CDM: Proposed new methodology expert form (version 04)

(To be used by methodology experts providing desk review for a proposed new methodology)

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Related F-CDM-NM document ID number	NM 0121

Note to those completing this form, as applicable: Please provide recommendations on the proposed new baseline and monitoring methodologies based on an assessment of CDM-NMB and CDM-NMM and of their application in sections A to E of the draft CDM-PDD, desk reviews and public input. Please ensure that the form is entirely filled and that arguments and expert judgements are substantiated.

A. Evaluation of the proposed new methodologies by desk reviewers:

I. Evaluation of the proposed new baseline methodology:

Title of new baseline methodology :>>Hydropower Projects that Create New Reservoirs or Expand Existing Ones.

i. Conditions under which this methodology is applicable to other potential projects (e.g. project type, region, data availability): Applicable:

>>- to grid connected hydro power projects where either a new reservoir is created or an existing reservoir is extended

- in countries where the electricity sector is not dominated by low or zero emission fuel types such as hydro and where the national electricity grid is too small or underdeveloped to undertake a combined margin analysis (see ACM 0002)

- for hydro power projects that displace off-grid produced electricity in the tropical region

ii. Strengths and weaknesses of the methodology:

>> Strengths: a) builds upon an existing approved consolidated methodology (ACM 0002); b) provides for quantification of CH4 and CO2 emissions from new and extended reservoirs and thus is adding a major component for project emissions from reservoirs that is not yet considered under ACM 0002 or another ACM or AM; c) suggests a component for projects where the grid is too small and underdeveloped and where the combined margin analysis as under ACM 0002 described cannot be used.

Weaknesses: a) The method to estimate project emissions is associated with may uncertainties, that are not further discussed in the methodology; b) method focuses only on new reservoirs and does not provide further guidance for extended reservoirs; c) does not clearly describe how GHG emissions for the pre dam situation are dealt with

iii. Any changes needed to improve the methodology:

a. Minor changes:>> Quantification of pre dam emissions should be elaborated on (e.g. describe the consequences if the pre-dam situation would be a carbon sink or carbon emitter)

b. Ref Baseline (CDM-NMB): The rule of thumb as described at page 6 should be clarified. What emission factor is used for the supply of 1200 MWh (see example)? The proponent should state more clearly why the more conservative emission factor of the two factors (a – default (diesel) factor and b – calculated CM factor) should be

used. The proponent should provide the underlying assumption for this rule and clarify what fuel type would be displaced if the electricity produced by the project would be beyond the MWh indicated.

c. Correct section E.4. in the PDD.

d. Provide an explanation of the abbreviations of HEP and BHP (see CDM-PDD, pg 28)

e. The methodology should include a reference for default emission fluxes used (for CO_2 = 190 mg/m²/day and for CH4 = 200 mg/m²/day). It is unclear to what vegetation type flooded the default values refer to, e.g. forests, grassland, wetlands…)

f. Major changes:>> The methodology should consider and be based on the Good Practice Guidance (2003) for land, land-use change and forestry, IPCC: Guidance can be found at http://www.ipcc.nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm. For instance, Section 3.5 provides instructions for land conversion to wetlands and Appendix 3a.3.3. offers emission estimation methods for "Flooded Land Remaining Flooded Land". The Good Practice Guidance provides default emission factors for tropical reservoirs and provide guidance to derive country-specific emission factors. This reference should be looked at in further detail. It might be sensible to allow country or region-specific emission default values instead of only one CO2 and CH4 default value that was applied by the methodology proponent to the project.

g. The methodology should differentiate between bubble, diffusive and degassing emissions and include N2O in the methodology, too.

