Protocol
Emissions from biomass combustion: Memo item on CO_2, CH_4 and N_2O emissions

IPCC Category:	Memo item on CO_2 emissions from biomass Biomass in 1A Waste in 1A1a
NFR Code:	n.a.
NOSE Code:	n.a.
NACE Code 2008	various

Foreword

Under the Kyoto Protocol, the Netherlands is required to set up and maintain a national system to monitor its greenhouse gas emissions. One of the elements of this system is a transparent and verifiable description of the methods and processes used in this monitoring system. These methods must meet international guideline criteria, which have been defined by the United Nations (UN) and the European Union (EU).

The Netherlands meets the aforementioned requirement, for example, by defining a series of Monitoring Protocols, which describe the methods and work processes used to determine greenhouse gas emissions and the amounts of carbon sinks available. Protocols have been written for about 40 greenhouse gas sources or sinks. This document describes the protocol for one of these sources or sinks.

The protocols have been compiled in close collaboration with experts from various sectors of society in the Netherlands, particularly experts from the Emissions Registration (ER). The ER is a collaborative group that includes institutions such as CBS, WUR, RIVM and PBL. Until 31 December 2009 this was coordinated by PBL (Planbureau for the Leefomgeving, or the Netherlands Environmental Assessment Agency), but on 1 January 2010 this coordination task was taken over by RIVM (the Netherlands institute for public health and the environment). Other institutions that have contributed to the protocols include NL Agency; Ministry of Agriculture, Nature and Food Quality; and the Ministry of VROM (Housing, Spatial Planning and the Environment).

1 Scope and significance of emission sources/activities

1.1 Scope and definition

This protocol describes the methods and working processes for determining CO_2, N_2O and CH_4 emissions from the combustion of biomass (non-fossil fuels) and from using biofuels for road traffic.

In order to provide a clear overview, it has been decided that the use of biomass (including waste) should not be described in the various protocols for group 1A, but should be described in this (separate) protocol.

This protocol therefore contains a description of:

1. CO_2, N_2O and CH_4 emissions from waste incineration[1]. The reporting occurs under IPCC category 1A1a. The CO_2 emissions from biomass (including the non-fossil parts of the waste) are also repeated in the memo item on CO_2 emissions from biomass.
2. CO_2, N_2O and CH_4 emissions from auxiliary biomass combustion in power plants. The reporting occurs under IPCC category 1A1a, and the CO_2 emissions are also repeated in the memo item on CO_2 emissions from biomass.
3. CO_2, N_2O and CH_4 emissions as a result of using biomass in industry and other sectors. The reporting occurs under IPCC categories 1A2, 1A4a and 1A4c. The CO_2 emissions are also repeated in the memo item on CO_2 emissions from biomass.
4. CO_2, N_2O and CH_4 emissions as a result of using biomass in households. The reporting occurs under IPCC category 1A4b, and the CO_2 emissions are also repeated in the memo item on CO_2 emissions from biomass.
5. CO_2, N_2O and CH_4 emissions from incinerating landfill gas are reported under IPCC category 1A1, and the CO_2 emissions are also repeated in the memo item on CO_2 emissions from biomass.
6. CO_2, N_2O and CH_4 emissions due to burning biogas from sewer water treatment plants (SWTPs) are reported under IPCC category 1A4a, and are also repeated in the memo item on CO_2 emissions from biomass.
7. CO_2, N_2O and CH_4 emissions from burning other biogas (including industrial fermentation gas) are reported under IPCC categories 1A2b through 1A2f, and are also repeated in the memo item on CO_2 emissions from biomass.
8. CO_2, N_2O and CH_4 emissions from using biofuels for road traffic are reported under IPCC category 1A3B. The CO_2 emissions are also repeated in the memo-item CO_2 emissions from biomass.

The CO_2 emissions from burning biomass (non-fossil fuels) are thus reported as a separate memo-item. The CO_2, N_2O and CH_4 emissions that arise from burning biomass are reported under the relevant IPCC 1A categories.

1.2 Significance and influences

1.2.1 Contribution to total national emissions

CO_2 emissions from combusting biomass (in the order of 10 Mton) are included both in the memo item on biomass and in the subcategories under group 1A, but not in the total emissions for 1A. These emissions also do not count towards the total national emissions. However, the CO_2 emissions from the fossil part of the waste (in SWTPs) do count towards the total emissions under 1A.

