Monte Carlo Analysis of Uncertainties in the Netherlands Greenhouse Gas Emission Inventory for 1990 – 2004

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1 Introduction

In their report "Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (IPCC, 2000) the IPCC has established guidelines that prescribe how uncertainties in National Greenhouse Gas Inventory Reports (NIR) should be analyzed and reported to the secretariat of the United Nations Framework Convention on Climate Change. The guidance offers countries the possibility to choose either a simplified uncertainty analysis that uses error propagation equations ('Tier 1'), or a comprehensive Monte Carlo based analysis on a more detailed level of aggregation ('Tier 2'). Because a full Tier 2 analysis is quite resource intensive, the guidance advices: "*...for the present, it is good practice for all countries undertaking uncertainty analysis to report Tier 1 results, and for all inventory agencies with sufficient resources and expertise to undertake Tier 2.*" (IPCC, 1996).

In the National Inventory Report (NIR), the Netherlands annually reports uncertainties according to the Tier 1 method. In commission of the Werkgroep Emissies Broeikasgassen (WEB), a first Tier 2 analysis was carried out for the Netherlands for the 1999 emissions (Olsthoorn and Pielaat, 2003). The goal of that study was to explore the viability of using a Tier 2 method for the Netherlands. That study concluded that there was no need to repeat a Tier 2 every year, because it is unlikely that uncertainties will change quickly over the years. In recent years, various other European countries also have carried out Tier 2 studies for their NIRs (see chapter 5 for an overview).

In the framework of a continuous improvement of the Netherlands emission inventory, recently the way in which emissions are calculated has been changed substantially (see NIR 2005 for a discussion). This has led to recalculations, also for the reference year 1990, which have been included in the NIR and the Common Reporting Format (CRF) for 2005. The Tier 1 analysis shows substantial differences in calculated uncertainty in total greenhouse gas emissions before and after the recalculations. Consequently, substantial changes in outcome due to improvements in inventory methodology are expected for Tier 2 outcomes as well. Furthermore, the earlier Tier 2 study was in several ways a preliminary one. It could not easily be compared to the Tier 1 study for the same year because the aggregation level differed significantly and the uncertainty assumptions were not harmonized across the two studies. This made it impossible to get a clear insight in the added value of a Tier 2 (more particularly, of accounting for correlations and including non-normal distributions) compared to the Tier 1. In addition, there has been little exploration of the effect of correlations, whereas the possibility to include correlations it is widely seen as one of the main advantages of Tier 2 over Tier 1. Finally, it has to be noted that for the NIR the Netherlands uses an improved version of Tier 1 by taking into account an extra term of the tailor series. It is expected that this improvement diminishes the differences in outcome between Tier 1 and Tier 2, but to explore that, a Monte Carlo analysis is needed at a comparable aggregation level and using the same assumptions for uncertainty ranges as the Tier 1 study where possible.

The present study is not a full-blown Tier 2 analysis but merely a Monte Carlo analysis at the Tier 1 aggregation level and using data and uncertainty assumptions from the Tier 1 study. A full-blown Tier 2 analysis would require a much more detailed emission model, implementing the Monte Carlo analysis using emission factors of individual fuels and processes, whereas at the Tier 1 aggregation level implied emission factors are used. Many correlations can be modelled much more adequately at a Tier 2 aggregation level, but the data required for a full-blown Tier 2 were not available for this project, nor did we have the resources to acquire these data.

The objective of the present study is four fold:

- To perform a Monte Carlo analysis of uncertainties in the NIR, accounting for all known correlations and using similar assumptions for uncertainty ranges as the Tier 1;
- To obtain insight in the differences in outcomes between the improved Tier 1 used annually in the Netherlands NIR and the Tier 2;
- To obtain insight in how the Netherlands Tier 2 and the Netherlands assumptions for uncertainty ranges in activity data and emission factors relate to Tier 2 studies performed in other European countries;

- To provide advice regarding the necessity and frequency of future Tier 2 studies for the Netherlands.

It should be emphasized that the NIR covers only those greenhouse gas emissions that are regulated under the Kyoto protocol. Not all anthropogenic greenhouse gases are part of the Kyoto protocol and not all anthropogenic sources of Kyoto greenhouse gasses are regulated by the Kyoto protocol. This mismatch between "real" anthropogenic greenhouse gas emission and the subset covered by the Kyoto protocol is outside the scope of this study. Secondly, it should also be emphasized that the inventory method developed by the IPCC and published in the "Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories" (IPCC, 1996) is taken for granted in this uncertainty analysis. For instance, uncertainty in the so called "global warming potentials" that are used to calculate CO_2-equivalents for emissions of non-CO_2 greenhouse gases are not included in the present analysis. The scope of the present uncertainty analysis is mainly limited to uncertainty in activity data and emission factors.

This report is structured as follows. Chapter 2 documents the base case for the Monte Carlo analysis. We discuss the methodology used for our analysis and the aggregation level chosen for the emission model, and we describe for each sector what assumptions were used for uncertainties and correlations in emission factors and activity data. Chapter 3 presents the results of the Monte Carlo analysis for the base case. In chapter 4 we do an importance analysis to get insight into what uncertainties in the input data and parameters of the emission monitoring calculations for the base case contribute the most to the uncertainty in the total greenhouse gas emission. The base case uses assumptions for uncertainty distributions that are harmonized as much as possible to the assumptions used in the Tier 1 in the NIR 2005. In order to test robustness of the analysis to the assumptions made, and to put these assumptions in perspective, we did a comparison of uncertainty assumptions used across Tier 2 studies published by European countries. This comparison is presented in chapter 5. Chapter 6 presents a range of scenario's to further explore robustness of the base case. The scenarios were chosen in close consultation with an advisory group (hereafter, the "Klankbord group") composed of Harry Vreuls (SENTER Novem), Laurens Brandes (Netherlands Environmental Assessment Agency, MNP), Romuald te Molder (MNP), Jos Olivier (MNP), Agnes Agterberg (Ministry of Housing Physical Planning and Environment, VROM) and key experts of the NIR from the MNP. The scenarios focus on those activity data and emission factors where there are reasonable arguments in support of other assumptions than the ones made in the base case, but lack of information makes it impossible to decide which assumption is the most adequate representation of the uncertainty.

Chapter 7 discusses the main findings, presents conclusions and provides some recommendations for further improvement of the Netherlands greenhouse gas emission monitoring. Tables with detailed results for the base case and the scenarios are shown in the Appendices.

2 Description of the Monte Carlo methodology for the base case scenario

An important aspect of an uncertainty analysis concerns the way in which the uncertainties associated with individual estimates or with the total inventory are expressed. The Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines) specify the following: '*Where there is sufficient information to define the underlying probability distribution for conventional statistical analysis, a 95 per cent confidence interval should be calculated as a definition of the range. Uncertainty ranges can be estimated using classical analysis or the Monte Carlo technique. Otherwise, the range will have to be assessed by national expert*s.'

In the context of this report, the basic goal of the Monte Carlo analysis is to quantitatively characterize the uncertainty and variability in estimates of Greenhouse Gas Emissions in the Netherlands. A secondary goal is to identify key sources of variability and uncertainty and to quantify the relative contribution of these sources to the overall variance and range of model results.

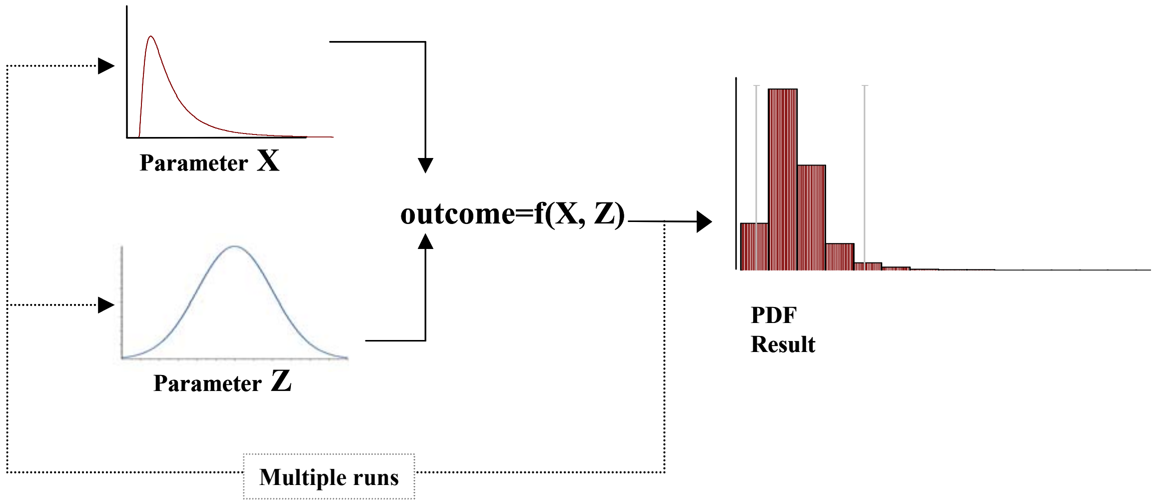
2.1 Monte Carlo methodology

Numeral statistical techniques (e.g. Monte Carlo) are suitable for estimating uncertainty in emission rates (from uncertainties in emission factors and activity data) when [IPCC, 2000]:

- Uncertainties are large or probability distributions function are non-gaussian,
- The emission calculation algorithm is composed of complex functions,
- Correlations occur between some of the activity data sets, emissions factors or both.

The Monte Carlo method, also called Monte Carlo analysis, is a means of statistical evaluation of mathematical functions using random samples. Monte Carlo allows to associate a range of values with a given probability curve instead of a fixed value to a variable. A simulation calculates multiple scenarios of a model by repeatedly sampling values from the probability distributions from the uncertain variables and using those values to generate a probability function for a desire outcome. A diagram representing the way a Monte Carlo analysis works is shown in Figure 2.1. In this project, we use the software tool @Risk to perform the Monte Carlo analysis. @Risk is an Excel “add-in’ tool which allows to define probability density functions to input and output parameters in an Excel model.

Figure 2.1. Simplified representation of Monte Carlo analysis to a model with two parameters and one outcome.



In the rest of this chapter we describe the distribution functions applied, the main characteristics of the Excel model and the correlations that have been taken into account.

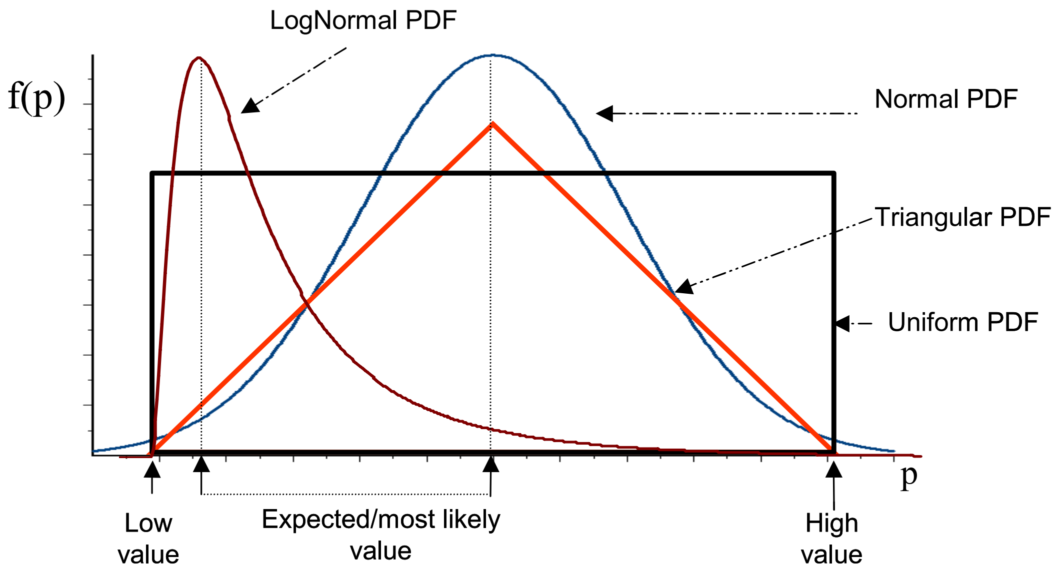
2.2 Distribution function types and default distributions used

As noted in section 2.1, Monte Carlo analysis is based on the use of probability density functions (PDF’s) to represent the uncertainty of variables. Unlike error bars, which only give a range in which the solution should fall, PDF’s attach a likelihood to each possible value. Formally, a PDF is any function f(x) that describes the probability density in terms of the input variable *x* such that:

1. $\int_a^b f(x)dx = \Pr[a \leq X \leq b]$ Equation 2.1
2. It is non- negative for all real *x* and,
3. The integral of the function is one.

PDF's are used as the basis of the Monte Carlo analysis and the proper specification of PDF's is essential for a meaningful analysis. PDF's can take a number of standard forms e.g. normal, lognormal, beta, etc. In this project, four distribution types have been used: uniform, normal, triangular and lognormal. Figure 2.2 shows the graphic representation of these probability distribution functions. A brief explanation of each type follows.

Figure 2.2 Graphic representations of several PDF types.



- *Uniform distribution*. It is the simplest kind of probability density function. A uniform density function *f* is a density function that is constant (see equation 2.2). In other words, in a uniform distribution, it is assumed that there are equal probabilities on a value being close to the mean or far away. This distribution is considered appropriate when it is possible to identify a range of possible values but is not possible to decide which value is more likely to occur.

$$1 = \int_a^b f(x)dx = \int_a^b kdx = k(b-a) \Rightarrow k = 1/(b-a)$$ Equation 2.2

- *Triangular distribution*: In this type of distribution it is assumed that the value is more likely to be near the most likely value than far away. Equation 2.3 shows the mathematical representation of this distribution. A triangular distribution is selected when there is some certainty about the most expected value but the shape of the distribution is not precisely known. In this way, the triangular distribution, with its apparently arbitrary shape and sharp corners, may help to prevent over interpretation of results or a false sense of confidence (Morgan and Henrion, 1990).

$$f(x) \begin{cases} \frac{2(x-a)}{(b-a)(c-a)} & for \quad a \le x \le c \\ \frac{2(b-x)}{(b-a)(b-c)} & for \quad c < x \le b \end{cases}$$ Equation 2.3

- *Normal distribution*: this is a symmetrical distribution, with a bell shape which shows a peak occurring at the mean. This distribution is a function of the form shown in equation 2.4 where μ is the mean and can be any real number and σ is the standard deviation and can be any positive real number. This type of distribution is used as the standard type in this report for parameters considered having a symmetrical uncertainty distribution and a limited range relative to the mean value (coefficient of variation < 30% for parameters that cannot be negative).

$$f(x) = \frac{1}{\sigma\sqrt{2\pi}} e^{-\left[(x-\mu)^2 / 2\sigma^2\right]}$$ Equation 2.4

- *Lognormal distribution*: This distribution is the probability distribution of any random variable whose logarithm is normally distributed. The lognormal distribution is a distribution skewed to the right. The PDF starts at zero, increases to its mode and decreases thereafter. The mathematical expression of the function is shown in equation 2.5. This type of distribution is used for parameters considered to have an asymmetrical uncertainty distribution, with no negative values. This distribution has been chosen when the standard deviation reported in the TIER1 is equal or greater than 30%.

$$f(x) = \frac{1}{x\sigma\sqrt{2\pi}} e^{-\left[(\ln x-\mu)^2 / 2\sigma^2\right]}$$ Equation 2.5

2.3 General methodology

A Monte Carlo analysis is applied to the calculations used to estimate greenhouse gas emissions in the Netherlands. The analysis is performed for the base year (1990[1]) and for 2004. Basic data for the emission calculations have been extracted from the detailed background information of the Dutch NIR as provided by the Netherlands Environmental Assessment Agency (in Dutch, Milieu-en Natuurplanbureau MNP)[2]. In general terms, emissions are calculated by applying an emission factor to an appropriate activity statistic (Equation 2.6). Hence, the uncertainty in the emission of a gas *i* derives from the uncertainties in both, the emission factors and the activity rate.

$$Emission_i = Factor_i \times Activity_i$$ Equation 2.6

Figure 2.3 provides a rough diagram of how the Monte Carlo model has been constructed. The PDFs of the activity data and emission factors for each sub sector are inputs into the model. The model calculates the distribution function for the greenhouse gas emissions of each sub sector, sector and the country by greenhouse gas type (CO_2, CH_4, N_2O, F-gas). A summary of the procedure used in this report is given below:

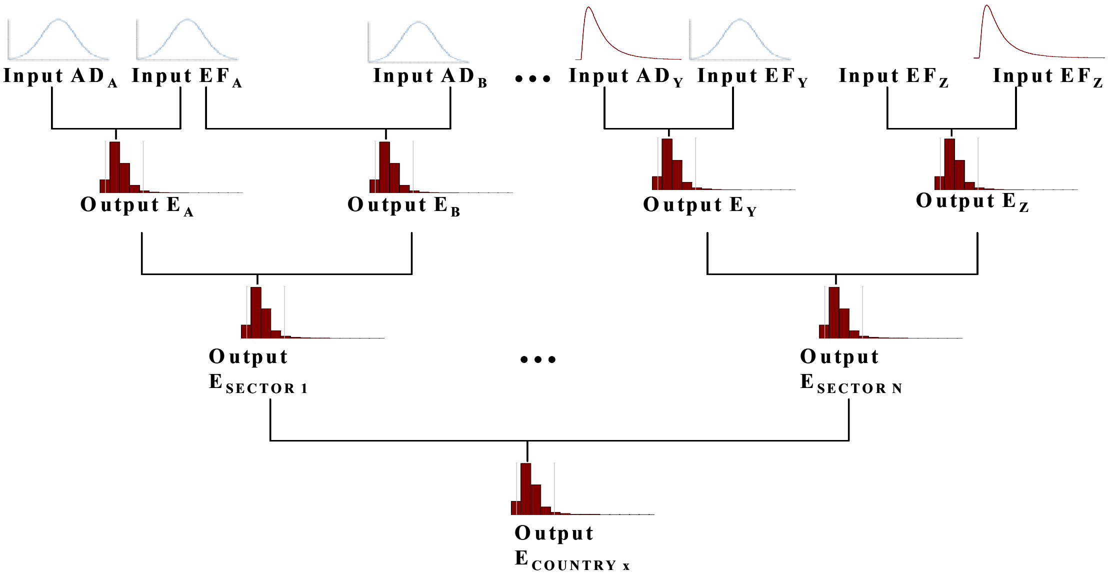
• First, an uncertainty distribution is allocated to each emission factor and each activity rate. The parameters of the distributions for each emission factor or activity rate were based on the uncertainty values used for the Tier 1 analysis of the

[1] Base year for F-gases is 1995.

[2] As explained in the introduction, the NIR for 2005 and the Monte Carlo analysis were being developed at the same time, hence the basic data used in the Model had to be modified several times. The final calculations of this report are based on the data provided by MNP in January 2006 (Excel file: NIR-2006-v8).

Greenhouse Gas inventory and by expert judgment from the MNP (Olivier and Brandes, 2006). PDFs have been truncated to zero when it is considered physically impossible that a parameter could take negative values.

Figure 2.3 Schematic diagram of the Monte Carlo model use to calculate greenhouse emissions



AD_A: activity data subsector *A*; EF_A: emission factor sub-sector *A*; E_A: emissions sub-sector *A*
$E_{sectpr\ 1}$: Total Emissions from sector *1*; $E_{country\ X}$: Total emissions from country *X*; Input: external data given to the model; Output: result of the Monte Carlo simulation

• A calculation was set up to estimate the emission of each pollutant by sampling individual data values from both the emission factor and activity rate distributions on the basis of probability densities and evaluating the resulting emission. The simulation parameters used in @Risk to generate the probability functions of the outcomes are:

- Number of iterations: 50.000
- Sampling type[3]: Monte Carlo
- Standard recalculation[4]: True EV
- Random generator seed[5]: Choose randomly
- Monitor convergence[6]: every 1000 iterations

[3] Sampling types vary in how they draw samples from across the range of distribution. @Risk allows choosing between two types: Latin Hypercube and Monte Carlo.
[4] This option specifies how distribution functions are valuated during a regular Excel recalculation. @Risk provides 3 options: Expected value (causes distribution functions to return their expected or mean value during a recalculation); Monte Carlo (causes to return a random sample value) and True EV (causes to return their expected or mean value during a recalculation).
[5] This option allows the entry of a seed value for the random number generator. There are three options: Choose randomly (@Risk randomly pick a new seed in each simulation), Fixed (@Risk uses the same seed in each simulation) and Multiple simulations used different seed values.

• Dependencies[7] between activity data or emission factors are included in the calculation (e.g. in Figure 2.3, a correlation has been depicted by using the same emission factor to calculate emissions E_A and E_B).

• The mean value for each emission estimate and the national total is recorded, as well as the standard deviation and the 95% confidence limits i.e. the emission values at the 2.5% cumulative probability and the 97.5% cumulative probability.

• Following the IPCC Tier 2 method (IPCC, 2000), uncertainties in the trend emissions were calculated in absolute terms (as the difference between the emission in the year t and the base year, with their corresponding distribution functions) and in relative terms (as the difference between the emission in the year t and the base year divided by the emissions in the base year).

•A key source analysis was undertaken, following the IPCC Tier 2 method (IPCC, 2000).

In this report, all emissions are reported in CO_2 equivalents. To transform the different emissions into CO_2 equivalents, the global warming potentials (GWPs) endorsed by the IPCC have been used. Although uncertainties are introduced into the emission calculations by the GWP factors[8] (e.g. the IPCC estimates that uncertainties on GWP for current values are in the range of at least 35% (IPCC, 2001)), the Monte Carlo analysis does not consider the uncertainties in Global Warming Potentials, since it has been agreed at the Third Session of the UNFCCC Conference of the Parties that national inventories will work with fixed GWP (uncertainty equal zero). Table 2.1 shows the different GWPs used. The GWP for CO_2 is, by definition, equal to one.

The level of sector aggregation at which results are calculated in this report was determined by the level of aggregation used in the Tier 1 analysis (since it is a main goal of this project to compare results between Tier 1 and a Monte Carlo analysis).

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[6] Convergence is monitored by examining the change in the mean, standard deviation and percentiles of each outcome between different iterations. In our case, we have considered that there is convergence when the change in the statistics is ≤1.5%.

[7] A correlation describes the strength of an association between variables. An association between variables means that the value of one variable can be predicted, to some extent, by the value of the other.

[8] Uncertainties in GWPs arise from our limited understanding of atmospheric processes which determine the lifetime of the gas in the atmosphere, its effect on other greenhouse gases, and its direct contribution to the greenhouse effect.

Depending on data availability, our model works with the most detailed level of information available and regroup it to arrive to the Tier 1 level of aggregation.

Table 2.1 Global warming potential factors by gas type.

Gas	Global Warming Potential
CO_2	1
CH_4	21
N_2O	310
CF_4	6500
C_2F_6	9200
HFC-23	11700
SF_6	23900

Detailed background information for the uncertainties used in the Dutch Tier 1 analysis has already been reported by Olivier and Brandes (2006) and therefore, the information will not be repeated in this report. We will, however, highlight the main aspects relevant for each sector.

2.4 Uncertainties assigned to the emission factors and activity data by sector.

2.4.1 Energy (Sector 1)

This sector is divided into two main sub-sectors: 1A- fuel combustion (energy industries, manufacturing industry and construction, transport, residential, services, agriculture/fisheries and military ships and aircrafts) and 1B- non-combustion or fugitive related sources (coke manufacture, oil production gas processing, oil refining, transport and distribution). Table 2.2 shows the uncertainties and PDF's used for this sector. Note that:

- Emissions of each greenhouse gas and category are basically calculated according to Equation 2.6.
- Activity data corresponds to the fuel consumption in each sub sector. Data are shown for five fuel types (liquid, solid, gaseous, biomass and 'other' fuels). In the case of gaseous fuels, this refers to natural gas only, while the 'other' fuels refers to the fossil waste component in waste incineration. Liquid and solid fuels are composed of several fuel types (e.g. the liquid fuel category is

composed of: residual chemical gas, HBO, LPG, residual fuel oil, Jet fuel petroleum basis, etc.). In most cases, there is no data available (fuel consumption and/or its related uncertainty) that would allow us to work at a detailed fuel level. As a main consequence, the emission factors provided by MNP (and with which we work out our emission estimates) are in fact, *implied emission factors* which reflect the mix of individual fuel types.

For this sector we take into account the following correlations:

- Activity data between years is assumed to be independent (correlation equal zero), with the exception of civil aviation in which the same activity data is reported for 1990 and 2004 (correlation equals one).
- Activity data used to calculate emissions (CO_2, N_2O, CH_4) within a given year from the same source category is 100% correlated (in other words, when the calculation of the individual gases from the same source use the same activity data). In the model, this is done by relating the calculations to a unique activity cell.
- There are four types of correlation factors used for the emission factors: *i*) when a fuel has the same emission factor between sectors and/or between years (e.g. natural gas), we assume a 100% correlation. In the model this is done by relating all calculations to a unique cell; *ii*) when a given fuel has a similar implied emission factor between years (diverging by less than 10%), we assume that the divergence is caused by a small change in the mix of fuels (since the same fuels mix is assumed to be present, the implied emission factors between the years are correlated). We assume the correlation factor (r) to be 0.75; *iii*) when the same fuel has an emission factor that between years diverge in the range of 10-40%, a weak correlation is assumed (r=0.5), and *iv*) when the same fuel has emission factors that diverge by more than 40% (between years or between sectors), we assume this to be independent (and therefore no correlated). Note that the correlation factors used only reflect our *qualitative* understanding of the relations. A sensitivity analysis will be performed to assess their influence in the robustness of the results.
- The total length of the gas distribution network (sub sector 1B2) is more accurately monitored than the length per type of material. Since two material

types are distinguished, the activity data of both are correlated through the lower uncertainty in the total. We assume a correlation factor of – 0.5.

- Uncertainty estimates for activity data are explicitly stated in the model with one exception: the commercial/institutional sector (1A4a). Activity data for this sector is calculated as the difference between the amounts attributed to the total sector and the other sub sectors. Hence, the uncertainty of the data is dependent on the uncertainties of the other amounts. There are different ways of accounting for these kinds of dependencies. The methodology applied to calculate the uncertainties in the activity data of the sector 1A4a can be schematized as follows:

  Given three dependent uncertain parameters A, B and C such as that A+B+C=Z, the probability distribution functions of each parameter can be calculated as:

$$A' = \frac{Z * A}{(A+B+C)}; B' = \frac{Z * B}{(A+B+C)}; C' = \frac{Z * C}{(A+B+C)}$$

  This way of accounting for complementary dependencies among the parameters does not result in PDFs that produce unrealistic values as would happen if the complementary dependencies were taken into account by, for instance, only subtracting the parameters (e.g. A'=Z-B-C), in which case a high amount of values would have to be filtered in order to assure that A+B+C would not be greater than Z, which in turn results in major deviations from the original mean values.

2.4.2 Industrial processes (sector 2)

This sector comprises all non-combustion emission from the manufacturing industry and all emissions from the use of F-gases, HFC, PFC and SF_6. This sector consists of the following sub sectors:

- Mineral products (2A)

- Chemical industry (2B)
- Metal production (2C)
- Other production (e.g. food and drink and paper and pulp) (2D)
- Production of halocarbons and SF_6, mainly HFC-23 as by-product (2E)
- Consumption of halocarbons and SF_6, called F-gases and emissions (2F)
- Other industrial (2G)

Tables 2.3 and 2.4 show the uncertainties used in the Monte Carlo analysis by sub sector. In the Tier 1 report there are a number of categories reported that are missing from Tables 2.3 & 2.4. Below we list these categories and add the problems found for each category:

- *CO_2 emission from chemical industry-others*: this category is the sum of three sub sectors: *Graphite*, *Carbon electrodes* and *Other chemical industry*. The activity and emission factors are only provided for the *Graphite* sub sector. For the other two sub sectors, the activity and emission factors are considered confidential and are, therefore, not reported (attempts to obtain these data proved unsuccessful). Furthermore, uncertainties are only available at the aggregate level and not for the three individual sub sectors.
- *CO_2 emission from other industrial products*: this category is the sum of emissions from the sub sectors: *Food and drink sector*, *Fireworks and candles* and *Process emissions in other economic sectors*. Only information on activity data, emissions (and their respective PDFs) is available for the sub sector firework and candles.
- *CH_4 from other industrial products*: this category is the sum of CH_4 emissions from the sub sectors: *Silicon carbide*, *carbon black production*, *Ethylene, Styrene, Methanol, Fireworks and candle*s, and *Degassing from groundwater*. The information needed to make a Monte Carlo analysis (i.e. activity data, emission factors and their corresponding distribution functions) is complete for only one of these sub sectors: *Fireworks and candles*, which is within the category, the smallest contributing sub sector.
- *SF_6 from SF_6 use:* the information needed to include the category into the Monte Carlo analysis is incomplete.
- *PFC emissions from PFC use:* the information needed to include the category into the Monte Carlo analysis is incomplete.

- *F emissions from substitute for ozone depleting substances:* the information needed to include the category into the Monte Carlo analysis is incomplete.
- *HFC byproduct emission from HFC manufacture:* the information needed to include the category into the Monte Carlo analysis is incomplete.

