Protocol
FOSSIL PROCESS EMISSIONS OF CO_2 AND CH_4

IPCC Category:	1A1b, 1B1b, 1B2a-iv, 2A4i, 2B1, 2B4i, 2B5i, 2B5-ii, 2B5-iv, 2B5-v, 2B5-vii, 2B5-viii, 2C1-vi, 2D2, 2G-iv
NFR Code:	n.a.
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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 methodology and working processes for determining the fossil process emissions of CO_2 and CH_4, which are released through a number of (chemical) processes, i.e.:

1. Producing cokes (IPCC code 1B1b)
2. Oil refining (IPCC codes 1A1b and 1B2a-iv)
3. Producing iron and steel (IPCC code 2C1-vi)
4. Producing soda ash (part of IPCC code 2A4i)
5. Producing ammonia[1] (in the fertiliser industry) (IPCC code 2B1)
6. Producing various chemical and industrial gases (IPCC codes 2B5-ii, 2B5-iv, 2B5-v, 2B5-vii)
7. Producing anodes (IPCC code 2B5-viii)

[1] According to the Dutch PRTR, there are three ammonia producers in the Netherlands.

8. Whitening sugar (IPCC code 2D2)
9. Using lubricants (IPCC code 2G-iv)

The aforementioned processes all involve CO_2 process emissions; the **CO_2 emissions** that are released during the production of Ethene (IPCC code 2B5-ii) and silicon carbide (IPCC code 2B4i) from petroleum coke, are calculated from combusting the residual chemical gases produced, the emissions of which fall under category 1A2 (i.e. ‘ Included elsewhere’, see the protocol for Stationary Combustion Fossil Fuels).
None of the aforementioned processes concern **N_2O emissions**.

This protocol also describes the **CH_4 emissions** that are reported for the production of:

- Cokes (IPCC code 1B1)
- Oil refining (IPCC code 1B2a-iv)
- Silicon carbide (IPCC code 2B4i)
- Carbon black (IPCC code 2B5i)
- Ethene (IPCC code 2B5-ii)
- Styrene (IPCC code 2B5-iv)
- Methanol (IPCC code 2B5-v)

The fossil process emissions of CO_2 are subdivided into two main groups:
(1) emissions resulting from <u>conversion losses</u> when converting from one fuel to another:

1. coke production (IPCC code 1B1b);
2. oil refining (IPCC codes 1A1b and 1B2a-iv) ;
3. using cokes as reduction medium during iron and steel production (IPCC code 2C1-vi);

(2) emissions directly relating to <u>non-energetic fuel consumption</u>:

4. soda ash production (part of IPCC code 2A4i);
5. ammonia production (in the fertiliser industry) (IPCC code 2B1);
6. production of industrial gases (IPCC code 2B5-vii);
7. anode production (IPCC code 2B5-viii);
8. whitening sugar (IPCC code 2D2);
9. use of lubricants (IPCC code 2G-iv).

CH_4 emissions are subdivided into two main groups:
(1) converting from one fuel to another:

- coke (IPCC code 1B1b);
- oil refining (IPCC code 1B2a-iv);

(2) producing specific chemical products:

- silicon carbide (IPCC code 2B4i);
- carbon black (IPCC code 2B5i);
- ethene (IPCC code 2B5-ii);
- styrene (IPCC code 2B5-iv);
- methanol (IPCC code 2B5-v).

The separate protocol for CO_2, CH_4 and N_2O process emissions from <u>non-fossil sources</u> includes the descriptions for CO_2 process emissions from:

- 2A1 Production of cement clinker
- 2A2 Limestone production
- 2A3 Use of dolomite and limestone (except in iron and steel, glass and agriculture)
- 2A4 Use of soda ash (water-free disodium carbonate, water-free soda)

- 2A7 Glass production
- 2B5 Activated carbon
- Part of 2C1 iron and steel (ore, limestone and dolomite usage)
- Part of 2C3 aluminium (anode usage)
- Other (2G) fireworks and candles
- 3A, 3B, 3D solvents/other product usage (indirect CO_2 emissions from NMVOC (air polluting volatile organic compounds))

and for CH_4 and N_2O emissions from:

- Other 2G: fireworks and candles
- Other 2G: CH_4 emissions from degassing drinking water from groundwater
- Other 3D: N_2O emissions from aerosols and anaesthesia

Another protocol contains the description of N_2O emissions from:

- 2B2: production of nitric acid
- 2B5: production of caprolactam.