The N_2O and CH_4 emissions from combusting biomass are reported in both the subcategories and are totalled under 1A, and thus count towards national greenhouse gas emissions. N_2O and CH_4 emissions from combustion of biomass contribute each less than 0.5% to the Netherlands annual greenhouse gas emissions.

1.2.2 Developments that infuence emissions

Emissions from combusting biomass are determined by the use of biofuels in the following sectors:

[1] During combustion, part of the waste can be used to produce biomass, while another part cannot be used in this way. The latter is considered to be an 'other (fossil) fuel'.

- Waste incineration (organic fraction of the waste);
- Electricity generation by energy companies (auxiliary combustion of biomass flows and biomass-fuelled plants);
- Industry (auxiliary combustion of biomass flows and use of other biogas (industrial fermentation gas));
- Other sectors (use of landfill gas, biogas SWTPs, other biogas and biomass combustion);
- Households (only for fireplaces and wood-burning stoves).
- Using biofuels for road traffic

With respect to the use of biofuels for road traffic, according to the European Biofuel Guideline (2003/30/EG), in 2010 the transport fuels used in all European countries must contain 5.75% biofuels. Biofuels have also been introduced into the Netherlands over the past few years. This development is important when calculating the CO_2, N_2O and CH_4 emissions resulting from the use of biomass.

2 Method, emission factors and activity data

2.1 Calculation method

1. Waste incineration (WI)
The term 'waste incineration' covers a wide range of plants and installations that process waste flows. These plants primarily process household refuse and waste residues from the TSG sector (trade, service and government). The Working Group on Waste Registration monitors the amounts of waste incinerated and the emissions from these processing plants, via an annual questionnaire to all such installations in the Netherlands.

Waste incineration within the industry does not fall under this category, along with emissions from power plants where (fuel from) waste is also burned with the primary fuels. Plants and installations that process waste flows belong to NACE-code 90 (2008.

Determining the amount of biomass
Appendix 3 (Waste Incineration Statistics) of the Renewable Energy Monitoring Protocol (Bosselaar et al, 2006) describes how the annual amounts of waste are categorised and how the energy value of this biomass is determined.

The calculation consists of several steps:
- The amounts of the various *partial flows* (household refuse, industrial waste, etc.) are submitted annually by the Working Group on Waste Registration, which sends a questionnaire to the 11 waste incineration plants in the Netherlands.
- The composition of these *partial flows* is determined under the framework of the environmental effect report, part of the National Waste Management Plan 2002-2012 (VROM (Ministry of Housing, Spatial Planning and the Environment), 2003). This document also contains a comparison between various types of processing for the flows that are currently incinerated in the WI plants. The composition is split into the *components:* paper/cardboard, wood, organic matter, other combustibles, synthetics and non-combustibles. The composition of all waste flows (except household refuse) is assumed to be constant.
- For residual household refuse (the greatest partial flow with respect to distance), the annual composition is updated each year using the sorting analysis. This is determined annually as part of the project to monitor household refuse.

- The amount of biomass is determined and expressed as energy content and carbon content. The *components* use the energy content (GJ/ton) and renewable percentage (= non-fossil or biomass), conform the Renewable Energy Protocol Monitoring (Bosselaar *et al*., 2006) and calculate both the fossil and biogenic carbon content. This latter calculation is used to determine the emissions.

Calculating emissions

The emissions released by SWTPs are calculated according to the composition of the waste. Using these data, fossil and biogenic CO_2 emissions can be determined as follows:

- CO_2 fossil emissions = $\sum_i \sum_j$ [Volume of waste$_{\text{partial flow i,component j}}$ ***** percentage of fossil carbon in component j * C-content in component j] * 44/12 (ton CO_2/ton C)
- CO_2 biogenic emissions = $\sum_i \sum_j$ [Volume of waste$_{\text{partial flow i,component j}}$ ***** percentage of biogenic carbon in component j * C-content in component j] * 44/12 (ton CO_2/ton C)

Further details on calculating CO_2 emissions from waste incineration can be obtained from the Renewable Energy Protocol Monitoring (Bosselaar *et al.,* 2006).