For the categories named above the Tier 1 analysis provides an estimation of the uncertainty at the aggregate level. Hence, although it is not possible to obtain PDFs for the emissions generated from these categories as an output of the Monte Carlo model, we can use the Tier 1 information to include these categories when calculating the uncertainty of the emissions of all GHG for the Netherlands (e.g. if looking at Figure 2.3, the PDF for E_B will not be an output of the model but it will provided as an input into the system and will be used from that point on).

Finally, for this sector we take into account the following correlations:

- Activity data used to calculate emissions (CO_2, N_2O, CH_4) within a given year from the same detailed source category is 100% correlated. In the model, this is done by relating the calculations to a unique activity cell.
- Activity data for the calculation of CO_2 from *aluminum production* and PFC from *aluminum production* is 100% correlated.
- Activity data between years is assumed to be independent (although some correlated bias may exist).
- Emission factors between years are correlated by using the four types of correlation factors described in section 2.4.1.
- Gas used as feedstock in ammonia is correlated with gas consumption in sub-sector 1A2c (category *chemicals* within Manufacturing industries and construction- sector energy combustion). The category chemicals is at a lower level of aggregation than the one used in the model, hence we account for the correlation by including a weak dependency (r=0.1) between the sub sector gas used in *Manufacturing industries and construction* and the gas used in *ammonia production*.

2.4.3 Total solvents and other product use (sector 3)

This sector comprises the indirect emissions related to the non-methane volatile organic compounds (NMVOC) from the use of solvents and other fossil carbon contained products. In addition, in this sector some N_2O emissions originating from the use of N_2O as anesthesia and as a propelling agent in aerosol tins are also reported. This source category comprises *paint application* (3A), *degreasing and dry cleaning* (3B) and *others* (3D). The indirect CO_2 emissions from NMVOC are calculated as follows:

$$CO_2 = \sum_i \left(NMVOC_i * C_{fraction-i}\right) * 44/12 \qquad \text{Equation 2.8}$$

The activity data here are the NMVOC emissions from solvent use. These are calculated assuming 100% evaporation of the solvents: NMVOC (in kg) from solvent use = solvent use (in kg) * 1. So the uncertainty in the NMVOC emissions is actually the uncertainty in the amount of solvents used, often calculated as fraction of the total product. The share of NMVOC in the products' composition remained the same during the whole period (Olivier, personal communication 2006). The emission factor in Equation 2.8 is the carbon content of the NMVOC emissions. The fraction of organic carbon (i.e. of natural origin) in the NMVOC emissions is assumed negligible. Table 2.5 shows the uncertainties in activity data and emission factors used in this analysis.

For this sector the following correlation is taken into account:

- Although in practice, the emission factors may change in time, in the model they are assumed constant (following the way in which these emission are calculated in the NIR). Hence, we consider the emission factors for CO_2 and N_2O to be 100% correlated. In the model, this is done by relating (within the same source category) the calculations to a unique activity cell.

2.4.4 Agriculture (sector 4)

This sector is composed of three sub sectors[9]:

1. Enteric fermentation: CH_4 emissions only (4A);
2. Manure management: CH_4 and N_2O emissions (4B);
3. Agricultural soils: N_2O emissions only (4D).

Table 2.6 shows the uncertainties (with their corresponding PDFs) in activity data and emission factors used in this study. In the model, the following correlations are taken into account:

- The amount of manure per type of livestock used as activity data for the sub sector 4B is correlated to the activity data used to calculate CH_4 emissions originated from *enteric fermentation* (4A). In both cases, the activity data has been estimated using the population size (animal numbers by type). In the model, this correlation is included by using unique cells (animal number) when performing both calculations.
- Emission factors between years (e.g. kg CH_4/head/year) are correlated by using the four types of correlation factors described in section 2.4.1.

2.4.5 Land Use and Change Forestry LUCF (sector 5)

In the Netherlands, this sector is composed of six sub-sectors: *Forest land* (5A), *Cropland* (5B), *Grassland* (5C), *Settlements* (5E), *Other land* (5F) *and Others* (5G). Tables 2.7 and 2.8 show the uncertainties (and PDF's) in the activity data and the different emission factors. Note that for the sub sector 5A1 (forest land remaining forest land), the CO_2 emissions reported in the Dutch NIR are the result of emissions in two categories *Trees outside forest* and *forest*. CO_2 from category 5A1 is estimated as shown in Equation 2.9. Emissions for the other sub sector are estimated according to Equation 2.6

[9] The number of sub sectors contained in the sector *Agriculture* in the IPCC guidelines is much higher, i.e. rice cultivation (4C), prescribed burning of savannas (4E), field burning of agricultural residues (4F) and others (4G). In the Netherlands, these activities do not occur.

CO_2 sector 5A1= {(*increase in carbon stock change in living biomass for tress outside forest*) + (*increase in carbon stock change in living biomass for forest*) - (*decrease in carbon stock change in living biomass for forest*) + (*Net carbon stock change in dead organic matter in forest*)} Equation 2.9

Correlations applied to the LUCF sector are:

- Emission factors between years are correlated by using the four types of correlation factors described in section 2.4.1.
- Some activity data (e.g. land converted to grassland, land converted to settlements) do not change between the base year and 2004. In the model, one unique cell is taken to perform the calculations for both years.

2.4.6 Waste (sector 6)

This sector comprises the categories *Solid waste disposal* (i.e. landfills) (6A), *Wastewater handling* (6B) and *Other waste* (e.g. industrial composting) (6D). This sector also comprises the category *Waste incineration*, which emissions are reported under sector 1A1a.

Methane emission from landfills (6A) is the result of converting 'organic carbon' into CH_4 by fermentation processes. These emissions are calculated in the Dutch NIR inventory using a first order decomposition model (see equation 2.9), which takes into account that methane generation in landfills is actually the result of summing up the delayed emissions from all solid waste deposited in the years. The Tier 1 analysis uses a simplified analysis of the uncertainty in the underlying data. Nevertheless, since all data to run Equation 2.10 are known as well as the uncertainties of each parameter, it was decided to perform a Monte Carlo analysis to the first-order decomposition model and to feed the results back into our original model (instead of just using the simplified assumptions used for the Tier 1).

$$E_T = (1-\delta)*\left[\left(\beta*\chi*\varepsilon*\sum_{t=t_0}^{t=T-1} W(t)*\alpha_t*k_t*e^{-k_t*(T-t)}\right)-(\chi*\lambda*R(T))\right] \qquad \text{Equation 2.10}$$

where,

E(T)= CH_4 emission in the present year T
W(t)= Amount of solid waste disposal (ktonne) in year t
R(T)= recovery of landfill gas (ktonne) in the present year T
t_0= the starting year of waste disposal at landfills (1945)
α_t= Fraction of biodegradable carbon in waste
ß= Fraction of organic carbon C actually reacting to gaseous material (=0.58)
χ= Fraction of gaseous material being methane (=0.6)
δ= fraction of methane that is oxidized within the disposal tip (in top layer)
ε = conversion factor for mass C to mass CH_4 (=16/12)
λ= conversion factor for volume C to mass CH_4 (=16/22.4)
k= rate constant k= 0.094 before 1990 decreasing to k=0.00693 in 1995 and constant after 1995

The uncertainties of each parameter are:

- Total amount of annually deposited waste W(t): 10% prior to 1980, linearly decreasing to 1% since 1990 (Kraakman, 2005, personal communication),
- Methane correction factor: -10%; +0% (IPCC default),
- Fraction of Degradable Organic Carbon (α_t): 20% (combined effect of shares of waste streams and organic C fraction per stream; Kraakman, 2005, personal communication),
- Fraction of Degradable Organic Carbon actually dissimilated (ß): 10% (IPCC country-specific default),
- Fraction of CH_4 in landfill gas (χ): 5% (IPCC default),
- Methane generation (i.e. decomposition) rate constant (k): 10% until 1990; 0% for 1990-present (Olsthoorn and Pielaat, 2003),
- Methane oxidation factor in top layer (δ): 100% (i.e. between 0.05 and 0.2) (Kraakman, 2005, personal communication),
- Recovered landfill gas (R(T)): 10% until 1990, linearly decreasing to 5% since 2000 (Kraakman, 2005, personal communication),

The correlations taken into account for sector 6A are:

- The fraction of organic carbon C actually reacting to gaseous material and the methane fraction of gaseous material are considered no time dependent.

- The amounts of solid waste disposal and recovered landfill gas are considered independent through the period studied.
- The fraction of methane in landfill gas, fraction of organic carbon C actually reacting to gaseous material, and the methane oxidation factor in the top layer are consider constant through the period of time (therefore 100% correlated) In the model, this correlation is included by using unique cells when performing both calculations.
- The methane generation rate (k) is constant until 1989 (100% correlated) and after 1995 (100% correlated). Between 1989 and 1995 no correlation is applied.
- The fraction of biodegradable carbon in waste is kept constant until 1989 (100% correlated). After 1989 we considered not correlated.
- Since the methane generation rate (k) depends on the fraction of biodegradable carbon on waste (α_t), these two variables are correlated. We have applied a correlation factor of 0.8.

The results of the Monte Carlo analysis for Sector 6A are shown in Appendix A. Emissions from the sub sector *Wastewater handling* (6B) are composed of the categories: *Industrial wastewater*, *Domestic and commercial wastewater* and *Other* (wastewater). As it happened with some categories of Sector 2 (industrial processes), information needed to perform a Monte Carlo analysis (i.e. activity data, emission factors and their corresponding distribution functions) is missing. This was the case for *Industrial wastewater*, within *Domestic and commercial wastewater* the category Sludge and for *Other* wastewater and N_2O from human sewage. Following the same procedure applied to categories with missing information from Sector 2, uncertainties in the emissions from these categories are not outputs of the Monte Carlo model but have been included into the model as inputs using the uncertainty values for the gas emissions generated in the Tier 1 analysis.

Uncertainties in the activity data and emission factors for the category *Domestic and commercial (wastewater)* and for the sub sector *Other waste* (6D) are shown in table 2.9. The only correlations applied to the sector and categories are for the emission factors: emission factors between years are correlated by using the four types of correlation factors described in section 2.4.1.

Table 2.2 Uncertainty data and PDFs used to estimate the uncertainty in the emissions generated by the energy sector.

Sector	Activity data		Emission factors					
			CO_2		CH_4		N_2O	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
1A- FUEL COMBUSTION								
1.A.1-Energy industries								
a. Public electricity and heat production								
Liquid fuels	0.5	Normal	10.0	Normal	50.0	Normal	100.0	Log-Normal
Solid fuels					50.0	Normal	200.0	Log-Normal
Coke Oven and BF gas	1.0	Normal	15.0	Normal				
Others (steenkool)	1.0	Normal	1.0	Normal				
Gaseous fuels	0.5	Normal	1.0	Normal	50.0	Normal	100.0	Log-Normal
Biomass	10.0	Normal	---		80.0	Log-Normal	100.0	Log-Normal
Other fuels	10.0	Normal	5.0	Normal	50.0	Normal	100.0	Log-Normal
b. Petroleum refining								
Liquid fuels	10.0	Normal	10.0	Normal	50.0	Normal	100.0	Log-Normal
Solid fuels	0.5	Normal	2.0	Normal	50.0	Normal	100.0	Log-Normal
Gaseous fuels	0.5	Normal	1.0	Normal	50.0	Normal	100.0	Log-Normal
c. Manufacture of solid fuels and other energy industries								
Liquid fuels	20.0	Normal	2.0	Normal	50.0	Normal	100.0	Log-Normal
Solid fuels	5.0	Normal	2.0	Normal	50.0	Normal	100.0	Log-Normal
Gaseous fuels	20.0	Normal	5.0	Normal	50.0	Normal	100.0	Log-Normal
1.A.2-Manufacturing Industries and construction								
Liquid fuels	1.0	Normal	5.0	Normal	50.0	Normal	100.0	Log-Normal
Solid fuels					50.0	Normal	100.0	Log-Normal
Coke Oven and BF gas	2.0	Normal	15.0	Normal				
Others (steenkool)	2.0	Normal	5.0	Normal				
Gaseous fuels	2.0	Normal	1.0	Normal	50.0	Normal	100.0	Log-Normal
Biomass	100.0	Log-Normal	5.0	Normal	80.0	Log-Normal	100.0	Log-Normal
Other fuels	10.0	Normal	5.0	Normal	50.0	Normal	100.0	Log-Normal
1.A.3-Transport								
a. Civil aviation								
Aviation Gasoline	50.0	Normal	0.5	Normal	100.0	Log-Normal	100.0	Log-Normal
Jet Kerosene	50.0	Normal	0.5	Normal	100.0	Log-Normal	100.0	Log-Normal
b. Road Transportation								
Gasoline	2.0	Normal	0.4	Normal	76.0	Log-Normal	66.0	Log-Normal
Diesel oil	5.0	Normal	0.2	Normal	77.0	Log-Normal	82.0	Log-Normal

Sector	Activity data		Emission factors					
			CO_2		CH_4		N_2O	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
Liquefied petroleum gases (LPG)	10.0	Normal	0.2	Normal	96.0	Log-Normal	101.0	Log-Normal
c. Railways								
Liquid fuels	5.0	Normal	0.2	Normal	100.0	Log-Normal	100.0	Log-Normal
d. Navigation								
Residual oil	20.0	Normal	0.2	Normal	100.0	Log-Normal	100.0	Log-Normal
Gas and diesel oil	20.0	Normal	0.2	Normal	100.0	Log-Normal	100.0	Log-Normal
1.A.4-Other sectors								
Liquid fuels	20.0	Normal			50.0	Normal	100.0	Log-Normal
Solid fuels	50.0	Normal			50.0	Normal	100.0	Log-Normal
Gaseous fuels	5.0	Normal			50.0	Normal	100.0	Log-Normal
Biomass	25.0	Normal			80.0	Log-Normal	100.0	Log-Normal
Other fuels								
a. Commercial/institutional								
Liquid fuels			2.0	Normal				
Solid fuels			5.0	Normal				
Gaseous fuels			1.0	Normal				
b. Residential								
Liquid fuels	20.0	Normal	2.0	Normal				
Solid fuels	50.0	Normal	5.0	Normal				
Gaseous fuels	5.0	Normal	1.0	Normal				
Biomass	25.0	Normal						
c. Agriculture/forestry/fisheries								
Liquid fuels	20.0	Normal	2.0	Normal				
Solid fuels	50.0	Normal	5.0	Normal				
Gaseous fuels	10.0	Normal	1.0	Normal				
1.A.4-Others (not-specified elsewhere)								
b. Mobile (Military use)								
Liquid fuels	20.0	Normal	2.0	Normal				
1B- NON-COMBUSTION OR FUGITIVE RELATED SOURCES								
1.B.1.b Solid fuel transformation	50.0	Normal	2.0	Normal	50.0	Normal		
1.B.2 Fugitive emissions from venting and flaring								
a. Oil								
Refining and storage	20.0	Normal			50.0	Normal		
b. Natural gas								
Transmission	20.0	Normal			50.0	Normal		

Sector	Activity data		Emission factors					
			CO_2		CH_4		N_2O	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
Distribution			50.0	Normal				
Pipes of green cast iron	2.0	Normal			50.0	Normal		
Pipes of another material	2.0	Normal			50.0	Normal		
c.Venting								
Oil	2.0				25.0	Normal		
Combined	2.0		50.0	Normal	25.0	Normal		
Flaring								
Oil	2.0				25.0	Normal		
Gas	2.0				25.0	Normal		

Table 2.3 Uncertainty data and PDFs used to estimate the uncertainty in the emissions generated by the sector industrial processes.

Sector	Activity data		Emission factors					
			CO_2		CH_4		N_2O	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
2A- MINERAL PRODUCTS								
2.A.1- ***Cement production***	5.0	Normal	10.0					
2.A.3- ***Limestone and dolomite use***	25.0	Normal	5.0					
2.A.7- ***Others (soda ash and gas production)***	25.0	Normal	5.0					
2B- CHEMICAL INDUSTRY								
2.B.1- *Ammonia production*	2.0	Normal	1.0	Normal				
2.B.2- *Nitric acid production*	10.0	Normal					50.0	Normal
2.B.5- *Others*								
Caprolactam	50.0	Normal					50.0	Normal
2C- METAL PRODUCTION								
2.B.1- *Iron and steel production*	3.0	Normal	5.0	Normal				
2.B.3- *Aluminum production*	2.0	Normal	5.0	Normal				
2D- OTHER								
Fireworks and candles	50.0	Normal					50.0	Log-Normal
Indirect N_2O from combustion and industrial processes	15.0	Normal					200.0	Log-Normal
Indirect N_2O from non agricultural NH_3 sources	50.0	Normal					200.0	Log-Normal

Table 2.4 emissions of PCF, SF_6 and HFC

Sector	Activity data		Emission factors					
			CF_4		C_2F_6		HFC-23	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF	Min-max	
PFCs AND SF_6 FROM METAL PRODUCTION								
PFCs from aluminium production	2.0	Normal	20.0	Normal	20.0	Normal		
PRODUCTION OF HALOCARBONS AND SF6								
By product emissions								
HFC-23	2.0	Normal					Min:20%	Triangular
							Max:30%	Triangular

Table 2.5 total solvents and other product use

Sector	Activity data		Carbon fractions		N_2O emission factors	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
3-TOTAL SOLVENTS AND OTHER PRODUCT USE						
3A. Paint application	25.0	Normal	10.0	Normal		
3B. Degreasing and dry cleaning	25.0	Normal	10.0	Normal		
3D. Other	25.0	Normal	10.0	Normal		
Use of N_2O for anaesthesia	20.0	Normal			50.0	Normal
N_2O from aerosol cans	20.0	Normal			50.0	Normal

Table 2.6 Agriculture

Sector	Activity data		CH_4 emission factors		Emission factor per animal waste management system N_2O	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
4-AGRICULTURE						
4A. Enteric fermentation						
Cattle	5.0	Normal	20.0	Normal		
Sheep	5.0	Normal	30.0	Normal		
Goats	5.0	Normal	30.0	Normal		
Horses	5.0	Normal	30.0	Normal		
Swine	5.0	Normal	50.0	Normal		

Sector	Activity data		CH_4 emission factors		Emission factor per animal waste management system N_2O	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
4B. Manure management						
Cattle	5.0	Normal	100.0	Log-Normal		
Sheep	5.0	Normal	100.0	Log-Normal		
Goats	5.0	Normal	100.0	Log-Normal		
Horses	5.0	Normal	100.0	Log-Normal		
Swine	5.0	Normal	100.0	Log-Normal		
Poultry	10.0	Normal	100.0	Log-Normal		
Nitrogen excretion per animal waste management						
Liquid system	10.0	Normal			100.0	Log-Normal
Solid storage and dry lot	10.0	Normal			100.0	Log-Normal
4C. Agricultural soils						
1. Direct soil emissions						
Synthetic fertilizers	10.0	Normal			100.0	Log-Normal
Animal manure applied to solids	10.0	Normal			100.0	Log-Normal
N-fixing crops	5.0	Normal			100.0	Log-Normal
Cultivation of histosols	10.0	Normal			100.0	Log-Normal
2. Pasture, Range and Paddock manure	10.0	Normal			100.0	Log-Normal
3. Indirect emissions						
Atmospheric deposition	50.0	Normal			200.0	Log-Normal
Nitrogen leaching and run-off	50.0	Normal			200.0	Log-Normal
4. Other						
Sludge application on land	20.0	Normal			50.0	Normal

Table 2.7 Land use and change forestry (LUCF)

Sector	Activity data		Emission factors							
			Increase living biomass per area		Decrease living biomass per area		Net carbon stock change in dead organic matter per area		Net carbon stock change in soils per area	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
5A-CHANGES IN FOREST AND OTHER WOODY BIOMASS STOCKS										
1-Forest land remaining forest land										
Tress outside forest	25	Normal	15	Normal						
Forest	25	Normal	10	Normal	30	Normal	50	Normal		
2-Land converted to forest land	25	Normal							50	Normal
5B-FOREST AND CROPLAND CONVERSION-TOTAL CROPLAND										
2-Land converted to cropland	25	Normal							50	Normal
5C-TOTAL GRASSLAND										
1.-Grassland remaining grassland	25	Normal							50	Normal
2- Land converted to grassland	25	Normal			61	Lognormal			50	Normal
5E-TOTAL SETTLEMENTS										
2-Land converted to settlements	25	Normal							50	Normal
5F-TOTAL OTHER LAND										
2-Land converted to other land	25	Normal							50	Normal

Table 2.8 Other categories belonging to LUCF

Sector	Activity data		Emission factors (carbon emission per unit of lime)	
	2σ (%)	PDF	2σ (%)	PDF
5G- OTHER CATEGORY				
Liming of soils	25	Normal	1	Normal

Table 2.9 Waste

Sector	Activity data		CH_4 emission factors		N_2O emission factors	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
6A-WASTE WATER MANAGEMENT						
2-Domestic and commercial waste water						
Wastewater	20	Normal	25	Normal	50	Normal
6D-OTHER WASTE HANDLING						
Compost production	20	Normal	25	Normal	50	Normal

3 Results of the Monte Carlo analysis base case scenario

In this chapter the main results of the Monte Carlo analysis which was described in Chapter 2 will be presented. Due to the large number of sectors, sub sectors and categories, the numeric values of the mean emissions, the 2.5% and 97.5% cumulative probabilities, the probability distribution functions and statistical characteristics of the different PDF's will only be shown for the following categories:

- Total greenhouse gas emissions in the Netherlands (with and without LUCF),
- Total CO_2 emissions (with and without LUCF),
- Total CH_4 emissions,
- Total N_2O emissions (with and without LUCF),
- Total F gases.

Furthermore, we will compare the results with those provided by the Dutch Tier 1 analysis and show also the uncertainties in the trends. In Appendix B, a table with the results for each individual sub sector is provided.

3.1 Total greenhouse gas emissions in the Netherlands

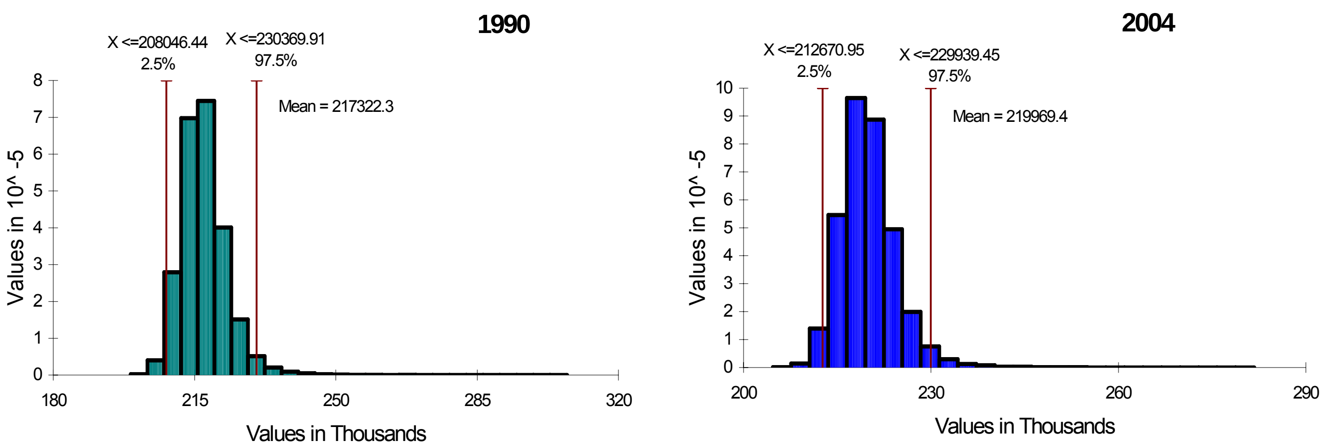
In the Tier 1 analysis of the Dutch NIR for 2004, the total amount of greenhouse gas emissions in the Netherlands (including LUCF) is calculated at 216394 Gg CO_2 equivalent and 219845 Gg CO_2 eq for the years 1990 and 2004 respectively. Without including the sector LUCF the emissions in 1990 and 2004 would account for 213493 Gg CO_2-eq and 217077 Gg CO_2-eq respectively, with a relative change in the trend of 1.6%. In both cases (with and without LUFC), the Tier 1 estimates an uncertainty in the emissions of ±4.5% (in the same Tier 1 analysis it is reported that the value should be around 6% since dependencies among the variables were not taken into account) and uncertainty in the trend of 3.3%. The results of the Monte Carlo analysis are shown in table 3.1 while figures 3.1 to 3.3 show the probability distribution functions.[10] The comparison of the Tier 1 and the Monte Carlo results shows that there is a slight change for the mean emissions (between 0.05% and 0.4%), which is the result of the asymmetrical PDF's attributed to some variables in the model. The standard deviations (2σ) of the PDF's for the total GHG emissions are lower than the ones reported in the Tier 1, while the uncertainty in the trend is higher than the one reported by the Tier 1.

Table 3.1 Results Monte Carlo analyses for the total Dutch GHG emissions[a].

	With LUCF			Without LUCF		
	1990	2004	Trend	1990	2004	Trend
Emissions (mean) [Gg CO_2 eq.]	217322	219969	2647 (1.3)*	214434	217211	2777 (1.3)*
2σ [%]	5.4	4.1	379 (4.5)**	5.3	3.9	355 (4.5)**
2.5% cum. prob. [Gg CO_2 eq.]	208046	212671	-7582	205693	210430	-7650
97.5% cum. prob. [Gg CO_2 eq.]	230340	229935	11513	227375	226654	11529

[a]: Please note that the numbers presented in this table are hyper precise: not all digits are significant. Because the inputs we received from various sources were hyper precise as well, we were not able to determine the proper number of significant digits. *: the value outside the brackets is the absolute difference between the emissions in the base year and 2004, while the value inside the brackets is the relative change compared to the 1990 emission and is a percentage. **: the value outside the brackets reflect the uncertainty (2σ) in the absolute difference between the emissions in the base year and 2004, while the value inside the brackets is the trend uncertainty (2σ) relative to the emissions in the base year.

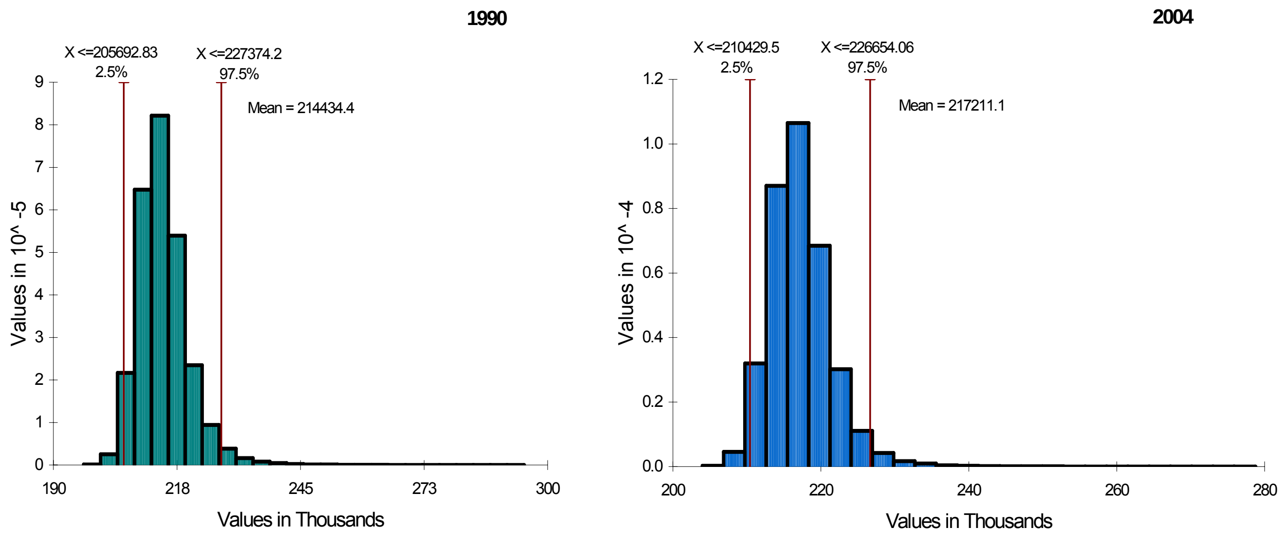
Figure 3.1 PDFs of the total GHG in the Netherlands for the years 1990 and 2004 (it includes the sector LUCF; in Gg CO_2-eq)



Year	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
1990	199152.0	307182.1	217322.3	211931.6	5862.2	34364960.0	1.710	13.706
2004	204664.3	281685.7	219969.4	216021.1	4456.5	19860110.0	1.205	8.464

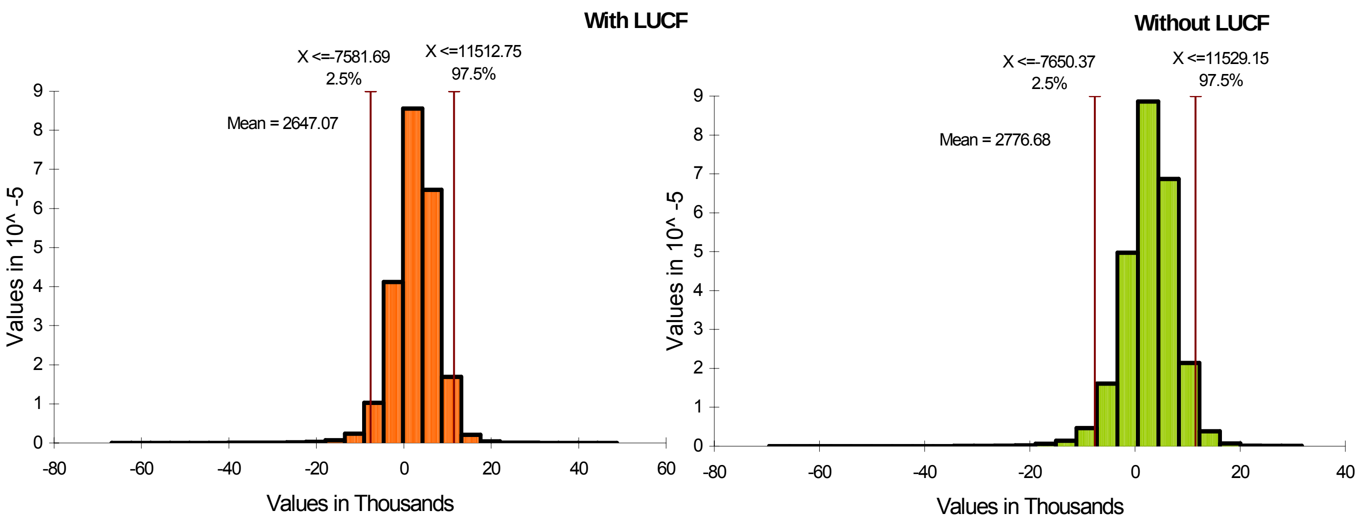
[10] The tables below the PDFs also report skewness and kurtosis. Skewness represent the asymmetry of a probability distribution. A symetric PDF has a skewness of 0. The higher the value, the more asymmetric the distribution is. Kurtosis is a measure of how peaked or flat the distribution of observed values is, compared to a normal distribution. A normal distribution has a kurtosis of 3.