Appendix 2 provides an overview of the descriptions of process emissions in the various protocols.

1.2 Significance and influences

1.2.1 Contribution to total national emissions

Fossil process emissions for CO_2 contribute about 2% of the total annual greenhouse gas emissions (in CO_2 equivalents).
Fossil process emissions for CH_4 contribute less than 1% of the total annual greenhouse gas emissions (in CO_2 equivalents).

1.2.2 Developments that infuence emissions

Not applicable

2 Method, emission factors and activity data

2.1 Calculation method

2.1.1 CO_2 process emissions

This protocol describes the CO_2 process emissions from <u>fossil fuels</u> with respect to the National Approach. The figures from the CBS Energiebalans (Netherlands energy management system) are used to determine the extent of the activity data (see also the section on 'activity data'). The extent of the <u>emissions</u> is determined in two ways:

(1) For sources 1-3, emissions are determined without multiplying by the storage factors, and refer to the total energy consumption (**transformationfigures),** thus by multiplying the activity data by the emission factors.
(2) For sources 4-9, emissions are determined by multiplying the **activity data** by emission factors and **storage factors.** This is because emissions for these six sources are related to the non-energetic use of fuels.

The emission factors are based on the national fuels list (Vreuls, 2006) or company-specific data (provided these are reliable). This information may be derived from sources such as the Annual Environmental Reports or Annual Emission Reports.

At the refinery, the carbon losses calculated on the basis of the carbon balance are seen as an incomplete measurement of the residual products (refinery gas), and are thus now reported, as a whole, as combustion emissions that are ‘unaccounted for liquid fuel’ under category 1A1b. From 2003 onwards this report has been integrated under 1A1b (normal fuels). The entry for CO_2 process emissions, included under 1B2a-iv, covers the conversion losses of Shell’s SGHP (gasification hydrogen processing) plant (PER + project), which has been in use since 1998. This is the pure CO_2 gas that is vented off along with the captured residual gas. This is reported separately in the annual environmental report. Apart from this plant there are no other conversion losses that have not been included in the combustion emissions.

Determining energy consumption
The individual energy data used as a source for the CBS Energiebalans are also used to determine the activity data for fossil fuels. In addition, the statistical increase necessary for the CBS Energiebalans is added as an extra (dummy) statistical unit. The transformationfigures (for sources 1-3) are taken from the CBS Energiebalans.

Validation of energy consumption
A validation is carried out for a limited group of companies, defined according to the extent of their energy consumption or use of specific fossil energy fuels (primarily coal and crude oil). A list of validated companies is drawn up annually. Information from other sources (e.g. Annual Environmental Reports) is used to check the information taken from the energy statistics. A complicating factor here is that a statistical unit, as used by the energy statistics, is not always exactly the same as that used by a company when compiling its Annual Environmental Report. If there are (considerable) deviations, further research is carried out and, where necessary, the next preliminary energy figures are modified accordingly (also for the CBS Energiebalans).

The activity data can be modified according to the findings of the trend analysis described under Section 3.1.

Calculating emissions
The CO_2 emissions (per RAP code) are determined as follows:

1. In the case of sources 4-9, by multiplying the non-energetic consumption by the emission factors and storage factors.
2. For sources 1-3, by multiplying the transformationfigures by the emission factors.

The emission factor can be company-specific (e.g. by using information from Annual Environmental Reports), provided it meets certain reliability criteria (see Appendix 1); otherwise the emission factors are taken from the national fuels list.