The IPCC default values are used for CH_4: for wood and other biomass: 30 kg/TJ

With respect to N_2O the calculations differentiate between waste incineration plants with or without Selective Non-catalytic Reduction (SNCR) deNox technology:

- For plants **not** fitted with SNCR, the N_2O emission factor is based on 20 g N_2O/ton waste (Spoelstra, 1993). This leads to an emission factor that, in 1990, amounted to 2.44 g/GJ and in 2004 was only 1.89 g/GJ.
- For plants that **are** fitted with SNCR, the N_2O emission factor is based on 100 g N_2O/ton waste (TNO, 1995). This leads to an emission factor that, in 1990, amounted to 12.2 g/GJ and, in 2004, had fallen to 9.43 g/GJ.

Over the past few years the number of plants fitted with SNCR has risen steadily. Further details can be found in the NIR 2008 (Van der Maas *et al*., 2008).

2. Auxiliary biomass combustion in power plants

Defining biomass

This auxiliary and co-combustion occurs from 1995 onwards, and is included in the NEH as steam generation and use of steam to produce heat/power. The primary data in the NEH are made consistent with information from the renewable energy statistics.

When revising the statistics for renewable energy in 2005, a differentiation was made between:

1. Auxiliary and co-combustion of biomass in power plants, and
2. Other biomass combustion.

Figures for the first group are reported in their entirety, but for the second group only partially (see Section 3b of this protocol) under IPCC category 1A1a.

Calculating emissions

The extent of the emissions is determined by multiplying these biomass data by the emission factors. The national fuels list (Vreuls, 2006), which includes the energy content and emission factors for solid, liquid and gaseous biomass, is used to determine the CO_2 emission factors or, in the case of CO_2, company-specific data may be used, providing these are reliable. Appendix 1 of the Protocol on Stationary Combustion of Fossil Fuels contains an overview of the primary elements for assessing the reliability of such data. This information may be derived from the company's annual environmental reports, or from annual emission reports.

The following IPCC default values (for energy industries) are used to calculate CH_4 and N_2O emissions:

- CH_4 : for wood and other biomass: 30 kg/TJ
- N_2O : for wood and other biomass: 4 kg/TJ

3. Using biomass in industry and other sectors

3a. Using biomass to generate heat for industry and other sectors

Defining biomass for combustion

Wood-burning stoves are used by industrial companies, the service sector and in agriculture, in order to generate heat: see the category 'wood-burning stoves for heat by companies'. Monitoring concerns wood-burning stoves used to generate heat, with a capacity in excess of 18 kW (Segers, 2005b). This capacity was updated in 1991, 1997, and (annually) from 2004 onwards.

Wood consumption is calculated by estimating the number of 'full-power hours' and the efficiency level. These estimates are based on information from the stove suppliers and a random test of 30 companies using a wood-burning stove (taken from the CBS corporate waste products study). The figures for the intervening years are interpolated, and extrapolated for previous years. Wood consumption (in TJ) is calculated using the capacity, plus an estimate of the number of full-power hours and the efficiency.

The wood-burning stoves used by companies are further differentiated in the NEH from 1995 onwards. Since this differentiation is the same for all years, the following is used to split the determination of the activity data divided over the IPCC categories, from 1990 onwards.

Industrial sector code	IPCC category	Fraction industrial sector
Agriculture and hunting	1A4c	0.05
Wood, cork and reed product industry	1A2f	0.5375
Furniture and mattress industry	1A2f	0.3125
Construction industry	1A2f	0.011475
Wholesale and trade intermediation	1A4a	0.065574
Other companies	1A2f	0.022951

Calculating emissions
The CO_2 emissions from wood-burning stoves are calculated using the standard emission factor of 109.6 for solid biomass (Vreuls, 2006).

The IPCC default emission factors (for manufacturing industries and construction) are used to calculate the CH_4 and N_2O emissions from burning wood and other biomass, i.e.:
- CH_4 : for wood and other biomass: 30 kg/TJ
- N_2O : for wood and other biomass: 4 kg/TJ

3b. Other biomass combustion

Defining biomass for combustion
A limited number of industrial and energy companies (other than power plants) burn biomass (including wood), which means that part of this biomass is also used to generate electricity. This is reported to CBS under the category 'other biomass combustion'. However, other information sources are also used, such as the annual environmental reports and the CertiQ certification system. For emission registration this category has been subdivided since 1995 into:
- IPCC category 1A1: biomass combustion with electricity generation;
- IPCC category 1A2b through f: residues from other biomass.