Figure 3.2 PDFs of the total GHG in the Netherlands for the years 1990 and 2004 (without the sector LUCF; in Gg CO_2-eq)



Year	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
1990	196756.2	294705.0	214434.4	210883.5	5660.5	32041030.0	1.557	10.742
2004	203967.8	278718.0	217211.1	216655.5	4231.7	17907470.0	1.424	10.352

Figure 3.3 PDFs of the trend between the base year and 2004 in the total GHG emissions in the Netherlands (in Gg CO_2-eq)



	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
with LUCF	-66860.1	48693.7	2647.1	3148.0	5016.0	25159840.0	-0.990	11.408
without LUCF	-69605.3	31729.5	2776.7	2654.0	4930.6	24310820.0	-0.784	8.404

3.2 Total CO_2 emissions

The total amount of carbon dioxide emissions in the Netherlands (including LUCF) is calculated in the Tier 1 analysis at 161482 Gg and 182158 Gg for the years 1990 and 2004 respectively. Without including the sector LUCF the emissions in 1990 and 2004 accounted for 158587 Gg and 179397 Gg respectively and a trend of 9.6%. The Tier 1 estimates an uncertainty in the emissions of 2.5% and 1.9% for CO_2 emissions with and without LUCF (for both cases, the same Tier 1 analysis reports that the value should be around 5% since dependencies among the variables were not taken into account) and uncertainty in the trend of 2.1%. The results of the Monte Carlo analysis are shown in table 3.2 while figures 3.4 to 3.6 show the probability distribution functions. As it happened with the total GHG emissions, the mean CO_2 emissions calculated in the Monte Carlo analysis are slightly higher than the ones reported in the Tier 1 analysis. The difference is, however, not significant (between 0.06 and 0.3%). The uncertainties in the emissions are found to be between 2.2 and 1.5%, which is in line with the original value reported in the Tier 1 (1.9 and 2.5%). The 5% reported in the Tier 1 as a more likely value, because of unaccounted dependencies, overestimates the uncertainty in the results.

At the sub sectoral level, the results of the Monte Carlo analysis- without LUCF- show substantial differences[11] for the following sub sectors (Appendix C shows the detailed list for all sectors): *Other sector, commercial and institutional gas use (1A4a), mobile combustion aircraft (1A3a), fugitive emission and venting flaring (1B2c), limestone and dolomite use (2A3).* With the exception of the last category, the Monte Carlo analysis shows lower uncertainties in the emissions as compared with the tier 1. Of these sectors, only the commercial and institutional sector contributes significantly to the total CO_2 emissions (about 6% in 2004 while the other sectors have a share of less than 0.5% of the total CO_2 emissions). For the sector *1A4a* Monte Carlo results in a lower uncertainty than the Tier 1 (about 6% vs 20%). The difference resides in the way the uncertainty in the activity data is derived in the analysis. In the Monte Carlo analysis the activity and its uncertainty is dependent on the other sub

[11] We limit the discussion here to those cases where the relative difference in the resulting emission uncertainties between Tier 1 and Tier 2 is greater than or equal to 50%, e.g. an uncertainty of ± 10% in tier 1 versus ± 15% in the Tier 2.

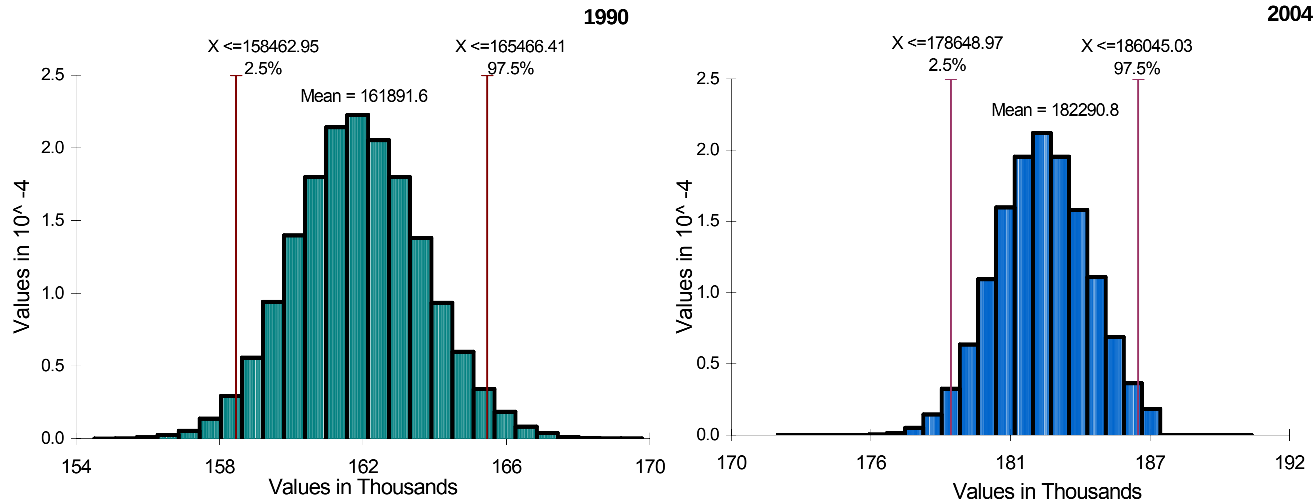
sectors (sector 1A4a is a residual category as explained in chapter 2) while in the Tier 1 the uncertainty value is an independent assumption which is higher than the output of the model.

Table 3.2 Results Monte Carlo analyses for the total Dutch CO_2 emissions[a].

	With LUCF			**Without LUCF**		
	1990	2004	Trend	1990	2004	Trend
Emissions (mean) [Gg.]	161892	182291	20399 (9.4)[*]	158975	179516	20541.5 (9.6)[*]
2σ [%]	2.2	2.1	16 (1.6)[**]	1.5	1.5	15.1 (1.6)[**]
2.5% cum. prob. [Gg]	158463	178649	17204	156660	176955	17502
97.5% cum. prob. [Gg]	165466	186045	23622	161351	182112	23580

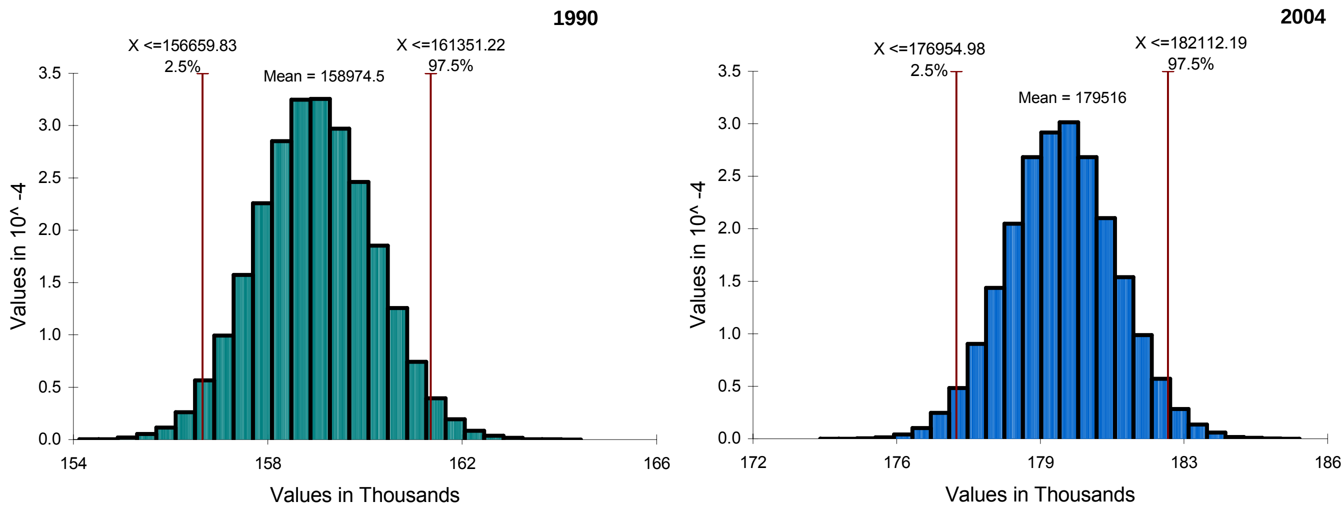
[a:] Please note that the numbers presented in this table are hyper precise: not all digits are significant. Because the inputs we received from various sources were hyper precise as well, we were not able to determine the proper number of significant digits.
[*:] The value outside the brackets is the absolute difference between the emissions in the base year and 2004, while the value inside the brackets is the relative change compared to the 1990 emission and is a percentage. [**]: the value outside the brackets reflect the uncertainty (2σ) in the absolute difference between the emissions in the base year and 2004, while the value inside the brackets is the trend uncertainty (2σ) relative to the emissions in the base year.

Figure 3.4 PDFs of the total CO_2 emissions in the Netherlands for the years 1990 and 2004 (it includes the sector LUCF; in Gg)



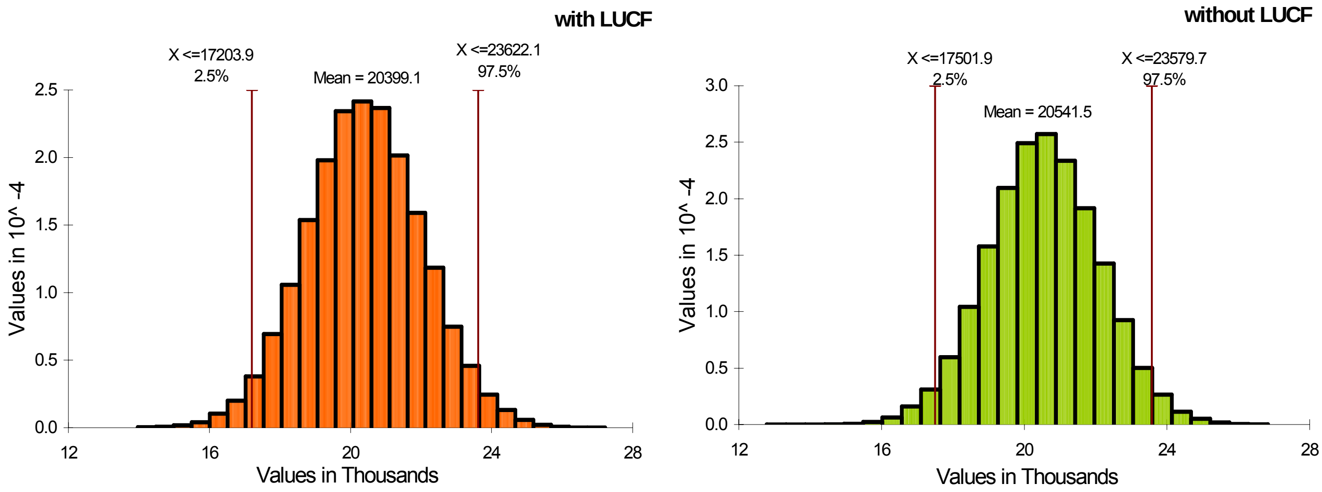
Year	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
1990	154509.6	169782.7	161891.6	161541.4	1786.9	3192885.0	0.079	3.027
2004	171822.3	190499.4	182290.8	180409.4	1881.3	3539118.0	0.077	3.024

Figure 3.5 PDFs of the total CO_2 emissions in the Netherlands for the years 1990 and 2004 (without the sector LUCF; in Gg)



Year	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
1990	154120.8	164436.3	158974.5	158297.1	1199.3	1438225.0	0.043	2.986
2004	173637.8	185306.1	179516.0	177994.8	1318.0	1737040.0	0.034	3.011

Figure 3.6 PDFs of the trend between the base year and 2004 in the total CO_2 emissions in the Netherlands (in Gg CO_2-eq)



	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
with LUCF	13966.8	27224.8	20399.1	18361.2	1631.7	2662419	0.016	3.025
without LUCF	12780.5	26836.5	20541.5	19337.8	1546.0	2390026	0.006	3.020

3.3 Total CH_4 emissions

Since the LUCF sector does not contribute to the total CH_4 emission, the results of the Monte Carlo analysis do not change whether or not the LUCF category is taken into account when running the simulation, and hence for this sector we do not differentiate the results with or without LUCF as done before. In the Tier 1analysis of the Dutch NIR, the total methane emissions in the Netherlands is calculated at 25437 Gg CO_2-eq and 17453Gg CO_2-eq for the years 1990 and 2004 respectively. The relative change between both years is calculated at –3.7%. The Tier 1 estimates an uncertainty in the emissions of ±18% (reported to be of ±25% if dependencies were to be taken into account) and an uncertainty in the trend of 1.4%. The results of the Monte Carlo analysis are shown in table 3.3 while figures 3.7 and 3.8 show the probability distribution functions. As it happened with the other GHG emissions, there is a slight increase in the emissions estimated in the Monte Carlo analysis, but the increase is certainly no significant. The uncertainty in the emission is below the original value reported in the Tier 1 (18%). The uncertainty in the trend estimated in the Monte Carlo model is higher than the one reported by the Tier 1 analysis.

At the sub sectoral level, the results of the Monte Carlo analysis- without LUCF- show substantial differences[12] for the following sub sectors (Appendix C shows the detailed list for all sectors): *emissions from stationary combustion* (1A), *emissions from solid waste deposit sites* (6A) and *emissions from wastewater handling* (6B). In the first two cases, the Monte Carlo analysis shows lower uncertainties than the ones shown by the Tier 1. In the first case, the difference resides in the fact that the Tier 1 assumes an uncertainty range for the whole category while in the Monte Carlo analysis the uncertainty is accounted for at a disaggregate level and then grouped into the level of aggregation shown by the Tier 1. For the sector 6A, which accounted for about 39% of the total CH_4 emissions in 2004, we worked out an independent Monte Carlo analysis (see section 2.4.6 for a detailed explanation) which is more accurate than the Tier 1 analysis. We should also point out that the difference between the uncertainties provided by both Tier's, for the sector 6A, is only found for the year 2004. The Monte Carlo analysis takes into account the cumulative production of CH_4 and the fact that, since 1990, the fraction of degradable carbon has decreased due to the separate collection of 'green waste'. These factors cannot be taken into account in the Tier 1 and hence it is not surprising that the Tier 1 tends to overestimate the uncertainties for the sub sector.

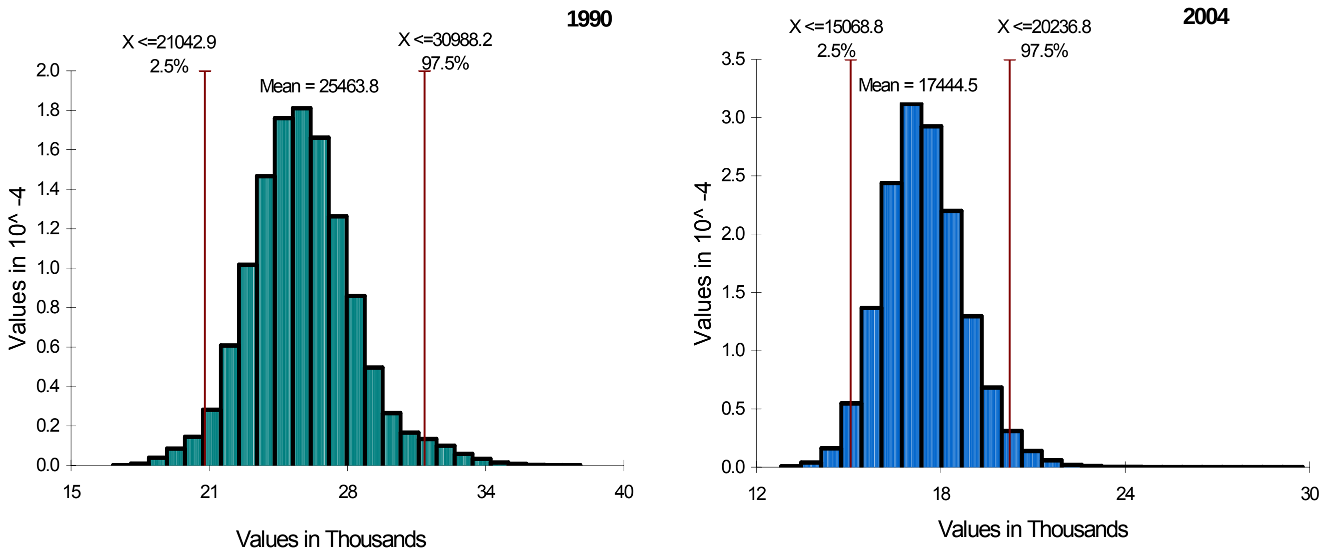
Table 3.3 Results Monte Carlo analyses for the total Dutch CH_4 emissions[a].

	CH_4 emissions		
	1990	2004	Trend
Emissions (mean) [Gg CO_2 eq.]	25464	17445	-8019 (-3.7)[*]
2σ [%]	18.7	15.1	61.2 (2.2)[**]
2.5% cum. prob [Gg CO_2 eq.]	21043	15069	-13541
97.5% cum. prob.[Gg CO_2 eq.]	30998	20237	-3371

[a]: Please note that the numbers presented in this table are hyper precise: not all digits are significant. Because the inputs we received from various sources were hyper precise as well, we were not able to determine the proper number of significant digits.[*]: the value outside the brackets is the absolute difference between the emissions in the base year and 2004, while the value inside the brackets is the relative change compared to the 1990 emission and is a percentage. [**]: the value outside the brackets reflect the uncertainty (2σ) in the absolute difference between the emissions in the base year and 2004, while the value inside the brackets is the trend uncertainty (2σ) relative to the emissions in the base year.

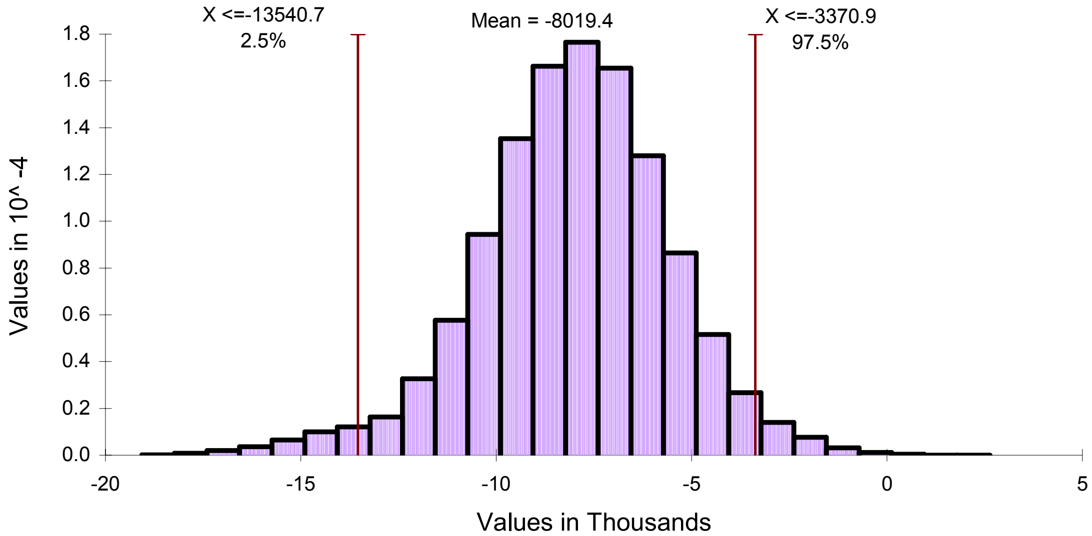
[12] See footnote 10

Figure 3.7 PDFs of the total CH_4 emissions in the Netherlands for the years 1990 and 2004 (in Gg CO_2-eq)



Year	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
1990	16890.0	38036.1	25463.8	25716.5	2381.7	5672456	0.443	3.980
2004	12807.7	29766.6	17444.5	17203.4	1315.2	1729642	0.380	3.685

Figure 3.8 PDFs of the trend between the base year and 2004 in the total CH_4 emissions in the Netherlands (in Gg CO_2-eq)



	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
PDF	-19071.7	2622.4	-8019.4	-7789.6	2455.0	6026952	-0.334	3.855

3.4 Total N_2O emissions

The total amount of Dutch N_2O emissions (including LUCF) reported in the Tier 1 is calculated at 21226 Gg CO_2-eq. and 17992 Gg CO_2-eq. in the years 1990 and 2004 respectively. Without including the sector LUCF the emissions in 1990 and 2004 accounted for 21219 GgCO_2-eq. and 17985 GgCO_2-eq. respectively. In both cases (with and without LUFC), the Tier 1 estimates an uncertainty in the emissions of ±45% (50% if correlations were to be taken into account) and uncertainty in the trend of 2.0%. The results of the Monte Carlo analysis are shown in table 3.4 while figures 3.9 to 3.11 show the probability distribution functions. In this case, we found a significant difference between the emissions reported in the Tier 1 and the one obtained from the Monte Carlo analysis for the year 1990 (including LUCF). The N_2O emissions from the Monte Carlo analysis for this year are about 9% higher. The uncertainty in the emissions is for 1990 slightly higher than the original value reported in the Tier 1 (46% vs 45%) but are not higher than the 50% uncertainty assumed if correlations were included. Also, the uncertainty in the trend obtained in the Monte Carlo analysis is significantly lower than the one reported in the Tier 1.

At the sub sectoral level, the results of the Monte Carlo analysis- without LUCF- show substantial differences[13] for the following sub sectors (Appendix C shows the detailed list for all sectors): *emissions from stationary combustion* (1A) and *emissions from wastewater handling* (6B). In the first case, the Monte Carlo analysis reports a higher uncertainty for the emission than the Tier 1 (about 90% vs 50%). As it happened with the *CH_4 emissions for stationary combustion*, in the Tier 1 a unique uncertainty value for the whole category is assumed while in the Monte Carlo analysis the model is defined at a lower level of aggregation and the result aggregated to the Tier 1 level (for comparison purposes). The combination of several uncertainties, PDFs and shares of sub sectors led to a higher level of uncertainty. For the sector 6B, due to data availability, the model combines Tier 1 results (for the subcategory N_2O from human sewage) and Tier 2 inputs (for the subcategory sludge form commercial and domestical waste). Hence, the uncertainty in the final emissions should be looked

[13] See footnote 10

at with caution. However, sector 6B only contributes with about 2% of the total N_2O emissions.

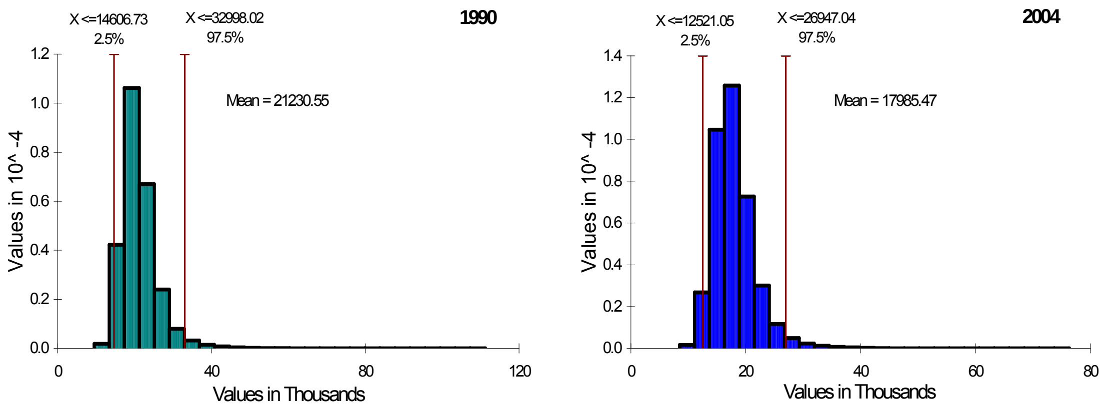
A final point that should be stressed is the difference in the uncertainties for *indirect N_2O emissions from nitrogen use in agriculture,* which is the most important contributor to the total GHG emission uncertainty in the Netherlands (see Chapter 4). The Monte Carlo analysis results in lower emission uncertainties than the ones shown by the Tier 1. The difference can be explained by the difference level of aggregation at which the model runs.

Table 3.4 Results Monte Carlo analyses for the total Dutch N_2O emissions[a].

	With LUCF			**Without LUCF**		
	1990	2004	Trend	1990	2004	Trend
Emissions (mean) [Gg CO_2 eq.]	23231	17986	-3245 (-1.5)[*]	21262	17999	-3263 (-1.5)[*]
2σ [%]	46.7	42.0	240.3 (3.4)[**]	46.2	42.0	235.3 (3.4)[**]
2.5% cum. prob. [Gg CO_2 eq.]	14607	12521	-11493	14650	12536	-11899.7
97.5% cum. prob. [Gg CO_2 eq.]	32998	26947	3174	33232	26813	3145

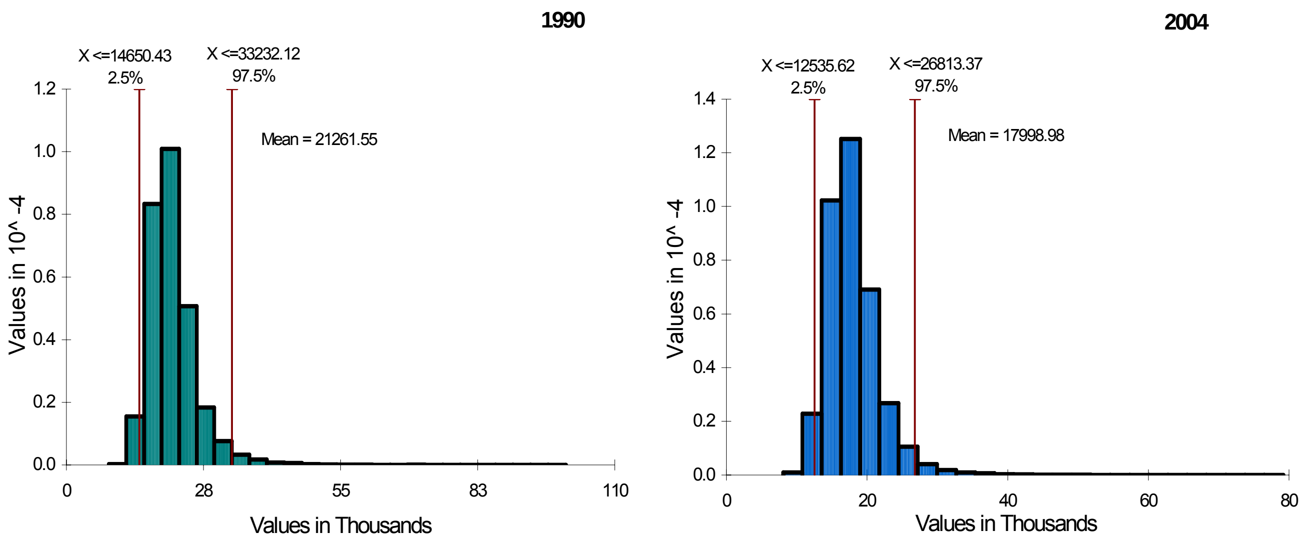
[a:] Please note that the numbers presented in this table are hyper precise: not all digits are significant. Because the inputs we received from various sources were hyper precise as well, we were not able to determine the proper number of significant digits.[*:] The value outside the brackets is the absolute difference between the emissions in the base year and 2004, while the value inside the brackets is the relative change compared to the 1990 emission and is a percentage. [**]: The value outside the brackets reflect the uncertainty (2σ) in the absolute difference between the emissions in the base year and 2004, while the value inside the brackets is the trend uncertainty (2σ) relative to the emissions in the base year.

