CLEAN DEVELOPMENT MECHANISM
PROPOSED NEW METHODOLOGY: MONITORING (CDM-NMM)
Version 01 - in effect as of: 1 July 2004

CONTENTS

A. Identification of methodology

B. Proposed new monitoring methodology

SECTION A. Identification of methodology

A.1. Title of the proposed methodology:

Title of the methodology - "Monitoring methodology for modal shifting in industry for product/feedstocks".
Version - 00
Date of completion of the document – 20/06/2005

A.2. List of category(ies) of project activity to which the methodology may apply:

Sector: Transportation

Section: Emission reductions in the transport sector

A.3. Conditions under which the methodology is applicable to CDM project activities:

The methodology was developed based on the circumstances at Aracruz Barra do Riacho Plant (but it can be adapted to other transportation projects).

The methodology is applicable to project activities in the pulp and paper industry with the following conditions:

- It is used in conjunction with "baseline methodology for modal shifting in industry for product/feedstocks".
- CO_2 emission reductions relate to CO_2 generated from combustion of fossil fuels used in a more efficient transportation mode.

A.4. What are the potential strengths and weaknesses of this proposed new methodology?

The potential strength of the monitoring methodology relies on straightforward collection and quality control of the main data needed to estimate baseline and project emissions, i.e., quantity of maritime fuel used on barges, quantity of diesel oil consumed by trucks and barges loading-unloading operations and the quantity of pulpwood feedstock at the considered plant, among other factors. Data collection and storage is subject to rigorous QA/QC procedures at the plant, ensuring that any claim of emission reductions is readily transparent and verifiable. Overall, the data needed to determine any emission reduction estimates is the type of information that would readily be collected at any industrial site.

While any data acquisition and QA/QC plan is subject to potential problems without sufficient due diligence on the part of the company responsible for implementation of such procedures, we foresee no potential weaknesses with the monitoring methodology. Quality and Environmental Management System approved procedures will ensure reliable, accurate data monitoring and collection.

SECTION B. Proposed new monitoring methodology

B.1. Brief description of the new methodology:

The proposed project activity consists in using a more efficient transportation mode to transport product/feedstock instead of using only the traditional mode (for instance, trucks). The traditional mode, such as trucks, produces higher amounts of CO_2 emissions and is responsible for many environmental and social impacts. The use of a more efficient transportation mode, such as barges, reduces these emissions. The following basic data will be monitored in order to estimate the emission reductions of the project: quantity of fuel used on alternative transportation mode (i.e., barges); quantity of fuel on alternative transportation mode (i.e., trucks and barges) for loading-unloading operations; and amount of product/feedstock transported to the considered plant. A Quality and Environmental Management System assures that all necessary records are kept and procedures established for all data, including procedures for monitoring, measuring and calibrating equipment used to conduct these activities. The procedures also establish that all personnel involved should be properly trained in order to guarantee the conformity of the system.

The Environment Department and the Plant Quality Department will have all the responsibility for collecting and maintaining the necessary information in order to monitor emission reductions due to implementation of the project activity.

B.2. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario:

B.2.1. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:

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	Product / Feedstock transported	Integrated management system	Ton	M	Annually	100%	Electronic (2y following the end of the crediting period)	For instance, wood transportation
2	Fuel consumption of alternative transportation mode	Integrated management system	m^3	M	Monthly	100%	Electronic (2y following the end of the crediting period)	For instance, diesel oil consumption of trucks and equipments
3	Fuel consumption of alternative	Integrated management system	m^3	M	Monthly	100%	Electronic (2y following the end of the crediting period)	For instance, Marine fuel consumption of barges

	transportation mode							
4	Fuel consumption of alternative transportation mode	Integrated management system	m^3	M	Monthly	100%	Electronic (2y following the end of the crediting period)	For instance, Maritime diesel oil consumption of barges

B.2.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Emissions from the project activity derive from three sources:

1. Consumption of fossil fuel to transport product/feedstock by alternative transportation mode (i.e., wood transportation by trucks from plantations to the port and from the port to the plant)

2. Consumption of fossil fuel to load and unload from alternative transportation mode (i.e., barges)

3. Consumption of fossil fuels to transport product/feedstock by alternative transportation mode to the plant (i.e., wood transportation by barges from port 1close to the plantation to port 2 close to the plant)

Emissions from these sources were determined by the following formulae (all calculations based on net heating value):

For energy consumption for transport of product/feedstock:

(Quantity of fuel consumed by alternative transportation mode, i.e., trucks)*(Net Calorific Value of fuel)* (Specific Weight of fuel) * (Carbon emission factor for fuel)*44/12, divided by 1000, to determine tons of carbon dioxide in metric tons.