For the years 1990-1994, the 'other biomass combustion' is included in its entirety under category 1A1. CBS generally uses the TJ values, not the kg.

Calculating emissions
The CO_2 emissions are calculated using the standard emission factor of 109.6 for solid biomass (Vreuls, 2006).

The IPCC default emission factors (for manufacturing industries and construction) are used to calculate the CH_4 and N_2O emissions from burning wood and other biomass, i.e.:
- CH_4 : for wood and other biomass: 30 kg/TJ
- N_2O : for wood and other biomass: 4 kg/TJ

4. Using biomass in households

Defining wood and waste usage
In 1999 a monitoring system for fireplaces and wood-burning stoves was developed (TNO, 1999) at the request of the WESP (Working group on Emissions, Service companies and Product use) task force. The use of wood-burning stoves in household situations was updated in 2001 (TNO, 2001). The method takes the average wood consumption for three types of wood-burning stoves, based on a 1996 study by the VHR (fireplace and flue association) into wood consumption by the owners of such stoves and fireplaces. Up to and including 2001, the VCW (comfortable living association) conducted an annual study into the penetration levels of household wood-burning stoves and fireplaces.

As part of the emission registration process, TNO provides an annual update of household wood consumption, based on the aforementioned sources. After 2001, this update covered only the increased numbers of homes with a fireplace or wood-burning stove, in accordance with the annual increase in housing stock in the Netherlands.

The energy consumption via household wood-burning stoves is determined using the standard heating value for solid biomass: 15.1 MJ/kg wood (Vreuls, 2006).

Calculating emissions
The CO_2 emissions from household use of wood-burning stoves and open fires are calculated using the standard emission factor (of 109.6 kg/GJ) for solid biomass (Vreuls, 2006).

The IPCC default (residential) emission factors are used for CH_4 and N_2O emissions resulting from households, i.e.:
- CH_4 : for wood: 300 kg/TJ
- N_2O : for wood: 4 kg/TJ

This IPCC default value for CH_4 is a factor of 10 higher than that for energy industries, manufacturing industries and construction respectively.

5. Combustion of landfill gas

Defining energy consumption
The amount of landfill gas is determined via the annual questionnaire sent out by the WAR (working group on waste registration). This is described further in Protocol 6A1: CH_4 from Managed Landfill Sites. The statistics for renewable energy are split into used and flared/vented landfill gas. The figures for usage are included in the NEH as energy generation on the one side, and use of cogeneration and final consumption, on the other. The flared/vented biogas is not used to generate energy, but is burned. This is included in the NEH as generation and final consumption.

Calculating emissions
Both the used and flared/vented landfill gases are burned. The CO_2 emissions are calculated using the standard emission factor of 100.7 kg/GJ for landfill-gas biomass (Vreuls, 2006).

For CH_4 and N_2O emissions from incinerating landfill gas, the value of 5 kg/TJ is used for CH_4, and 0.1 kg/TJ for N_2O. These emission factors are the IPCC default values for natural gas (manufacturing industries and construction) (IPCC, 1996, Reference Manual, p. 1.35 and 1.36).

6. Combustion of biogas from wastewater (SWTP-biogas)

Defining activity data
The annual amount of biogas from wastewater is determined using CBS statistics 'Purifying wastewater' (see also Protocol 6B: CH_4 and N_2O from Wastewater). The data are obtained via integral questionnaires from the 27 water-quality managers in the Netherlands.

In total around 90 of the 380 sewer water treatment plants produce biogas. This biogas is used in gas engines, to heat sludge fermentation tanks and for drying sludge. The unused biogas is then burned via a flaring/venting system (known as 'discharge with flaring').

SWTP-biogas is converted using the standard energy content of 23.3 MJ/Nm^3 (Vreuls, 2006).

Occasionally the biogas is vented directly into the air (up to 2002 this was marked as 'destination unknown' and from 2002 onwards as 'discharge without flaring and destination unknown'). This biogas is <u>not</u> included in combustion figures and is reported under IPCC category 6B (see also Protocol 6B: CH_4 and N_2O from Wastewater).