Figure 3.9 PDF's of the total N_2O emissions in the Netherlands for the years 1990 and 2004 (it includes the sector LUCF; in Gg CO_2-eq)



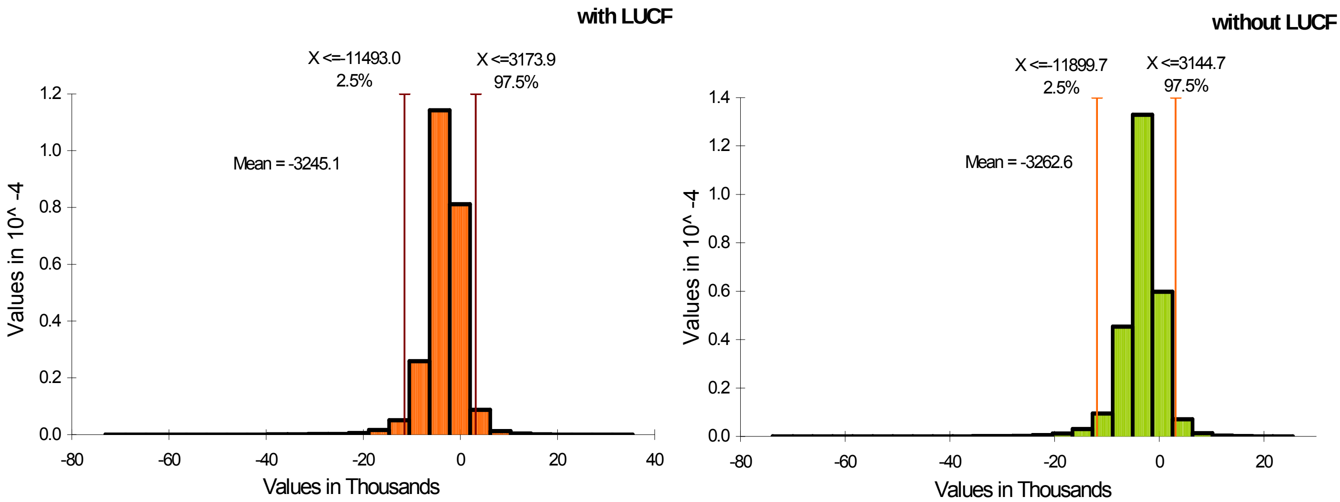
Year	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
1990	9502.7	111159.8	21230.6	23993.5	4961.1	24612430.0	2.708	22.901
2004	8459.7	76267.2	17985.5	12875.4	3779.5	14284300.0	1.903	12.930

Figure 3.10 PDFs of the total N_2O emissions in the Netherlands for the years 1990 and 2004 (without the sector LUCF; in Gg CO_2-eq)



Year	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
1990	8511.8	100122.1	21261.6	20106.1	4907.0	24078210.0	2.343	16.888
2004	8085.4	79178.2	17999.0	19580.3	3780.6	14292880.0	2.006	14.693

Figure 3.11 PDFs of the trend between the base year and 2004 in the total N_2O emissions in the Netherlands (in Gg CO_2-eq)



	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
with LUCF	-73132.8	35415.3	-3245.1	-2768.3	3898.3	15196520	-2.014	25.121
without LUCF	-73885.5	25460.9	-3262.6	-2516.5	3838.6	14734510	-1.589	17.776

3.5 Total F-gas emissions

The results provided by the Monte Carlo analysis for this category should be studied with caution since, as explained in the methodology chapter, the necessary data to perform a Monte Carlo analysis was only available for two of six sub sectors (PFC from aluminum production and HFC-23 emissions from HCFC-22 manufacture which accounted for 93% and 21% of the total F-gas emissions in 1995 and 2004 respectively) and thus, we had to combine outputs of the Tier 1 analysis for the 4 categories with Tier 2 inputs for 2 categories.

Since the sector LUCF does not contribute to the emissions of F-gases, there is no need to differentiate in the results on whether or not the sector LUCF is included in the Monte Carlo simulation. The total amount of F-emissions in the Netherlands is calculated in the Tier 1 at 8250 Gg CO_2-eq and 2242 Gg CO_2-eq in the years 1995 and 2004 respectively. The relative change is calculated at –2.8%. The Tier 1 estimates an uncertainty in the emissions of ± 28 % (50% if correlations were to be taken into account) and uncertainty in the trend of 0.4%. The results of the Monte

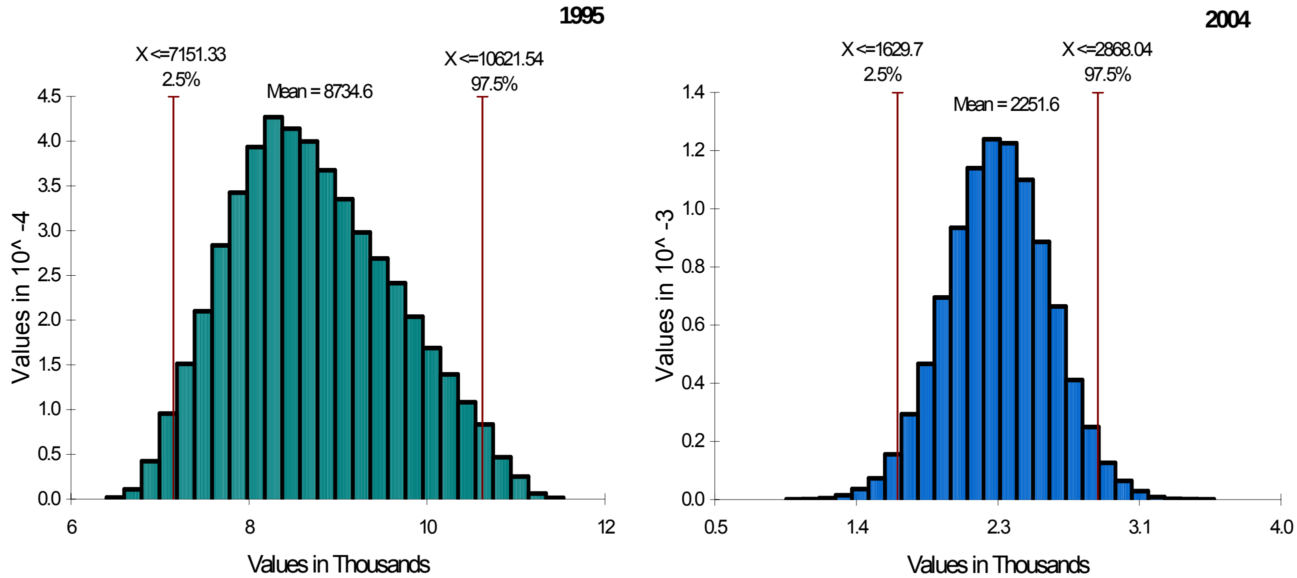
Carlo analysis are shown in table 3.5 while figures 3.12 and 3.13 show the probability distribution functions. The differences in the emissions and uncertainties found in the model and the ones reported in the Tier 1 are only significant for one year 1990 (emissions from the model are about 5% higher than the ones reported in the Tier 1). Also the model reports a lower uncertainty 21% and 28% for 1995 and 2004 respectively. Note that the share of the sub sector with the lower uncertainties decreases between the base year and 2004 while the shares of those with larger uncertainties increase which explains why the model shows a larger uncertainty for 2004 than for the base year. However, we never arrive at the 50% uncertainty expected in the Tier 1 if correlations were to be taken into account.

Table 3.5 Results Monte Carlo analyses for the total Dutch F- emissions[a].

	F-emissions		
	1995	2004	Trend
Emissions (mean) [Gg CO_2 eq.]	8734	2252	-6483 (-3.0)[*]
2σ [%]	21.1	28.1	30 (0.9)[**]
2.5% cum. prob [Gg CO_2 eq.]	7151	1630	-8474
97.5% cum. prob [Gg CO_2 eq.]	10622	2868	-4778

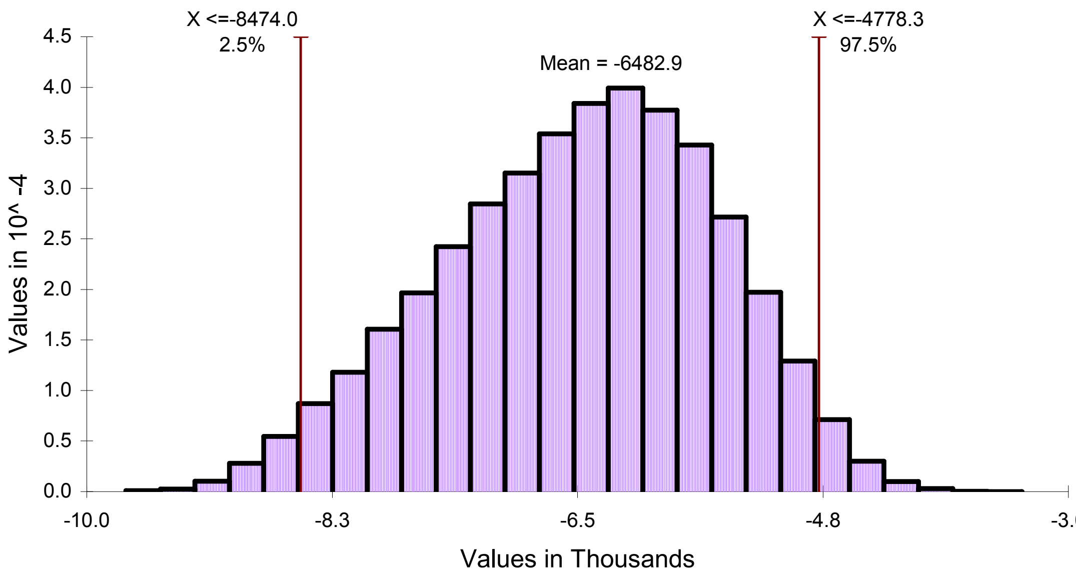
[a]: Please note that the numbers presented in this table are hyper precise: not all digits are significant. Because the inputs we received from various sources were hyper precise as well, we were not able to determine the proper number of significant digits.
[*]: the value outside the brackets is the absolute difference between the emissions in the base year and 2004, while the value inside the brackets is the relative change compared to the 1990 emission and is a percentage. [**]: the value outside the brackets reflect the uncertainty (2σ) in the absolute difference between the emissions in the base year and 2004, while the value inside the brackets is the trend uncertainty (2σ) relative to the emissions in the base year.

Figure 3.12 PDFs of the total F- emissions in the Netherlands for the years 1995 and 2004 (in Gg CO_2-eq)



Year	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
1995	6400.4	11534.4	8734.5	6914.6	920.5	847411	0.289	2.467
2004	941.1	3587.0	2251.6	2301.0	316.5	100143	-0.013	2.994

Figure 3.13 PDFs of the trend between the base year and 2004 in the total F-emissions in the Netherlands (in Gg CO_2-eq)



	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
PDF	-9720.5	-3333.0	-6482.9	-6446.1	972.3	945344.2	-0.249	2.563

4 Importance analysis

4.1 Sensitivity analysis

The @Risk software allows to carry out a variance decomposition to show to what degree the variance in total CO_2 emission can be attributed to variance in the various inputs of the calculation. This allows ranking the uncertain inputs according to their importance. Figure 4.1 shows a so-called tornado graph for the total Netherlands' greenhouse gas emission in 2004 as calculated for the base case without LUFC. Figure 4.2 plots the tornado graph for the uncertainty in the trend. In both figures, the regression sensitivity is used as metric for sensitivity.

Figure 4.1 Regression sensitivity for total GHG emissions NL 2004

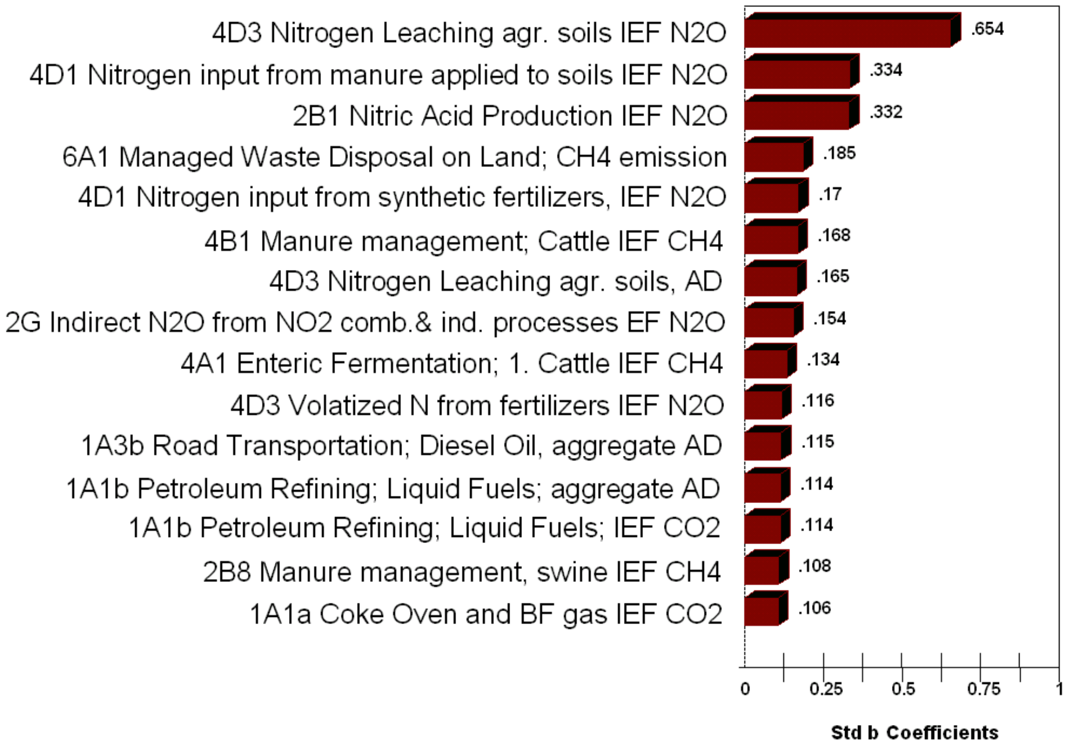
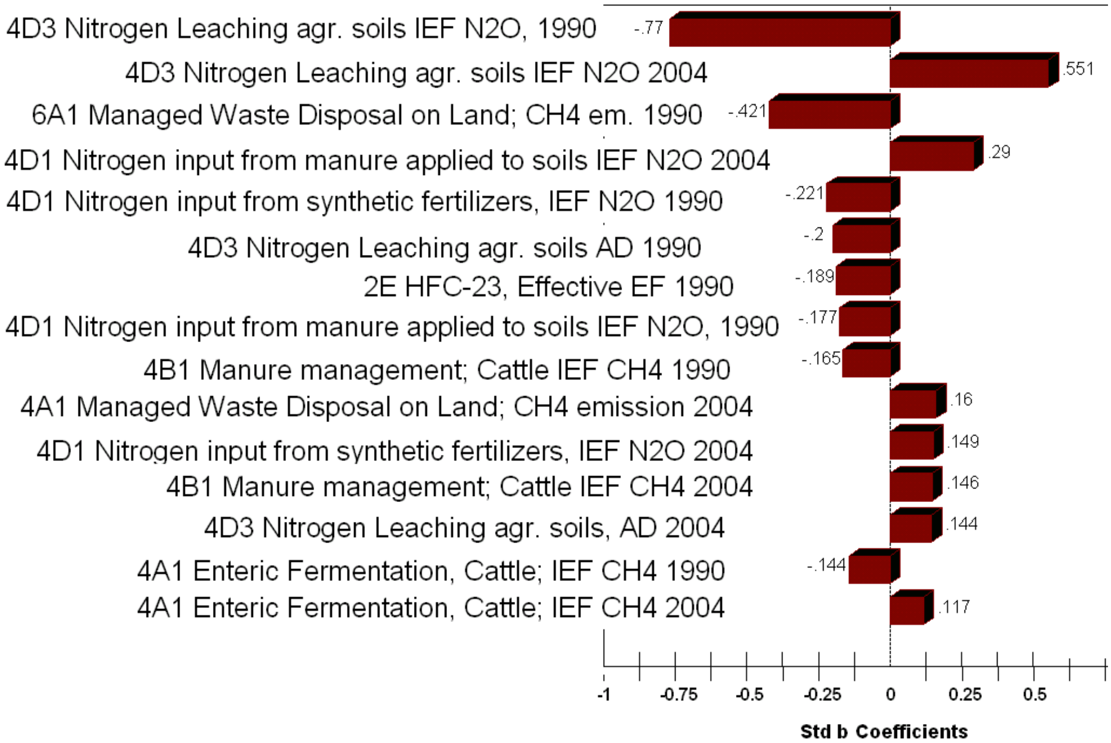


Figure 4.2 Regression sensitivity for uncertainty in trend



The regression sensitivity or Standard B coefficient is a metric that indicates how sensitive the model output is to a change in the input. The standard B coefficient has a value between -1 and +1. A standard B coefficient of for example +0.17 means that a +1 standard deviation (of the input) increase in that input causes a +0.17 standard deviation (of the output) increase in the output.

The Monte Carlo sensitivity analysis shows that the main contributors to uncertainty in emissions and in the trend are related to N_2O emissions from agricultural soils. Other important factors are the N_2O implied emission factor of Nitric Acid Production, CH_4 from managed solid waste disposal on land, and the implied emission factor of CH_4 from manure management from cattle.

In the Tier 1 study, a similar ranking of sources was made according to their contribution to the uncertainty in total national emissions (using 'Combined Uncertainty as % of total national emissions in 2004' as metric for importance). The

Tier 1 top 10 sources contributing most to total annual Tier 1 uncertainty in 2004 are given in table 4.1 (NIR 2006).

Table 4.1 Top 10 sources contributing most to total annual Tier 1 uncertainty in 2004

IPCC cat.	Category	Gas	Combined Uncertainty as % of total national emissions in 2004
4D3	Indirect N2O emissions from nitrogen used in agriculture	N_2O	3.0%
4D1	Direct N2O emissions from agricultural soils	N_2O	1.4%
2B2	Nitric acid production	N_2O	1.3%
1A4a	Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO_2	1.0%
6A1	CH4 emissions from solid waste disposal sites	CH_4	1.0%
4B1	Emissions from manure management : cattle	CH_4	0.7%
1A1b	Stationary combustion : Petroleum Refining: liquids	CO_2	0.6%
2G	Indirect N2O from NO2 from combustion and industrial processes	N_2O	0.6%
4A1	CH4 emissions from enteric fermentation in domestic livestock: cattle	CH_4	0.5%
1A3b	Mobile combustion: road vehicles: diesel oil	CO_2	0.4%

Table 4.2 Top 10 sources contributing most to Tier 1 trend uncertainty

IPCC cat.	Category	Gas	Uncertainty introduced into the trend in total national emissions
4D3	Indirect N2O emissions from nitrogen used in agriculture	N_2O	1.9%
1A4a	Stationary combustion : Other Sectors: Commercial/Institutional, gases CO2	CO_2	1.5%
6A1	CH4 emissions from solid waste disposal sites	CH_4	1.4%
1A3b	Mobile combustion: road vehicles: diesel oil	CO_2	0.6%
1A1b	Stationary combustion : Petroleum Refining: liquids	CO_2	0.6%
1A4b	Stationary combustion : Other Sectors, Residential, gases	CO_2	0.6%
1A4c	Stationary comb.: Other Sectors, Agriculture/Forestry/Fisheries, gases	CO_2	0.5%
2B2	Nitric acid production	N_2O	0.4%
1A4c	Stationary comb. : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO_2	0.4%
4D1	Direct N2O emissions from agricultural soils	N_2O	0.3%

If we compare the top 15 from the Monte Carlo sensitivity analysis for the total GHG emission 2004 (figure 4.1) to the top 10 of the Tier 1 analysis (table 4.1), we see that they are to a large extend in agreement. In comparing the results one should be aware that the Monte Carlo analysis distinguished for most sources between activity data and emission factor. The Tier 1 ranking takes the contribution of the entire source

together. This explains why the IPCC category 1A4a (4th in the Tier 1 ranking) is not in the top 15 from the Monte Carlo sensitivity chart.
For the trend uncertainty the differences in ranking are bigger. Only four source categories in the Tier 1 top 10 were also identified in the Monte Carlo top 15: 4D3 (rank 1, 2, 6 and 13 in Monte Carlo), 6A1 (rank 3 in MC), 1A1b (rank 12 in MC) and 4D1 (rank 4, 5, 8 and 11 in MC). If we look beyond the top 15 of the Monte Carlo analysis, three more sources from the Tier 1 top 10 are identified: 1A3b (rank 17 in MC), 1A4b (rank 22 and 24 in MC) and 1A4c gases (rank 23 in MC). Again, the fact that in de Monte Carlo analysis distinguishes between activity data and emission factor is the main explanation, whereas the accounting for correlations in the Monte Carlo analysis may be an other explanation for the differences in rankings found.

4.2 Pedigree analysis

The statistical uncertainty quantified in the probability density functions assumed for all inputs of the emission model does not capture all information that we have about the uncertainties (Funtowicz and Ravetz, 1990). Usually, we also have information on the state of knowledge on which the quantification of the inputs and their uncertainty ranges is based, and this state of knowledge varies amongst inputs. To systematically assess strengths and weaknesses in the knowledge base, a pedigree assessment is carried out. Pedigree analysis is a part of the NUSAP system (Numeral, Unit Spread Assessment, Pedigree for uncertainty assessment and communication (Funtowicz and Ravetz, 1990, Van der Sluijs et al. 2005a)). NUSAP conveys an evaluative account of the production process of a quantity and indicates different aspects of the underpinning of the numbers and scientific status of the knowledge base where it stems from. Pedigree is expressed by means of a set of pedigree criteria to assess these different aspects. Criteria used in this study are proxy (how good or close a measure of the quantity which is actually measured is to the quantity about which we seek information), empirical basis (refers to the degree to which direct measurements are used to estimate the variable), methodological rigor (refers to the norms for methodological rigour in this process applied by peers in the relevant disciplines) and degree of validation (This metric refers to the degree to which one has been able to cross-check the data against independent sources) (Risbey et al., 2001, Van der Sluijs et al., 2005b). These criteria are used as indicators for data- and parameter strength. Assessment of pedigree involves *qualitative* expert judgement. To minimise arbitrariness and subjectivity in measuring strength a pedigree matrix is used to code qualitative expert judgements for each criterion into a discrete numeral scoring-scale from 0 (weak) to 4 (strong) with linguistic descriptions (modes) of each level on the scoring-scale (Table 4.1). Note that these linguistic descriptions are mainly meant to provide guidance in attributing scores to each of the criteria for a given parameter. It is not possible to capture all aspects that an expert may consider in scoring a pedigree in a single phrase. Therefore, a pedigree matrix should be applied with some flexibility and creativity. The pedigree matrix used here is documented and discussed in Risbey et al., (2001).

Table 4.3 Pedigree matrix for emission monitoring. Note that the columns are independent (Risbey et al., 2001).

	Proxy	Empirical basis	Methodological rigour	Validation
4	Exact measure	Large sample of direct measurements	Best available practice	Compared with independent measurements of same variable
3	Good fit or measure	Small sample of direct measurements	Reliable method commonly accepted	Compared with independent measurements of closely related variable
2	Well correlated	Modelled/derived data	Acceptable method limited consensus on reliability	Compared with measurements not independent
1	Weak correlation	Educated guesses / rule of thumb estimates	Preliminary methods, unknown reliability	Weak / indirect validation
0	Not clearly related	Crude speculation	No discernable rigour	No validation

We carried out a quick and dirty pedigree scoring for the 15 inputs of the emission model that have the highest contribution to the uncertainty in the output , both for the total GHG emission in 2004 and for the trend uncertainty. For this purpose we did a

card-sorting and scoring exercise with several experts involved in the NIR. For each sensitive input a scoring card was made. The experts were asked to sort these cards according to each criterion, starting with Proxy, from weakest to strongest on that criterion. After sorting, they were asked to first attribute a pedigree score for that criterion to the two extremes (the card with the weakest proxy and the card with the strongest proxy) and then give scores to all the cards in between. Sorting the cards before attributing the scores helps to warrant consitency in the scoring. The same procedure (card sorting, deciding scores for the weakest and strongest card on that criterion, and giving the scores for the cards in between) was repeated for each of the other criteria: empirical basis, methodological rigor and degree of validation. In total, 5 experts were involved in the pedigree scoring: Jos Olivier (MNP) and Romuald te Molder (MNP) each completed the full set of cards, Marian van Schijndel (MNP), Kees Peek (MNP) and Anco Hoen (MNP) together completed a third set of cards.
The averaged pedigree scores (averaged over the experts) are presented in tables 4.4 (for total 2004 greenhouse gas emission) and 4.5 (trend). Following a traffic light analogy, we have marked low pedigree scores red, medium scores amber and high pedigree scores green.

Table 4.4 Regression sensitivity (Std. b coefficient), average pedigree scores (scale 0-4, see table 4.3) and standard deviation in pedigree scores for the 15 inputs that contribute most to uncertainty in total 2004 greenhouse gas emission.

Rank	IPCC Cat	Description	Std b coeffi.	avg. proxy	avg. emp.	avg. meth.	avg. val.	stdv. proxy	stdv. emp.	stdv. meth.	stdv. val.	avg. pedigree
#1	4D3	Agricultural Soils; 3. indirect emissions; 2. Nitrogen Leaching and Run-off; N from fertilizers, animal manures and other that is lost through leaching and run-off; implied emission factor 2004	0.654	1.3	1.3	1.7	0.3	0.6	0.6	0.6	0.6	1.2
#2	4D1	Agricultural Soils; 1. Direct soil emissions; 2. Animal Manure Applied to Soils; Nitrogen input from manure applied to soils; implied emission factor N2O, 2004	0.334	1.7	2	2.3	1.7	0.6	0	0.6	**1.5**	1.9
#3	2B2	B. Chemical industry; 2. Nitric Acid Production; implied emission factor N2O 2004	0.332	3	3.3	3	2.3	1.0	0.6	0	1.2	2.9
#4	6A1	Solid waste disposal; 1 Managed Waste Disposal on Land; CH4 emission aggregate 2004	0.185	1.5	2	2.5	1	0.7	0	0.7	0	1.8
#5	4D1	Agricultural Soils; 1. Direct soil emissions; 1. Synthetic Fertilizers; Nitrogen input from application of synthetic fertilizers; implied emission factor N2O, 2004	0.17	1.7	2	2.3	1.7	1.2	0	0.6	**1.5**	1.9
#6	4B1	Manure management; 1. Cattle implied emission factor CH4, 2004	0.168	2	2	2	2	0	1	0	1	2
#7	4D3	Agricultural soils; 3. Indirect emissions: 2. Nitrogen Leaching and Run-off; N from fertilizers, animal manures and other that is lost through leaching and run-off; Activity data, 2004	0.165	1.5	2	2.5	1.5	0.7	0	0.7	0.7	1.9
#8	2G	G. Other; Indirect N2O from NO2 from combustion and industrial processes, Gg NO2, emission factor N2O, 2004	0.154	1.7	1.3	1.7	0.7	0.6	0.6	0.6	1.2	1.3
#9	4A1	Enteric Fermentation; 1. Cattle; implied emission factor CH4 2004	0.134	2	2.7	3	2.7	0	0.6	0	0.6	2.6
#10	4D3	agricultural soils; 3. Indirect Emissions; 1. Atmospheric Deposition; Volatized N from fertilizers, animal manures and other; Implied emission factor N2O, 2004	0.116	1	1.3	1.7	0.3	0	0.6	0.6	0.6	1.1
#11	1A3b	1.A.3 Transport; b. Road Transportation; Diesel Oil, aggregate activity data, 2004	0.115	2.7	3.3	3.3	3.3	0.6	1.2	0.6	0.6	3.2
#12	1A1b	1.A.1. Energy Industries; b. Petroleum Refining; Liquid Fuels; aggregate activity data ,2004	0.114	3	3	3	2	0	1	0	**1.7**	2.8
#13	1A1b	1.A.1. Energy Industries; b. Petroleum Refining; Liquid Fuels; implied emission factor CO2, 2004	0.114	2	2.3	2.7	2	1	**1.5**	0.6	**1.7**	2.3
#14	2B8	Manure management; 8. Swine, implied emission factor CH4, 2004	0.108	2	2	2	2	0	1	0	1	2
#15	1A1a	1.A.1. Energy Industries; a. Public Electricity and Heat Production; Coke Oven and BF gas Coke Oven and BF gas	0.106	2.3	2.7	2.7	3	0.6	0.6	0.6	0	2.7

* Pedigree scores between 0 and 1.3 are marked red, 1.4-2.6 amber and 2.7-4 green. High standard deviations are printed in red and very high (>1) in bold.

Table 4.5 Regression sensitivity (Std. b coefficient), average pedigree scores (scale 0-4, see table 4.3) and standard deviation in pedigree scores for the 15 inputs that contribute most to the trend uncertainty.

