

Where:

$Q_{DS,total,y}$ Total annual quantity of the dust/sludge generated from the steel works in year y on a dry weight basis (t-dry-ds/year)

$Q_{DS,LF,n}$ Historical annual quantity of the dust/sludge which was landfilled in year *n* on a dry weight basis (t-dry-ds/year)

$Q_{DS,total,n}$ Historical total annual quantity of the dust/sludge generated from the steel works in year *n* on a dry weight basis (t-dry-ds/year)

n Year prior to the implementation of the project activity

Leakage

20. If the equipment of dust/sludge recycling system is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered.

21. If the dust/sludge is sold to “Outside User” for thermal application, the use of alternative material to replace the dust/sludge by the “Outside User” after the project implementation will lead to CO_2 emission as the dust/sludge contains carbon. This CO_2 emission needs to be considered as leakage. The amount of leakage emission can be assumed to be the same as the amount of CO_2, which would have been emitted from the dust/sludge in the absence of the project activity.

22. Even if the dust/sludge is sold to “Outside User” as an iron source, in the case that the alternative material, identified in accordance with the approach stipulated in the paragraph 3, contains certain amount of carbon, the CO_2 emission due to the use of the alternative material by “Outside User” needs to be considered as leakage.

Emission reductions

23. Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y \quad \textbf{(12)}$$

Where:

ER_y	Emission reductions in year *y* (t CO_2e/yr)
BE_y	Baseline emissions in year *y* (t CO_2e/yr)
PE_y	Project emissions in year *y* (t CO_2/yr)
LE_y	Leakage emissions in year *y* (t CO_2/yr)

Monitoring

24. Parameters that are obtained prior to the project activity:

(a) $Q_{pig\,iron,HY}$: The average quantity of pig iron production of the most recent three years (excluding abnormal years) before the implementation of the project activity (t-pig/year); extreme values are to be excluded from the available values of output rate,

(b) NCV_{coke} : Net calorific value of coke (TJ/t-coke). Reliable local or national data shall be used; 2006 IPCC default values should be used only when country or project specific data are not available or difficult to obtain.

(c) $EF_{CO2,coke}$: CO_2 emission factor of coke (tCO_2/TJ). Reliable local or national data shall be used; 2006 IPCC default values should be used only when country or project specific data are not available or difficult to obtain.

(d) $Q_{coke,HY}$: The average quantity of coke consumption of the most recent three years (excluding abnormal years) before the implementation of the project activity (t-coke/year);

(e) $Q_{before,c}$: The quantity of carbon fed into blast furnace to produce one ton of pig iron before DRI input into the blast furnace during the period of the one-month *ex ante* monitoring (t-C/t-pig);

25. Parameters that should be monitored every year during the crediting period:

(f) $Q_{pig\,iron,y}$: The quantity of pig iron production in year y (t-pig/year);

(g) $Q_{coke,PJ,y}$: The coke consumption in year *y* after the implementation of the project activity (t-coke/year);

(h) $Q_{DRI,y}$: Quantity of DRI pellet fed into the blast furnace in year *y* (t-DRI/year);

(i) $F_{Fe\_DRI,y}$: Fraction of metallic iron in DRI pellet produced by the project activity in year *y* (t-Fe/t DRI). For example this parameter can be measured by conducting fluorescent X-ray analysis in laboratory;

(j) $F_{c\_coke,y}$: Fraction of carbon in coke fed into the blast furnace in year *y* (t-C/t-coke). This parameter can be measured by conducting chemical analysis in laboratory;

(k) $Q_{after,c,y}$: The quantity of carbon fed into blast furnace to produce one ton of pig iron after DRI input into the blast furnace during the period of the one-month *ex post* monitoring in year *y* (t-C/t-pig). ;

(l) $Q_{after,pig,y}$: The amount of pig iron produced during the period of the one-month *ex post* monitoring in year *y* (t-pig/month);

(m) $Q_{after,DRI,y}$: The amount of DRI pellet fed into the blast furnace during the period of the one-month *ex post* monitoring in year *y* (t-DRI/month);

(n) $F_{after,Fe\_DRI,y}$: Fraction of metallic iron in DRI pellet fed into the blast furnace during the period of the one-month *ex post* monitoring in year *y* (t-Fe/t-DRI). This parameter can be measured by conducting fluorescent X-ray analysis in laboratory;

26. For the determination of project activity emission, the following parameters should be monitored. In addition, the monitoring parameters stipulated in the latest version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" need to be monitored, if applicable.

a) Parameters that are obtained prior to the project activity:

(a) NCV_{OG}: Net calorific value of the off gas consumed by the dust/sludge recycling system (TJ/Nm^3);

(b) CC_{DS}: Carbon content of the dust/sludge which would be landfilled in the absence of the project activity on a dry weight basis (t-C/t-dry-ds);

(c) $Q_{DS,LF,n}$ Historical annual quantity of the dust/sludge which was landfilled in year *n* on a dry weight basis (t-dry-ds /year);

(d) $Q_{DS,total,n}$: Historical total annual quantity of the dust/sludge generated from the steel works in year *n* on a dry weight basis (t-dry-ds/year).

b) Parameters that should be monitored every year during the crediting period:

(e) $Q_{OG,y}$: Quantity of the off gas consumed by the dust/sludge recycling system in year y (Nm^3/year) (if applicable);

(f) $EF_{CO2,FF,y}$: CO_2 emission factor of the fossil fuel to be used instead of the off gas by the other steel making processes which currently use the off gas as a fuel in year *y* (tCO_2/TJ) (if applicable). Reliable local or national data shall be used; 2006 IPCC default values should be used only when country or project specific data are not available or difficult to obtain. The project participants shall identify the type of fossil fuel through the monitoring activity stipulated in the paragraph 17. In the case that it is difficult to identify the type of alternative fossil fuel, project participants shall monitor all types of the fossil fuel that are used by the steel making processes which are currently consuming the off gas. Project participants should assume that the alternative fuel is the fossil fuel with the highest CO_2 emission factor;

(g) $Q_{DS,total,y}$: Total annual quantity of the dust/sludge generated from the steel works in year *y* on a dry weight basis (t-dry-ds/year).

Project activity under a programme of activities

The proposed methodology is not applicable to project activities under a programme of activities.

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