Calculating emissions
The biogas (also known as fermentation gas or sewer gas) that is released during fermentation of sewage sludge consists primarily of methane (up to around 80%, depending on the type of wastewater) and carbon dioxide. The CO_2 emissions from burning biogas are calculated using the standard emission factor of 84.2 kg/GJ (Vreuls, 2006).

When calculating CH_4 and N_2O emissions from burning biogas, the value of 5 kg/TJ is used for CH_4, and 0.1 kg/TJ for N_2O. These emission factors are the IPCC default values for natural gas (manufacturing industries and construction) (IPCC, 1996, Reference Manual, p. 1.35 and 1.36).

7. Combustion of other biogas (including industrial fermentation gas)

The term 'industrial fermentation gas' is often used when referring to the category 'other biogas'. This is confusing, because manure fermentation and compostable-waste fermentation also fall into this group. Industrial fermentation is currently the dominant element, but legislation and subsidies are leading to new initiatives for manure fermentation. This is why the term 'other biogas' is used here, rather than 'industrial fermentation gas'. The differentiation of the biogases into SWTP-biogas, landfill gas and other biogas is thus consistent with international energy statistics that are also used for these three groups.

Defining activity data
Biomass fermentation in the industrial sector releases industrial fermentation gas that is used for heat and/or electricity generation, or is flared/vented into the atmosphere.

Industrial fermentation gas is converted using the standard energy content of 23.3 MJ/Nm^3 (Vreuls, 2006).

Although CBS receives data from each company, this information is not split into the various industrial categories.

Calculating emissions
The CO_2 emissions are calculated using the standard emission factor of 84.2 kg/GJ for industrial fermentation gas (Vreuls, 2006).

When calculating CH_4 and N_2O emissions from burning other biogas, the value of 5 kg/TJ is used for CH_4, and the value of 0.1 kg/TJ for N_2O emissions. These emission factors are the IPCC default values for natural gas (manufacturing industries and construction) (IPCC, 1996, Reference Manual, p. 1.35 and 1.36).

8. Using biofuels for road traffic

Determining activity data
The amount of biofuels used can be found on the Statline website: http://statline.cbs.nl/. Select: Industrie en Energie/Energie/Duurzame energie/Biobrandstoffen voor het wegverkeer (industry and energy/energy/sustainable energy/biofuels for road traffic).

Calculating emissions
The emissions are calculated using emission factors and specific heating value in the following table.

	Specific heating value [1] (MJ/kg)	CO_2 emission factor [1] (g/MJ)	CH_4 emission factor [2] (mg/MJ)	N_2O emission factor [2] (mg/MJ)
Bio petrol	44,0	72,0	17,4	4,81
Bio diesel	42,7	74,3	1,58	2,21

[1] Vreuls, 2006
[2] Klein e.a., 2008

2.2 Emission factors

Complete combustion is assumed for the waste processing plants, i.e. that every ton of carbon burned produces around 1,0 ton of CO_2. The amounts of carbon and the fossil percentages per component are determined and defined in the Renewable Energy Protocol Monitoring.

The relevant standard CO_2 emission factors from the national fuels list (Vreuls, 2006) are used for all biomass. For further substantiation, please refer to this list and its accompanying fact sheets.

In addition, at corporate level, specific emission factors for auxiliary biomass combustion when generating electricity may be taken from the legally required annual environmental reports, rather than the standard factors, providing this is sufficiently substantiated. This is explained further in Appendix 1 of the Protocol on Stationary Combustion of Fossil Fuels.

When determining the CO_2, N_2O and CH_4 emissions from using biofuels in road traffic, information is taken from the Statline website: http://statline.cbs.nl/.
Select: Industrie en Energie/Energie/Duurzame energie/Biobrandstoffen voor het wegverkeer (industry and energy/energy/sustainable energy/biofuels for road traffic). The calculations also use the 'monitoring sustainable energy protocol' [Bosselaar *et al.*, 2006].

For the Emission factors for CH_4 and N_2O, see Section 2.1 of this protocol.