In 2004 the storage factors were redefined for the entire period 1990-2003. Limited use was made of the sector-specific storage factors (experimentally determined using the Annual Environmental Reports (Huurman, 2005), as shown in the following table. In other situations that concern non-energetic use (situations 4-9), all fuels are assumed to be stored entirely (storage factor = 1), with the exception of lubricating oils and fats, where the storage factor is set to 0.5.

Table: Sector-specific storage factors for situations where emissions are determined directly from non-energetic use

SBI-code	Sector description	Fuel	Storage factor
26	Cement and concrete	Petroleum coke	0
31	Other electrical equipment	Petroleum coke	0.95
24.1	Residual base chemicals	Natural gas (Slochteren)	0.8
24.1	Residual base chemicals	Petroleum coke	0.3
15/16	Other foodstuffs	Coke	0
24.1	Inorganic base chemicals (excl. gas, pigments)	Coke	0
24.15	Fertiliser industry	Natural gas (Slochteren)	0.17
26	Cement and concrete	Lubricant	0
27.1/27.3	Base metal: iron and steel	Coke	0
27.1/27.3	Base metal: iron and steel	Lubricant	0
27.4/27.5	Base metal: non-ferrous	Petroleum coke	0.95
15/16	Meat	Coke	0
26	Glass	Petroleum coke	0
26	Glass	Lubricant	0
26	Glass	HBO	0

Depending on the results of the trend analysis day (see Section 3.1), emission factors may (also) be modified.

As part of this CO_2 is sustainably stored underground, the stored CO_2 is deducted from the previously determined (gross) CO_2 emissions. Reports on the stored CO_2 provide insight into the leakage losses during capture, transport and injection.

2.1.2 CH_4 process emissions

Only categories 1B1b (coke production), 1B2a-iv (oil refining), 2B4i (carbide production) and a number of chemical products (2B5i, 2B5-ii, 2B5-iv, 2B5-v, 2B5-vii) produce CH_4 emissions. The IPCC default values (per ton of product) are used as emission factor.

The CH_4 process emissions from coke production (1B1b) and silicon carbide (2B4i) are calculated on the basis of a fixed ratio of 0.5 kg CH_4 per ton of coke and 11.6 kg CH_4 per ton of silicon carbide (the IPCC default values). The CH_4 process emissions from oil refining are taken from the individual company statistics used in the annual environmental report.

The CH_4 process emissions from producing specific chemical products (2B5) are calculated using the following emission factors (in kg CH_4 per ton product):

- carbon black (IPCC code 2B5-i): emission factor 11 ;
- ethene (IPCC code 2B5-ii): emission factor 1;
- styrene (IPCC code 2B5-iv): emission factor 4;
- methanol (IPCC code 2B5-v): emission factor 2.

2.2 Emission factors

CO_2 emission factors are taken from the standard factors used in the national fuels list (Vreuls, 2006). For substantiation of these data, please see the list itself (and the accompanying fact sheets). In addition, at corporate level, specific emission factors are taken from the legally required corporate environmental reports (rather than the standard factors), providing these are sufficiently substantiated (see Appendix 1 for the criteria used).

CH_4 emission factors are based on the IPCC values, as included in the Revised 1996 Guidelines, Workbook for silicon carbide, page 2.20 (value for step 3, tier 1b) and page 2.22 (Table 2.9) (IPCC, 1997):

- coke production (IPCC code 1B1b): 0.5 kg CH_4 per ton coke;
- silicon carbide (IPCC code 2B4i): 11.6 kg CH_4 per ton silicon carbide.

The CH_4 process emissions from manufacturing specific chemical products (category 2B5) are calculated using the following emission factors, in kg CH_4 per ton product (Revised 1996 Guidelines, Workbook page 2.22, Table 2.9 (IPCC, 1997)):

- carbon black (IPCC code 2B5i): emission factor 11 kg CH_4 per ton product;
- ethene (IPCC code 2B5-ii): emission factor 1 kg CH_4 per ton product;
- styrene (IPCC code 2B5-iv): emission factor 4 kg CH_4 per ton product;
- methanol (IPCC code 2B5-v): emission factor 2 kg CH_4 per ton product.

