Sample check of transport chapter of Netherlands' National Inventory Report (NIR)

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Contents

1 Introduction

1.1 Background

Under the framework of the UNFCCC, countries have to develop and maintain a system for the monitoring of GHG emissions. The Netherlands have established such a system in line with the requirements of UNFCCC.

UNFCCC requires a systematic reporting approach on the basis of the guidelines developed. Part of the systematic approach (illustrated in the good practice guidance) are the quality assurance procedures. These consist of regular audits, to comply with UNFCCC requirements.

An important goal of the IPCC inventory guidance is to support the development of national greenhouse gas inventories that can be readily assessed in terms of quality. It is good practice to implement quality assurance/quality control and verification procedures in the development of national greenhouse gas inventories to accomplish this goal, to guarantee transparency, consistency, comparability, completeness and accuracy of national greenhouse gas inventories.

The audits can be either a peer review or a sample check. A peer review has the aim to ensure that the inventory's result are based on the latest knowledge and in agreement with the IPCC guidelines. A sample check is a more in-depth analysis that also focusses on the (internal) documentation of databases, manuals and instructions, and on the reproducibility of the calculations made. This report presents the results of a sample check of the transport chapter of the 2013 Dutch National Inventory report (NIR, 2013) and the organisation responsible for the submission of the transport chapter, the Transportation Task Force within the Dutch Emission Registration (ER).

1.2 Objectives and project framework

The work plan 2013 of the Netherlands Pollutant Release and Transfer Register (PRTR), which is responsible for compiling the annual Dutch National Inventory Reports, foresees in a sample check for the Transport chapter of the 2013 National Inventory report (NIR). The sample check consists of the following three analyses:

- general consistency and transparency of the documentation;
- use and documentation of datasets, calculations and manuals with reference to the ICT systems;
- reproducibility of the calculations made (sample check).

For the reproducibility of the calculations made, it was agreed to make a sample check for gasoline passenger cars, i.e. emissions of CO_2, CH_4 and N_2O.

The analysis is not meant to be exhaustive and mainly targeted the key aspects from the transport chapter in the NIR and the matching protocols.

1.3 Method

Three approaches have been used to meet the objectives: A review of the documentation, an interview with John Klein (who is mainly responsible for documentation and calculations) and a sample calculation for gasoline passenger cars.

For the review of the documentation, the following documents have been analysed:

- National Inventory Report 2013 (transport chapter and relevant annexes).
- NIR protocols:
  - Protocol 1A3a: CO_2, N_2O and CH_4 from Inland aviation (NIR, 2013);
  - Protocol 1A3b: CO_2 from road traffic (NIR, 2013);
  - Protocol 1A3b: N_2O and CH_4 from road traffic (NIR, 2013);
  - Protocol 1A3c: CO_2, N_2O and CH_4 from Rail transport (NIR, 2013);
  - Protocol 1A3d: CO_2, N_2O and CH_4 from Inland shipping (NIR, 2013).
- Background report: Methods for calculating the emissions of transport in the Netherlands (Klein et al., 2013). This report is hereafter referred to as the Method report.
- Internal manual for calculating emissions mobile sources ('Handleiding berekenen emissies door mobiele bronnen').

The protocols and the NIR 2013 report were checked according to the checklist below. Basis for this checklist were the relevant elements of the QA/QC procedure from the IPCC guidelines: General QC procedures, documentation, checklists in the annexes (IPCC, 2006b).

Table 1 Checklist for assessment of protocols

Criteria	Remarks
Transparency	Clear and transparent Understandable for those who are involved in the process Use of language and spelling
Consistency	Are the documents mutually consistent (NIR, protocol, Method report) Are the figures consistent? Are the formulas consistent?
Completeness of documentation	Includes assumptions and criteria for the selection of activity data and emission factors. Information on the uncertainty associated with activity data and emission factors. Rationale for choice of methods. Methods used, including those used to estimate uncertainty and those used for recalculations. Most relevant data sources are retraceable.
Adequacy	Is the method in agreement with the prescribed IPCC method? (Tier, emission factors, activity data)

The review of the use and documentation of datasets, calculations and manuals consisted of an interview with John Klein. The evaluation was done according to a checklist based on the QA/QC from the IPCC guidelines. This checklist can be found in the Annex of this report.