II. Evaluation of the proposed new monitoring methodology:

Title of new monitoring methodology: >>Hydro Power Projects that Create New Reservoirs or Expand Existing Ones.

i. Conditions under which this methodology is applicable to other potential projects (e.g. project type, region, data availability):

>> ACM 0002 governs the monitoring for grid connected renewable energy projects that would be applicable for the presented case. The proposed methodology for monitoring reservoir emissions can be used for tropical regions but in principle can be extended to other climatic areas, too.

ii. Strengths and weaknesses of the methodology:

>>Strengths: a) uses available elements of ACM 0002; b) provides a straightforward method of how to measure CH4 and CO2 that are project emissions

Weaknesses: a) Extrapolated measurement results bear considerable uncertainties i) due to uncertainties associated with defining the clusters for which samples will be taken and ii) due to uncertainties that are related to false sample handling and false handling of the laboratory analysis;

b) The methodology does not explicitly require independent third-party experts to carry out the recommended measurements but leaves it to the project operator (in the case of this project it will be staff from the Special Purpose Company (SPC)) to appoint staff and the management structure for monitoring (page 9, CDM-NMM). This should not be allowed for two reasons: i) there is a conflict of interest, and ii) the quality of measured data might be poorer as if measurements were done by an independent third-party expert

c) The monitoring methodology (CDM-NMM) does not include to measure pre-dam sources and sinks and does not provide guidance on how to do it, which would result in an estimate of net and not gross emissions. In contrast, pg 3 of the CDM-NMB, last paragraph (continued at pg 4) refers to naturally occurring CO2 emissions in the pre-project stage to be subtracted from the measured reservoir emissions. This shows the proponent is aware of the issue of gross versus net emissions; however, a feasible approach for getting the net emissions was not further discussed. The proponent should consider on this issue also the public comment made on the methodology by International Rivers Network USA.

d) The method does not provide for monitoring N2O emissions.

e) Emissions from decay of above-water biomass are not looked at as potential sources. Such emissions could be typical for some reservoirs in tropical regions, though.

f) The monitoring of emissions from reservoirs requires expensive technology, trained staff and the provision of laboratory facilities, which might be a bottleneck in some countries.

iii) Any changes needed to improve the methodology:

a. Minor changes:>>A lot of repeating information is presented throughout the CDM-PDD, CDM-NMB and CDM-NMM. The methodology proponent should delete any repetition and make sure the information presented matches the headings.

b. The methodology should elaborate on how to monitor CH4 and CO2 emissions in the case of extended reservoirs in particular and highlight potential methodological differences – if any – compared to the methodology provided for new reservoirs.

c. Major changes:>> Guidance should be provided on how to measure or otherwise quantify pre-dam emissions (natural emissions that occur anyway) to be subtracted from gross emissions measured above the reservoir.

d. Extend the methodology for monitoring N2O emissions

e. The methodology should insist that all measurements and analysis of reservoir fluxes be done by third-party bodies with no interest in the outcome of the work. The QA/QC analysis needs elaboration. It is problematic if trained Personnel (provided by the operator) perform the tests.

f. The methodology should add a suggestion of how to account for uncertainties associated with e.g. cluster definition, quality of measured data etc.

B. Details of the evaluation of the proposed new methodology by the desk reviewer:

I. Proposed new baseline methodology *(specify title here):* >> Hydropower Projects that Create New Reservoirs or Expand Existing Ones.

(1) Short description of the methodology, including an assessment of which approach from paragraph 48 of the CDM modalities and procedures was used:

a) Describe the methodology:

>>The proposed methodology has two components: a) estimating reservoir emissions as project emissions and b) estimating Baseline emissions for grid connected renewable projects, where the project represents a special case in addition to what has been defined in ACM 0002.

On component a): In the absence of robust country specific CO_2 and CH4 emission factors the method for calculating reservoir emissions suggests to use default emission fluxes of 190 mg/m²/day for CO_2 and 200 mg/m²/day for CH4 taken from literature. These figures are mentioned in the CDM-PDD but are not fully discussed in the CDM-NMB.

On component b) the methodology uses elements of ACM0002, Version 01. The proponent applies §48a) existing actual or historic emissions. The method proposes that for cases where a combined margin analysis is not possible (e.g. the national grid is too small) the diesel default emission value as outlined in the small-scale methodology for renewable energy projects should be used. This approach is backed with the argument that the hydro power project would mainly displace existing off-grid diesel applications as well as grid connected electricity that represents the Baseline. The methodology does not foresee the use of different default emission factors for cases where off-grid electricity is generated by other fuel types such as heavy fuel oil.

b) State the approach selected:

>>see ACM0002 for aspects related to calculating the CM (Combined Margin) CO2 emission factor. For cases where a CM emission factor cannot be calculated and most of the off-grid electricity will be displaced by the project, the methodology suggests a new component to ACM 0002, which is to use the default

emission factor of 0.8 for diesel used for off-grid electricity production. This factor is taken from the methodology for small scale renewable energy projects (Section I.D., see Version 05-02-03). The methodology also provides a suggestion of how to deal with a situation where the Hydro power project will impact both the grid and off-grid production. In such cases it is proposed to use the lower emission factor from the two possible options, a) the combined margin figure or the default value for diesel.

c) Indicate (in summary form) why the approach selected is the most appropriate. Please provide your expert judgement on the appropriateness of the selected approach to the project category:

>>The proposed new methodology is understood as an extension to ACM 0002. The main elements of ACM 0002 are appropriate to be used. As for allowing the use of the default emission factor for diesel of 0.8 to be multiplied with the MWh generated per year, the approach looks appropriate. The approach does not allow for considering other fuel types than diesel for off-grid electricity generation (e.g. heavy fuel oil could be used instead in some countries that require a different emission factor).

The desk reviewer has general concerns about the appropriateness of the methodology to be used for a project that will displace installed grid electricity AND off-grid electricity. It seems not realistic why a hydro power CDM project in LDCs (Least developed Countries) should displace the small amounts of fossil fuel based electricity capacity installed. Electricity demand in these countries is constantly increasing. Instead, it can rather be assumed that large energy project add capacity to the installed capacity. The desk reviewer is of the opinion that this option should not be offered under the methodology.

(2) Basis for determining the baseline scenario:

a) State whether the documentation explains how the baseline scenario is to be chosen and identified:

>>Yes, it is clearly mentioned that ACM 0002 is the reference document for choosing the Baseline scenario. Clear arguments are provided under which conditions the default emission factor for diesel (see small-scale renewable energy project methodology) should be used.

b) State the basic underlying rationale for algorithms/formulae used (e.g. marginal vs. average basis) (see also section 4 below):

>>Algorithms and formulae used refer to ACM0002.

A: Project will displace only off-grid diesel consumption and not impact grid electricity production: For too small grids and where the CM method cannot be used or would result in over-counting the emission reduction impacts of the project, a simple formula for determining the Baseline emissions should be used as follows

BE = EF*EG, with

BE = Baseline CO2 emissions in metric tonnes

EF = Baseline emission factor, here: for high efficiency diesel = 0.8 in metric tonnes per MWh, and

EG = the generated electricity in MWh

B: Project will displace only a portion of off-grid diesel consumption and has an impact on grid electricity production (e.g. displace fossil fuel based electricity: It is suggested to use EF=0.8 kg CO2e/kWh for any annual kWh generated over the maximum production potential for the grid in the Baseline year, since it can be assumed that this portion will displace off-grid electricity production. Should the project generate more electricity than what has been expected after project implementation, the more conservative figure of the two (either default diesel emission factor or CM emission factor) should be used. In principle, using more conservative figure would be recommendable.

c) State whether the documentation explains how, through the use of the methodology, it can be demonstrated that a project activity is additional and therefore not the baseline scenario. If so, what are the tools provided by the project participants?

>>The methodology states that the project developer will be required to use the Additionality Test tool. The proponent notes that large infrastructure projects such as dams often would be part of national (government) energy strategies and that project developers need to consider them in their additionality discussion. If large

dams are part of national energy strategy, the project developer need to show other barriers that would prevent the project from being implemented despite the governmental will to do it. The reviewer notes that such argumentation could be hard to provide in many cases.

d) State whether the basis for determining the baseline scenario and for assessing additionality is appropriate and adequate:

>> It seems not realistic that in countries with increasing electricity demand new large power projects would – even if only in part – displace installed fossil fuel based electricity capacity (see above comment). Maintaining the status quo (e.g. no capacity extensions) would not be a plausible baseline, since no increase in demand is considered.

(3) Assessment of the description of the proposed methodology and its applicability

a) State whether the methodology has been described in an adequate manner:

>>No, see Section I. iii) for items where clarification and elaboration is needed. The author of the methodology should also note, that there is also a lot of repetition in the text that is either not needed or appears in sections where it not matches the heading. The same applies for the CDM-NMM and CDM-PDD. The CDM-NNB also refers quite often to information that only fits into the CDM-NMM.

b) State whether the proposed methodology is appropriate for the referred proposed project activity and the referred project context (described in Sections A - E of the draft CDM-PDD and submitted along with CDM-NMB):

>> The application of the methodology to the CDM project is in some parts not accurate, is incomplete and thus is not fully appropriate. Further remarks are provided below, where improvements are required:

E.1. of the PDD: The formula for estimating GHG emissions by sources (representing a part of project activity emissions) is incorrect. The figure 106 must read 10^6 to match the total estimated annual emissions of 17000t/CO2e. An Excel spreadsheet calculation would help to better understand how the project emissions were calculated.