Rank	IPCC Cat	Description	Std b coeffi.	avg. proxy	avg. emp.	avg. meth.	avg. val.	stdv. proxy	stdv. emp.	stdv. meth.	stdv. val.	avg. pedigree
#1	4D3	Agricultural Soils; 3. indirect emissions; 2. Nitrogen Leaching and Run-off; N from fertilizers, animal manures and other that is lost through leaching and run-off; implied emission factor 1990	-0.77	1.3	1.3	1.7	0.3	0.6	0.6	0.6	0.6	1.2
#2	4D3	Agricultural Soils; 3. indirect emissions; 2. Nitrogen Leaching and Run-off; N from fertilizers, animal manures and other that is lost through leaching and run-off; implied emission factor 2004	0.551	1.3	1.3	1.7	0.3	0.6	0.6	0.6	0.6	1.2
#3	6A1	Solid waste disposal; 1 Managed Waste Disposal on Land; CH4 emission aggregate 1990	-0.421	1.5	2	2.5	1	0.7	0	0.7	0	1.8
#4	4D1	Agricultural Soils; 1. Direct soil emissions; 2. Animal Manure Applied to Soils; Nitrogen input from manure applied to soils; implied emission factor N2O, 2004	0.29	1.7	2	2.3	1.7	0.6	0	0.6	**1.5**	1.9
#5	4D1	Agricultural Soils; 1. Direct soil emissions; 1. Synthetic Fertilizers; Nitrogen input from application of synthetic fertilizers; implied emission factor N2O, 1990	-0.221	1.7	2	2.3	1.7	1.2	0	0.6	**1.5**	1.9
#6	4D3	Agricultural Soils; 3. indirect emissions; 2. Nitrogen Leaching and Run-off; N from fertilizers, animal manures and other that is lost through leaching and run-off; activity data 1990	-0.2	1.7	2	2.3	1.3	0.6	0	0.6	0.6	1.8
#7	2E	Effective emission factor HFC-23, 1990	-0.189	3.0	3	2.7	2	1	1.0	0.6	1	2.7
#8	4D1	Agricultural Soils; 1. Direct soil emissions; 2. Animal Manure Applied to Soils; Nitrogen input from manure applied to soils; implied emission factor N2O, 1990	-0.177	1.7	2.3	2.3	1.7	0.6	0.6	0.6	**1.5**	2.0
#9	4B1	Manure management; 1. Cattle implied emission factor CH4, 1990	-0.165	2	2	2	2	0	1	0	1	2.0
#10	6A1	Solid waste disposal; 1 Managed Waste Disposal on Land; CH4 emission aggregate 2004	0.16	1.5	2	2.5	1	0.7	0	0.7	0	1.8
#11	4D1	Agricultural Soils; 1. Direct soil emissions; 1. Synthetic Fertilizers; Nitrogen input from application of synthetic fertilizers; implied emission factor N2O, 2004	0.149	1.7	2	2.3	1.7	1.2	0	0.6	**1.5**	1.9
#12	4B1	Manure management; 1. Cattle implied emission factor CH4, 2004	0.146	2	2	2	2	0	1	0	1	2
#13	4D3	Agricultural Soils; 3. indirect emissions; 2. Nitrogen Leaching and Run-off; N from fertilizers, animal manures and other that is lost through leaching and run-off; activity data 2004	0.144	1.5	2	2.5	1.5	0.7	0	0.7	0.7	1.9
#14	4A1	Enteric Fermentation; 1. Cattle; implied emission factor CH4 1990	-0.144	2	2.7	3	2.7	0	0.6	0	0.6	2.6
#15	4A1	Enteric Fermentation; 1. Cattle; implied emission factor CH4 2004	0.117	2	2.7	3	2.7	0	0.6	0	0.6	2.6

* Pedigree scores between 0 and 1.3 are marked red, 1.4-2.6 amber and 2.7-4 green. High standard deviations are printed in red and very high (>1) in bold.

4.3 Diagnostic Diagrams

With the results from the pedigree analysis and the Monte Carlo sensitivity analysis we have mapped two independent properties of uncertainties in the inputs of the emission monitoring. The rank correlations from the Monte Carlo assessment express the sensitivity to inexactness in input data whereas pedigree expresses the quality of the underlying knowledge base of these data, in view of its empirical and methodological limitations. The two metrics can be combined in a so called Diagnostic Diagram (Van der Sluijs et al., 2005a) mapping pedigree and sensitivity of key uncertain inputs. The Diagnostic Diagram is based on the notion that neither sensitivity alone nor pedigree alone is a sufficient measure for quality. Robustness of monitoring output uncertainty of an input could be good even if pedigree is low, provided that the outcome is not critically influenced by the uncertainty range in that input. In this situation our ignorance of the true value of that input has no immediate consequences because it has a negligible effect on the output. Alternatively, the output can be robust against spread in certain input data even if its relative contribution to the total spread in model is high provided that the strength of the knowledge base where it stems from is also high. In the latter case, the uncertainty in the outcome adequately reflects the inherent irreducible uncertainty in the emissions monitored. Uncertainty then is a property of the (best available practice) way in which monitoring takes place and does not stem from imperfect knowledge on the inputs used. Mapping the input data in a diagnostic diagram thus reveals the weakest critical links in the knowledge base of the emission monitoring system with respect to the overall emissions, and helps in the setting of priorities for improvement of the monitoring.

Figures 4.3 and 4.4 present the diagnostic diagrams for respectively total 2004 GHG emission and trend uncertainty. A combined ranking based on pedigree and sensitivity can be made by scanning the diagnostic diagram from the top right corner to the bottom left corner. It follows from the diagrams that for the uncertainty in total GHG emission improvements in our knowledge of the emission factors for categories 4D3, 4D1, 2G and 4B1 might be given the highest priority. Inspection of table 4.4 shows that the main problem in the knowledge base of these categories is in validation and empirical basis. For the trend uncertainty the ranking does not alter substantially from the one in table 4.4.

Figure 4.3 Diagnostic diagram for 2004 greenhouse gas emission. The numbers of the inputs plotted correspond to the rank number in table 4.4.

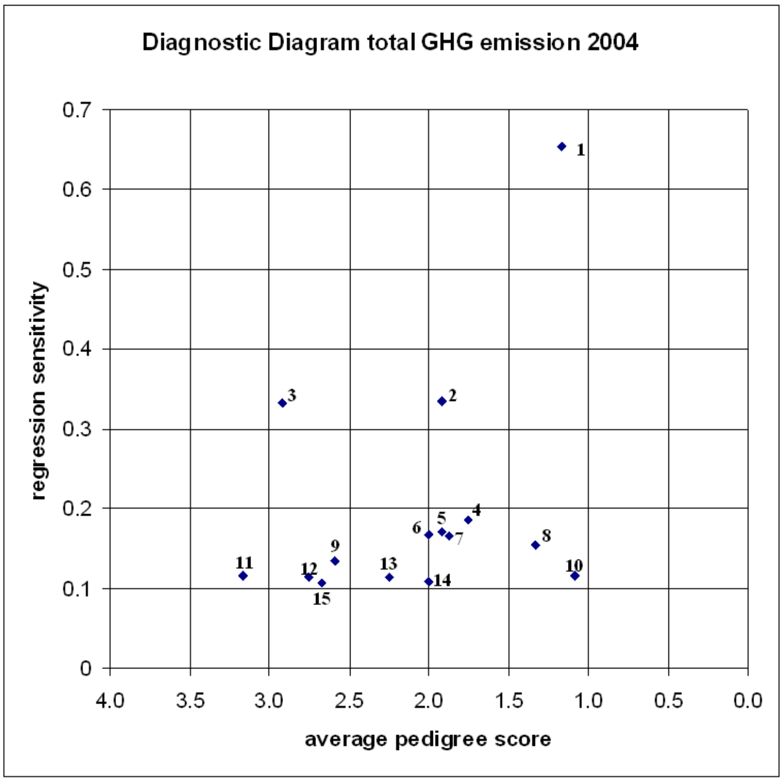
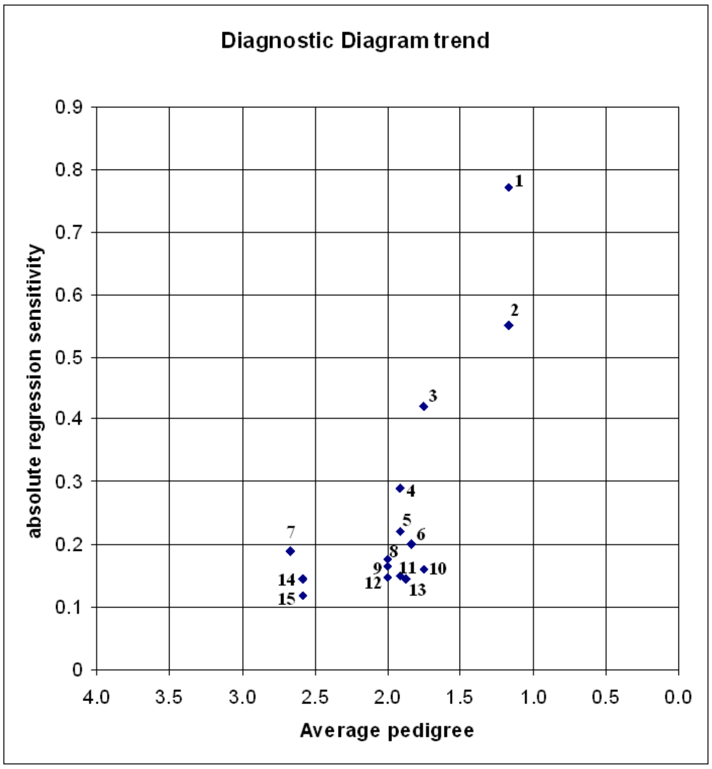


Figure 4.4 Diagnostic diagram for trend uncertainty The numbers of the inputs plotted correspond to the rank number in table 4.5.



5 Overview of uncertainty ranges and correlations assumed in Tier 2 studies of several European countries

5.1 Introduction

In various European countries Tier 2 studies have been carried out since the end of the 1990's, in response to and during the development of the IPCC report 'Good Practice Guidance and Uncertainty Management in National Greenhouse Inventories' (IPCC, 2000). In this Chapter, we present an overview of the uncertainty ranges and probability distribution functions (PDF's) that are used in such European Tier 2 studies. Since this overview will be used to put the ranges used in the Dutch NIR in context, where possible, the aggregation level in the European Tier 2 comparison will be kept similar to the aggregation level of the Tier 1 analysis that is used in the Dutch NIR. Furthermore, we focus the comparison on the Dutch key source categories.

In addition to the uncertainty ranges and PDF's, an overview of the correlations assumed in the European Tier 2 studies will be presented. This overview was used to help drafting the list of relevant correlations that were taken into account in the Dutch Monte Carlo analysis (Chapter 2).

So far, the following European countries have published results of their Tier 2 uncertainty studies: Austria, Flanders (Belgian province), Finland, Norway and the United Kingdom. Some other countries (e.g. Germany) are currently conducting Tier 2 analysis, but results are not yet available.

The Austrian Tier 2 analysis is published in a report and a journal article (Winiwarter and Orthofer, 2000; Winiwarter and Rypdal, 2001). A characteristic that differentiates the Austrian study from others is that, in their analysis, both random and systematic errors are explicitly taken into account. The random uncertainty covers the fluctuation of a large set of measurements. This may include both random uncertainty of the measurements and the variability of a parameter. A systematic error is a deviation which may be caused by a systematically wrong estimate, omission or false interpretation of certain data or statistics. The estimates for systematic errors in the Austrian study result from discrepancies between different data sources.

The first Finnish Tier 2 uncertainty analysis was published in 2003 for the emissions of 2001 (Monni and Suri, 2003). The uncertainties were further updated in 2004 for the emissions of 2002 and, within the NIR of 2005, for the emissions of 2003 (Monni, 2004; Statistics Finland, 2005). For the comparison made in this Chapter, only the most recent uncertainty ranges have been included.

The Flemish Tier 2 analysis was published in 2004. Part of the Flemish uncertainty estimates were either based on the IPCC good practice values or rose from a comparison of uncertainty ranges used in other European countries (Boogaerts and Starckx, 2004).

Uncertainties in the Norwegian emission inventory have been reported in 2000 and 1999. In 2005, an updated Tier 2 analysis has been carried out and published in the Norwegian NIR. The updated analysis was based on the 2000 report with some modifications. Since in the NIR no PDFs are reported, we use the uncertainties and PDF's reported in the 2000 report (Bjotveit, 2005; Rypdal and Zhang, 2000). The 2000 report tries to reach the best conclusion on the uncertainty in the trends of the emissions, by using, as far as possible, a realistic data set for the Kyoto target year (approximately 2010). Therefore the official projected emissions from the Norwegian Ministry of Environment are used. The used uncertainties were based on current knowledge.

Uncertainties present in The United Kingdom's Tier 2 analysis were published in the NIR of 2005 (Baggott et al., 2005). It should, however, be noted that the aggregation level of the uncertainties used for this report is completely different of the one used in the Dutch Tier 1 analysis. The implications of the differences in the level of aggregation will be discussed later.

In the rest of this Chapter, uncertainties used in the different European Tier 2 studies are compared to the uncertainties used in this study for the Netherlands. Note that the uncertainty values used for the Netherlands in this report are based on the Tier 1 uncertainties used in the Dutch NIR as explained in Chapter 2.

5.2 Overview of the uncertainty ranges and comparison with Dutch uncertainty assumptions

5.2.1 Stationary combustion (1A1, 1A2 & 1A4)

The stationary combustion sector is responsible for more than 60 percent of all greenhouse gas emissions in the Netherlands. We will first present the comparison of uncertainties in the activity data and then in the emission factors.

- ***Activity data***

Table 5.1 shows a comparison of uncertainties in the activity data in several European countries. Because various countries use different (types of) aggregation levels, not all the uncertainty values are directly comparable. The level at which one can compare the uncertainties is depicted in the table in a graphical way. Hence, if the background colour of the uncertainty value is white, the value is well comparable to the Dutch source categories. An orange colour means that the value is less comparable to the Dutch situation. The uncertainties for the Dutch 2006 NIR are available at a more detailed level than the ones shown in Table 1. In the table, the data has been aggregated to a higher level of aggregation in order to make the comparison with the uncertainties reported by other countries easier.

As shown in table 5.1, the aggregation level for stationary combustion in Austria and Finland is very similar to the Dutch aggregation level. Both systematic and random uncertainties are presented for Austria; the normal PDF represents the random uncertainty, while the uniform PDF represents the systematic uncertainty. In Norway, the aggregation level is higher than for the Dutch Tier 1 analysis. The uncertainties are given for similar fuel types (liquids, gases, solids and other), but at the sector level (stationary combustion sector 1), instead of at the sub sector level (i.e. energy industries, manufacturing industries, etc). In the Flemish analysis, uncertainties in activity data are available at a lower aggregation level than in the Netherlands. In order to be able to compare the data, we have aggregated the uncertainties using simple error propagation techniques. If the activity data of the subtotal is the sum of several subcategories, the uncertainty is the root of the sum of the squares of the absolute uncertainties of the activity data of these subcategories. The result is the uncertainty values provided in Table 5.1.

In the case of the United Kingdom, uncertainties are provided for the main fuel types, e.g. coal, natural gas and LPG. The uncertainties are not further disaggregated into sectors or sub sectors. For instance, the uncertainty of the activity data of 'coal' is given, but it is not known what the uncertainties of coal are for the sector *Energy combustion* (sector 1) or *Industrial processes* (sector 2) or for the sub sectors *energy industries* (1A1) or *manufacturing industries and construction* (1A2). This makes a comparison with the Dutch uncertainty information difficult.

Table 5.1 Uncertainties in activity data and PDF's used for stationary combustion by country

IPCC	Source category	Uncertainty in Activity Data (2 std dev in %)						
		NL	FI	UK	NO	AU-R	AU-S	FL
1A1 l	Energy Industries, liquids	7.6 N	2 N	0.8 .. 24 N	3 N	0.5 N	5U	4.3 N
1A1 s	Energy Industries, solids	1 N	1.5 N	1.2 ..5.6 N		0.5N	10U	1 N
1A1 g	Energy Industries, gases	1.4 N	1 N	2.4 N	4 N	2 N	5U	2 N
1A1 o	Energy Industries, other fuels	10 N						
1A2 l	Manufacturing Industries and Construction, liquids	1 N	2 N	1.1..25N	3 N	1 N		3.4 N
1A2 s	Manufacturing Industries and Construction, solids	2 N	1.5 N	1.1..5.6N	5 N	1N	8U	1.8 N
1A2 g	Manufacturing Industries and Construction, gases	2 N	1 N	2.4 N	4 N	5 N		2 N
1A4 l	Other Sectors, liquids	20 N	3 N	1.4..24N	3 N			11.6 N
1A4 s	Other Sectors, solids*	50 N	10 N	1.2..5.6 N	20 N			11.7 N
1A4 g	Other Sectors, gases	5 N	5 N	2.4 N				5 N

NL (Netherlands), FI (Finland), UK , NO (Norway), AU-R (Austria, random), AU-S (Austria, systematic), Fl (Flanders)
pdf's N (normal), U (uniform)
* No key source category

From the comparison, we can conclude that most of the uncertainties used in the Dutch analysis for the activity data of the sector 1A1 *liquids* are greater than the ones reported for other European countries. This is, in fact, caused by large underlying uncertainties in the activity data of the sub sectors 1A1b *Petroleum Refining* and 1A1c *Manufacture of Solid Fuels* (Olivier and Brandes, 2005). The uncertainty of the sector 1A1 *solids* is comparable to those used in Finland and Flanders. The high (systematic) uncertainties reported by Austria for all sectors are caused by a large difference (up to

10%) in the fuel statistics between two major Austrian institutions (Winiwarter and Rypdal, 2001). This is reflected not only in the high uncertainty values, but also by the use of uniform PDF's. The uncertainty of the Dutch activity data for the sector 1A1 *gases* is higher than that of Finland but lower than for the other European countries.

In the Dutch sub sector 1A2 *Manufacturing industries and construction*, only the uncertainty for *liquids* is (slightly) lower than in most other countries. In sub sector 1A4 *liquids and solids* the uncertainty in activity data is much higher than in other European countries. Unfortunately, the level of information currently available does not allow us to explore the causes of the differences.

Table 5.2 Uncertainties in emission factors of CO_2 and PDFs, for stationary combustion by country

IPCC	Source category	Uncertainty in Emission factor (2 std dev in %)					
		NL	FI	UK	NO	AU	FL
1A1 l	Energy Industries, liquids	8.4 N	2 N	2..5 N	3 N	0.5 N	2 N
1A1 s	Energy Industries, solids	3.4 N	3 N	3..6 N	7 N	0.5 N	2 N
1A1 g	Energy Industries, gases	1 N	1 N	1 N	7 N	0.5 N	1 N
1A1 o	Energy Industries, other fuels	5 N					
1A2 l	Manufacturing Industries and Construction, liquids	5 N	2 N	2..5 N	3 N	0.5 N	2 N
1A2 s	Manufacturing Industries and Construction, solids	14 N	3 N	3..6 N	7 N	0.5 N	5 N
1A2 g	Manufacturing Industries and Construction, gases	1 N	1 N	1 N	7 N	0.5 N	1 N
1A4 l	Other Sectors, liquids	2 N	2 N	2..3 N	3 N		2 N
1A4 s	Other Sectors, solids*	5 N	5 N	3..6 N	7 N		5 N
1A4 g	Other Sectors, gases	1 N	1 N	1 N			1 N

NL (Netherlands), FI (Finland), UK (United Kingdom), NO (Norway), AU (Austria), Fl (Flanders, Belgium)
pdf's N (normal), U (uniform)
* No key source category

- ***Emission Factors***

The uncertainties of CO_2 emission factors for stationary combustion are presented in Table 5.2. The uncertainties for the Dutch sector 1A1 *liquids* are significantly higher than in all other European countries. A possible explanation for this is that '*residual chemical gas'* constitutes a large part of this category, especially in 2004 (Olivier and Brandes, 2005). The amount of 'residual chemical gas' in this sector is unknown in other countries. For the sector 1A1 *gases*, Norway reports a high uncertainty in the emission factor. At the moment, there is not enough information available to explain this. For the Netherlands, the uncertainties of the emission factor in 1A2 for *liquids* and *solids* are slightly higher than those of other countries. This can be explained by a relative high percentage of residual chemical gas and blast furnace/Oven Furnace gas.

Table 5.3 Uncertainties in CH_4 emission factors and PDF used by country

IPCC	Source category	Uncertainty in CH_4 Emission factor (2 std dev in %)					
		NL	FI	UK	NO	AU	FL
1A	Emissions from stationary combustion: non-CO2	32 N	-75+10 B	50 N	-50+100 LN/TN	50 N	50 N

NL (Netherlands), FI (Finland), UK (United Kingdom), NO (Norway), AU (Austria), Fl (Flanders, Belgium)
pdf's N (normal), B (beta), TN (truncated normal), LN (lognormal)

The uncertainties in the CH_4 emission factors are shown in Table 5.3. The uncertainty in the Netherlands appears to be smaller than those reported in other countries. The uncertainty for this emission factor in the Netherlands is ±50 % with a normal PDF for every sub category, e.g. for liquid fuels in the section public electricity. The Dutch value presented in Table 5.3 is the uncertainty in the CH_4 emission factor for the whole stationary combustion section, which in the analysis done for the Netherlands is an outcome of the model, since the inputs are on a different aggregation level than the Tier 1 analysis. Therefore, the emission factor for the whole sector in the other countries marked with an orange background might be smaller as well. Another difference is found in the PDFs used, for example Finland uses a beta-distribution, while in Norway lognormal and truncated normal distributions are used for different categories.

5.2.2 Transport (1A3)

An international comparison of uncertainties in activity data and emission factors for the Dutch key categories in the transport sector are shown in Table 5.4. Note that uncertainties in the activity data for the Netherlands are on the high side compared with other European countries. In contrast to this, uncertainties in the Dutch emission factors of CO_2 are significantly on the low side compared with other countries. This is because, contrary to other countries, the Netherlands reports the standard deviation of the mean instead of the standard deviation of the sample population. Following the IPCC Good Practice Guidance, the standard deviation of the mean in the proper metric for uncertainty to be used in the Tier 1 and Tier 2 analysis if the concerned factor has been measured on more than one individual occasion within the inventory period (IPCC, 2000). This was indeed the case in the Netherlands. Also, the uncertainty of the N_2O emission factor in the Netherlands is lower than those in the United Kingdom and Finland. The sensitivity of the lower uncertainties of the emission factor will be tested later, see Chapter 6.

Table 5.4 Uncertainties for key categories in the Transport sector by country.

IPCC	Source category	NL	FI	UK	NO	AU	FL
		Uncertainty in Activity data (in %)					
1A3b	Mobile combustion: road vehicles: total		1 N	0.8..24 N	3..20 N	10 N	2 N
	Mobile combustion: road vehicles: gasoline	2 N	1 N	0.8 N			
	Mobile combustion: road vehicles: diesel oil	5 N	1 N	1.4 N			
	Mobile combustion: road vehicles: lpg	10 N	1 N	24 N			
1A3	Mobile combustion: water-borne navigation	20 N	10 - 20 N	10 N			10 N
		Uncertainty in Emission Factor CO_2 (in %)					
1A3b	Mobile combustion: road vehicles: total		2 N	2..3 N	3 N		2 N
	Mobile combustion: road vehicles: gasoline	0.4 N	2 N	2 N			
	Mobile combustion: road vehicles: diesel oil	0.2 N	2 N	2 N			
	Mobile combustion: road vehicles: lpg	0.2 N	2 N	3 N			
1A3	Mobile combustion: water-borne navigation	0.2 N	2 N		3 N		5 N
		Uncertainty in Emission Factor N_2O (in %)					
1A3	Mobile combustion: road vehicles: total		315 LN	110..170 N	-66+200 B	-30 +70 Tri	116 LN
	Mobile combustion: road vehicles: gasoline	66 LN	315 LN	170 N			
	Mobile combustion: road vehicles: diesel oil	82 LN	99+158 T	140 N			
	Mobile combustion: road vehicles: lpg	101 LN	116 LN	110 N			

NL (Netherlands), FI (Finland), UK (United Kingdom), NO (Norway), AU (Austria), Fl (Flanders, Belgium)
pdf's: N (normal), LN (lognormal), B (beta), Tri (triangular),

5.2.3 Industry (2)

The comparison of the uncertainties in activity data and emission factors for the European countries for the Dutch key categories is presented in Tables 5.5 (for CO_2 emitting sources), 6 (for N_2O emitting sources) and 7 (for F gases). In sector 2, the only key sub sector for methane emissions is the sub sector '*Other Industrial*', no comparisons with other countries could be made for this sub sector.

Table 5.5 Uncertainties for key categories in the industrial sector that emit CO_2, by country

IPCC	Source category	Uncertainty in Activity data (in %) NL	FI	UK	NO	AU	FL
2A3	Limestone and dolomite use	25 N	-5 + 7 Tri	1 N			
2B1	Ammonia production	2 N			3 N	5 N	1 N
		Uncertainty in Emission Factor CO_2 (in %)					
2A3	Limestone and dolomite use	5 N	-9 + 5 Tri	5 N			
2B1	Ammonia production	1 N			7 N		1 N

NL (Netherlands), FI (Finland), UK (United Kingdom), NO (Norway), AU (Austria), Fl (Flanders, Belgium)
pdf's: N (normal), Tri (triangular)

The uncertainty in the Dutch activity data of *Limestone and dolomite use* is clearly much higher than those reported for Finland and the United Kingdom; the uncertainty of the CO_2 Emission factor is very similar to those reported in those countries. The high uncertainty of the Dutch activity data for Limestone can be due to the fact that in the Netherlands plaster is used as activity indicator instead of real limestone (VROM, 2005), which increases the uncertainty of the values provided. In the case of ammonia production, the uncertainty in activity data is in the range found for the other countries. In Norway, natural gas is used for the *ammonia production*. Since the Norwegian uncertainty for the CO_2 emission factor of gas is high compared to the other countries, the uncertainty for the emission factor of *ammonia production* in Norway is also high (Rypdal, 1999). The Dutch uncertainty for the emission factor of *ammonia production* is equal to the one used in Flanders.

Table 5.6 Comparison of Uncertainties for key categories in the sector Industry that emit N_2O

IPCC	Source category	Uncertainty in Activity data (in %) NL	FI	UK	NO	AU	FL
2B2	Nitric acid production	10 N	5 N	10 N		20 N	2 N
2B5	Caprolactam production	50 N					2 N
2G	Indirect N2O from NO2 from combustion and industrial processes	15 N					
		Uncertainty in Emission Factor N_2O (in %)					
2B2	Nitric acid production	50 N	116 LN	230 N	7 N	20 N random -20..120 U sys	116 LN
2B5	Caprolactam production	50 N					25 N
2G	Indirect N2O from NO2 from combustion and industrial processes	200 LN					

NL (Netherlands), FI (Finland), UK (United Kingdom), NO (Norway), AU (Austria), Fl (Flanders, Belgium)
pdf's: N (normal), LN (lognormal), B (beta), Tri (triangular),

The range of uncertainties for nitric acid production used in the countries studied is large for both activity data and emission factors. The used uncertainty in activity data for *nitric acid production* in the Netherlands is equal to the one used in the United Kingdom and lower than in Austria. In Flanders, only one producer of nitric acid remains, which has reliable data available. This explains the low uncertainty reported. Also in Finland, the number of nitric acid producers is small and the data is considered reliable. The uncertainty of the emission factor that is used in the Netherlands is higher than in Norway, but lower than in the other countries. Austria has a large systematic uncertainty for the emission factor of *nitric acid production*. The uncertainty estimates for *caprolactam production* are much higher for the Netherlands than for Belgium. Unfortunately, there is not enough information available to explain this difference.

Table 5.7 Comparison of uncertainties for key categories for F-gases

IPCC	Source category	Uncertainty in Activity data (in %)			
		NL	UK	NO	AU
2F	SF6 emissions from SF6 use#	50 N			25 N
2C3	PFC from aluminium production	2 N		3 N	5 N
2F	PFC emissions from PFC use#	5 N			
2F	Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC#	10 N			20 N
2E	HFC-23 emissions from HCFC-22 manufacture	10 N			
2E	HFC by-product emissions from HFC manufacture	10 N			
		Uncertainty in Emission Factor SF_6, PFC, HFC (in %)			
2F	SF6 emissions from SF6 use#	25 N	16* N	60 LN	50 N
2C3	PFC from aluminium production	20 N		-30..+50 LN	2 N
2F	PFC emissions from PFC use#	25 N			-
2F	Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC#	50 N		50 LN	50 N
2E	HFC-23 emissions from HCFC-22 manufacture	10 N			-
2E	HFC by-product emissions from HFC manufacture	20 N			-

NL (Netherlands), FI (Finland), UK (United Kingdom), NO (Norway), AU (Austria), Fl (Flanders)
pdf's: N (normal), LN (lognormal), B (beta), Tri (triangular),
TIER-1 methodology, see text
* Uncertainty in emission

The uncertainties for the activity data and emission factor of F gases are presented in Table 5.7. In the Netherlands, there was not enough information available for all F gas categories to perform a complete Monte Carlo analysis. For these categories, the Tier 1 uncertainties are given in Table 5.7. A more detailed explanation is given in Chapter 2. In Norway, the uncertainty of *PFC emissions* from *aluminum production* has been reported to have a lognormal probability distribution with a 95% confidence interval between -30 and +50 %. This range is based on two measurements from 1992 (Rypdal, 1999). As seen from the table, the uncertainties for *aluminum production* in Norway are slightly higher than the Dutch uncertainties. The uncertainty of the activity data in Austria is higher than in the Netherlands. The random uncertainty of the emission factor for *aluminum production* in Austria is very low. There is, however, not enough information available to explain the difference.