For the sample check for gasoline cars (CO_2, CH_4 and N_2O emissions), the calculations were repeated according to the corresponding protocols. It was checked if the same emission figures could be reproduced.

2 Consistency and transparency of documentation

2.1 Introduction

This chapter deals with the general consistency and transparency of the documentation. Generally, the method report and the protocols give significant guidance on how the Dutch emissions are calculated.
The quality of the Dutch reporting system is good. However, some remarks on the protocols and the method report can be made, which are described in this chapter. For each protocol a checklist was used, which can be found in Table 1. The checklist addresses transparency, consistency, completeness of documentation and adequacy. First, we discuss some remarks that apply to all the protocols in this section. In the next sections the various protocols are discussed more in detail.

For assessing and understanding the documentation, it was very much searching and switching between documents. This is due to the unclear hierarchy between the documents. If the protocols would be seen as an annex (more elaboration) to the NIR report, the structure would be clearer. At the moment, the method report is more elaborated on some points and the protocols on other points. Here, the hierarchy can be improved. One option is that the NIR report is the main document, the protocols serve as annexes and the Methods report as a reference document for further details.

In the current protocols, some parts (foreword, uncertainty) are almost identical in every protocol and have few added value. The function of the protocols is to give an up to date overview of: Scope and definition for IPCC calculations, calculation method, emission factors used, activity data and the working process. The other parts (points of improvement, uncertainty analysis) could be referenced to the Method report and not be part of the protocols. The interaction of the Method report with the protocols is sometimes unfortunate, because there is overlap and either the Method report or the protocols are outdated. For example, all the protocols include a paragraph on points of improvement, but are often not consistent with the Method report. Either the repeating sections in both documents have to be identical, or a choice must be made where to put the section.

All protocols state (Paragraph 4.2) that all changes of emissions as a result of recalculations are documented in CRF table 8(b), but this is not right. In CRF table 8(b) no recalculations for transport are included. In the NIR report, paragraph 3.2.8 (source specific recalculations) the recalculations are well described, this is sufficient. Either the protocols or the CRF tables should be adjusted.

The use of Tier 1/2/3 in the protocols and the NIR report is confusing and often not accurately described. This is different per substance and transport mode, many times this was misunderstood or described confusingly. This is also due to the confusing prescriptions in the IPCC guidelines and probably because the guidelines have changed in this aspect over time. This aspect deserves some extra attention and has to be described consistently in the protocols and NIR report and in accordance with the IPCC guidelines.

All the country specific emission factors for CO_2 in the protocols are consistent with the emission factors in the NIR report (annex 2). However, for railways and navigation, the N_2O en CH_4 default emission factors were updated in the IPCC guidelines (2006a), but the old default factors (from 1996) are still used in the calculations. This is the correct approach until the emission year 2012. After 2012 the 2006 Guidelines should be followed.

The names of the protocols are not always consistent with subcategories in the IPCC Guidelines. For the consistency between documents it would be advisable to align these names.

In the road transport protocols the use of biofuels is clearly indicated. The use of biofuels in non-road transport is unclear from the documents, while this is important for the IPCC calculations. To prevent confusion, this should be addressed in the other protocols as well (also if there is no use of biofuels).

2.2 Protocol 1A3a Inland aviation

Overall, the protocol is transparent and consistent with other documents, with some minor details that can be improved. One important background report could not be retrieved. The checklist in Table 2 shows specific remarks per criteria.

Table 2 Checklist protocol 1A3a Inland aviation

Criteria	Specific remarks
Transparency	The source for the energy use of jet kerosene and aviation gasoline (AVGAS) seems to be different, and it is recommended that these two are separately described. The description in the protocol on source activity data is confusing: Pulles (2000) or energy balance The paragraph on improvements gives the answer: *Up until 2011 aviation gasoline consumption by civil aviation in the Netherlands was also based on the report of Pulles (2000). This estimate for the year 2000 was applied to the entire time series, as is currently still the case for kerosene. Since 2012, aviation gasoline consumption is derived from the Energy Balance from Statistics Netherlands.* The protocol explicitly shows the emission factors that were used. The calculation method is clear and consistently used.
Consistency	The calculation formula is consistent in the protocol and method report. The description of activity data for IPCC emissions in the Method report is outdated. The description of data sources in the NIR report and the protocol are consistent and both address the new source for AVGAS fuel sales statistics. The NIR report is more elaborate on this topic. The figures in the NIR report are consistent with the CRFs.
Completeness of documentation	The emission factors are included. All relevant studies are available within the task force.

