Annex 16

A/R Methodological tool

"Estimation of direct nitrous oxide emission from nitrogen fertilization"

(Version 01)

I. SCOPE, APPLICABILITY AND PARAMETERS

Scope

This tool allows for estimating direct nitrous oxide emission from applying nitrogenous fertilizer within project boundary of an A/R CDM project activity[1], for both *ex ante* and *ex post* estimation.

Applicability

This tool is not applicable when:

- A/R CDM project activities are implemented on wetlands;
- Flooding irrigation or any flood has occurred within period of 3 months from date of fertilization.

Parameters

This tool provides procedures to determine the following parameter:

Parameter	SI Unit	Description
$N_2O_{direct-N,t}$	t-CO2-e	Direct N_2O emission as a result of nitrogen application within the project boundary in year t

II. PROCEDURES

This tool can be used for both ex ante and ex post estimation of the nitrous oxide emissions from

[1] As per the EB decision (EB 26 para 50, http://cdm.unfccc.int/EB/026/eb26rep.pdf):
(a) Only direct (e.g. volatilization), and not indirect (e.g. run-off), emissions of N_2O from application of fertilizers within the project boundary shall be accounted for in A/R project activities.
(b) If the only source of N_2O emissions, which is located outside the project boundary is due to the application of fertilizer in nurseries supplying seedlings to the A/R project activity, then these N_2O emissions (either direct or indirect), may be considered as negligible.

nitrogenous fertilizer application within the boundary of an A/R CDM project activity. For *ex post* estimation purposes, activity data (quantities and nitrogen content of synthetic and organic nitrogen fertilizers) are monitored. As PPs may use various types of fertilizers, it is important to identify and record the fertilizer types applied and their nitrogen content. The direct nitrous oxide emissions from nitrogen fertilization can be estimated using equations as follows:

$$N_2O_{direct-N,t} = (F_{SN,t} + F_{ON,t}) \cdot EF_1 \cdot MW_{N_2O} \cdot GWP_{N_2O} \quad \textbf{(1)}$$

$$F_{SN,t} = \sum_i^I M_{SFi,t} \cdot NC_{SFi} \cdot (1 - Frac_{GASF}) \quad \textbf{(2)}$$

$$F_{ON,t} = \sum_j^J M_{OFj,t} \cdot NC_{OFj} \cdot (1 - Frac_{GASM}) \quad \textbf{(3)}$$

Where:

$N_2O_{direct-N,t}$	Direct N_2O emission as a result of nitrogen application within the project boundary, t-CO_2-e in year t
$F_{SN,t}$	Mass of synthetic fertilizer nitrogen applied adjusted for volatilization as NH_3 and NO_X, t-N in year t
$F_{ON,t}$	Mass of organic fertilizer nitrogen applied adjusted for volatilization as NH_3 and NO_X, t-N in year t
$M_{SFi,t}$	Mass of synthetic fertilizer type i applied, tonne in year t
$M_{OFj,t}$	Mass of organic fertilizer type j applied, tonne in year t
EF_1	Emission Factor for emissions from N inputs, tonne-N_2O-N (t-N input)$^{-1}$
$Frac_{GASF}$	Fraction that volatilises as NH_3 and NO_X for synthetic fertilizers, dimensionless
$Frac_{GASM}$	Fraction that volatilises as NH_3 and NO_X for organic fertilizers, dimensionless
MW_{N_2O}	Ratio of molecular weights of N_2O and N (44/28), tonne-N_2O (t-N)$^{-1}$
GWP_{N2O}	Global Warming Potential for N_2O, kg-CO_2-e (kg-N_2O)$^{-1}$ (IPCC default = 310, valid for the first commitment period)
NC_{SFi}	Nitrogen content of synthetic fertilizer type i applied, g-N (100 g fertilizer)$^{-1}$
NC_{OFj}	Nitrogen content of organic fertilizer type j applied, g-N (100 g fertilizer)$^{-1}$
I	Number of synthetic fertilizer types

J Number of organic fertilizer types

As noted in IPCC 2006 Guidelines (table 11.1), the default emission factor (EF_1) is 1% of applied N, and this value should be used when country-specific factors are unavailable. The default values for the fractions of synthetic and organic fertilizer nitrogen that are emitted as NO_X and NH_3 are 0.1 and 0.2 respectively in 2006 IPCC Guidelines (Table 11.3). Project participants may use emission factors from the peer reviewed scientific literature that are specific for the project area.

Data and parameters <u>not</u> monitored

Data / Parameters	Data unit	Descriptions	Vintage	Sources	Measurement procedures (if any)	Comments
EF_1	t-N_2O-N (t-N input)$^{-1}$	Emission Factor for emissions from N inputs	Most updated	Country-specific data, IPCC		
$Frac_{GASF}$	Dimensionless	The fraction that volatilises as NH_3 and NO_X for synthetic fertilizers	Most updated	Country-specific data, IPCC		
$Frac_{GASM}$	Dimensionless	The fraction that volatilises as NH_3 and NO_X for organic fertilizers	Most updated	Country-specific data, IPCC		
$F_{SN,t}$	t-N yr^{-1}	Mass of synthetic fertilizer nitrogen applied adjusted for volatilization as NH_3 and NO_X	Annually	Estimated		
$F_{ON,t}$	t-N yr^{-1}	Mass of organic fertilizer nitrogen applied adjusted for volatilization as NH_3 and NO_X	Annually	Estimated		
NC_{SFi}	g-N (100 g fertilizer)$^{-1}$	Nitrogen content of synthetic fertilizer type i applied	Before the project starts	Producers of synthetic fertilizer purchased and used	Keep record of nitrogen content from producers	If producers do not provide data of nitrogen content, the nitrogen content should be determined by qualified lab.

Data / Parameters	Data unit	Descriptions	Vintage	Sources	Measurement procedures (if any)	Comments
NC_{OFj}	g-N (100 g fertilizer)$^{-1}$	Nitrogen content of organic fertilizer type j applied	Before the project starts	Organic fertilizer manufacturer, or determination in lab	Standard lab procedures	

Data and parameters monitored

Data / parameter:	Data unit	Description	Source of data	Measurement procedures (if any)	Monitoring frequency	QA/QC procedures	Comments
$M_{SFi,t}$	t	Mass of synthetic fertilizer type i applied in year t	Record of synthetic fertilizer purchased and used	Keep record of quantities purchased and used	Annually	Cross check with synthetic fertilizer purchased and quantity used and total area applied at project level.	
$M_{OFj,t}$	t	Mass of organic fertilizer type j applied in year t	Record of organic fertilizer purchased and/or used	Keep record of quantities purchased and/or used	Annually	Cross check with organic fertilizer purchased and quantity used and total area applied at project level.	

History of the document

Version	Date	Nature of revision(s)
01	EB 33, Annex 16 27 July 2007	Initial adoption