E.4. of the PDD: "Estimated anthropogenic emissions by sources of greenhouse gases of the baseline". The content in this section is not appropriate. The methodology proponent/project developer needs to calculate here the Baseline emissions and not the emission reductions. The 27 MW power plant in Sierra Leone is mentioned as the only existing power plant in the country. The proponent should: a) indicate the load factor per year for this plant (in hours/year), get the annual MWh electricity generated from the existing plant and then multiply it with the appropriate emission factor, and b) get figures for the installed capacity (in MW) of off-grid electricity devices in the country (e.g. by using sales statistics), multiply the MW with the annual average load factor and emission factor, c) should sum up a) and b) to get the Baseline emissions, d) should make a provision for demand growth over years and should add these emissions to c). This detailed level of data will provide some indication, whether full displacement of off-grid diesel applications through the hydro power plant is realistic. If not, then installed capacity is extended. Then the methodology should clearly indicate what fuel type would be avoided in the future and this would be determined.

E.5. of the CDM-PDD: needs to be corrected, see comment above under E.4.

E.4. The rule of thumb as provided in CDM-NMB, Version 1 has not been applied or discussed in its application in the PDD. It is assumed that hydro power electricity will fully displace off-grid diesel based electricity generation. This assumption must be verified.

c) State whether the application of the methodology could result in a baseline scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity.

>>There is no electricity demand increase considered in the Baseline discussion, which would be very likely in LDCs. The methodology does not present a reasonable Baseline.

Please explain: see suggestions above to improve the Baseline emission calculations

(4) Assessment of algorithms/formulae and type of data needed:

a) State whether the description of the methodology includes algorithms and generic formulae that can be applied to other potential project activities (if not, the proposed new methodology will be

considered as a project-specific methodology):

>>As far as reference is made to ACM 0002, yes. There is no generic formula provided in the CDM-NMB for the estimation of reservoir emissions (for CO2 and CH4) to get a first proxy. The calculation procedure is only described in text format in the CDM-PDD. There is no mention in CDM-NMB of default emission factors for CO2 and CH4 that should be used to estimate project (reservoir) emissions in the Baseline Study. The discussed default values for tropical areas should be cross-checked with default values provided in the IPCC LUCF Best Practice Guidance, where more regionalised data is available.

b) Explain the spatial scope of data used to determine the baseline and whether the scope is appropriate:

>> Default emission factors for CO_2 = 190 mg/m²/day and CH4 = 200 mg/m²/day were used in the application of the project (CDM-PDD). These values might represent a good proxy for tropical regions only, but not necessarily for Sierra Leone. For other areas, such as cold temperate and warm temperate, default values should be provided to extend the methodology to projects in these areas.

c) Explain the vintage of data used (in relation to the duration of the project crediting period) and whether the vintage of data is appropriate, indicating the period covered by the data:

>>The above mentioned emission fluxes represent results form 2002/2003 measurements in tropical reservoirs. Long time series (e.g. a 10 or 20 year time series) of emissions fluxes from the same reservoir do not exist yet in many cases. Attention should be given to changes of emissions fluxes of reservoirs over many years. While in the first year/s of flooding new area, CO_2 and CH4 fluxes increase exponentially, fluxes will decrease as the reservoir gets older, as shown in some reservoir emission measurement campaigns. The methodology makes no differentiation of emission fluxes over time. This approach is conservative and still can be used. However, the estimates may be misleading for CER buyers who want to know quite robust net emission reductions over time.

(5) Definition of the project boundary related to the baseline methodology:

a) State how the project boundary is defined in terms of:

i) Gases and sources: Gases: CH4 and CO2; Sources: a) national electricity grid including all power plants, b) all off-grid diesel generators in especially poor countries where no developed grid exists, c) the new (or extended) reservoir as result of the dam construction

ii) Physical delineation: above mentioned GHG emissions directly from reservoirs and degassing immediately downstream of the dam

b) Indicate whether this project boundary is appropriate:

>>Boundary is appropriate. N2O should be included in methodology as an additional gas.