Criteria	Specific remarks
Adequacy	The methodology is reported as an IPCC Tier 2 methodology. The IPCC guidelines state that the Tier 2 methodology requires separate calculations on LTO emissions and cruise emissions. Also LTO emissions should be calculated on an aircraft type basis. The calculation method presented in the protocol corresponds with the Tier 1 method from the Guidelines. Moreover, the Tier 2 method is only applicable for jet fuel use. As inland aviation is not a key category, the chosen Tier 1 methodology is sufficient according to the IPCC guidelines. The default emission factors used are in accordance with the guidelines.

Important points to improve:
- the description of Tier methodology should be accurate;
- separate the description for activity data on AVGAS and jet fuel before and after 2012 in the protocol.

2.3 Protocol 1A3b Road traffic CO_2

This protocol qualifies. There are no important points to improve.
Table 3 shows the specific remarks per criteria.

Table 3 Checklist protocol 1A3b - CO_2

Criteria	Specific remarks
Transparency	The protocol is clear and transparent.
Consistency	The figures in the NIR report are consistent with the CRFs. The protocol is for the most part consistent with the NIR and Method report. The points of improvement in the protocol are outdated, in the Method report this is more elaborate. Also the formula in the Method report (par 1.4.2) is not the same as in the protocol, as it does not include biofuels. The formulas on calculating the CO_2 emission from the specific fuel sales are slightly different on page 3 and 4 of the protocol. The formula on page 3 implies that the specific heat for biofuels is the same as for fossil fuels.
Completeness of documentation	Protocols 1A3b CO_2 and 1A3b CH_4/N_2O are not completely consistent regarding the scope: special vehicles, tractors with semi trailers are not mentioned in the first protocol. Recreational boat traffic is part of the scope, according to protocol 1A3d, but this is not mentioned in Scope and definition. The formula used in this protocol for CO_2 emissions is not correct, 'percentage of biofuels' should be 'biofuels sales'. Data sources for fuel sales and biofuels sales are easy to find with the information from the protocol.
Adequacy	Regarding the Tier methodology chosen, the protocol itself is inconsistent. In par 1.1 it is explained that a Tier 2 method was used, but in par 2.1 Tier 1 is mentioned. According to the available country specific fuel carbon contents, the Tier 2 is used, which also complies with the criteria set by the IPCC.

Important points to improve:
- the formulas should be consistent;
- the description of the Tier methodology should be accurate.

2.4 Protocol 1A3b Road traffic CH_4 N_2O

This protocol qualifies. The calculation methodology is complicated, but explained transparently. Table 4 shows the specific remarks per criteria.

Table 4 Checklist protocol 1A3b CH_4 N_2O

Criteria	Specific remarks
Transparency	The calculation method is complicated, but clearly explained in the protocol. The use of language and spelling is satisfactory. The protocol refers to the tables of the Method report many times in paragraph 2.1. This is unclear for someone who is unfamiliar with this report.
Consistency	The NIR, protocol and Method report are mutually consistent.
Completeness of documentation	Almost all the important sources are referenced in the protocol, with the corresponding tables in the table set (from the Method report) included. Only the specific energy consumption is not available[1]. Recreational boat traffic is part of the scope, according to protocol 1A3d, but this is not mentioned in Scope and definition
Adequacy	It is not clear from the IPCC guidelines whether Tier 3 or a combination of Tier 3 and fuel sales (Tier 1) should be used. From the decision tree (figure 3.2.3) it seems that a vehicle activity based model should be used (Tier 3). However, par 3.2.1.4 (on Completeness) recommends that where cross-border transfers take place in vehicle tanks, emissions from road vehicles should be attributed to the country where the fuel is loaded into the vehicle (Tier 1). A fuel sales based model seems more appropriate. The chosen solution by the task force (calculate fuel specific emission factors based on a vehicle activity model and combine this with fuel sales) seems adequate. The IPCC guidelines could be improved in this aspect.

