

Protocol

1A3b: CO₂ From Road Traffic

IPCC Category:	1A3b
NFR Code:	1A3b
NOSE Code:	201
NACE Code 2008	49.3, 49.4

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 individual protocols have been drawn up in a close collaboration between experts from various sectors of Dutch society, the Emissions Registration (ER, which is coordinated by PBL, the Netherlands Environmental Assessment Agency), SenterNovem, the Ministry of Agriculture, Nature and Food Quality (LNV), and the Ministry of Housing, Spatial Planning and the Environment (VROM).

1 Scope and significance of emission sources/activities

1.1 Scope and definition

This protocol describes the methodology for calculating the CO₂ emissions from road traffic due to the use of motor fuels sold in the Netherlands (IPCC-category: 1A3b and SBI code: 49.3, 49.4). Road traffic consists of all motorized vehicles driving on public roads, including foreign vehicles. This refers to emissions from road vehicles, such as cars, delivery vans, lorries, cabins (for articulated lorries), buses, special vehicles, motorbikes and mopeds.

The road traffic CO₂-emissions depend on the fuel consumption per fuel type. The CO₂-emissions can also be related to the emissions of components containing carbon such as CO, VOC and particulates (PM₁₀). In the CO₂ emission calculations however it has been assumed that the carbon - available in the fuel - is completely released as CO₂. Compared with the amount of CO₂ the emissions of the other components are negligible [Klein et al].

The CO₂ emissions are calculated using a tier 2 method that complies with the criteria set by the IPCC [IPCC, 2001].

1.2 Significance and influences

1.2.1 Contribution to total national emissions

The CO₂ emissions from road transport provide an annual contribution of around 15% to the greenhouse gas emissions in the Netherlands. The contribution to the Netherlands' CO₂ emissions amounts to around 20%.

1.2.2 Major developments that influence emissions

The CO₂ emissions from road transport in the Netherlands shows that, over the past few years, there is a general increasing trend. This has primarily been caused by the increase in road traffic, although a number of other developments also play a role:

- Over the past few years, the diesel consumed by road traffic in the Netherlands has increased fairly sharply compared to the use of petrol and LPG. The CO₂ emissions from diesel vehicles have therefore also increased fairly sharply compared to vehicles running on petrol and LPG.
- Partly as a result of European agreements and legislation, new cars have become more efficient over the past few years. This has ensured that the cars being driven in the Netherlands are also more efficient. At the same time, there is also a clear trend towards larger, heavier cars that, comparatively speaking, use more fuel per kilometre driven. The reduction in fuel consumption by new cars is therefore limited.
- The number of new cars fitted with air conditioning continues to increase. The use of air conditioning leads to increased fuel consumption.
- As a result of European legislation, part of the fuel used by road traffic contains biofuels. The CO₂ emissions released from burning these fuels are reported separately, and are not calculated as road traffic.

2 Method, emission factors and activity data

2.1 Calculation method

CO₂ emissions by road traffic, as reported to the UNFCCC, are calculated on the basis of statistical data on the sales of motor fuels ('top-down', tier 1). The aggregated fuel sales figures (in kilograms) per fuel type are converted to Joules and multiplied by constant CO₂-emission factors (kg/Joule) per fuel type. This methodology meets the requirements of the IPCC [IPCC, 2001].

According to the European Guideline on biofuels (2003/30/EG), in 2010 the transport fuels sold in all European countries must contain 5.75% biofuels. In the Netherlands, the obligation is to go for 4% in 2010. As a consequence, the Netherlands has also introduced biofuels over the past few years. This development is important when calculating CO₂ emissions resulting from the combustion of biomass.

The CBS Statline database (<http://statline.cbs.nl/> Select: Industrie en Energie/Energie/Duurzame energie/Biobrandstoffen for road transport) forms the basis for determining CO₂ emissions from biofuels used in road transport. These calculations also use the 'Protocol monitoring sustainable energy' [Bosselaar et al., 2006].

Calculations of CO₂ emissions from fossil fuels are implemented as follows:

$$\text{CO}_2 \text{ emission (kg)} = \sum_{\text{fuel type}} (\text{fuel sales (kg)} - \text{percentage of biofuels (kg)}) * \text{specific heat (MJ/kg)} * \text{CO}_2 \text{ emission factor (kg/MJ)}$$

The CO₂ emission factors (in kg/GJ) are based on the fairly constant carbon content of the various types of fuel, plus the assumption that all carbon from the fuel is converted into CO₂.

The background figures used to calculate CO₂ emissions from road traffic are published annually and updated in a *set of tables* that accompany the methodology report for calculating the emissions of mobile sources in the Netherlands [Klein et al.]. Each table in the set states which source is used for the figures. The methodology report itself contains a detailed description of the way in which emission factors and emissions are calculated.

The basic data for calculating CO₂ emissions from road traffic (including sales of biofuels) can be found in Table 1.31 of the *set of tables*.