The (limited) CH_4 process emissions from oil refining are taken from the individual corporate figures in the annual environmental reports. The emission factors used are not known, but an effective emission factor can be calculated per ton of oil input.

2.3 Activity data

The following information sources are used for fossil energy fuels used for stationary combustion:

- The (confidential) individual company data and the aggregated statistical data from the CBS Energiebalans, which are published annually by the CBS (see www.cbs.nl).
- Emission factors from legally required annual environmental reports (for format, see www.fo-industrie.nl) providing these are of sufficient quality.
- Standard emission factors from the national fuels list (Vreuls, 2006).
- In 2005, certain storage factors were also used (Huurman, 2005).

3 Working processes

3.1 CO_2 process emissions

The following section describes the process for determining emission figures in the national emissions register (ER).

Supplying primary data

Information is supplied to the CBS (Statistics Netherlands) via the following two methods. Activity data are entered via both methods, and emission (factor) data via the second method (b).

a) The CBS obtains data concerning energy consumption as a raw material via questionnaires (monthly, quarterly, or annually), which are completed by manufacturers, traders and users of fuels. The CBS then incorporates this information into the energy balance (see www.cbs.nl under Statline).

b) Individual figures are also submitted by the companies via their annual environmental reports. These reports must be submitted before 1 April each year (following the year in which emissions took place) to the competent authority (usually the provincial government). The competent authority is responsible for validating the figures in the annual environmental report. Several months later the competent authority submits these validated figures to the CBS. In addition to the figures that can be used for the aforementioned validation process (see Section 2.1), the annual environmental report also contains information on company-specific emission factors.

Processing data
The CBS enters these figures into an SQL database and implements the steps mentioned in Section 2.1, for all process emissions derived from fossil fuels. The database then generates a table showing the emissions according to the relevant RAP codes.

Until 2002 a modification was made by adding the conversion losses from refineries, and the associated CO_2 emissions, to the stationary combustion figures (see also the protocol for stationary fossil emissions).

Supplying data
This table is then submitted to the ER. MNP is responsible for further data processing.

Trend analysis
Once MNP has incorporated the contributions from all task forces into the complete file, this file is then sent (in November each year) to the institutes participating in the ENINA task force, for inclusion in the so-called ‘trend analysis’ or ‘trend verification day’ (TAD) for greenhouse gas emissions. During the two weeks prior to the TAD the institutes check the emission data and compare these figures to previous years. The TAD is organised by MNP/ER. MNP provides the tables of greenhouse gases for these analyses, conform the IPCC specifications. Any changes to the figures are determined by the relevant task force chairperson, in consultation with the work package leader, and are set out in a final list of action points. The work package leader (CBS) makes the changes to the primary data, and supplies a new table to the ER within a period of one week.

Formal approval
MNP processes the changes and makes the modified total figures available to everyone involved as a complete work file. All participating institutes verify and approve the data.

Drawing up the CRF
The data from the ER are also used as input for the Common Reporting Format (CRF) for the UNFCCC and the EU. The international reporting standards demand that the greenhouse gas emissions be reported via a specific layout or format. The data from the ER, which focus on target groups, are converted into the CRF format, conform the IPCC requirements, to show greenhouse gas emissions per sector. The CRF tables (and files) are submitted by MNP/ER, before 15 January, to the Ministry of VROM/KvI. VROM then submits them to the EU before 15 January.

The trends and figures are further explained and incorporated into the National Inventory Report (NIR). The first draft NIR is used for reporting to the EU before 15 January. The draft NIR and CRF are then subject to an external peer review, which must be finalised before 1 March. The final version of the CRF and NIR (for the year t-2) must be submitted to the EU before 15 March, and to the UN before 15 April.