(6) Key assumptions/parameters (including emission factors and activity levels) and data sources:

a) List the implicit and explicit key assumptions. Identify those, if any, which are problematic and explain:

>> Average values for CO2 and CH4 emission fluxes are assumed for tropical regions. The figures used imply that they can be used regardless of the type of vegetation to be flooded such as forests, grassland etc. This assumption is problematic. No decrease of CO2 and CH4 emissions in the reservoir over time are assumed. Gross emissions (including natural emissions) are assumed. No carbon inflows from the surrounding catchments in the form of dissolved particulate organic carbon are assumed. It is assumed that the reservoir reacts as a carbon source not a sink. (Note: some measurements showed that reservoirs sometime can behave as carbon sinks).

b) State whether the key assumptions are arrived at in a transparent manner:

>>No, e.g. the default emission factors have not been precisely quoted from scientific literature.

c) Give your expert judgement on whether the assumptions/parameters are adequate:

>>Using the same default emission factor for various types of vegetation and not considering changes in CO2 and CH4 fluxes from reservoirs over time are over-simplifying real situations.

d) Indicate which data sources are used and how the data are obtained (e.g. official statistics, expert judgement):

>> The default emission factors used have not been clearly referenced. There is no discussion of the various categories of land to be flooded and their potential or tendency to release or store CO2 and CH4.

e) Give your expert judgement on whether the data used are adequate, consistent, accurate and reliable:

>>Data used are not adequate and accurate. They may be reliable for reservoirs only in those regions that are almost identical to tropical regions where the measured emission fluxes were used for.

f) State possible data gaps:

>>Load factor of existing thermal power plant (27MW), load factor of planned hydro power plant, no differentiation between degassing, diffusion and bubbling emissions, no N2O emissions covered

(7) Assessment of uncertainties:

a) State whether the methodology includes an assessment of uncertainties regarding:

i) The basis for determining the baseline scenario:

>>No uncertainty assessment included.

ii) Algorithms/formulae:

>>No uncertainty assessment included

iii) Key assumptions:

>>No key assumptions provided.

iv) Data:

>>No data such as standard deviation is discussed.

b) State whether the uncertainties presented are reasonable:

>>The methodology proponent did not provide an uncertainty assessment. In the absence of a full understanding of uncertainties related to reservoir emissions from a scientific point of view, the proponent should refer to the major discussed uncertainty sources in literature and try to relate them to the emission factor discussion. For instance, available data and statistics do not allow defining, with an acceptable uncertainty on a scientific basis, the average rate of decomposition of the flooded organic material, the net GHG emissions for many reservoirs studied. Further uncertainties should be discussed such as decline of annual CO2, CH4 emissions over time etc. The proponent should consult: *Rosa, L.P.; dos Santos, M.A. Certainty and Uncertainty in the Science of Greenhouse Gas Emissions from Hydroelectric Reservoirs, Thematic Review II.2 prepared as an input to the World Commission on Dams, Cape Town, www.dams.org.*

(8) Leakage:

a) State how the baseline methodology addresses any potential leakage due to the project activity:

>>The discussion on leakage in CDM-NMB cannot be fully understood. The proponent should discuss potential leakage emissions as result of the construction of the dam. This may lead to e.g. colonisation of forest areas, deforestation, and other local and cumulative aspects. A full discussion should be provided.

b) Indicate whether the treatment for leakage is appropriate and adequate:

>>Not fully appropriate, see above comment.

(9) Transparency and "conservativeness":

a) Indicate whether the baseline methodology was developed in a transparent way:

>>The Baseline setting for the electric ity grid follows mainly ACM 0002. The proponent discusses a special situation where the CM analysis is not possible. This discussion is made in a transparent way and an example is provided. Baseline emissions from the pre-dam vegetation are not discussed/quantified.

b) State whether the baseline methodology is conservative:

>>As far as pre-dam CO2 emissions (that could be considered as natural emissions) are concerned,

emission factors for CO2 and CH4 were used for the Sierra Leone project that refer to measurement results from a climatically comparable region. Without an uncertainty discussion and a discussion of how the expected uncertainties reflect the used data the desk reviewer can't state fully whether the Baseline methodology is conservative.