Important points to improve:
- the description of Tier methodology should be accurate.

[1] For the new NIR report (2014) the specific energy consumption for passenger cars and trucks are available since November 2013.

2.5 Protocol 1A3c Rail transport

In general this protocol is sufficient, but the spelling errors are noticeable. For some parts the protocol is outdated (point of improvement paragraph). Table 5 shows the specific remarks per criteria.

Table 5 Checklist protocol 1A3c

Criteria	Specific remarks
Transparency	The use of language and spelling is sloppy in this protocol. There are many mistakes. The protocol explicitly shows the emission factors that were used. The calculation method is clear and consistently used.
Consistency	The reference to the Method report states that it contains a detailed description of the way in which emission factors and emissions are calculated, while actually this description is very brief. The points for improvement in the protocol are not consistent with those in the Method report. The protocol seems outdated, still referring to 2012 as the future. NIR2013 is much more detailed and specific than the protocol on the recalculation of fuel sales data for railways. This is fine, but the protocol loses its value concerning this aspect. The figures in the NIR report are consistent with the CRFs.
Completeness of documentation	In the protocol, the working process has to be updated for new source (Vivens), this is still NS. The emission factors are included. The source for fuel data is also included.
Adequacy	In the protocol no reference is made to the choice of methodology (which Tier). The NIR report states that a Tier 2 methodology is used. From the calculation method in the protocol it seems that this is Tier 2 for CO_2 and Tier 1 for CH_4 and N_2O. This is adequate for this category.

Important points to improve:
- correct spelling errors;
- protocol should be updated (points of improvement).

2.6 Protocol 1A3d Waterborne navigation

This protocol is somewhat confusing concerning the use of data and for some aspects outdated. Table 6 shows the specific remarks per criteria.

Table 6 Checklist protocol 1A3d

Criteria	Specific remarks
Transparency	The scope and definition is clear in this protocol, which is good as the scope is somewhat complicated. The protocol includes a list of emission sources that are (not) included, this is transparent. The protocol clearly describes that only diesel vessels are included and that gasoline ships (recreational) are included in road transport. It is not totally clear if the emission calculations are based on fuel sales (which are divided into national/international based on the EMS database) or on ton-kilometres travelled according to the EMS database. The protocol says that 'the IPCC emissions have been set equal to the actual emissions'. This is only understandable for those who are familiar with the Method report and should be explained.
Consistency	The NIR seems more up to date than the protocol, as the sources for activity data are inconsistent: according to NIR the activity data is based on Hulskotte (2012) and not EMS (2003) anymore. The points for improvement are not consistent in the protocol and Method report. The figures in the NIR report are consistent with the CRFs. The description in par 2.1 on the calculation method is very brief and does not reflect the actual calculation method well, which includes disaggregation to vessel classes, cargo situations, routes, directions. From the protocol it is not clear if the formula in the Methods report (p43) is also used. Title: water borne navigation in NIR and IPCC guidelines, should be consistent (NIR/IPCC: waterborne navigation, protocol: inland shipping, Method report: inland navigation).
Completeness of documentation	Source for EMS (2003) was not included in the reference list. The emission factors are included. Activity data is described.
Adequacy	The protocol states that a Tier 2 methodology was used, which is right for CO_2, but actually for CH_4 and N_2O a Tier 1 methodology was used with IPCC default emission factors. This is adequate for this category, but it should be clearly documented.

Important points to improve:
- more clearly describe the use of activity data;
- update activity data in protocol for Hulskotte (2012).

2.7 Documentation accessibility

Besides the evaluation on the protocols and the NIR report, it was also evaluated if the relevant documents were easily accessible. The overall conclusion is that the accessibility is very good. All necessary information can be found very easily, i.e. the protocols, NIR, Method report and references. Two websites include all information. On the website nlagency.nl/nie the monitoring protocols, national reports, CRFs, references are included[2].
On the website emissieregistratie.nl, under documentation, air, transport the Method report and other relevant background reports can be retrieved
Both websites are logical and transparent. All information can be found easily. Also both websites are available in Dutch and English.