3.2 CH_4 process emissions

The CH_4 process emissions for category 1B1b are added (by CBS) to the table that is drawn up for CO_2 emission figures, before these are submitted to the ER. The CH_4 process emissions from oil refining are taken from the individual corporate figures in the annual environmental reports, which cover the entire sector.

The CH_4 process emissions for category 2B4 (silicon carbide) and the various productions from 2B5, are determined by the MNP (Netherlands Environmental Assessment Agency) based on the activity data taken from the annual environmental reports and the IPCC default emission factors, and these are submitted to the ER. For silicon carbide, the production amounts are available in the annual environmental reports from 1998 onwards; the years prior to this are estimated via extrapolation.

The remainder of the process is identical to the aforementioned description for CO_2.

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-totaal 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 [Olivier et al, 2009].

IPCC	Category	Gas	AD onz.	EF onz.	Uncertainty estimates tot
1A1b	Stationary combustion : Petroleum Refining: liquids	CO_2	10	10	14
1A1b	Stationary combustion : Petroleum Refining: gases	CO_2	0.5	1	1
2G	Other industrial: CO_2	CO_2	5	20	21
2G	Other industrial: CH_4	CH_4	10	50	51
2B1	Ammonia production	CO_2	2	1	2
2B5	Other chemical product manufacture	CO_2	50	50	71
2C1	Iron and steel production (carbon inputs)	CO_2	3	5	6
1B2	Fugitive emissions venting/flaring	CH_4	2	25	25
1B2	Fugitive emissions from oil and gas operations: gas distribution	CH_4	2	50	50
1B2	Fugitive emissions from oil and gas operations: other	CH_4	20	50	54
1B1b	CO_2 from coke production	CO_2	50	2	50
1B2	Fugitive emissions venting/flaring: CO_2	CO_2	50	2	50

Non-combustion or related sources of fugitive emissions (1B)
Fugitive emissions from solid fuels (coke manufacture) (1B1), activity data
CO2 emissions were calculated from the calculation model below: a carbon balance with coking coal as input, and coke and coke oven gas as output:

CO2 from coke and coal inputs = amount of coke * EFcoke + amount of coal * EFcoal – (blast furnace gas + oxygen oven gas produced) * EFBFgas

The uncertainty in coking coal input was estimated at 1% (assuming the same accuracy as for coal use in power plants), and the coke and coke oven gas outputs at 2% and 20%, respectively. The uncertainty of 20% in the amount of coke oven gas produced, reflected the interannual variation in resulting net CO2 emissions per tonne of coke produced, which can be up to 25% (see Table 3.42 in NIR 2005). The accuracy of the C content in these fuels was estimated at 3% for coking coal, vs. 1% for coke and 15% for coke oven gas (Corus, 2004). This resulted in an overall uncertainty in the activity data of about 45% (rounded at 50%), which is quite large given the relatively low uncertainties for the separate terms in the carbon balance [Olivier et al, 2009].

Fugitive emissions from solid fuels (coke manufacture) (1B1), emission factors
The uncertainty in the implied emission factor of CO2 was estimated at 20%, based on the interannual variation of the CO2 emissions per tonne of coke produced (see Table 3.42 in NIR 2005). The large uncertainty in the CO2 emission factor also reflects the way in which these emissions were calculated. The uncertainty in the CH4 emission factor was estimated at 50% [Olivier et al, 2009].

Methane from gas distribution (1B2), activity data and emission factors
The IPCC Tier 3 approach for CH4 from ‘gas distribution’ (1B2) was based on two country-specific emission factors: 610 m3 (437 Gg) methane from grey cast iron, and 120 m3 (86 Gg) from other materials per 1000 kilometres of pipeline, both due to leakages. These emission factors were based on seven measurements of leakage per hour from grey cast iron, at one pressure level, and on 18 measurements, at three pressure levels, from other materials (PVC, steel, nodular cast iron and PE). Subsequently, the results were aggregated to factors for the material mix in 2004. From 2004 onwards, the gas distribution sector annually recorded the number of leaks found per substance, and any future trends in the emission factors will be derived from these data [Olivier et al, 2009].