(10) Potential strengths and weaknesses of the proposed baseline methodology *(please explain)*:

>>See comments made under A.I.ii)

(11) Other considerations, such as a description of how national and/or sectoral policies and circumstances have been taken into account *(please explain)*:

>>For grid renewable energy projects the project proponent should refer to ACM 0002. The application of this methodology to the project content makes an unclear comment. Quote: "This project … may also possibly displace some of the output from the ... power plant in Freetown" (page 4, CDM-PDD. This implies the existing capacity be partly displaced, which is unrealistic for a country with a growing energy demand. There is no discussion on demand and supply, which would better describe the baseline situation.

(12) Applicability of the proposed methodology across project types and regions *(please indicate)*:

>>Provided the revisions of the methodology are made, the methodology would be applicable for hydro power projects creating new or extending existing reservoirs and could be used for most CDM host countries, in particular those in the tropical region.

(13) Any other comments:

a) State whether any other source of information (i.e. other than documentation on this proposed methodology available on the UNFCCC CDM web site) has been used by you in evaluating this methodology. If so, please provide specific references:

>>Tremblay et al.: Greenhouse Gas Emissions – Fluxes and Processes. Hydroelectric Reservoirs and Natural Environments. Springer. 2005.

Rosa, L.P.; dos Santos: M.A. Certainty and Uncertainty in the Science of Greenhouse Gas Emissions from Hydroelectric Reservoirs, Thematic Review II.2 prepared as an input to the World Commission on Dams, Cape Town, www.dams.org.)

Greenhouse Gas Emissions from Reservoirs at www.hydropower.org

Rosa et al.: Hydroelectric Reservoirs and Global Warming. For RIO 02. World Climate & Energy Event, January 6-11, 2002

Dam Reservoirs and Greenhouse Gases. Report on the Workshop held on February 24 & 25, 2000, Hydro-Quebec, Montreal. Final Minutes.

Good Practice Guidance for land, land-use change and forestry, IPCC, 2003

b) Indicate any further comments:

>> The new IPCC guidelines for national GHG inventories will include a section on flooded land. The elaborated guidelines will become available in 2006 and will include the latest knowledge on GHG emission quantification from flooded land. The elaborated guidelines should be considered for a methodology review, provided that a new Baseline and monitoring methodology for quantifying reservoir emissions will be approved prior to issuance of the new IPCC work.

Regarding reservoir emissions and their relevance to global warming, two possible hypothesises can be discussed (see *Rosa, L.P.; dos Santos, M.A. Certainty and Uncertainty in the Science of Greenhouse Gas Emissions from Hydroelectric Reservoirs, Thematic Review II.2 prepared as an input to the World Commission on Dams, Cape Town, www.dams.org.*). Hypothesis 1: the carbon can arise from the biomass decomposition. Hypothesis 2: the carbon can have mineral origin in the soil or dissolved in the water from the watershed. For hypothesis 1 it could be argued that carbon is derived from the atmosphere and its emission do not effectively add new CO2 from the global warming point of view. The cycle is closed

and there is no intensification of the greenhouse effect, unless the gas is emitted as CH4 with a higher GWP. In the case of hypothesis 2, new carbon is added into the atmosphere and global warming is intensified. Accounting or not accounting CO2 emissions from biomass degradation would be an essential element in the CDM methodology.

II. Proposed new monitoring methodology *(specify title here):* >> Hydropower Projects that Create New Reservoirs or Expand Existing Ones. Note: The following comments refer to monitoring reservoir (and thus project) emissions.

In respect of the proposed new monitoring methodology, evaluate each section of CDM-NMM to the draft CDM-PDD. Please provide your comments section by section:

(1) Brief description of new methodology:

Describe new methodology:

>>The proposed methodology suggests measuring CO2 and CH4 above the newly created (or extended) reservoir to monitor these emissions over the crediting period. As the preferred method the proponent suggests to use air sampling at representative points in the reservoir to measure the increase in concentrations of GHGs that are emitted to chambers. Measurement results will be reported in mg/m²/day and will be multiplied by the respective cluster area the sample belongs to. Different samples will be taken over each year since emission fluxes vary according to seasons and weather. The methodology proposes to define clusters across the reservoir. Each cluster should correspond to a certain water depth or vegetation type that will be flooded. All other data as far as related to the specifics of the project will use elements provided in ACM 0002. The methodology is reflected in the CDM-PDD in so far as the proponent provided tables outlining a cluster and that can be used as a template to record the measurement results. No such generic table has been provided in the CDM-NMM, though.