For energy consumption to load and unload from alternative transportation mode (i.e., barges):

(Quantity of fuel to load and unload from alternative transportation mode, i.e., barges)*(Net Calorific Value of fuel)* (Specific Weight of fuel)*(Carbon emission factor for fuel)*44/12, divided by 1000, to determine tons of carbon dioxide in metric tons.

For energy consumption to transport product/feedstock by alternative transportation mode (i.e., wood transportation by barges from port 1 to port 2):

(Quantity of each fuel consumed by alternative transportation mode, i.e., barges) * (Net Calorific Value of each fuel) * (Specific Weight of each fuel) * (Carbon emission factor for each fuel) *44/12, divided by 1000, to determine tons of carbon dioxide in metric tons.

B.2.3. Relevant data necessary for determining the baseline of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:								
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
1	Product / Feedstock transported	Integrated management system	Ton	M	Annually	100%	Electronic (2y following the end of the crediting period)	For instance, wood transported to the plant
2	Fuel consumption by existing transportation mode	Integrated management system	m^3	M	Monthly	100%	Electronic (2y following the end of the crediting period)	For instance, diesel oil for trucks

B.2.4. Description of formulae used to estimate baseline emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Emissions in the baseline derive from:

- Consumption of fossil fuel for product/feedstock transportation (i.e., from the plantation to the plant)

Emissions from this source were determined by the following formulae (all calculations based on net heating value):

For energy consumption to transport products/feedstock by existing transportation mode to the plant (i.e., wood transportation by trucks from the plantations to the plant):

(Quantity of fuel consumed by existing transportation mode, i.e., trucks) * (Net Calorific Value of fuel) * (Specific Weight of fuel) * (Carbon emission factor for fuel)*44/12, divided by 1000, to determine tons of carbon dioxide in metric tons.

For CH_4 and N_2O emissions due to fuel consumption, the following formulae will be used:

(Quantity of fuel consumed by existing transportation mode, i.e., trucks) * (Net Calorific Value of fuel) * (Methane emission factor of fuel) * (GWP CH_4) * 4.1868, divided by 10^6, to determine tons of carbon dioxide in metric tons.

(Quantity of fuel consumed by existing transportation mode, i.e., trucks) * (Net Calorific Value of fuel) * (Nitrous oxide emission factor of fuel) * (GWP N_2O) * 4.1868, divided by 10^6, to determine tons of carbon dioxide in metric tons.

B.3. Option 2: Direct monitoring of emission reductions from the project activity:

Not applicable.

B.3.1. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:

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

Not applicable.

B.3.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Not applicable.

B.4. Treatment of leakage in the monitoring plan:

GHG emissions within the project boundaries derive from CO_2 from fuel combustion activities. No leakage is expected from the project activity. The data include information on the quantity of product/feedstock transported, the amount of fuel used for existing transportation mode, and the amount of fuels used for alternative transportation mode. The emission reductions that occur from this project activity are directly related to the transparent monitoring and reporting of these variables. As noted, there are also small amounts of CH_4 and N_2O emissions that occur from combustion in both the project and baseline activities. However, according to the calculations, the CH_4 and N_2O emissions due to fuel consumption are not significant when compared to the total emissions in the baseline and in the project and are estimated to be lower in the project activity due to the lower fuel requirements. There are also emission reductions resulting from the fuel savings since fuel supply trucks no longer need to deliver as much oil to the plant, as they were required to do in the baseline; and there are emission reductions due to CH_4 and N_2O emissions in the project compared to the baseline. These additional emission reductions,

however, have not been included as the project's benefits to reinforce the conservative and transparent manner in which the emission reduction calculations were done.

B.4.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity:								
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

Not applicable.

B.4.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

Not applicable.

B.5. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO_2 equ.):

The net emission reductions from the project can be calculated by:

Project Life-time Emission Reductions = Σ_{yr} (Annual Emissions Reductions) = Σ_{yr} [($Em_{baseline}$ - $Em_{proj\ yr}$)]

where:

$Em_{baseline}$ = baseline emissions

$Em_{proj\ yr}$ = project emissions per year

Yr = project years

Project emissions derive from the same source described above and use a similar formula to calculate the emissions:

- Fuel-based CO_2 Generation – the combustion of fossil fuel used for the alternative transportation mode to transport product/feedstock (i.e., wood transportation by trucks from plantations to port 1 and from port 2 to the plant), producing CO_2 as an energy-related emission source
- Fuel-based CO_2 Generation – the combustion of fossil fuel used to load and unload from alternative transportation mode (i.e., barges), producing CO_2 as an energy-related emission source
- Fuel-based CO_2 Generation – the combustion of fossil fuels used for the alternative transportation mode to transport product/feedstock (i.e., wood transportation by barges from port 1 to port 2), producing CO_2 as an energy-related emission source

Emissions from this source were determined by the following formulae:

For energy consumption to transport product/feedstock to the plant (i.e., from plantations to port 1 and from port 2 to the plant):

(Quantity of fuel consumed by the transport mode, i.e., trucks)*(Net Calorific Value of fuel)* (Specific Weight of fuel) * (Carbon emission factor for fuel)*44/12, divided by 1000, to determine tons of carbon dioxide in metric tons.

For energy consumption to load and unload from the alternative transportation mode (i.e., barges):

(Quantity of fuel to load and unload from the alternative transport mode, i.e., barges)*(Net Calorific Value of fuel)* (Specific Weight of fuel)*(Carbon emission factor for fuel)*44/12, divided by 1000, to determine tons of carbon dioxide in metric tons.

For energy consumption to transport product/feedstock by alternative transportation mode (i.e., wood transportation by barges from port 1 to port 2):

(Quantity of each fuel for product/feedstock transportation) * (Net Calorific Value of each fuel) * (Specific Weight of each fuel) * (Carbon emission factor for each fuel) *44/12, divided by 1000, to determine tons of carbon dioxide in metric tons.

For CH_4 and N_2O emissions due to fuels consumption, the following formulae will be used:

(Quantity of each fuel consumed by alternative transportation mode, i.e., trucks and barges) * (Net Calorific Value of each fuel) * (Methane emission factor of each fuel) * (GWP CH_4) * 4.1868, divided by 10^6, to determine tons of carbon dioxide in metric tons.

(Quantity of each fuel consumed by alternative transportation mode, i.e., trucks and barges) * (Net Calorific Value of each fuel) * (Nitrous oxide emission factor of each fuel) * (GWP N_2O) * 4.1868, divided by 10^6, to determine tons of carbon dioxide in metric tons.

It should be noted that the emission reduction credits from the project are based on the lower resource requirements for fuel combustion needed for transporting each year's quantity of feedstock (i.e., wood) to the plant, adjusted for the quantity of output transported (i.e., wood) with these resource requirements.

Actual emission reductions from the project take this project value of CO_2 emissions/ton of product/feedstock transported, subtract it from the baseline value of CO_2 emissions/ton of product/feedstock transported, which provides a net reduction in CO_2 emissions per ton of product/feedstock transported. This net reduction value is then multiplied by the amount of product/feedstock transported in the project year to determine the total reduction in CO_2 emissions that has occurred from the project.

B.6. Assumptions used in elaborating the new methodology:

All the information needed for the monitoring plan is going to be measured or calculated by the personnel of the plant. Key elements used to determine the baseline for the project activity are:

All the information related to consumption of each fuel (in the project's case at the plant, ports and barges) is provided by the project participant.

Heating Values and Specific Weight of each fuel were taken from the "2003 Brazilian Energetic Balance" (Ministry of Mines and Energy) and provided by the project participant based on each fuel quality characteristics at the plant.

Information related to CO_2, CH_4 and N_2O emission factors of each fuel used by each transportation mode and Global Warming Potentials (GWPs) were taken from Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories: Reference Manual," Volume 3, OECD/IEA.

B.7. Please indicate whether quality control (QC) and quality assurance (QA) procedures are being undertaken for the items monitored:

Data *(Indicate table and ID number e.g. 3.-1.; 3.2.)*	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
1	Low	There will be QA/QC procedures for these data based on project participant's management system, mainly because these data will be indirectly used for calculation of emissions reductions.
2	Low	There will be QA/QC procedures for these data based on project participant's management system, mainly because these data will be indirectly used for calculation of emissions reductions.
3	Low	There will be QA/QC procedures for these data based on project participant's management system, mainly because these data will be indirectly used for calculation of emissions reductions.

4	Low	There will be QA/QC procedures for these data based on project participant's management system, mainly because these data will be indirectly used for calculation of emissions reductions.

B.8. Has the methodology been applied successfully elsewhere and, if so, in which circumstances?

This methodology was developed especially for the wood maritime transportation project, but it can be generalized and replicated for other transportation projects.

Many of the key control elements have been used in industry for a long time for other purposes; as a result, there is a high degree of confidence in the accuracy of this methodology. There's no similar methodology approved.

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