For CH4 from gas distribution, the uncertainty in the emission factors was estimated at 50%. This uncertainty referred to the limited number of measurements, per gas leak, for different types of substances and pressures, on which the Tier 3 approach of methane emissions from gas distribution was based. The uncertainty in the length of pipeline, per substance, was estimated at 2% (based on apparent inconsistencies in the time series of subsequent surveys) [Olivier et al, 2009].

Emission factors for venting and flaring) (1B2)
The uncertainty in the emission factor of CO2 from gas flaring and venting (1B2) was estimated at 2%, for flaring, taking into account the variability in the gas composition at the smaller gas fields, and, for venting, taking into account the variability in CO2 gas produced at a few locations where CO2 is extracted and subsequently vented [Olivier et al, 2009].
For CH4 from fossil fuel production, the uncertainty in the emission factors was estimated at 25% for gas venting, and 50% for gas distribution. These uncertainties referred to the changes in reported emissions from venting in the oil and gas production industry, over the previous

years, and to the limited number of measurements, per gas leak, for different types of substances and pressures, on which the Tier 2 approach for methane emissions from gas distribution was based [Olivier et al, 2009].

Emissions from non-combustion or related sources
The uncertainty in annual CO2 emissions from coke production (1B2) was estimated to be about 50%. For the annual CO2 emissions from gas flaring and venting this was about 50%. The uncertainty in annual methane emissions was estimated to be 25% from oil and gas production (venting), and 50% from gas transport and distribution (leakage) [Olivier et al, 2009].

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 MNP.

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

When recalculating the CO_2 emissions (Huurman, 2005) from stationary combustion (from 1990 onwards), the process emissions from fossil sources were also redefined.

Furthermore, for the years from 1998 onwards, the calculations for refineries and the allocation of CO_2 from ‘unaccounted-for liquid fuel’ (now part of the liquid fuels under 1A1c) and CO_2 process emissions (under 1B2a-iv) have been improved by using annually weighted emission factors for refinery gas, accompanied by figures per sector. These, together with the other energy consumption for combustion, cover the entire CO_2 combustion emissions. The category ‘unaccounted-for liquid fuel’ is no longer used. In addition, the CO_2 process emissions under 1B2a-iv include the conversion losses of Shell’s SGHP plant (PER + project), which has been in use since 1998. This is the pure CO_2 gas that is vented alongside the captured residual gas, and which is reported separately in the annual environmental report. Apart from this plant there are no other conversion losses that have not been included in the combustion emissions.

4.4.2 Future
Not applicable

5 Remaining aspects

5.1 Point source criteria
Not applicable

5.2 Substance profiles
Not applicable

5.3 Regionalisation
Splitting the Netherlands into regions is important because the provinces often draw up (and implement) their own climate policy plans. This is currently causing considerable problems because the individual corporate data are not included in the system.

5.4 Time-based variations in source strength
Not applicable

6 References and additional information

6.1 References

- Huurman J.W.F. 2005a: *Recalculation of Dutch stationary Greenhouse Gas Emissions based on sectoral energy statistics 1990-2002*. Statistics Netherlands (CBS), Voorburg.
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- Vreuls, H.H.J., The Netherlands: list of fuels and standard CO_2 emission factors, SenterNovem, 2006

6.2 Additional information

Appendix 1: Main elements for evaluating the reliability of company-specific CO_2 emission factors
Appendix 2: Description of CO_2, CH_4 and N_2O in IPCC sectors 2 and 3 in protocols

APPENDIX 1: Main elements for evaluating the reliability of company-specific CO_2 emission factors

The following elements are used to determine whether the specific emission factors reported by a company are of sufficient quality to be used, instead of the standard emission factors.

1. Availability of documentation

The company-specific factor will only be considered if there is suitable written substantiation of the data. A copy of the documentation should preferably be sent to the CBS for inclusion in its data. If this is not possible then the documentation should at least be available for viewing. In any case the documentation substantiating the emission factor should not only be available at the premises of the reporting company, but also at another organisation.