2.3 Activity data

This protocol describes the activity data from the sustainable energy statistics. When defining this, a methodology is used that is taken from the 'monitoring sustainable energy protocol' [Bosselaar *et al.*, 2006]. The data is collected by CBS, in consultation and in combination with various organisations. This results in the CBS data for sustainable energy that, in turn, are integrated into the figures on fossil fuels in the NEH (Netherlands energy management system).

With respect to emissions from non-fossil fuels, the NEH is taken as the central element, the same as when determining CO_2, N_2O and CH_4 emissions from the stationary use of fossil fuels (see the protocol on stationary use of fossil fuels). Biomass is currently published in the NEH as steam/hot water. However, the emissions are actually determined by the underlying biomass data.

The following sources are used for non-fossil fuels:

- Netherlands Energy Management System, annual statistics;
- Statistics for renewable energy, annual data;
- Waste processing in the Netherlands, annual statistics;

- Questionnaires concerning wood consumption in households, implemented by the VHR and VCW, up to and including 2001.

The use of sustainable energy statistics and the NEH means this is a tier 2 method for all activity data.

3 Working processes

Process for estimating (t-1)
If preliminary figures are required at any point, the following process is used to estimate the figure for t-1. The preliminary data for the work package leader are calculated by extrapolating them from the previous years' figures, based on prognoses for the developments in the most important activity data (taken from CBS (Statistics Netherlands) or other statistical sources).

INPUT	PROCESS	OUTPUT	BY WHOM
Preliminary data work package leader (t-1)	Include t-1 data in ER database	ER-db with (t-1) data	Work package leader
ER-db with (t-1) data	Check emission figures: compare with previous years (trend), modify if required and document everything	ER-db (t-1) with any modified figures	Task force

Process for final determination of (t-2)
The final emission figures (as described in this protocol) are calculated using the following process.

INPUT	PROCESS	OUTPUT	BY WHOM
1. amount and composition of waste incinerated (SenterNovem) **(A1)** 2. *Auxiliary combustion of biomass (CBS, CertiQ, AERs)* ***(A2)*** *3.* Biomass use *in industry* ***(A3)*** *4.* Biomass use *in households* ***(A4)*** 5. Combustion of *landfill gas (VA)* ***(A5)*** *6.* Combustion of *SWTP-biogas* ***(A6)*** *7.* Combustion of *other biogas* ***(A7)*** *8. Using biofuels for road traffic (A8)* *Emissionfactors (kg/GJ) per fuel type* ***(B)*** Heating value (MJ/kg) **(C)**	A x B x C	CO_2-, CH_4- and N_2O-emissions of biomass **(D)** (= Final data Work package leader (t-2))	CBS
Final data Work package leader (t-2)	Include (t-2) data in ER database	ER-db with (t-2) data	Work package leader
ER-db with (t-2) data	Check, and trend analysis of air emissions: explain deviations or modify figures	Final defined emission figures (t-2)	Task forces and PBL experts

4 Uncertainty and quality

4.1 Estimating uncertainties

A Tier-1 uncertainty analysis is implemented every year before the NIR is submitted by the ER, based on the greenhouse gas inventory and in compliance with IPCC guidelines. The assumptions used and the results thereof are described in a background report to the NIR. In addition to this, where included in the QA/QC programme for the relevant period, extra analyses are implemented regularly in specific situations, which include any updating of the Tier-2 uncertainty analyses.
The Tier-2 uncertainty assessment was last updated in 2006. This assessment showed that a Tier-1 uncertainty assessment is sufficiently reliable and that Tier-2 uncertainty assessments need only be implemented at periodic intervals of around 5 years, unless a major change in an important source is sufficient to require earlier reassessment.

- Source-specific uncertainty
The uncertainty estimate $_{total}$ concerns the root of the sum of uncertainty in the data sources used (AD_{onz}) in the square and the uncertainty of the emission factor (EF_{onz}) in the square. The extent of the total uncertainty is here primarily determined by the greatest AD or EF uncertainty.

$$\text{Uncertainty estimate}_{\text{total}} = \sqrt{EF_{onz.}^{2} + AD_{onz.}^{2}}$$

The uncertainty estimates concerning the data sources (AD) and emission factors (EF) used, and the total uncertainty estimate, are listed in the following table.