(2) Key assumptions/parameters:

a) List the implicit and explicit key assumptions. Identify those, if any, which are problematic and explain:

>>Assumption A: Cluster building is required because the land to be flooded is unlikely to only represent one vegetation type. One must assume a different behaviour of different vegetation types in terms of their emission fluxes over time. Such assumption is plausible.

Assumption B: CO2 and CH4 emission levels alter over a year due to changing weather and climate conditions, which requires multiple samples to be taken and analysed over a year. The assumption is plausible.

Assumption C: gross emissions should be measured. The methodology does not make a clear provision how to factor out natural CO2 (and CH4) emissions to get net emissions. The assumption to record gross emissions is problematic, because one would count emission that otherwise would occur anyway.

Assumption D: CO2 and CH 4 are the major emissions that occur from reservoirs. In addition, degassing will take place downstream of a dam. This assumption is correct. N2O emission are lacking in the entire method, however.

Assumption E: All reservoir samples should be taken in floating chambers. This assumption is plausible.

Assumption F: Using floating chambers may not be the most accurate sample method for measuring degassing emissions. Provision is made in the methodology to correct for the uncertainties.

b) State whether the key assumptions are arrived at in a transparent manner:

>> Assumption A is derived in a transparent manner. The cluster setting provided in CDM-NMM is discussed under “Number of Frequency of Tests”, which is, however, the wrong chapter for such discussion. Assumption B: has been explained. Assumption C: The PDD mentions the need for considering net emissions only but the methodology does only consider gross emissions. The assumption has not been derived in a transparent manner. Assumption E: The methodology should at least provide arguments why N2O should not be considered under the proposed monitoring methodology. Assumption E: This assumption should be backed with a brief advantage/disadvantage discussion of commonly used measurement methods.

c) Give your expert judgement on whether the assumptions/parameters are adequate:

>>Some of the above mentioned assumptions are not adequate (see under a)). No assumption is made on possible carbon sequestration from the atmosphere by reservoir water, which should be included.

(3) Data sources and data quality:

a) Indicate which data sources are used and how the data are obtained (e.g. official statistics, expert judgement):

>>No data sources will be used since all data (if not estimated such as m² of reservoir fitting each category) are measured.

b) Give your expert judgement on whether the data used are adequate, consistent, accurate and reliable:

>>The data to be used for determining project emissions represents measured data. Depending whether a laboratory expert or newly trained staff will collect and analyse the samples, the data quality might vary between good and poor. Uncertainties with determining emissions from degassing downstream of the dam are mentioned (CDM-NMM, page 8/9), if the same method is used as measuring CH4 and CO2. A suggestion is made for a slightly changed measurement procedure, which looks adequate.

c) *State possible data gaps:*

>> The QA/QC analysis refers to the quality of results. Not clear is the following sentence: "Tests must be performed until at least three results are within 5 % of each other - for each point in the reservoir and for each time period within the project year". It is unclear whether this refers to the correlation coefficient.

(4) Assessment of the description of the proposed methodology and its applicability:

a) State whether the proposed methodology has been described in an adequate manner:

>>A clear instruction of how to organise the measurement of reservoir and degassing emissions is missing. The proponent provides a choice between on-site measurement and laboratory measurement. The desk reviewer suggests to allow for only one standardised detection method (either laboratory tests or independently performed on-site tests with mobile detection equipment) because both approaches have a different level of precision. In case both approaches should still be allowed, an explanation should be provided how the different precision levels of detection methods can be taken into account. Some level of standardisation will ensure results across countries and different regions are better comparable, in particular for the CDM, where emission reductions represent assets. The methodology description is currently also lacking a more practical description of how to build clusters, set up the tests, calibrate the equipment etc.. It does also not outline qualification requirements of the Personnel undertaking the measurements (see QA/QC analysis, which needs elaboration). Despite the fundamental approach of monitoring emissions is clear to the desk reviewer (the proponent quoted some of the relevant references), the methodology as a whole is not described in an adequate manner since major aspects are missing. In addition, the CDM-NMM (also CDM-PDD and CDM-NMB) repeats a lot of information, which sometimes is not relevant for a certain section heading.