If the company-specific factor deviates by 5% (+ or -) from the standard value, a copy of the documentation should be available at the CBS.

2. Quality of the documentation

The method of determining the emission factor by the company in question must be fully detailed in the documentation. If the emission factor is determined by the composition of the fuel (e.g. batches of coal of various qualities) then the documentation must at least describe how the quality of each batch is determined and, during random evaluation, how this has been carried out, also including the uncertainty margins used. If the emission factor is taken from measurements during the corporate processes, the measurement method (and resulting uncertainty margins) must be described.

If there is no annual document produced to substantiate the specific emission factor, the documentation should preferably be updated every three years (max. every five years).

The methodology for determining the emission factor should preferably be verified by an external consultant. If the documentation is drawn up under the framework of the CO_2 emissions trade, and this is approved as such (e.g. as monitoring protocol) by the Netherlands Emissions Authority, then the quality of the documentation is considered to be sufficient.

3. Periods for which the documentation is available

Data covering a period of at least two years must be used to determine the company-specific emission factors, before it can be used to replace the standard factors.

4. Changeability in the emission factor over time

The specific emission factor can also be determined on a one-off basis, if this is seen as logical for the methodology used (e.g. annual changes within, or just outside, the reliability interval). In that case the factor must be reassessed at least every five years.

APPENDIX 2: Description of CO_2, CH_4 and N_2O in IPCC sectors 2 and 3 in protocols

	Protocol fossil		**Protocol non-fossil**			**Other protocol**
1 TOTAL ENERGY	**CO_2**	**CH_4**	**CO_2**	**CH_4**	**N_2O**	
1A. Fuel Combustion Activities, Energy Industries						
1.b Petroleum Refining	X [1]					
1B. Fugitive Emissions from Fuels						
1.b. Solid Fuel Transformation	X	X				
2.b.iv. Oil Refining/Storage	IE [2]	X				
2. INDUSTRIAL PROCESSES						
A. Mineral Products						
1. Cement Production			X			
2. Lime Production			NE			
3. Limestone and Dolomite Use			X			
4. Soda Ash						
Soda Ash Production	X					
Soda Ash Use			X			
5. Asphalt Roofing		NE				
6. Road Paving with Asphalt		NE				
7. Other; Glass Production			X			
B. Chemical Industry						
1. Ammonia Production (3)	X					
2. Nitric Acid Production						N_2O
3. Adipic Acid Production						(NO)
4. Carbide Production:						
Silicon Carbide	X	X				
Calcium Carbide						(NO)
5. Other *(please specify)*						
Carbon Black		X				
Ethylene	X	X				
Dichloroethylene						(NO)
Styrene		X				-
Methanol		X				
Caprolactam						N_2O
Production other chemicals	X					
Carbon electrodes	X					
Production-activated carbon			X			
C. Metal Production (4)						
1. Iron and Steel Production						
Steel			X			
Pig Iron, Sinter, Coke			IE			
Other *(please specify)*						
Coke, incl. inputs in blast furnace (-BF and oxygas)	X					
Limestone use			X			
2. Ferro-alloy Production						(NO)
3. Aluminium Production			X			
4. SF_6 Used in Aluminium and Magnesium Foundries						-
5. Other *(please specify)*						(NO)
D. Other Production						
1. Pulp and Paper						
2. Food and Drink	X					
G. Other *(please specify)*						
Fireworks and candles			X	X	X	
Process emissions in other economic sectors	X					
Degassing drinking water from groundwater				X		
3. SOLVENTS AND OTHER PRODUCT USE						
A. Paint application			X			
B. Degreasing and dry cleaning			X			
D. Other			X		X	

(NE= Not Estimated; NO=Not Occurring; NA=Not Applicable; IE = Included Elsewhere) [1] included in 1A1b under normal fuels; [2] Shell's SGHP-installation.