2.8 Conclusion

Generally, the method report and the protocols give significant guidance on how the Dutch emissions are calculated. The quality of the Dutch reporting system is good. For the different protocols some remarks have been made, but they do not affect the results of the NIR analyses.

[2] Actually, while finishing this sample check report, the name of the organisation NL Agency has changed and therefore some links are outdated.

3 Use and documentation of datasets, calculations and manuals

3.1 Introduction

To assess the quality of the use and documentation of datasets, calculations and manuals, an interview, including an assessment of the computer and data systems, was held with John Klein of CBS on November 27th. He is responsible for the emission calculations for mobile sources that are reported in the National Inventory Report of the Netherlands. The focus of this visit was to understand the process of calculations from input data to output, to see whether the calculations are transparent, structured and reproducible.

Internal documentation

The IPCC guidelines (IPCC, 2006b) on good practice (paragraph 6.11.1) prescribes that it is good practice to document and archive all information relating to the planning, preparation, and management of inventory activities. The checklist from the IPPC guide was assimilated into this review and included in Table 7. For the purpose of this review the checklist was divided into Organisation, ICT and Methodology related aspects. The aspects relating to Methodology were checked in chapter 2 under the criteria Completeness.

Table 7 Checklist for internal documentation

Category	Checklist if information is available	Where to find it
Internal organisation	Project organisation, identification of all contributors and responsibilities.	-
Internal organisation	Institutional arrangements, procedures for the planning, preparation, and management of the inventory process.	-
Internal organisation	Identification of individuals providing expert judgement for uncertainty estimates and their qualifications to do so.	-
ICT	Extensive description of the step-to-step data processing steps and calculation process.	Internal manual
ICT	Data files on emission factors/other parameters used, references to the IPCC document for default factors or to published references.	ICT, checked in interview
ICT	Data files on activity data or sufficient information to enable activity data to be traced to the referenced source.	ICT, checked in interview

The completeness of the methodological and technical documentation was assessed in chapter 2 and evaluated as good. There is very little documentation on organisational aspects. This is all implicit knowledge for the task group members.

3.2 Internal organisation

The task force on transportation[3] works together on the research and reporting of emissions of transport in the Netherlands and is part of the Emissieregistratie that is responsible for reporting the emissions in the Netherlands. The conceptual internal organisation within the Emissieregistratie and task forces in general is described in RIVM (2010), by explaining the different roles and responsibilities in the task force.

The IPCC GHG calculations for mobile sources are part of the research of the task force on transportation, which covers the emissions of nine substances: CO_2, CH_4, N_2O, CO, VOC (without methane), NH_3, NO_x, SO_2 en PM_{10}. The IPCC calculations are carried out simultaneously with the other emission calculations. This is an integrated process. The task force works together on collecting all the input data and delivering the methodology report (Klein et al., 2013). This report describes the methodologies and underlying data used to calculate emissions for the National Inventory Report (amongst others) in detail. John Klein is responsible for making the calculations, except for the part of waterborne navigation which is calculated by Jan Hulskotte (TNO). John collects the input from different sources and processes them for the emission calculations.

To make the detailed knowledge of John available for others, there is a back up plan. To share his expertise, John put together a manual for the calculation of emissions of mobile sources. It is important that this manual is available for the potential stand-in. We received a copy of this manual for the purpose of this audit. With this manual a stand-in would be able to fill in for John. However due to the complexity of the calculation process the stand-in has to be an expert in Excel and it is likely that the stand-in will need some additional help from John because the structure and data processing of the calculations are extensive and require some introduction by the specialist. The stand in would need to be familiar with the IPCC mobile sources protocols and the methodical report (Klein et al., 2013). This is understandable. It would be an added value if the potential stand-in was made familiar already with the technical manual and ICT organisation.

There is not a second person who checks the calculations every year, but the output is thoroughly checked for possible mistakes. This is sufficient, due to the repeating nature of the calculations and the trend analysis that is performed every year. Also an extensive extra check would require many more resources.