b) State whether the proposed methodology is appropriate for the referred proposed project activity and the referred project context (described in Sections A - E of the draft CDM-PDD and submitted along with CDM-NMM):

>>The methodology is appropriate for the referred project activity provided the required revisions are made.

c) State whether this proposed monitoring methodology is compatible with the proposed baseline methodology described in CDM-NMB of the draft CDM-PDD:

>>The monitoring methodology is compatible with the Baseline methodology. Project emissions are mainly monitored and thus will verify the project emissions estimated in the Baseline Study.

(5) Leakage *(please elaborate, if appropriate)***:**

>>Section B.4 of the CDM-NMM does not fit a proper leakage discussion. A leakage discussion should consider whether the project through its implementation will cause additional GHG emissions outside the project boundary. See also comments made above on the Baseline methodology. The monitoring methodology should explain how possible leakage will be quantified (measured or calculated, recorded using questionnaires and/or other methods).

(6) Quality assurance and control procedures *(please explain)***:**

>>Little information is provided on QA/QC. Field tests and ex-situ analysis (laboratory analysis) have different precisions. To be able to get comparable results only one detection method (either in-situ or ex-situ) should be allowed, otherwise allowance should be made for corrections in case a detection method with a lower precision is used. The QA/QC discussion should clearly refer to the issue of "rejected fluxes", meaning those samples that result in a lower correlation coefficient than a defined value. Such standardised value must be provided and agreed to, to keep the quality of detected values under a certain level of control. A large percentage of "rejected fluxes", however, would mean that costs for monitoring increase.

(7) Potential strengths and weaknesses of the proposed monitoring methodology *(please explain)***:**

>>see comments provided in A II)

(8) Applicability of the proposed methodology across project types and regions *(please indicate)***:**

>>The monitoring methodology (sampling, measuring) is not restricted to regions. Measurement of CO_2 and CH4 emissions will derive project specific data. The methodology is applicable for dam projects that create new or extended existing dam reservoirs and that are located worldwide.

(9) Any other comments:

a) State whether any other source of information (i.e. other than documentation on this proposed methodology available on the UNFCCC CDM web site) has been used by you in evaluating this methodology. If so, please provide specific references:

>>see above, same as for the Baseline (CDM-NMB) review

b) Indicate any further comments:

>>Measuring reservoir emissions is very time consuming, costly and labour intensive since project specific and depends from the availability and access to suitable detection equipment. It is questioned by the desk reviewer whether such time and cost intensive approach would be feasible under the CDM since it could increase transaction costs on the project developers side considerably, in particular, if the number of "rejected fluxes" would be high.

One could think about whether a requirement for clearing the land prior to flooding would be advisable, which would make such cumbersome measurement campaigns obsolete to some extend. Cleared land would prevent the creation of unfavourable situations in the reservoir (e.g. the development of anaerobic conditions resulting in CH4 emissions). CO2 emissions from biomass decomposition will not occur and thus not effectively add new CO2 from the global warming point of view. There will be still CO_2 emissions from soil that would be recorded as project emissions. The monitoring method would be further facilitated in so far, that natural emissions would be factored out already and the potential for CH4 creation is inhibited. The cleared biomass could be collected in the country and for instance be used to generate electricity and heat. Additional compensation measures are possible such as planting new trees in the neighbourhood of the dam.

The application of the mentioned IPCC Best Practice Guidance should be further considered for elaborating on the proposed Baseline methodology. A mechanism to account for uncertainties should be introduced. Only a few test measurements would then be required under the monitoring methodology during a year and would only serve the purpose to cross-check whether the reservoir emission fluxes behave nearly the default emissions fluxes used. A country-by-country, climatic region–by-climatic region or reservoir type-by-reservoir type default value sheet should be developed and be based on existing reservoir emission

measurement campaigns. Where country data is not available, average data for the corresponding climatic region should be referenced and used.
Signature of desk reviewer ……. Date: 25 / July / 2005

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