The uncertainty of the Dutch activity data of *sulphur hexafluoride* (SF_6) use is higher than the one used in Austria, while the uncertainty for the emission factor is lower than those for Norway and Austria. The uncertainties reported for the ODS substitutes for Norway and Austria are similar to the Dutch values; the uncertainty of the activity data in Austria is higher than the one used in the Netherlands.

Sector 3 of the NIR (solvents use) is not a key source in the Netherlands. Therefore, an international comparison of the uncertainties reported for this sector is not carried out in this report.

5.2.4 Agriculture (4)

Table 5.8 shows the uncertainties in activity data and CH_4 emission factors for the agricultural sector. The Dutch uncertainties for activity data for *enteric fermentation* are similar to those found for most other European countries. The Dutch uncertainties reported for CH_4 emission factors for *enteric fermentation* are lower than those used in Finland and Austria. The Austrian value is estimated at ±50 %, because the food intake by cattle may vary up to a factor of two according to one expert. Part of the food intake is converted into methane, therefore the methane emissions per cattle may vary strongly. The Finnish uncertainty estimates for cattle are the result of a more detailed study. The uncertainty values used in Flanders are based on Tier 2 IPCC default values, the ones used in Norway are also based on the IPCC guidelines.

The uncertainty of the activity data for *manure management* in the Netherlands is higher than those reported for other countries. This can be explained by the different methodologies used to calculate activity data for this sub sector. In the Netherlands, the activity data is estimated as the amount of animals times the amount of excretion per animal, so the Dutch activity data is the total amount of excretion. In the other countries the activity data only consists of the amount of animals. Since, including the amount of excretion in the calculation would increase the uncertainty (the number of animals in the agricultural sector is generally well monitored while the amount of excretion is an estimate which would depend on factors such as specie, age, feed type, etc.), it is not surprising that the values reported by the Netherlands are on the higher side.

The uncertainty in the emission factor from *manure management* is much higher for the Netherlands than for other European countries. Flanders and Norway based their uncertainty values on IPCC Good Practice values. In Finland, a value of ±30 % is used, which is the result of expert judgment and a comparison to other countries. In the Netherlands the uncertainty is assumed to be 100 % with a lognormal distribution.

Table 5.8 Uncertainties for activity data and CH_4 emission factor for the sector Agriculture, by country

IPCC	Source category	Uncertainty in Activity data (in %)					
		NL	FI	UK	NO	AU	FL
4A1	CH4 emissions from enteric fermentation in domestic livestock: cattle	5 N	3 N	0.1 N		10 N	5 N
4A8	CH4 emissions from enteric fermentation in domestic livestock: swine	5 N					10 N
4A	CH4 emissions from enteric fermentation in domestic livestock: other	5 N	5 N	0.1 N	5 to 10N		10 N
4B1	Emissions from manure management : cattle	10 N	3 N				5 N
4B8	Emissions from manure management : swine	10 N					5 N
4B9	Emissions from manure management : poultry	10 N					5 N
4B	Emissions from manure management : other	10 N	5 N	0.1 N	5 to 10 N		5 to 10 N
		Uncertainty in Emission Factor CH_4 (in %)					
4A1	CH4 emissions from enteric fermentation in domestic livestock: cattle	20 N	24..+40 LN			50 N	
4A8	CH4 emissions from enteric fermentation in domestic livestock: swine	50 N					
4A	CH4 emissions from enteric fermentation in domestic livestock: other	30 N	50 N	20 N	25 N		20 N
4B1	Emissions from manure management : cattle	100 LN					
4B8	Emissions from manure management : swine	100 LN					
4B9	Emissions from manure management : poultry	100 LN					
4B	Emissions from manure management : other	100 LN	30 N	30 N	25 N		40 N

NL (Netherlands), FI (Finland), UK (United Kingdom), NO (Norway), AU (Austria), Fl (Flanders, Belgium)
pdf's: N (normal), LN (lognormal), B (beta), Tri (triangular),

In Table 5.9 the comparison of uncertainties concerning N_2O emissions in the agricultural sector is presented. For several categories, the Dutch uncertainty values can only be compared to one other country. The Dutch values are slightly on the high side for the uncertainties in activity data from *manure management*. The range of values of the uncertainties of the direct N_2O emissions from *agricultural soils* for different countries is large; the Dutch values are sometimes high and sometimes low. The uncertainties in the N_2O emission factors for the Netherlands are similar to those used in Flanders.

Table 5.9 Uncertainties in activity data and Emission factors for N_2O-emissions in the agricultural sector by country

IPCC	Source category	Uncertainty in Activity data (in %)				
		NL	FI	UK	NO	FL
4B	Emissions from manure management	10 N	3 ..5 N	0.1 N	5 to 10 N	5 to 10 N
4D1	*Direct N2O emissions from agricultural soils: synth fertilizers*	10 N	10 N		5 N	10 N
	Direct N2O emissions from agricultural soils: manure to soils	10 N			20 N	
	Direct N2O emissions from agricultural soils: N-fixing crops	5 N	30 N			
4D3	Indirect N2O emissions from nitrogen used in agriculture	50 N				10 N
4D2	Animal production on agricultural soils: *Manure dropped in meadows*	10 N				10 N
		Uncertainty in Emission Factor N_2O (in %)				
4B	Emissions from manure management	100 LN				82 LN
4D1	*Direct N2O emissions from agricultural soils: synth fertilizers*	100 LN				116 LN
	Direct N2O emissions from agricultural soils: manure to soils	100 LN				
	Direct N2O emissions from agricultural soils: N-fixing crops	100 LN				
4D3	Indirect N2O emissions from nitrogen used in agriculture	100 LN				116 LN
4D2	Animal production on agricultural soils: *Manure dropped in meadows*	100 LN				116 LN

NL (Netherlands), FI (Finland), UK (United Kingdom), NO (Norway), AU (Austria), Fl (Flanders, Belgium)
pdf's: N (normal), LN (lognormal)

5.2.5 Land Use Change and Forestry, LUCF (5)

The comparison of uncertainties for the sector Land Use Change and Forestry are presented in Table 5.10. This sector is relatively new in the inventories, which explains why not all the other countries have reported uncertainty values. For only two sub sectors a comparison can be made. In both cases, the uncertainty values for the activity data are similar to the values reported by Finland and the random uncertainty value reported by Austria. The Finnish value for the uncertainty of the emission factor for the sub sector *grassland remaining grassland* is based on the IPCC guidelines and is higher than the Dutch value. The Austrian uncertainty value for the sub sector *Forest Land* is much lower than the value used in the Dutch analysis. In contrast to the Netherlands, in Austria the specific density of the wood and the carbon content are considered very reliable.

Table 5.10 Uncertainties in activity data and emission factors for the LUCF category, by country

IPCC	Source category	Uncertainty Activity data (%) NL	FI	AU
5A1	Forest Land remaining Forest Land	25 N		20 N random + 30 N system
5A2	Land converted to Forest Land	25 N		
5C1	Grassland remaining Grassland	25 N	30 N	
5C2	Land converted to Grassland	25 N		
5F2	Land converted to Other Land	25 N		
		Uncertainty in Emission Factor CO_2 (in %)		
5A1	Forest Land remaining Forest Land	61.8 N		10 N
5A2	Land converted to Forest Land	48 N		
5C1	Grassland remaining Grassland	50 N	90 N	
5C2	Land converted to Grassland	104 N		
5F2	Land converted to Other Land	50 N		

NL (Netherlands), FI (Finland), AU (Austria), Fl (Flanders, Belgium)
pdf's: N (normal)

5.2.6 Waste (6)

The uncertainty overview for *landfills* is shown in Table 5.11. The Netherlands uses a model for the calculation of landfill emissions that is similar to the model used for the Finnish inventory (for a description of the Dutch model see Chapter 2). The other countries use a different method for estimating landfill emissions, the results are not easily comparable and therefore the Dutch uncertainties are only compared with the Finnish one. The uncertainty used for the *total amount of annually deposited waste* for the Netherlands is much lower than the ones used in Finland. The Dutch uncertainties are based on expert knowledge from SenterNovem (Olivier, personal communication). According to the expert the values for the amount of annually deposited waste are highly reliable. The historical activity data for the amount of waste in Finland are based on the current annual amount of waste and the historic changes in gross domestic product (GDP) and population. The uncertainty estimates are also based on expert knowledge.

The uncertainties for the Netherlands and Finland are equal for the *fraction of degradable organic carbon* and *the fraction of actually dissimilated degradable organic carbon*. The uncertainty of the *fraction of methane in landfill gas* in the

Netherlands is the IPCC default value. The uncertainty that is used in Finland is much higher and is based on measurements made at 12 different landfills in Finland. This might cause an overestimation of the values, because the uncertainties in the measurement might be larger than the physical variation of the fraction of methane in landfill gas (Monni and Suri, 2003). However the Finnish measurements could as well be closer to reality, since at least they use measured values and not a rough estimate like the Netherlands which uses the IPCC default uncertainty. Finland does use the IPCC default for the value of the fraction of methane in landfill gas.

The uncertainties for the *methane generation rate constant* (k) differ a lot. The uncertainty values from Finland for k=0.05 and k=0.03 are based on the IPCC Good Practice Guidelines with a different PDF than the one recommended by the IPCC. The Finnish uncertainty value for k=0.2 is based on expert knowledge. The *methane generation rate constant* is decreasing in the Netherlands after 1990, the year in which separate collection of 'green' waste was started (therefore amount of organic waste disposed in landfills decreased with the consequent influence on CH_4 generation). The model assumes a constant decrease of the methane generation constant with an uncertainty of 0 %. The fact that experts are reporting a 0% uncertainty is troublesome, since even in the case in which the generation rate was completely known, one could still expect uncertainties in the measurements. This should constitute a point of discussion/revision in the following NIR.

The Netherlands reports an uncertainty of 100 % with a lognormal distribution function for *the methane oxidation factor in the top layer*. This is based on expert knowledge. In Finland, the reported uncertainty is smaller. In both countries, the uncertainties for the *recovered landfill gas* are pretty similar and quite small.

Table 5.11 Comparison of uncertainties for the sector landfill

	Netherlands			Finland		
	year	pdf	unc.	year	pdf	unc.
Total amount of annually deposited waste	<1980	Normal	10%	1900-1930	LN	130 %
	1980-1990	Normal	#	1931-1950	LN	100%
	>1990	Normal	1%	1951-1970	gamma	-33..+82%
				1971-1996	Normal	30%
				1997-2001	Normal	15%
fraction of Degradable Organic Carbon (DOC)		Normal	20%		Normal	20%
fraction of DOC actually dissimilated (DOCF)		Normal	10%		Normal	10%
fraction of CH4 in landfill gas (F)		Normal	5%		Normal	22%
methane generation rate constant	k=0.094 <1990	Normal	10%	k=0.05 k=0.03	Weibull	-40.+300%
	k<0.094 >1990	Normal	0%	k=0.2	beta	-75..+10%
methane oxidation factor in top layer		LN	100%		gamma	-50..+10%
recovered landfill gas	<1990	N	10%		Normal	5%
	1990-2000	N	*			
	>2000	N	5%			

uncertainty is linearly decreasing from 10% in 1980 to 1% in 1990
* uncertainty is linearly decreasing from 10 % in 1990 to 5 % in 2000

Uncertainties for the N_2O emissions from *waste water handling* are shown in Table 5.12. The uncertainty of the Dutch activity data is higher than the ones in Flanders and the United Kingdom, but slightly lower than the one used in Norway.

Table 5.12 Comparison of uncertainties for the sector wastewater handling

IPCC	**Source category**	**Uncertainty in Activity data (in %)**			
		NL	**UK**	**NO**	**FL**
6B	N_2O Emissions from wastewater handling	20	10 N	25 N	10 N (6B2)
		Uncertainty in Emission Factor CH_4/N_2O (in			
6B	N_2O Emissions from wastewater handling	50	97.5 percentile as 100 times 2.5 percentile		

NL (Netherlands), FI (Finland), UK (United Kingdom), NO (Norway), Fl (Flanders, Belgium)
pdf's: N (normal), LN (lognormal)

5.3 Correlations

One of the main differences between a Tier 1 and a Monte Carlo analysis is that correlations among variables can be included. In this section, we will first compare the correlations used for activity data and emission factors within a given year by country. Secondly, we will describe correlations found between different years (i.e. the base year and year of study).

We should point out that the correlations used in the analysis of uncertainties by other countries are not always applicable to the Dutch situation because of different aggregation levels or methodologies used. A more detailed description of the way in which correlations have been included in the Dutch Monte Carlo analysis is given in Chapter 2.

The correlations found for activity data are listed in Table 5.13. In the last column, it is pointed out whether the correlations are relevant for the Dutch situation. Full correlations are implicitly included in the Dutch Monte Carlo analysis, by referring to the same cell with emission factor or activity data, when that is used for more than once to calculate emissions. This is the case for the correlation of the number of animals (nr. 3 and 13), which are used for the calculations of both *enteric fermentation* (sector 4A) and *manure management* (sector 4B). This is also true for the situation when the same activity data is used to estimate the emissions of more than one pollutant within the same year (nr. 4, 6, 12, 14 and 15).

In Norway, the activity data was assumed dependent for the *consumption of oil products* in each sector (nr. 1 and 2). The total consumption of oil products is better known and has a lower uncertainty than the distribution between applications, e.g. cars with and without catalytic converters. These correlations are not applicable in this form for the Dutch situation, since we use data at a lower aggregation level.

Table 5.13 Correlations for activity data within one year

Norway (Rypdal and Zhang, 2000)	NL
▪ The sum of all oil products has a lower uncertainty than the consumption in each sector. The total consumption of oil is better known than the distribution between applications having different emission factors. Therefore, activity data is correlated.	*No, uncer-tainties at lower level*
▪ The consumption of gasoline and diesel (oil products) for the applications cars with catalytic converter, cars without catalytic converter and off-road applications. The split between the various applications is more uncertain than the total and therefore the data is correlated.	*No, different aggregation level*
▪ Number of domestic animals. The same data are used for estimating methane from enteric fermentation, methane from manure management and partly nitrous oxide from agricultural soils.	*Yes*
▪ Same activity data is used to estimate emissions of more than one pollutant.	*Yes*
United Kingdom (Baggott et al., 2005)	**NL**
▪ The uncertainties used for the fuel activity data were estimated from the statistical difference between supply and demand for each fuel. This means that the quoted uncertainty refers to the total fuel consumption rather than the consumption by a particular sector, e.g. residential coal. To avoid underestimation, uncertainties for same fuel types in different sectors were correlated.	*No, different aggregation level*
▪ Same activity data were used to calculate emissions of CO_2, CH_4 and N_2O.	*Yes*
▪ CH_4 Activity data is independent between years, but activity data for major fuels were correlated in the same year in a similar manner to that described above for carbon. Also see 5.	*No, different aggregation*
▪ N_2O Activity data are independent between years, but similar fuels are correlated in the same year. See 5 & 7	*No, different aggregation*
Finland (Monni, 2004; Monni and Suri, 2003; Monni et al., 2004)	**NL**
▪ The use of gasoline is assumed fully (100%) correlated in road transportation (in cars with or without catalytic converters), waterborne navigation (leisure boats) and off-road machinery.	*No, different aggregation*
▪ Liquid and gaseous fuels (r=0.8). A positive correlation between the sum and its elements has to be introduced in the model, because otherwise the residual will not correspond well to reality. The reason is that obviously, if one element of the sum is relatively high the sum also has to be high.	*See text*
▪ The same activity data has been used for CO_2, CH_4 and N_2O of a specific source category, and therefore the activity data of a specific source category fully correlates between gases.	*Yes*
Flanders (Boogaerts and Starckx, 2004)	**NL**
▪ Correlation if same activity data is used to calculate CO_2, CH_4 and N_2O emissions (1A and 6)	*Yes*
▪ For activity data of sectors 4B and 4A, the number of animals for enteric fermentation and manure management are correlated.	*Yes*
▪ Data is correlated if the same activity data is used for calculating CH_4 and N_2O in the sector Land Use Change & Forestry.	*Yes*
▪ Data is correlated if the same activity data is used for calculating CO_2 and CH_4 in the sub sector: Iron and Steel production.	*Yes*

The dependencies of the emission factors used in the Tier 2 studies are shown in Table 5.14. Correlation 16 states that when the same fuel is present in more subcategories, the used emission factor is dependent.

Table 5.14 Emission factor correlations for European countries

Norway (Rypdal and Zhang, 2000)	**NL**
▪ CO_2 emission factors for each fuel type is dependent	*yes*
▪ The methane and nitrous oxide emission factors from combustion are dependent when they have been assumed to be equal in the emission estimation model. Frequently, the same emission factors for CH_4 and N_2O are used for several emission sources because of lack of data.	*Not relevant*
▪ In a few cases, the emission factors of different pollutants are correlated. That happens when for instance CO_2 is oxidised from methane (oil extraction, oil loading and coal mining).	*Not relevant?*
▪ **UK (Baggott et al., 2005)**	*NL*
▪ CO_2 emission factors for LPG, orimulsion and Municipal Solid Waste were correlated with those for the same fuel used in different sources.	*yes*

The correlations between years for activity data are shown in Table 5.15. In most cases, activity data is not correlated between the base year and year of study. In Austria, the activity data of solid waste, other waste and cement production are correlated, because the uncertainty is assumed to be at least partly derived from a systematic error. For the two waste categories the partial correlation is in accordance with the fraction of the assumed systematic error. The high value of 90 % for cement production is not thought to be important for the total, because the uncertainty of the cement sector hardly influences the uncertainty of emission totals or of the trend (Winiwarter and Rypdal, 2001).

Table 5.15 Correlations between activity data in base year and end year

Norway (Rypdal and Zhang, 2000)	***NL***
▪ No, except when activity data is not updated annually. The only exception is the area of histosols where data in all years are dependent as they have been assumed to be equal.	*No, no separate histosols*
Finland (Monni, 2004; Monni and Suri, 2003; Monni et al., 2004)	***NL***
▪ Peat production areas and arable peatlands (same Activity Data are used)	*No, not reported separately in Dutch NIR*
Austria (Winiwarter and Rypdal, 2001)	***NL***
▪ Solid waste (r=0.6) ▪ Other waste (r=0.5) ▪ Cement production (r=0.9)	*See text*
Flanders (Boogaerts and Starckx, 2004)	***NL***
▪ Activity data is not correlated between years.	-

The dependencies between emission factors in the base year and end year are described in Table 5.16. Most emission factors are assumed to be fully correlated and unchanging between the base year and end year.

Table 5.16 Correlations between emission factors in base year and end year

Norway (Rypdal and Zhang, 2000)	**NL**
▪ Most of the emission factors are assumed to be the same from 1990 to 2001. Those that are not, are based on the same assumptions. This implies that all the emission factors are fully correlated between the two years. In reality, it is expected that most emission factors are changing over time, but the degree of change is usually not known.	*Yes, depending on the emission factor and the level of aggregation.*
United Kingdom (Baggott et al., 2005)	**NL**
▪ Emission factors of similar fuels are correlated (i.e. gas oil with gas oil, coke with coke etc).	*Yes*
▪ CO_2 emissions from the Land Use Change and Forestry sector are correlated.	*yes*
▪ CH_4 emission factors for enteric fermentation and manure management are correlated for a given species.	*Yes*
▪ CH_4 Landfill emissions were partly correlated across years in the simulation. It is likely that the emission factors used in the model will be correlated, and also the historical estimates of waste arising will be correlated since they are estimated by extrapolation from the year of the study. However, the reduction in emissions is due to flaring and utilisation systems installed since 1990 and this is unlikely to be correlated. As a crude estimate, it was assumed that the degree of correlation should reflect the reduction. Emissions have been reduced by 63% hence the degree of correlation was 37%.	*a different model is used in the NL, landfill emissions are correlated to a different degree*
▪ CH_4 emissions from gas leakage are fully correlated.	*Yes*
▪ CH_4 Open cast and coal storage and transport emissions are correlated. Emissions from deep mines were not correlated across years as they were based on different studies, and a different selection of mines. Open cast and coal storage and transport were correlated since they are based on default emission factors.	*No, no coal mines in the NL*
▪ N_2O emissions from agricultural soils were correlated between base and end year.	*Yes*
▪ N_2O The emission factor used for sewage treatment was assumed to be correlated, though the protein consumption data used as activity data were assumed to be not correlated.	*Yes*
Finland (Monni, 2004; Monni and Suri, 2003; Monni et al., 2004)	**NL**
▪ All emission factors are correlated.	*yes*
Austria (Winiwarter and Rypdal, 2001)	**NL**
▪ 100 % correlation for all emission factors.	*yes*
Flanders (Boogaerts and Starckx, 2004)	**NL**
▪ All emission factors of 1990 and 2001 are correlated.	*yes*

5.4 Comparison of results of Tier 2 analyses of several European countries

The results of the Monte Carlo analyses for the studied countries are compared in Table 5.17. The upper part of the table represents the analysis including the Sector *LUCF* (5). For Austria the presented uncertainties include the systematic uncertainties. The lower part of the table presents the analysis without the Sector LUCF, for Austria only the results for the random uncertainties are shown.

Table 5.17 Comparison of results of TIER-2 analyses

	NL with LUCF 2004			UK with LUCF 2003			Austria with LUCF 1997, incl sys unc*			Flanders with LUCF 2001			Finland with LUCF 1997		
	Tg CO_2 eq	level	uncertainty (2σ) %	Tg CO_2 eq	level	uncertainty (2σ) %	Tg CO_2 eq	level	uncertainty (2σ) %	Tg CO_2 eq	level	uncertainty (95% interval)	Tg CO_2 eq	level	uncertainty (95% interval)
Total	220	100%	4,1	650	100%	14	78	100%	10,5	92	100%	-3,95..+4,97	86	100%	-14..+15
CO_2	182	83%	2,1	556	86%	2,4	60	77%	4,7	76	83%	±2,75	73	86%	±15
CH_4	17	8%	15,1	41	6%	13	8	11%	47,5	7	7%	-14,6..+17,2	5	6%	±20
N_2O	18	8%	42,0	40	6%	226	9	12%	69,4	9	10%	-28,9..+44.6	7	8%	-40..+100
F	2	1%	28,1	13	2%	17,9							1	1%	-10..+20

	NL without LUCF 2004			Austria without LUCF 1997, only random			Norway without LUCF 2010			Finland without LUCF 1997		
	Tg CO_2 eq	level	uncertainty (2σ) %	Tg CO_2 eq	level	uncertainty (2σ) %	Tg CO_2 eq	level	uncertainty (2σ) %	Tg CO_2 eq	level	uncertainty (95% interval)
Total	217	100%	3,9	80	100%	3,8	63	100%	17	63	100%	-4..+8
CO_2	180	83%	1,5	68	85%	1,0	48	76%	4	50	80%	±2
CH_4	17	8%	15,1	10	12%	28,5	6	10%	20	5	8%	±20
N_2O	18	8%	42,0	2	3%	23,9	6	10%	170	7	11%	-40..+100
F	2	1%	28,1				3	5%		1	1%	-10..+20

We conclude that the uncertainty in the total greenhouse gas emissions in the Netherlands is at a similar level as the uncertainty in Flanders, Finland and the random uncertainty for Austria. The uncertainties in the total GHG emissions in the United Kingdom, Finland with LUCF, Norway and Austria (including the systematic uncertainties) are much larger than the Dutch uncertainty.

As seen in section 5.2.1 the Dutch uncertainties for several sub sectors in the *Stationary Combustion* sector are slightly higher than the European average, apparently these sub sectors do not have a large impact on the uncertainty in the total CO_2 emission, since that is quite similar to those reported by other European countries. Also, it is important to point out that a relative large amount of natural gas is used in the Netherlands. Since natural gas consumption is well monitored, uncertainties in the activity data and emission factors are quite low.

The large uncertainty in the total GHG emissions in the United Kingdom is mainly a result of the very large uncertainty in their total N_2O emissions, which is caused by the N_2O uncertainties in the sub sectors *Nitric Acid production* (230 %), *agricultural soils* (341 %) and emissions from *wastewater handling* (215 %). The large uncertainty in Austria is the result of large systematic uncertainties and a larger share of non CO_2 greenhouse gas emissions. In Finland, the sector LUCF causes a large uncertainty in the total CO_2 emissions. The Norwegian uncertainties for all types of gases are larger; also the share of non-CO_2 greenhouse gas emissions is larger.

We conclude that major differences in the uncertainty of the total greenhouse gas emissions are caused by the size of the uncertainty in the total N_2O emissions, which vary between around 40 and 230 %. Also the relative share of non-CO_2 gases, especially N_2O, is of major importance.

6 Scenarios and results

6.1 Introduction

In Chapters 2 and 3 the methodology used for the Monte Carlo analysis has been described as well as the results of the base case scenario, with and without the sector *Land Use Change and Forestry* (LUCF).

In this chapter, we describe nine scenarios that have been developed to test the robustness of the results of the Monte Carlo analysis to certain changes, and we will present their results. All scenarios include the category LUCF, unless it is explicitly stated otherwise. Most of the scenarios are based on information supplied by expert knowledge from the MNP and/or discussions with the 'advisory panel'.

The scenarios developed are:

A. Change of the assumed uncertainty and PDF in the CO_2 emission factor of natural gas to a:
   1. Triangular distribution (asymmetric positively skewed)
   2. Uniform distribution
B. Increase of assumed uncertainty in the CO_2 emission factor of fossil waste incineration
C. Increase of assumed uncertainty in the CO_2 emission factor of liquid fuel combustion by refineries
D. Change in assumed uncertainty in the CH_4 emission factor of gas distribution
E. Change in assumed uncertainty in the N_2O emission factor of coal power plants
F. Test the sensitivity of the results to changing assumed correlation factors
G. Scenario based on European comparison. This scenario is based on the European comparison of uncertainties presented in Chapter 5
H. Combination of the above scenarios without scenario F
   1. With LUCF
   2. Without LUCF

I. IPCC default uncertainty ranges for the majority of the inputs, for few sub sectors no default uncertainties were available

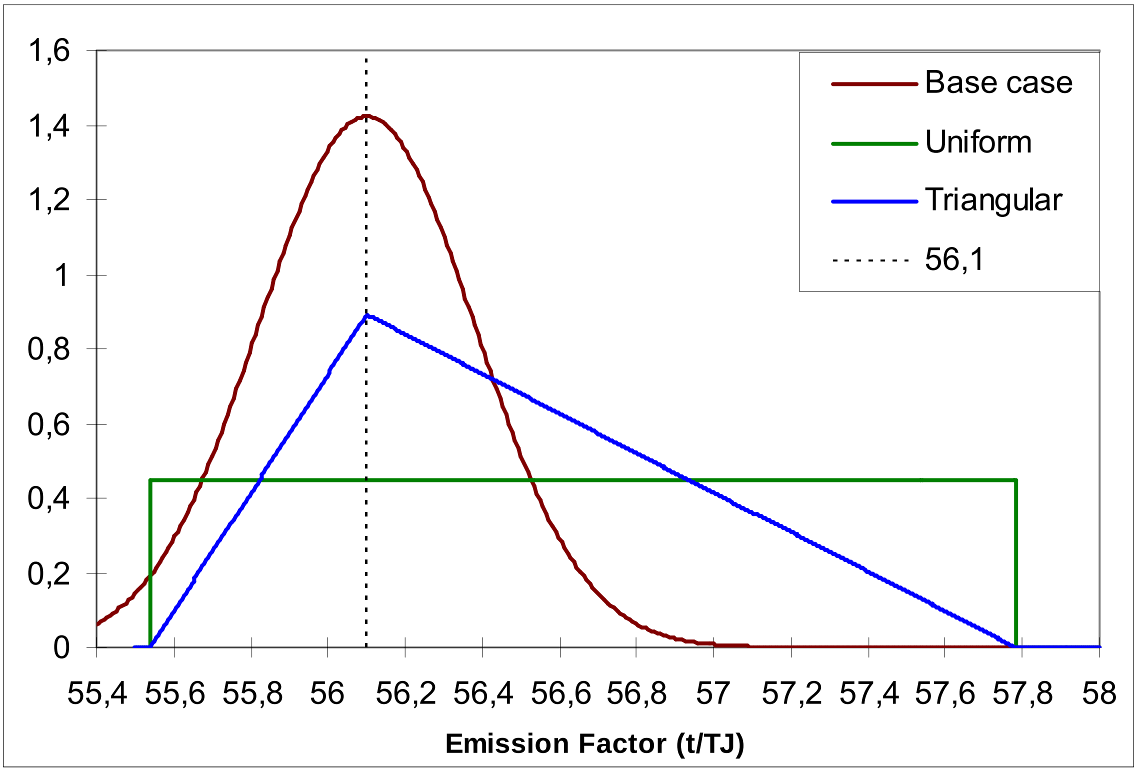
The scenarios and their results will be described in more detail in the following sections of this chapter. A more comprehensive overview of the results of the scenarios is given in Appendix E.