Every year a trend analysis check is performed on the calculation results by Gerben Geilenkirchen. The trend analysis consists of a comparison with data from the previous year. The work package leader has to provide an explanation if the increase or decrease of emissions exceeds 5% (target group) or 0.5% (national) compared to the previous year. The trend analysis covers CO_2, CH_4 and N_2O for all modalities, sub modalities and if applicable road types. The whole time series is evaluated and also the differences in historical time series are compared to the time series of the year before. This is an elaborate and sound trend analysis check.

[3] Officially the 'Task force on transportation of the Dutch Pollutant release and transfer Register'.

This year CBS has performed a periodical internal evaluation (not available to the reviewers) for their own purposes, which is also relevant for this review Personal communication on the internal evaluation revealed that the main conclusion of this evaluation was that the nature of the calculations ('one man statistics') has some drawbacks and introduces a risk for the continuity of the calculations, if John would not be available. This is due to the complexity of the calculations.

3.3 ICT organisation

The interview has shown that the data files are compiled logically and the data system is structured properly. The files are stored in one folder which is part of the CBS computer system, which guarantees regular backups and automatic protection in case of an emergency (e.g. power failure). All the input data is stored in the folder 'data', the calculation system in the folder 'prog' and calculation results in 'resulN'. There are specific separated folders for output for IPCC calculations, CBS, Emissieregistratie and Milieubalans. There is no systematic archive of all the data and calculation files for previous years. The input data has a fixed structure that is updated every year by adding a sheet in the excel files with the current year. The data format is maintained.

Some remarks:

- Names of organisations are sometimes outdated (TNO-MEP, BSV, etc.) but this does not result in any problems for the calculations.
- The system is very structured to be able to handle with the large amount of data. Several macros are used to copy and paste the correct data in the calculation process. A disadvantage is that the system needs to have a fixed structure ant is therefore less flexible for changes. An example is the possible development of alternative technologies (e.g. electric/hybrid, hydrogen, cng) vehicles.
- The system structure is in some aspects characterized by its development through time. For example: At first own calculations for cold start, airco etc. Now this data is delivered by TNO. The calculation spreadsheets still exist but are not used. This could be confusing for a stand-in.
- Because there is no systematic archiving system, there may be a risk for not being able to retrace the exact same calculations some years later. Newer and older data may be mixed. A data archive would reduce this risk.

3.4 Calculation process

The calculation process was also explained during the interview. There are three calculation programs for road transport. This can be explained historically. The calculation programs are made in Excel with as input the base year for the calculations and the substances that are required in the output. A macro then combines the input files and writes the output to the right folders.
The output files are standardized in agreement with different institutions that require the output for their reports and administration, such as CBS Statline, PBL (Netherlands Environmental Assessment Agency), Emissieregistratie.

The calculations are made carefully and nothing is changed in the format of the databases and calculation sheets, because this would be sensitive for mistakes. This protects the calculation process from mistakes but also makes the process somewhat inflexible.

3.5 Conclusion

The internal organisation is very dependent on John Klein. Most knowledge is well documented, but some knowledge (especially on the organisation, collection of input data, involved people) is not explicitly documented. It would have an added value if a potential stand-in was made familiar with the technical manual and the ICT organisation.

The ICT organization and calculation process are set up in a structured and accurate way. Spreadsheets are clearly arranged, the data are properly organized as input for the calculations, and the data are transferred to the appropriate format and processed carefully. The output is standardized. The whole process is sound. However, for a stand-in it is a lot to process.

4 Sample check

4.1 Introduction

A sample check was performed for road transport, specifically gasoline passenger cars. The sample check was made for road transport in total for CO_2 emissions (2011) and for gasoline passenger cars specific, for N_2O and CH_4 emissions (2011). For this specific emission source it was checked that emissions are calculated correctly. The emissions were reproduced trough an elaborated calculation. This choice for the subject was made in agreement with the Task Force on Transportation.

The source is representative because road transport is the largest contributor in the mobile sources (97% of emissions). Gasoline cars contribute most in road transport. N_2O and CH_4 calculations require the most detailed and complex methodology used in the IPCC calculations and are a good check for finding all the required data and checking if the methodology description is clear.

4.2 CO_2 - road transport

The total CO_2 calculation for road transport is based on the fuel sales (PJ) and constant CO_2-emission factors (tonnes/PJ) per fuel type. As this is not done on the level of vehicle type, a sample check was made of the total fuel sales according to the CRFs and Dutch energy statistics.