IPCC	Category	Gas	AD $_{onz.}$	EF $_{onz.}$	Uncertainty estimates $_{tot}$
1A1a	Stationary combustion: Public Electricity and Heat Production: liquids	CO_2	0.5	10	10
1A1a	Stationary combustion : Public Electricity and Heat Production: solids	CO_2	1	3	3
1A1a	Stationary combustion : Public Electricity and Heat Production: gases	CO_2	0.5	1	1
1A1a	Stationary combustion : Public Electricity and Heat Production: waste incineration	CO_2	10	5	11

4.2 Quality assurance and quality control (QA/QC)

The ER work package leaders check that:

1. the basic data are well documented and adopted (check for typing errors, use of the correct unit sizes and correct conversion);
2. the calculations have been implemented correctly;
3. assumptions are consistent, also whether specific parameters (e.g. activity data) are used consistently;
4. complete and consistent data sets have been supplied.

Any actions that result from these checks are noted on an ‘action list’. Before defining the data, supervisors check whether the relevant actions on this list, plus the QC checks, have all been completed. Defining the data is carried out by the WEM (working group on emissions monitoring), and confirmed in writing via an e-mail from the institute representatives to the ER project leader at PBL.

The work package leaders fill out a new documentation sheet when adding new data. For reasons of efficiency a minimum level has been set for obligatory documentation, i.e. 5% changes at target group level, and 0.5% at levels concerning the national total. These documentation sheets form part of the trend analysis, as well as the eventual definition of the data set.

The ER work package leaders communicate by e-mail regarding these QC checks, results and actions. They send a printed copy to the ER secretary, who keeps a logbook and compiles these e-mails into an 'action list'. This shows explicitly that the required checks and corrections have been carried out.

4.3 Verification

In order to check the quality of the emission figures for the sources in this protocol, general QA/QC procedures have been followed that are in line with the IPCC guidelines. These are described further in the QAQC programme used by the National System, and the annual working plans published by the ER.

- Sector-specific QC

No additional specific verification procedures are implemented for the sources defined in this protocol.

4.4 Possibilities for improvement compared to the current calculation method

4.4.1 History

In 2005, CBS compiled new information for renewable energy over the period 1990-2004 (Segers, 2005a), whereby the statistics for renewable energy were better integrated into the NEH (CBS, 2005).

The improved calculation method, as defined in the Protocol on Monitoring Renewable Energy (Bosselaar et al, 2006), was used to compile this information, which includes the following improvements:

- Better differentiation of biomass combustion between co-combustion in power plants and other biomass combustion;
- Replacing the data from CBS questionnaires with figures taken from the Association of Waste Companies questionnaires, with respect to landfill gas;
- Drawing up new information on the use of biomass over a complete time period.

The landfill gas questionnaire has been take over by working group 'Afvalregistratie'.

4.4.2 Future

<u>Activity data</u>

Since 2005, CBS has been operating an automation project aimed at allowing biomass data to be published like other fuels, and included in the NEH. This project is expected to be completed in 2007. It should then also be clear to third parties that the emissions for biogenic fuels are taken from the NEH in the same way as emissions from stationary combustion of fossil fuels.

During the winter of 2006-2007 the VHR will ask similar questions concerning household wood consumption in fireplaces and wood-burning stoves, as part of the WOON study by the Ministry of VROM.

Emission factor
When defining the carbon percentage and biogenic percentages of the components, for SRF (Fuels prepared from non-hazardous waste) the protocols are used that have been defined over the past few years, with respect to defining and monitoring renewable energy from mixed flows (NEN, 2004).

5 Remaining aspects

5.1 Point source criteria
Not applicable

5.2 Substance profiles
Not applicable

5.3 Regionalisation
The input of partial flows is clearly known per plant, and thus per region, but the factors used to define the emissions (Tables 2 and 3) use the average waste for the entire country. Regional differences, and it is accepted that these exist for the composition of residual waste such as from households, mean that the values for the individual processing plants may be different. The extent of these differences is not known, but the calculation method is not meant to determine emissions of individual plants.

5.4 Time-based variations in source strength
Not applicable

6 References and additional information

6.1 References

- Bosselaar L, T. Gerlagh: *Protocol monitoring duurzame energie, update 2006* (Renewable Energy Monitoring Protocol, update 2006), SenterNovem, 2DEN0611, December 2006
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6.2 Additional information

Not applicable