6.2 Emission factor of natural gas (scenario A)

The combustion of natural gas accounts for more than 35 % of the total greenhouse gas emissions in 2004 in the Netherlands (NIR, 2006). In 1990, natural gas mainly came from the Dutch gas field in Slochteren. This gas has a stable composition and the uncertainty in the CO_2 emission factor (56.1 kg/GJ) has been reported as 1 % (2 standard deviations with a normal distribution). This analysis reflects the emission factor used in the NIR 2005. This uncertainty is based on measurements of the emission factor of the Slochteren gas in 1988 with a random measurement error. In the final version of the NIR/CRF 2006 a new emission factor of 56.8 kg/GJ has been introduced based on detailed new information on the average gas composition, with other uncertainty estimates for 2004 and 1990. Since 1990, increasing amounts of natural gas from small fields have been used. Natural gas from these small fields has a higher calorific value. In addition, an increasing amount of gas with a different composition than the Slochteren gas has been imported. As a result, since 1990 natural gas used in the Netherlands has a composition with a higher variability. In this section, we do not change the emission factor, since at the time of the analysis no official decision about changing it had been taken. However it was considered, that the new emission factor for 2004 could have a different uncertainty than in 1990. We have taken this into account by increasing the uncertainty of the CO_2 emission factor. Because there is relatively more high calorific gas in 2004 than in 1990, in a first scenario (triangular A1), we consider that the uncertainty is asymmetric and positively skewed. In a second scenario (uniform A2), we study the effect of the uncertainty having a uniform probability distribution. This can, in fact, be considered a 'worst case scenario' since it indicates that there is no knowledge about the most expected value for the emission factor, and that there is only some knowledge about the range in which such expected value can be found.

In the first scenario 'triangular A1', the assumed uncertainty of the CO_2 emission factor in 2004 is changed from 1 % (2 std dev, with a normal distribution; base case) to a triangular distribution with a minimum of –1% and a maximum of +3 % of the mode. A slight increase of the mean CO_2 emission is expected, since the distribution is skewed to the right. In the second scenario 'uniform A2', the probability distribution is changed to a uniform distribution from -1 to +3 %. In Figure 6.1 the probability distribution functions of the CO_2 emission factor of natural gas in the base case scenario, the triangular scenario and the uniform scenario are plotted.

Figure 6.1 PDFs of the CO_2 emission factor of natural gas for the base case, triangular and uniform scenario.



Changing the PDF of the base case will have implications in the PDFs obtained for the final emissions in the Netherlands. A summary of the changes for those categories that belong to the *Stationary combustion sector* (1A) that use most of the natural gas in the Netherlands, is given in this section. Detailed results for this sector are given in

Appendix E. Also the emission and uncertainty information for the total CO_2 emissions and the total GHG emissions are presented in the Appendix. Furthermore, information is given there on the trends between 1990 and 2004 and the uncertainties in the trends.

In 2004, natural gas use in the sub sector *Public Electricity and Heat Production* (1A1a) resulted in an emission of more than 25 Tg CO_2 equivalents, which is equivalent to more than 10% of the total GHG emissions in the Netherlands. The probability density functions of the CO_2 emissions for this category in the base case, triangular and uniform scenarios are shown in Figure 6.3. The characteristics of the outcome distribution function are shown in Table 6.1. We found that changing the PDF of natural gas to a triangular and a uniform distribution, increased the mean of the outcome slightly with a similar percentage as the increase of the mean of the emission factor (respectively 0.7 and 1.0 %). The influence of the PDF of the emission factor on the shape of the PDF of the CO_2 emission is clearly visible in Figure 6.3. The uncertainty, expressed as two times the standard deviations, was 1.12 % in the base case. It increased to 1.76 % for the triangular scenario and to 2.34 % in the uniform scenario. The relative trend of the CO_2 emission in this sector was 5.5 % in the base case, this percentage changed to 5.6 % in both the triangular and the uniform scenario.

Table 6.1 Statistics on the results of scenario A1 and A2 compared to the base case for 2004[a]

		Minimum	Mean	Maximum	Std Dev	Variance	Skewness	Kurtosis	Mode	2 std.dev.
Public Electricity	base case	24624	25174	25743	141	19803	0,00	2,97	25289	1,12%
Public Electricity	triangular	24750	25343	26061	222	49501	0,38	2,51	25147	1,76%
Public Electricity	uniform	24717	25426	26144	298	88742	0,01	1,91	25472	2,34%
Residential	base case	16578	18556	20562	473	224034	0,01	2,99	18147	5,10%
Residential	triangular	16883	18678	20766	493	242695	0,03	2,98	18151	5,28%
Residential	uniform	16506	18741	21193	515	265694	0,02	3,01	17990	5,50%
Total CO2	base case	171822	182291	190499	1881	3539118	0,08	3,02	180409	2,06%
Total CO2	triangular	175486	182834	191076	1943	3776296	0,08	3,02	181054	2,13%
Total CO2	uniform	174115	183070	192347	2057	4232370	0,06	2,96	181524	2,25%
Total	base case	204664	219969	281686	4456	19860110	1,20	8,46	216021	4,05%
Total	triangular	205788	220530	274926	4470	19979510	1,14	7,59	217258	4,05%
Total	uniform	206513	220767	325471	4534	20559270	1,39	13,99	215849	4,11%

[a]: Please note that the numbers presented in this table are hyper precise: not all digits are significant. Because the inputs we received from various sources were hyper precise as well, we were not able to determine the proper number of significant digits.

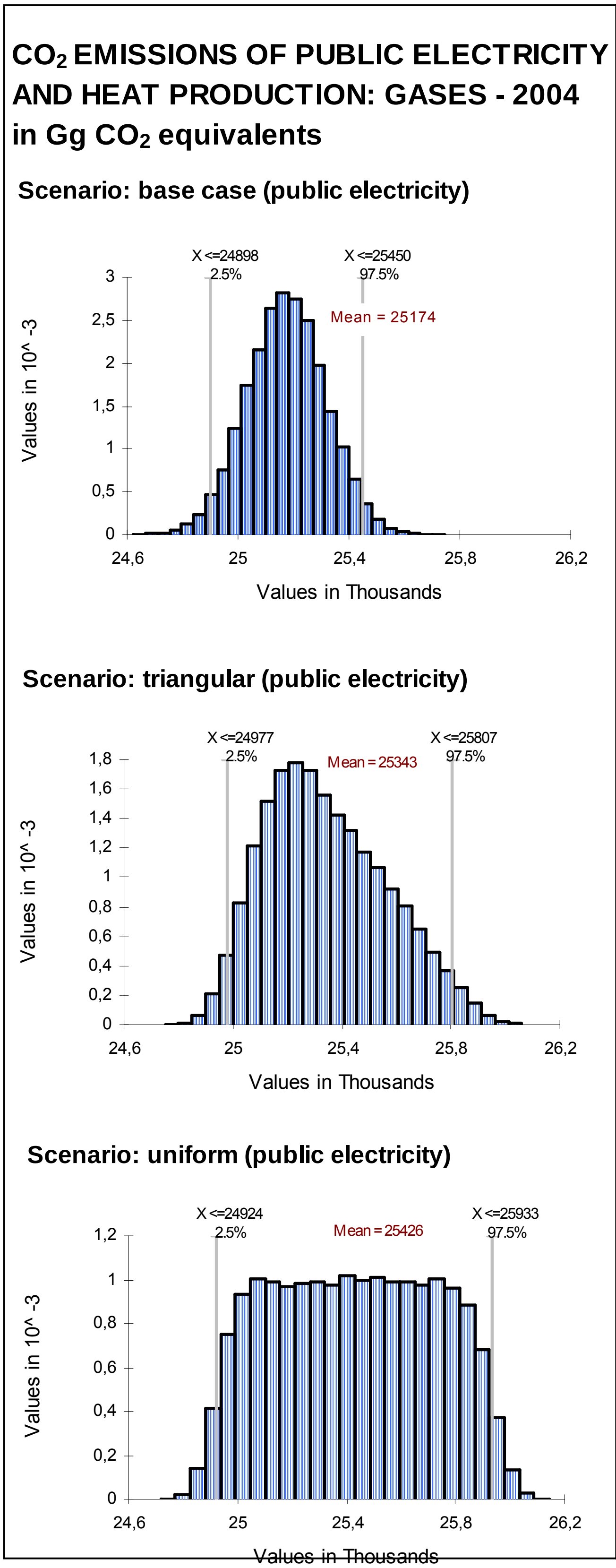


Figure 6.2 CO_2 emissions of Public electricity and heat production (1A1a) for gases in 2004 for base case, triangular and uniform scenarios

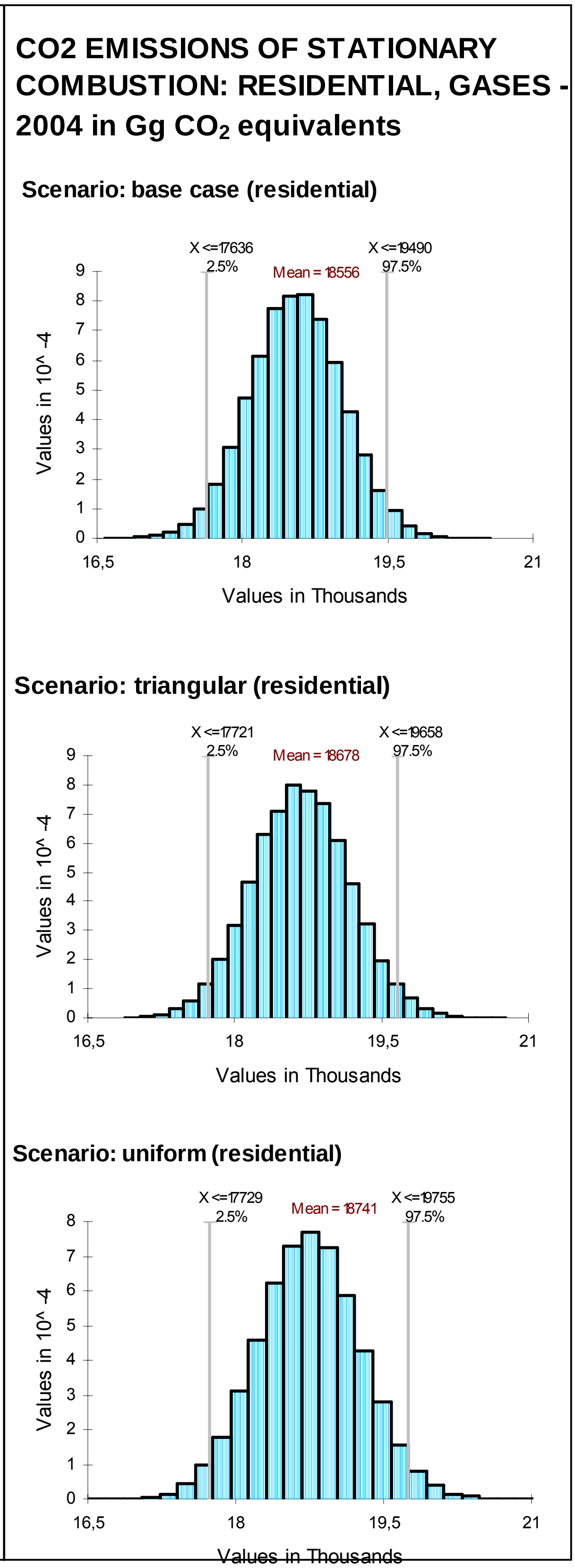


Figure 6.3 CO_2-emissions of Other sectors: Residential, gases (1A4b) in 2004 for base case, triangular and uniform scenarios

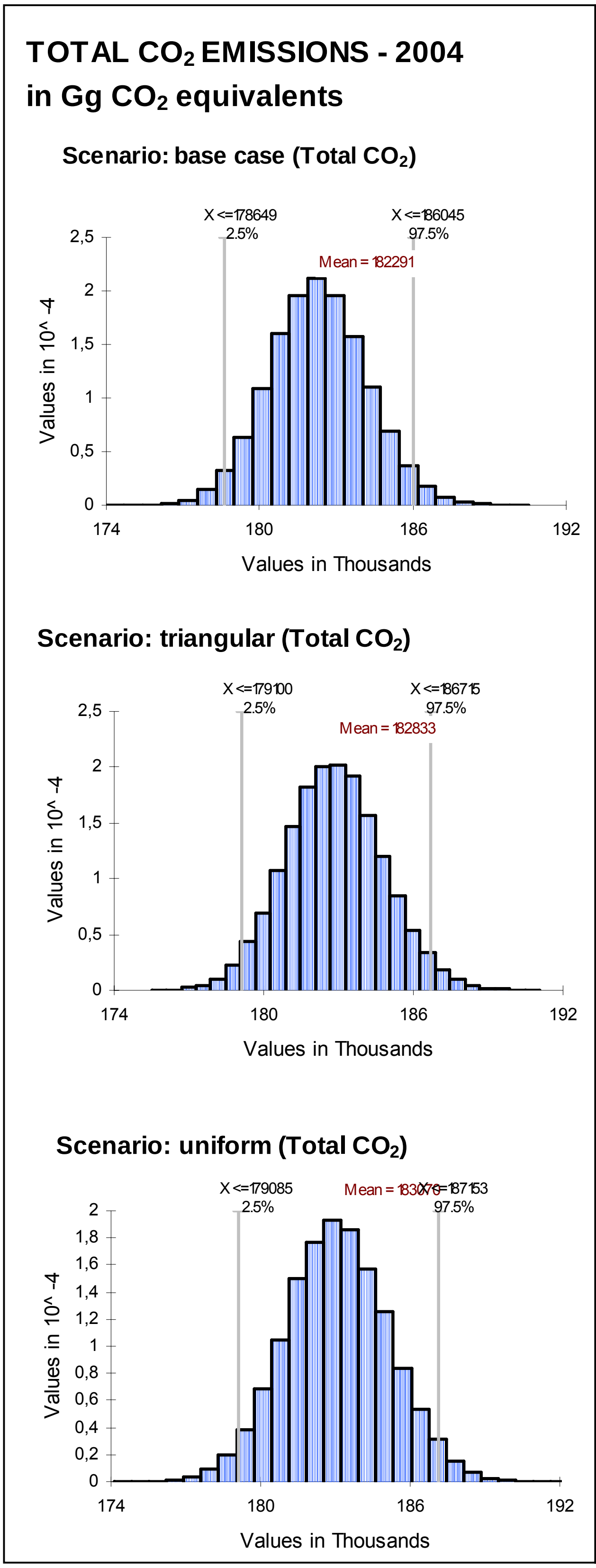


Figure 6.5 Total CO_2 emissions in base case, triangular and uniform scenarios

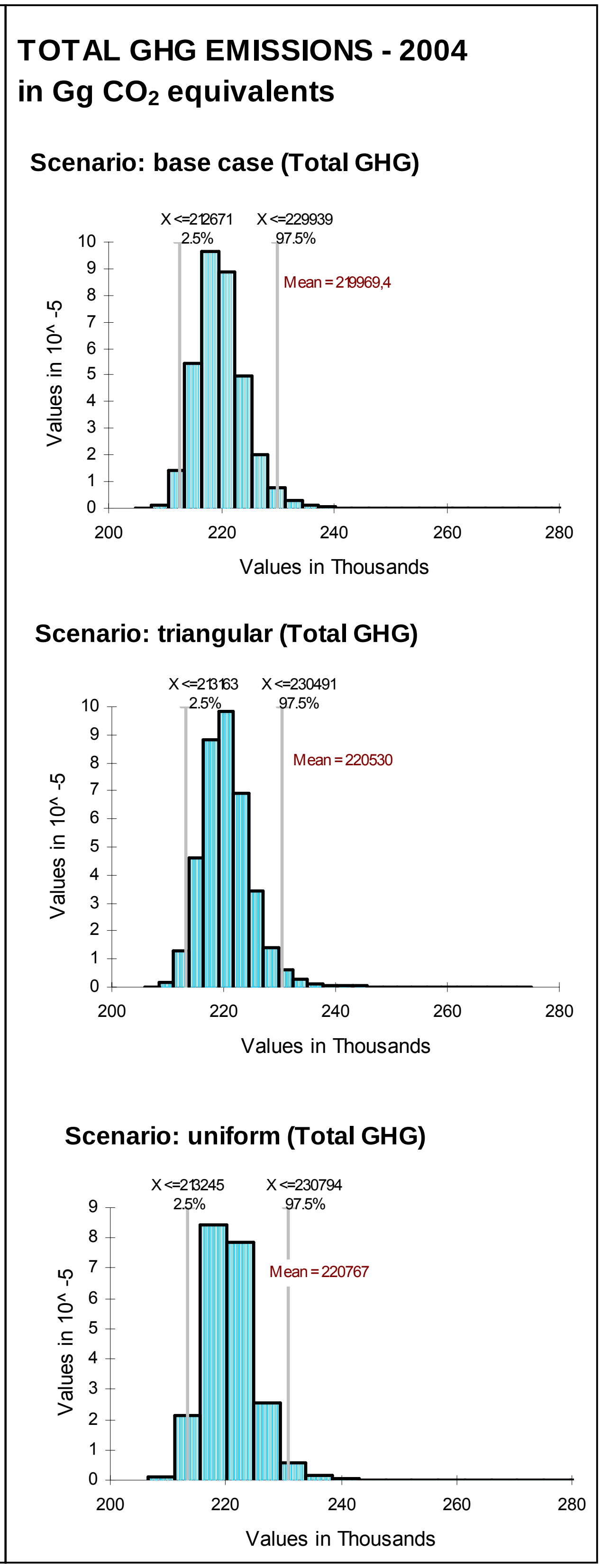


Figure 6.4 Total greenhouse gas emissions in base case, triangular and uniform scenarios

The second largest sub sector of natural gas use in the Netherlands is *Residential gas use* (1A4b), which is responsible for the emission of more than 18 Tg CO_2 equivalents. As a consequence of the change to a positively skewed PDF of the CO_2 emission factor, the CO_2 emissions from this sub sector increase slightly. The probability distribution graphs of the results are shown in Figure 6.2. Because the activity data of this category has an uncertainty of 5 % (2 σ), the effect of changing the PDFs is less visible in these graphs, than in those of category 1A1a, where the uncertainty of the activity data is only 0.5 %. The uncertainty in the emissions of *Residential gas use* increases slightly from 5.1 % in the base case, via 5.3 % in the triangular scenario to 5.5 % in the uniform scenario.

The total CO_2 emission in the Netherlands increases slightly for the triangular and uniform scenarios compared to the base case. The probability distribution of the total CO_2 emissions is shown in Figure 6.5. The uncertainty in this category, which is responsible for more than 80 % of the total greenhouse gas emissions, increases slightly for the triangular and uniform scenarios, from 2.06 % (base case) to 2.13 and 2.25 % respectively. At this level of aggregation, the effect of the scenario is still visible, but it is very small.

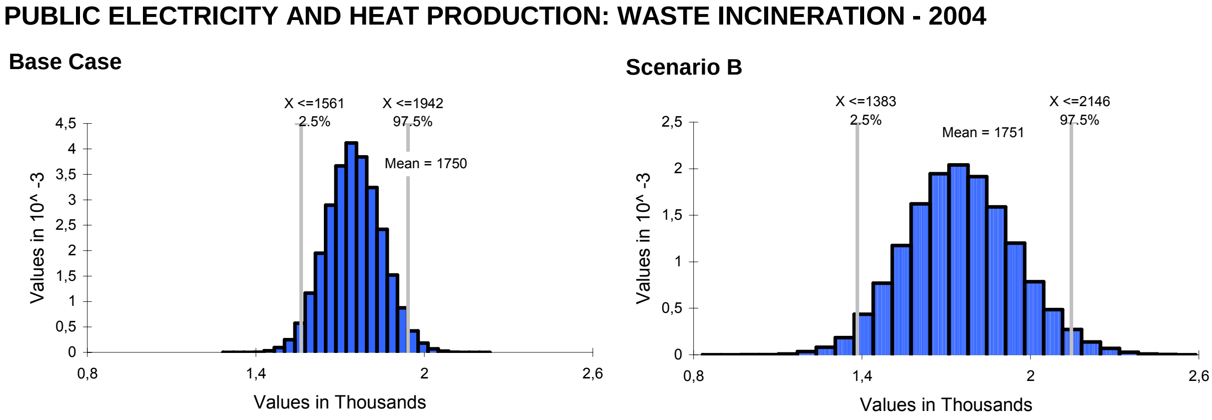
The increase of the mean in the total greenhouse gas emissions in the Netherlands is negligible (Figure 6.4). The uncertainty does not increase significantly in the triangular scenario. In the uniform scenario a very small increase is visible, from 4.05 to 4.11 %. It should be kept in mind that we use a convergence of 1.5 %, so these changes are not significant.

6.3 Increasing the assumed uncertainty in the CO_2 emission factor of fossil waste incineration (scenario B)

The uncertainty in the CO_2 emission factor of *fossil waste incineration* (1A1a) is considered higher from the year 2000 onwards. The reason for this is that there are indications that the component fractions (including the carbon fraction) per waste stream have changed. Therefore, in this scenario we analyse the influence of these changes in the final results by increasing the uncertainty of the CO_2 emission factor of *fossil waste incineration* in 2004 from 5 to 20%. (Olivier and Brandes, 2006, §4.1)

The emission resulting from fossil waste incineration is small, but has increased threefold between 1990 and 2004, since less waste is dumped in landfills and more waste is being incinerated. The emissions increased from 592 Gg CO_2 equivalents in 1990 to 1750 Gg in 2004. The increase in the uncertainty of the emission factor results in a larger uncertainty in the emission. This can be clearly seen in Figure 6.6. The uncertainty in the emission increases from 11 % to 22 %. However, since the category is so small, this increase does not influence the uncertainty of the total GHG emissions. A detailed overview of the results is given in Appendix E.

Figure 6.6 CO_2 emission of fossil waste incineration for the base case and scenario B



	Minimum	Mean	Maximum	Std Dev	Variance	Skewness	Kurtosis	Mode	2 std.dev.
Base Case	1283	1750	2233	97	9498	0,05	2,99	1714	11,14%
Scenario B	832	1751	2587	195	38142	0,12	3,07	1406	22,30%

6.4 Increasing the assumed uncertainty of the CO_2 emission factor of liquid fuel combustion by refineries (scenario C)

The uncertainty of the CO_2 emission factor for *liquid fuel combustion* by refineries may be higher in 2004 than the one used in the base case. Recently reported emission factors for refinery gas differ significantly from the values currently used in the NIR. In this scenario, the uncertainty for 2004 is changed from 10 to 20 %. (Olivier and Brandes, 2006, §4.1)

The sub sector *Petroleum refining liquids* (1A1b) accounts for circa 5% of the total CO_2 emissions in the Netherlands. The increase in the uncertainty of the emission factor results in a larger uncertainty in the CO_2 emissions of this specific category (Table 6.2, Figure 6.7). It also results in an increase in the uncertainty in the Total CO_2 emissions in the Netherlands (from 2.06 to 2.25 %). Furthermore, the uncertainty in the Total GHG emissions increases by 0.1 %. The mean values do not change significantly in this scenario.

Table 6.2 Statistics on the resulting PDFs for scenario C compared to the base case for 2004[a]

		Minimum	Mean	Maximum	Std Dev	Variance	Skewness	Kurtosis	Mode	2 std.dev.
Petroleum refining, liquids	base case	7056	9556	12595	678	459465	0,10	3,01	9790	14,19%
	C	5497	9553	14098	1069	1143395	0,11	3,01	8522	22,39%
Total CO2	base case	171822	182291	190499	1881	3539118	0,08	3,02	180409	2,06%
Total CO2	C	174038	182270	191045	2048	4194493	0,08	3,01	180145	2,25%
Total	base case	204664	219969	281686	4456	19860110	1,20	8,46	216021	4,05%
Total	C	205382	220001	307119	4566	20847830	1,32	11,28	216194	4,15%

[a]: Please note that the numbers presented in this table are hyper precise: not all digits are significant. Because the inputs we received from various sources were hyper precise as well, we were not able to determine the proper number of significant digits.

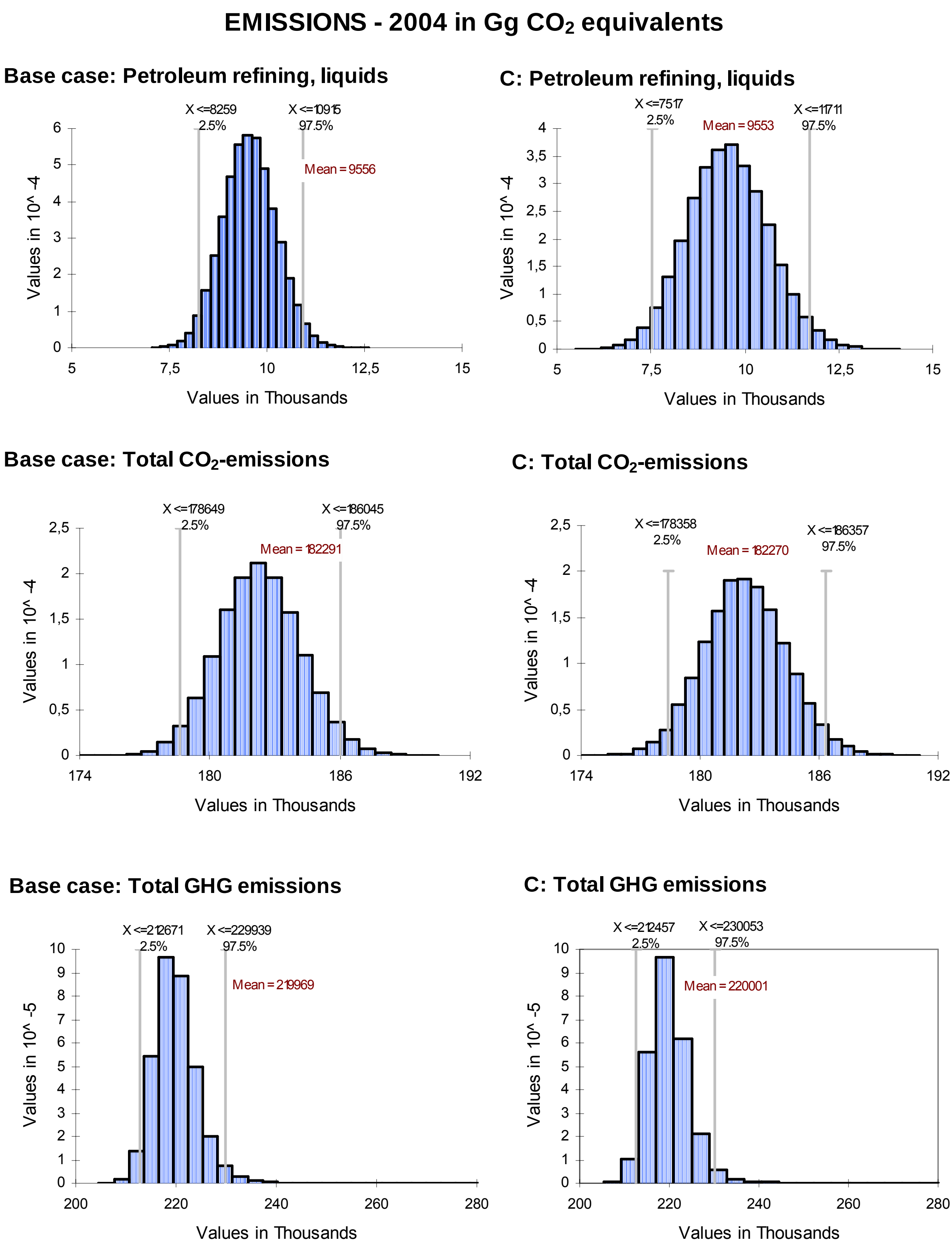


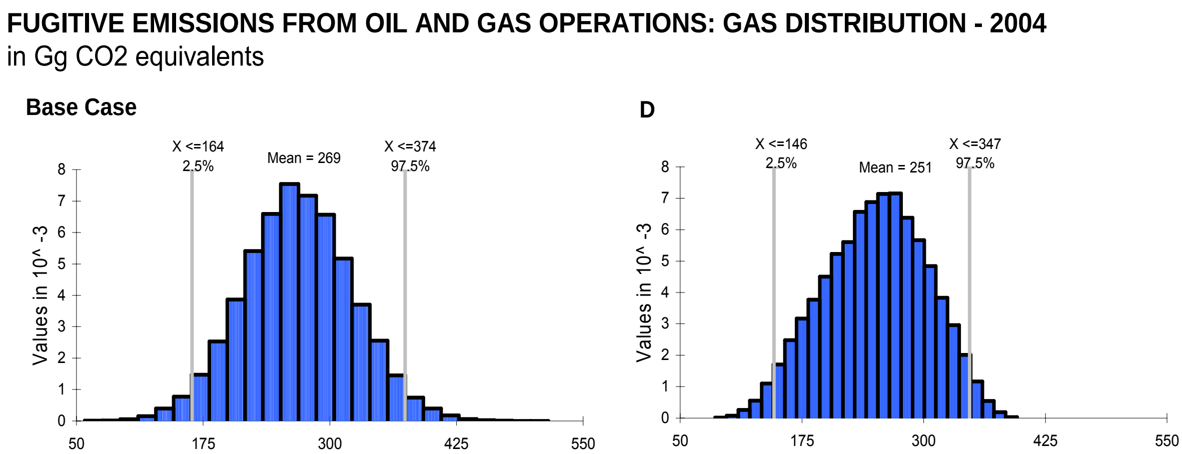
Figure 6.7 PDFs of CO_2 emission for the sub sector Petroleum refining, liquids, for the Total CO_2 emissions and the Total GHG emissions for base case and scenario C.