Table 8 **Comparison of energy statistics 2011**

	Energy use (PJ)	
Fuel type	**Energy balance - CBS Statline**	**IPCC - CRF Table1.A(a)s3**
LPG	13.0	12.64
Gasoline	181.37*	181.43
Diesel	271.19*	271.50
Gaseous fuels	0.6	0.56
Biomass	13.44	13.44

* Gasoline and diesel are reported as a total of biomass and fossil fuels in the energy balance.

The energy usage for road transport corresponds with the energy usage stated in the CRF datasheet. There are small differences, but it is unclear what their origin is.

Table 9 **CO_2 emission factors per fuel type**

Fuel type	CO_2 EF (Gg/PJ)
Gasoline	72.0
Diesel oil	74.3
LPG	66.7
Natural gas	56.5

These were combined to calculate the total CO_2 emission from road transport. In total the CO_2 emissions calculated were 34,109.21 Gg, compared to 34,106.96 Gg CO_2 in the CRF tables. This means a difference of 0.01% which is most likely due to rounding.

4.3 CH_4 and N_2O - gasoline passenger cars

For the sample check on CH_4 and N_2O from gasoline passenger cars, the IPCC protocol was followed. Emissions of CH_4 and N_2O are more difficult to estimate accurately than those for CO_2 because emission factors depend on vehicle technology, fuel and operating characteristics. A calculation at Tier 3 level is needed therefore.

First, the total N_2O and CH_4 emissions within the Netherlands (kg) were determined for all subdivisions (Euro-classes and production year). For this, the vehicles kilometres within the Netherlands (km) were multiplied with the specific N_2O and CH_4 emission factors (g/km) per vehicle type. The N_2O and CH_4 emission factors (g/km) for all different vehicle types were available from the Method report. The CH_4 emissions were calculated via the VOC-emission factors (kg/km) and the CH_4 content in VOC (kg/kg). The result was 1.58 mln kg CH_4 and 0.259 mln kg N_2O.

Next, the energy consumption within the Netherlands of gasoline cars (MJ) was calculated, based on the vehicles kilometres within the Netherlands (km) per road type and the specific energy consumption of gasoline cars (MJ/km). The result was 178.7 PJ.

By dividing the emissions within the Netherlands by the energy consumption, the average energy-specific N_2O and CH_4 emission factors (kg/MJ) were obtained.

Last, the average N_2O and CH_4 emission factors (kg/MJ) for gasoline cars were multiplied with the fuel sales (MJ) to obtain the N_2O and CH_4 emissions for all fuel sold to passenger cars in the Netherlands, conform IPCC guidelines (kg).

The specific fuel sale for gasoline cars is unknown, because fuel sales of gasoline are only available for the total amount sold (including mobile machinery, motorbikes). Therefore the share of fuel sales by gasoline cars was assumed as for the energy consumption within the Netherlands (calculated bottom up). The result of the calculations is shown in Table 10.

Table 10 Sample check results

Source	Emissions 2011 (gG)		
	CO_2	CH_4	N_2O
IPCC gasoline cars	12,669.51	1.61	0.263
Sample check calculations	12,669.48	1.61	0.264
Difference	0.0%	+0.1%	+0.2%

The CRF tables only display the emissions on an aggregated level. For the purpose of this sample check, the underlying figures and calculation sheets were obtained from the task group. This way the IPCC emissions could be compared with the sample check calculations. The differences are very small.

4.4 Conclusion

On the basis of the sample check calculations, no omissions have been found.

5 References

Klein, et al., 2013
John Klein, Hermine Molnár-in 't Veld (CBS) ; Gerben Geilenkirchen (PBL) ; Jan Hulskotte, Amber Hensema, Norbert Ligterink (TNO) ; Paul Fortuin (DVS)
Methods for calculating the emissions from transport in the Netherlands
Retrieved from: http://www.pbl.nl/en/publications/methods-for-calculating-transport-emissions-in-the-netherlands
The Methodoly Report and the tables in the Excel files are updated annually

IPCC, 2006a
IPCC Guidelines for National Greenhouse Gas Inventories
Volume 2: Energy, Chapter 3: Mobile Combustion
Geneva : Intergovernmental Panel on Climate Change (IPPC), 2006