2.2 Emission factors

The CO₂ emission factors (in kg/GJ) are based on the more or less constant carbon content of the different fuel types, and the assumption that all the fuel's carbon is converted into CO₂. Indeed, a complete combustion doesn't take place, but compared with the total amount of CO₂ the correction would be negligible. As a result of this the CO₂ emission factors per fuel type remain constant since 1990.

The fuel conversion factors, emission factors and fuel sales are published in a background document which also gives a detailed description of the methods for the calculation of emissions by mobile sources in the Netherlands [Klein et al.]. This methodology report will be updated once a year.

Table 1 Specific heat en CO₂ emission factors in 2002

	Specific heat (MJ/kg)	CO ₂ emission factor (g/MJ)
(Bio) Petrol	44.0	72,0
(Bio) Diesel fuel	42.7	74,3
LPG	45.2	66,7

Source: Vreuls, 2006

The emission calculations concerning biopetrol and biodiesel are also implemented using the emission factors as stated in the table above.

2.3 Activity data

In the ('top-down') CO₂ calculation method aggregated fuel sales figures are used, which are published by Statistics Netherlands (CBS) in their general internet database called Statline [<http://www.cbs.nl> Choose: Statline; select: Binnenlandse aflevering aardolieproducten]. From monitoring year 2006 onwards [Van der Maas et al, 2008] the activity data in the emission calculations have been corrected for the fraction of biofuels. The fraction biofuels can be found via <http://statline.cbs.nl/> select Industrie en Energie/Energie/Duurzame Energie/Biobrandstoffen voor wegverkeer.

CO₂ resulting from the use of biofuels in road transport is reported under IPCC category 1A3b. The CO₂ emissions for the 'bio' part of the fuel can be found in the CRF (common reporting format) under the memo-item 'biomass'. The amount of biofuel used is shown in the Statline database (<http://statline.cbs.nl/> select: Industrie en Energie/Energie/Duurzame energie/Biobrandstoffen voor het wegverkeer).

3 Working processes

Process for estimating (t-1)

The ER produces annual preliminary emission figures for the previous year (T-1). These preliminary data are calculated by extrapolating the figures from the previous year, based on the development prognoses for the most important activity data (derived from CBS and other statistics).

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
Fuel sales (kg) (source: www.CBS.nl) (A1) CO ₂ -emission factors (kg/GJ) per fuel type (B) Specific heat (MJ/kg) (C1) Bio fuel share (kg) (A2) CO ₂ -emission factors (kg/GJ) per fuel type (B) Specific heat (MJ/kg) (C2)	$((A1 \times C1) - (A2 \times C2)) \times B$	CO ₂ -emissions road traffic in accordance with IPCC (D) Final data Work package leader (t-2)	Statistics Netherlands
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-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.

IPCC	Category	Gas	AD _{onz.}	EF _{onz.}	Uncertainty estimates _{tot}
1A3b	Mobile combustion: road vehicles: petrol	CO ₂	2	0.4	2
1A3b	Mobile combustion: road vehicles: diesel oil	CO ₂	5	0.2	5
1A3b	Mobile combustion: road vehicles: LPG	CO ₂	10	0.2	10

Activity data (AD)

The uncertainty in fuel use by road vehicles was estimated to be 2% for petrol, 5% for diesel oil, and 10% for LPG. These uncertainty estimates were based on an analysis according to the national approach (based on vehicle-kilometre statistics), and the IPCC approach (based on fuel deliveries to fuelling stations) [Olivier et al, 2009].

Emission factors (EF)

For petrol and diesel fuel, the national default was determined from the C contents of 50 fuel samples of both fuels, covering summer and winter qualities and the uncertainty in the mean value: 0.4 and 0.2% for petrol and diesel fuel, respectively. For LPG in road transport, the uncertainty was estimated at 0.2% [Olivier et al, 2009].

Annual emissions

The uncertainty in CO₂ emissions from road transport was estimated to be 3% in annual emissions [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 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

Since 1990 no changes have been made with respect to the source of the fuel sales. The CO₂-factors are derived from Vreuls, 2006. For each fuel a factsheet is delivered in which the methodology of data collection and interpretation is clarified in more detail. From monitoring year 2006 onwards [Van der Maas et al, 2008] the activity data in the emission calculations have been corrected for the fraction of biofuels.

4.4.2 Future developments

Not applicable

5 Remaining aspects

5.1 Point source criteria

Not applicable

5.2 Component profiles

Not applicable

5.3 Regionalisation

Not applicable

5.4 Time-based variations in source strength

Not applicable

6 References and additional information

6.1 References

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- Klein, J.A.P. e.a. (CBS, PBL, RWS-Waterdienst/Deltares, RWS-DVS, TNO-M&L, TNO-EST), Methods for calculating the emissions of transport in the Netherlands. The report, including the tables in the Excelfile, can be found on: <http://www.cbs.nl>; choose: Thema's / Natuur en Milieu / Methoden / Onderzoeksbeschrijvingen / Aanvullende onderzoeksbeschrijvingen.
The Methodology Report and the tables in the Excelfile are being updated once a year
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- Vreuls H.H.J., The Netherlands: list of fuels and standard CO₂ -emission factors, SenterNovem, 2006

6.2 Additional information

Not applicable