IPCC, 2006b
IPCC Guidelines for National Greenhouse Gas Inventories
Volume 1: General Guidance and Reporting
Chapter 3: QA/QC and Verification
Geneva : Intergovernmental Panel on Climate Change (IPPC), 2006

RIVM, 2010
Emissieregistratie : Strategienota 2010-2013
S.l. : RIVM, 2010
Retrieved from: http://www.emissieregistratie.nl/ERPUBLIEK/documenten/Algemeen%20(General)/680355001%20Emissieregistratie%20Strategienota%202010-2013%20Versie%201.1.pdf

Also checked:

- Peer review of the Dutch NIR 2010 for the category transport, W.G. Roeterdink, C.H. Volkers, C.B. Hanschke, ECN, 2010
- Peer review of transport chapter of NIR 2007, Eelco den Boer, Bettina Kampman, CE Delft, 2007

Annex A QA/QC checklists

In accordance with the IPCC guidelines for good practice, checklists were drawn up to facilitate the evaluation of the use and documentation of datasets and calculations. In this annex the checklists are presented with observations that were made in the evaluation.

A.1 Checklist internal documentation

The important documents for the internal documentation are:
- Method report.
- Internal Manual: 'Handleiding berekenen emissies door mobiele bronnen'.

Data documentation: quality checks	Remarks
Check project file for completeness	Estimates are reported for all categories and for all years. Known data gaps are documented
Confirm that bibliographical data references are included (in spreadsheet) for every primary data element	All bibliographical data references are included (also with link if digital is available)
Check that all appropriate citations from the spreadsheets appear in the inventory document and include all relevant information	In general the protocols are complete regarding the citations and include all relevant information. See also chapter 2
Check that assumptions and criteria for selection of activity data, emission factors and other estimation parameters are documented	All well documented in Methodological Report (Klein et al., 2013)
Check that changes in data or methodology are documented	There is a separate table in the Methodological Report Tables (10.1) that reports the changes in data or methodology per year. The report and the Tables are available both in Dutch and in English
Check version management and documentation	The methodological report is updated every year and the most recent version can be easily found. Older versions are difficultly accessible. There is no archive of former versions of the data, calculation sheets of manuals, these are updated every year

A.2 Checklist calculations

Calculating emissions and checking calculations	Remarks
Check that all calculations are included (instead of presenting results only)	Al the input, calculating programs and output were shown
Check whether units, parameters, and conversion factors are presented appropriately	Units are not presented in every calculation sheet, but this is in our opinion also not necessary. In every input and output file units and parameters are presented appropriately. Conversion factors are added in the calculations manually (e.g. from PJ to TJ, from mg to mln kg), this makes the calculation sensitive for mistakes, but no mistakes were observed
Check if units are properly labelled and correctly carried through from beginning to end of calculation	In all evaluated input and output sheets units are properly labelled. This is also the case for the 'methodological report tables'.
Check that conversion factors are correct	Some randomly selected calculations were discussed in detail, in which the conversion factors were correctly processed.
Check that temporal and spatial adjustment factors are used correctly	This was not thoroughly evaluated. As for the energy statistics on road traffic: Energy use by vehicles in the Netherlands was also calculated bottom up, so that the emissions calculated in Tier 3 could be attributed to energy use correctly (see protocol 1A3b: CH_4 and N_2O)
Check the data relationships (comparability) and data processing steps (e.g., equations) in the spreadsheets	All data processing steps are performed clearly organized and there were no observed mistakes.
Check that spreadsheet input data and calculated data are clearly separated	Input data and calculated data are stored in different folders.
Check how data within a category is aggregated	Aggregation is clearly organised. Also, during the calculation process subtotals are checked for consistency
Check for consistency: Identify parameters (e.g., activity data, constants) that are common to multiple categories and confirm that there is consistency in the values used for these parameters in the emission/removal calculations.	There is consistency in values used for parameters. Constants are sometimes rounded off in intermediate data processing steps, which introduces a small deviation. The mixed use of emission factors including / excluding biomass can be confusing sometimes
Check if there is a clear match between protocols and calculations	The protocols are discussed in detail in chapter 2.