6.5 Change in assumed uncertainty in the CH_4 emission factor of gas distribution (scenario D)

CH_4 emissions from leaks in underground pipelines may be partly oxidized by bacteria. In the base case this is neglected, since it is unknown how significant this effect is and furthermore, it is considered a secondary effect. In literature, oxidation fraction values of up to 20 % are reported. In this scenario, the CH_4 emission factor for 1990 and 2004 will be changed from a normal distribution with 50 % uncertainty into a triangular distribution with a minimum of –70% and a maximum of +50 %. (This choice was based on a personal communication (Jos Olivier, 2006)).

This scenario results in a slight increase in the magnitude of the uncertainty in the emissions of gas distribution from 40 to 42 %. The probability distribution function changes significantly towards a more asymmetrical shape as can be seen in Figure 6.8. The impact on the total GHG emissions of the Netherlands in 2004 is negligible, which is not surprising since the contribution of this category to the total CH_4 emission is very small.

Figure 6.8 PDFs of CH_4 emissions of gas distribution for the base case and scenario D in 2004



	Minimum	Mean	Maximum	Std Dev	Variance	Skewness	Kurtosis	Mode	2 std.dev.
Base Case	58	269	515	54	2875	0,03	3,02	168	39,91%
Scenario D	86	251	396	53	2810	-0,14	2,48	261	42,29%

6.6 Change in assumed uncertainty of N_2O emission factor of coal power plants (scenario E)

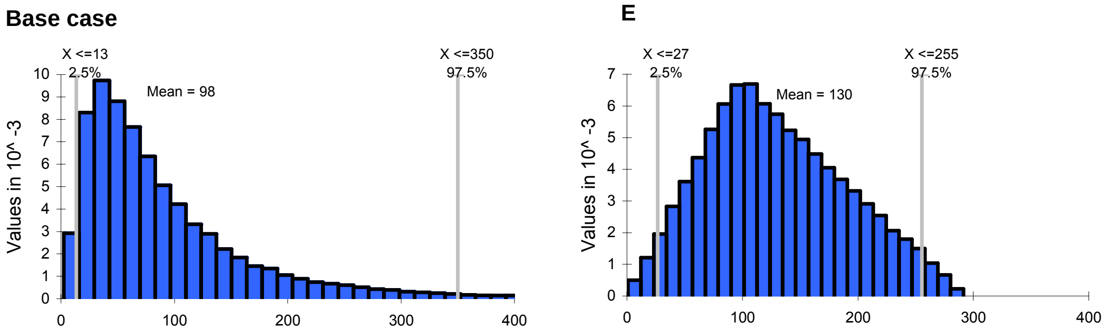
In this scenario, the N_2O emission factor for *stationary combustion* at coal power plants changes from a lognormal distribution with a 200 % uncertainty to a triangular distribution with a minimum of -100 % and a maximum of +200 %. This was done to cut off the tail of the lognormal distribution at the high side. (Jos Olivier personal communication) The activity data of the sub sector *solid fuels* in the sector *Public Electricity and Heat Production* (1A1a) consists of about 10 % of Coke Oven and Blast Furnace Gas and about 90 % of Coal. Coal is not present in the model as a separate fuel for the calculation of N_2O emissions; the emission is calculated on basis of the total solid fuel category in sector 1A1a. Since the large majority of the solid fuels used is coal, in this scenario the uncertainty of the N_2O emission factor of the whole solid fuel sector in the *Public Electricity and Heat Production* sector is changed into a triangular distribution from -100 % to +200 %.

This scenario results in a decrease of the uncertainty of the N_2O emissions of solids in *Public Electricity and Heat Production (1A1a)* from 200 % to 94 %. Since the triangular distribution of the emission factor has a higher mean and is positively skewed, the emission in this scenario is higher than in the base case. The shape of the PDF changes significantly as can be seen in Figure 6.9. The change in uncertainty has a large effect on the N_2O emissions of the total *Stationary Combustion* category. The mean increases by more than 10 % and the uncertainty decreases from 86 % to 50 %. The solid fuels used in the sector *Public Electricity and Heat Production* emit less than 1 % of the N_2O emissions in the Total N_2O category; therefore the influence of this scenario on the total GHG is negligible.

Figure 6.9 PDFs of N_2O emission for the base case and scenario E

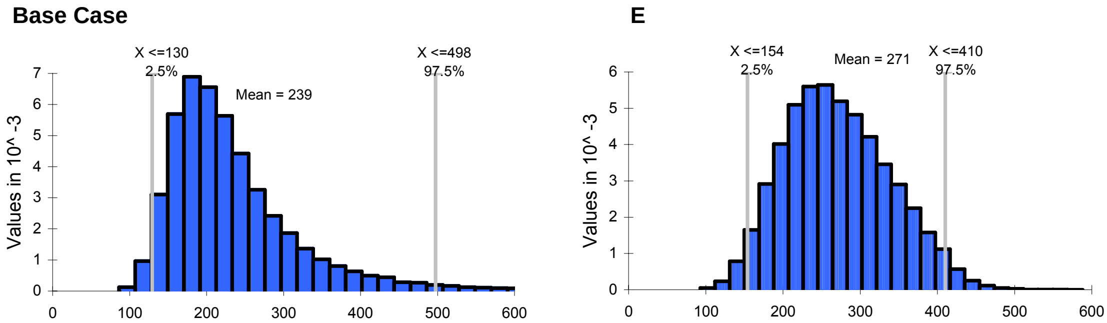
EMISSIONS - 2004 in Gg CO_2 equivalents

PUBLIC ELECTRICITY AND HEAT PRODUCTION: SOLIDS N_2O-EMISSIONS



	Minimum	Mean	Maximum	Std Dev	Variance	Skewness	Kurtosis	Mode	2 std.dev.
Base Case	2	98	2021	98	9530	3,89	32,98	35	200,24%
Scenario E	1	130	292	61	3709	0,32	2,42	109	93,99%

N_2O-EMISSIONS FROM STATIONARY COMBUSTION



	Minimum	Mean	Maximum	Std Dev	Variance	Skewness	Kurtosis	Mode	2 std.dev.
Base Case	86	239	2189	102	10485	3,42	28,11	188	85,85%
Scenario E	93	271	588	68	4627	0,32	2,69	250	50,21%

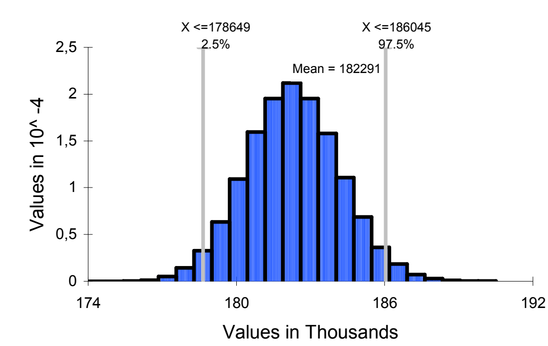
6.7 Sensitivity to assumed correlation coefficients (F)

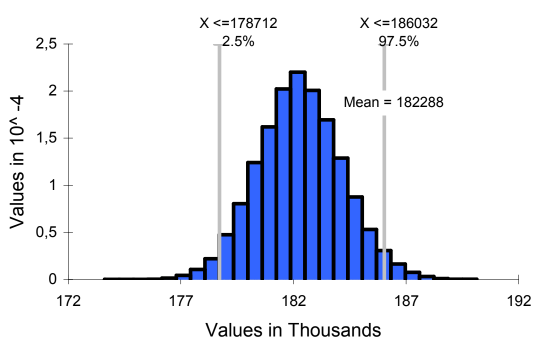
In this scenario the impact of the correlation coefficient on the robustness of the results of the Monte Carlo simulation will be tested. Since the correlations are not exactly known, a best estimate has been made in the base case scenario (Chapter 2). Scenario F consists of two parts. In the first part (scenario F1), the correlation coefficients are systematically increased. All correlation factors (r) where 0.5 had been assumed are changed to 0.75 and correlation factors of 0.75 are changed to 0.9. In the second part (scenario F2), correlation factors of 0.5 are systematically lowered to 0.1.

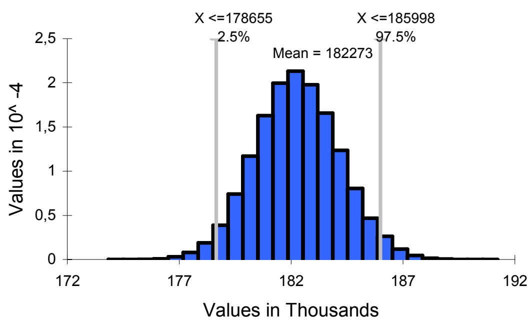
The sensitivity analysis shows that neither the mean nor the uncertainties change significantly in both scenarios. In scenario F1, the uncertainty in 1990 of the total CO_2 emissions changes from 2.21 to 2.22 % while for the year 2004, it decreases from 2.06 to 2.05 % (Figure 6.10). These changes can hardly be called significant. Also, the uncertainties of the total GHG emissions that originate from other gases do not change significantly (for 1990, it decreases from 5.39 to 5.35 % and for 2004, it increases from 4.05 to 4.09 %). The uncertainties in the trends do change slightly as a result of the increasing correlations. The uncertainty in the trend for the total CO_2-emissions changes from 1.64 to 1.54 %. The uncertainty in the trend for the total GHG emissions changes from 4.53 to 3.93 %. This is largely due to the reduced uncertainty in the N_2O emissions, which is especially caused by a reduced trend uncertainty in the *Indirect N_2O-emissions from nitrogen used in agriculture* sub sector. The trend uncertainty in this sub sector decreases from 2.94 % for the base case to 2.36 %. The reason is that the 1990 and 2004 values are correlated in the base case with r=0.75, and in this scenario with r=0.90.

The uncertainty values of scenario F2 do not differ significantly from those found in the base case. The uncertainty in the trend of the total emission increases from 4.53 % in the base case to 4.75 % in this scenario. The uncertainty in the trend of the total CO_2 emissions increases from 1.64 % in the base case to 1.77 % in the current scenario.

CO_2-EMISSIONS - 2004 in Gg CO_2 equivalents







	Minimum	Mean	Maximum	Std Dev	Variance
Base case	171822	182291	190499	1881	3539118
F1	173615	182288	190141	1867	3484228
F2	173834	182273	191214	1875	3515084

	Skewness	Kurtosis	Mode	2 std.dev.
Base case	0,08	3,02	180409	2,06%
F1	0,08	3,02	181425	2,05%
F2	0,06	3,02	179551	2,06%

Figure 6.10 Total CO_2-emissions for scenario F1 and F2

6.8 Scenario based on European comparison (G)

In Chapter 5, a comparison was made between the uncertainty values used in Tier 2 studies in other European countries, the uncertainty values used in this report and those used in the Dutch Tier 1 study. In scenario G, several uncertainties used in the base case are increased to a rough estimate of the 'average' European uncertainty Note that only those Dutch uncertainties that were significantly lower than the average European uncertainties are increased. A condition we used to change the assumed uncertainty range is that there should be uncertainty values available for at least two other European countries, an unique uncertainty value provided by one European country does not give an indication of whether the value used in the Netherlands is on the low side or not. The changes made in this scenario are listed in Table 6.3.

Table 6.2 Changes of uncertainty values in scenario G

Uncertainty value in:	category	pdf	original value	increased to
Activity data of Manufacturing Industries and Construction liquid fuels	1A2	Normal	1%	3%
CO_2-emission factor of mobile combustion: road vehicles gasoline	1A3b	Normal	0,4%	2%
CO_2-emission factor of mobile combustion: road vehicles diesel	1A3b	Normal	0,2%	2%
CO_2-emission factor of mobile combustion: road vehicles lpg	1A3b	Normal	0,2%	2%
CO_2-emission factor of mobile combustion of waterborne navigation	1A3d	Normal	0,2%	2%
N_2O-emission factor of mobile combustion: road vehicles gasoline	1A3b	Lognormal	66%	132%
N_2O-emission factor of mobile combustion: road vehicles diesel	1A3b	Lognormal	82%	164%
N_2O-emission factor of mobile combustion: road vehicles lpg	1A3b	Lognormal	101%	202%

The results of scenario G for the total CO_2 emissions and the total greenhouse gas emissions are plotted in Figure 6.11. As shown, the uncertainty of these categories increased slightly but not significantly.

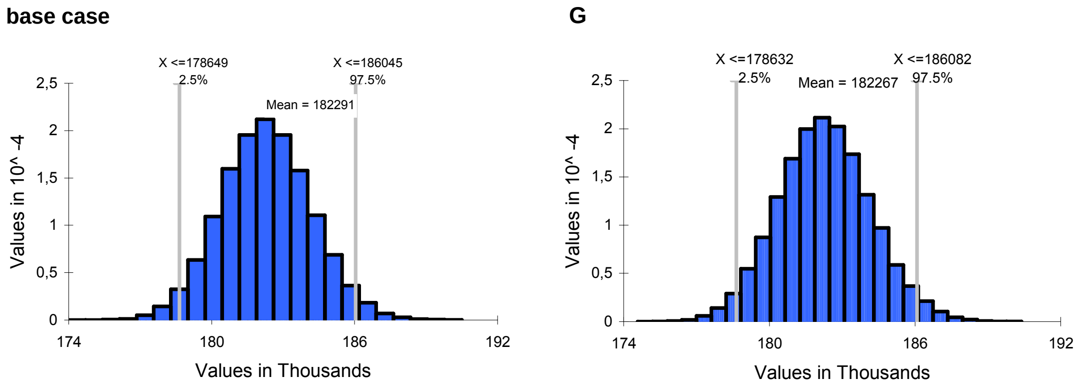
Increasing the uncertainty of the activity data of the sub sector *liquid fuels in the Manufacturing Industries and Constructions* increased the uncertainty of the emission for this sub sector from 5.08 to 5.87 %. Since, the uncertainty in the emission factor is 5 %, the increase of the uncertainty in the activity data from 1 to 3 % does not result in a large increase of the uncertainty in the sub sector’s emission.

The change in the uncertainty of the CO_2 emission factor in the *mobile combustion* sector seems large (e.g. from 0.2 % to 2 % for LPG and diesel) but, since the uncertainty in the activity data is much larger (between 2 and 20 % for the different categories), the impact on the uncertainty in the CO_2 emission is small and can be considered negligible.

A doubling of the uncertainties of the N_2O emission factor in the *mobile combustion* sector results in almost a doubling of the uncertainty in the emissions. Since this sector only account for less than 3 % of the total N_2O emissions in the Netherlands, it is not surprising that the impact on the total N_2O emissions of the change in uncertainties in the emission factors is negligible.

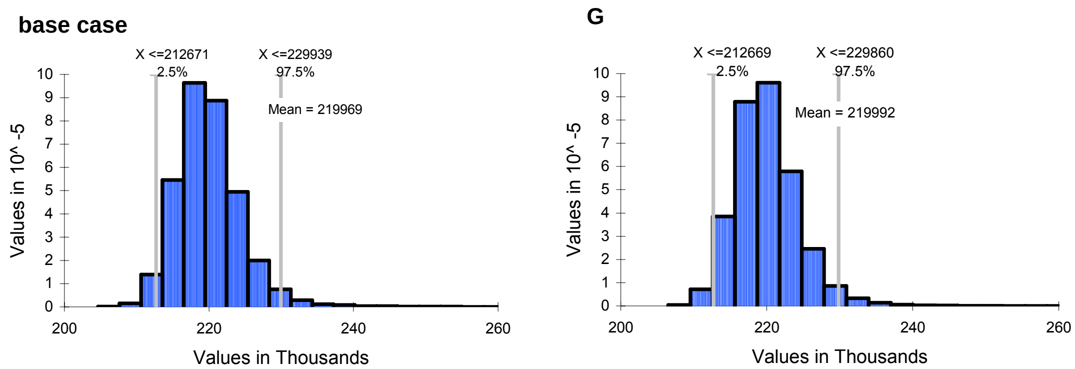
Figure 6.11 Probability density functions of Total CO_2 emissions and Total GHG emissions for the base case and the 'worst case European scenario'

TOTAL CO_2 EMISSIONS - 2004 in Gg CO_2 equivalents



	Minimum	Mean	Maximum	Std Dev	Variance	Skewness	Kurtosis	Mode	2 std.dev.
Base Case	171822	182291	190499	1881	3539118	0,08	3,02	180409	2,06%
Scenario G	174568	182267	190384	1892	3578475	0,09	3,03	181390	2,08%

TOTAL GHG EMISSIONS - 2004 in Gg CO_2 equivalents



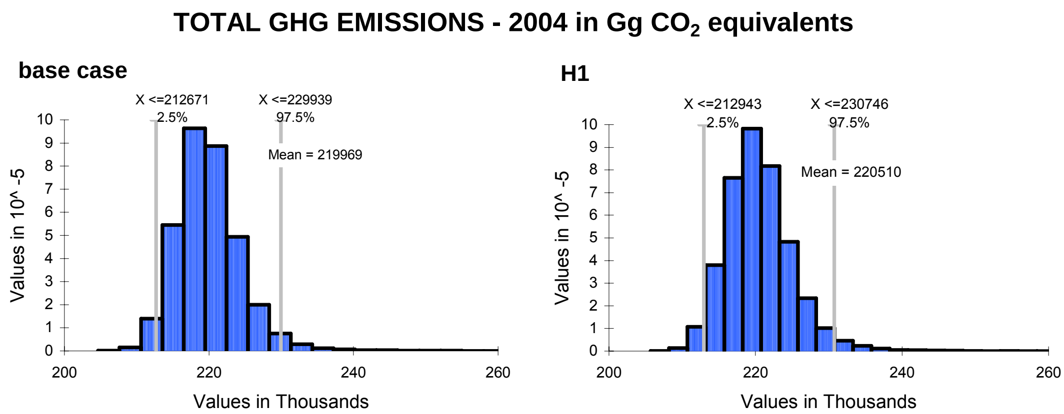
	Minimum	Mean	Maximum	Std Dev	Variance	Skewness	Kurtosis	Mode	2 std.dev.
Base Case	204664	219969	281686	4456	19860110	1,20	8,46	216021	4,05%
Scenario G	206475	219992	328661	4488	20145260	1,55	17,05	220856	4,08%

6.9 Combined scenario (H)

To explore the joint effect on the outcome of the scenarios discussed so far, we constructed a combined scenario in which we include all of the above described changes, excluding the changes in the correlation factors (Scenario F). From scenario A, the triangular scenario is used. The combined scenario was run both with (H1) and without (H2) the sector LUCF. The results for the total emissions with LUCF are shown in Figure 6.12. The probability density functions for the total emissions without LUCF, compared to the base case without LUCF are shown in Figure 6.13.

In the scenario carried out in this section, which includes the sector LUCF, the uncertainty of the total CO_2 emissions increased from 2.06 to 2.34 % for 2004. The uncertainty of the total CH_4 emissions in 2004 increased from 15.08 to 15.18 % and the uncertainty of the total N_2O emissions for the same year increased from 42.03 to 42.44 %. The uncertainty of the total emissions increased slightly from 4.05 to 4.17 %. The trend increased from 1.3 to 1.5 %, while the uncertainty of the trend increased from 4.53 to 4.59 %. The changes are very small.

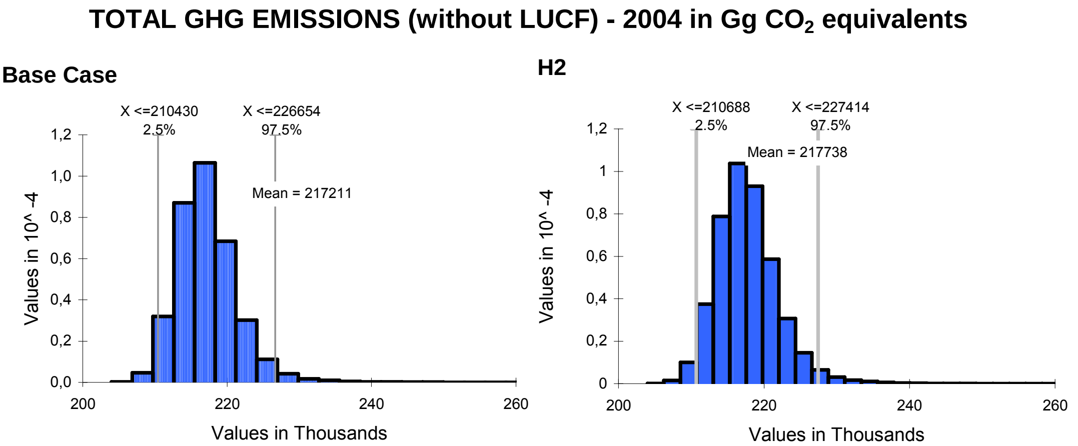
Figure 6.12 ***PDFs for Total GHG emissions with LUCF for base case and the combined scenario H1***



	Minimum	Mean	Maximum	Std Dev	Variance	Skewness	Kurtosis	Mode	2 std.dev.
Base Case	204664	219969	281686	4456	19860110	1,20	8,46	216021	4,05%
Scenario H1	205693	220510	270979	4602	21177180	1,20	8,18	214964	4,17%

In the combined scenario without LUCF, the uncertainty in the total emission changed from 3.90 to 4.00 %. The uncertainty in the total CO_2 emission increased from 1.51 to 1.80 %. The uncertainty increase in the totals of the other gases is similar to the one of the scenario with LUCF.

Figure 6.13 PDF of total emissions without LUCF for the base case and combined scenario H2



	Minimum	Mean	Maximum	Std Dev	Variance	Skewness	Kurtosis	Mode	2 std.dev.
Base Case	203968	217211	278718	4232	17907470	1,42	10,35	216656	3,90%
Scenario H2	203978	217738	294349	4355	18969960	1,32	10,17	215471	4,00%

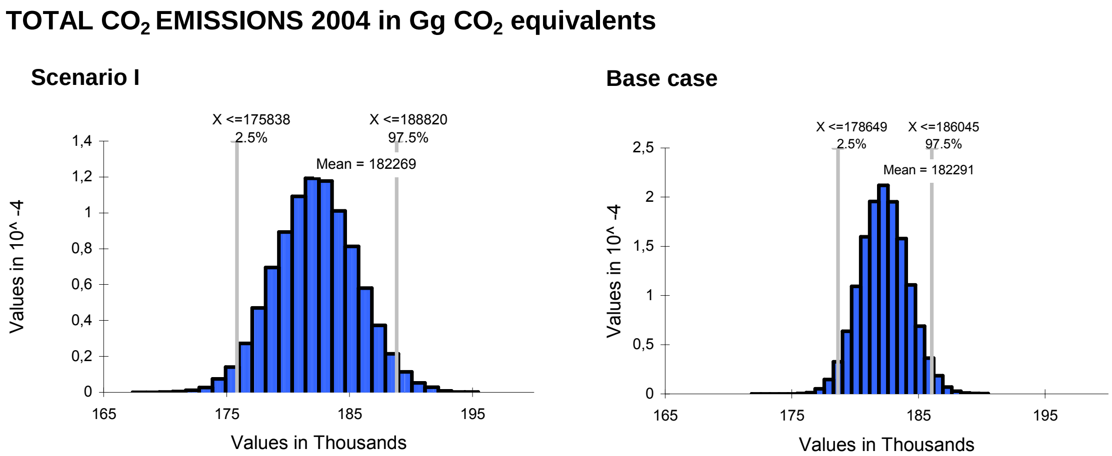
6.10 IPCC default scenario (scenario I)

In this scenario, the IPCC default uncertainty values are used instead of the Dutch specific values. The IPCC values are taken from the 'Pre-publication Draft 2006 IPCC Guidelines for National Greenhouse Gas Inventories'. In the sub sectors where no IPCC default uncertainty values are available, the uncertainty values are not changed. The uncertainty values used are listed in Appendix B. The values that have been changed are indicated in blue. If the IPCC guidelines mention a range of uncertainty values, a medium (average) value was chosen for the uncertainty. If the IPCC guidelines mention uncertainties for TIER 1, TIER 2 or TIER 3[14] analyses, the uncertainty value for the TIER 2 analysis are taken.

[14] A tier represents a level of complexity of the method. Tier 1 is the basic method, Tier 2 is the intermediate method and Tier 3 requires the most data and is the most methodologically the most complex. (IPCC Guidelines, 2006)

Our results show that the uncertainty of the total CO_2 emission for 1990 increased from 2.21 to 3.64 %, while the uncertainty for 2004 increased from 2.06 to 3.64 % (Figure 6.14). The major cause for the change is the increase in the uncertainty of the CO_2 emission factor for some of the major categories of the stationary combustion sector (sector 1A) to 7 % (for gases and solids in the base case the uncertainty in the emission factors were between 1 and 2 %). This holds, for example, for natural gas and solid fuel use for the sub sector *public electricity and heat production*, and natural gas use for *manufacturing industries and construction* and for *residential use*. Together, these categories account for more than half of the total carbon emissions in the Netherlands.

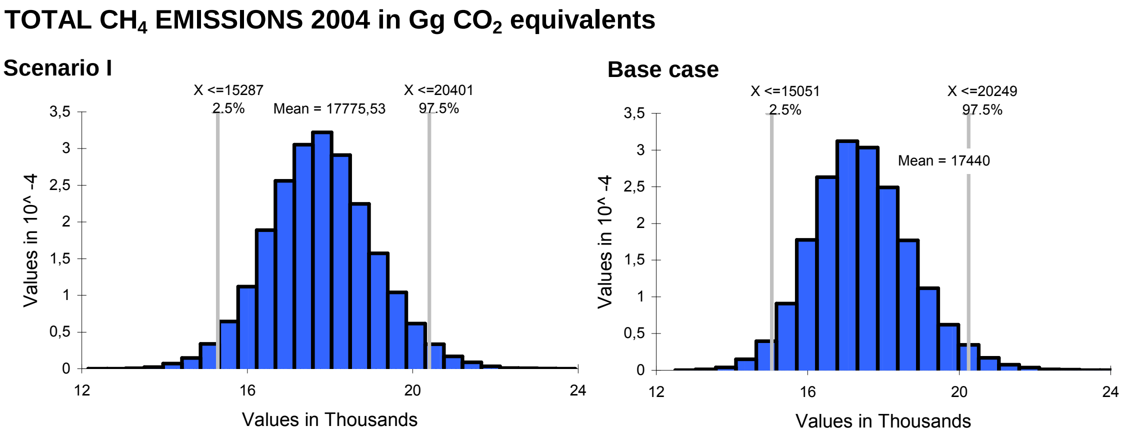
Figure 6.14 PDFs of the Total CO_2 emissions for scenario I and the base case in 2004.



	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
Scenario I	167358	195463	182269	178131	3317	11002940	0,02	2,98
Base case	171822	190499	182291	180409	1881	3539118	0,08	3,02

For 1990, the uncertainty of the total CH_4 emissions increased from 18.6 % for the base case to 19.1 % in this scenario. For 2004, the uncertainty decreased from 15.1 to 14.5 %, as can be seen in Figure 6.15. The decrease in 2004 is mainly caused by the decrease in uncertainty in the CH_4 emissions from enteric fermentation and manure management (sector 4A and 4B respectively). While the IPCC default uncertainty for the activity data for both sectors is slightly higher than the uncertainty in the Dutch Tier 1 analysis, the uncertainty for the emission factor is much lower than the one used in the Dutch NIR. For manure management, the uncertainty used for the emission factor is 100 %, while the IPCC default is 20 % for a Tier 2 analysis.

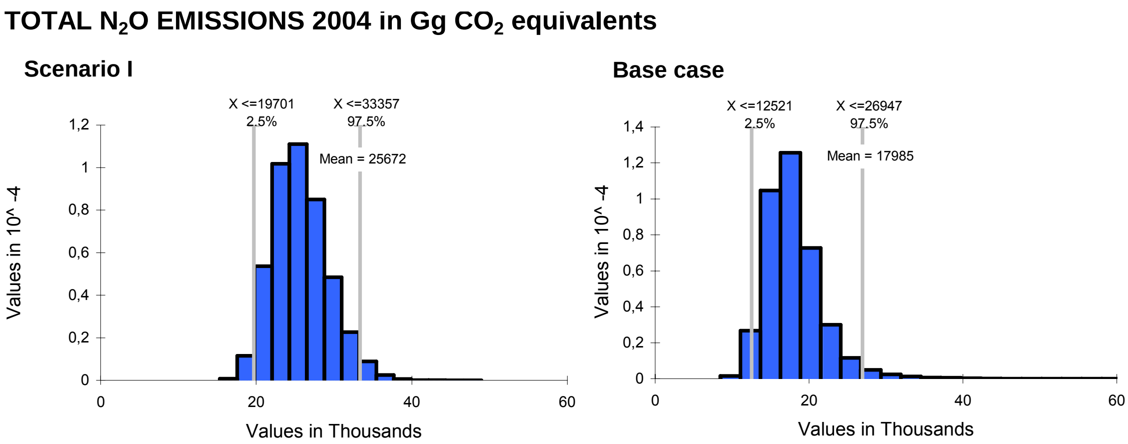
Figure 6.15 PDFs of the Total CH_4 emissions in scenario I and the base case for 2004



	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
Scenario I	12155	23918	17776	16664	1284	1648435	0,13	3,25
Base case	12506	26385	17440	16699	1315	1728997	0,37	3,63

The uncertainty in the total N_2O emissions in 1990 decreased from 47 % in the base case to 27 % in scenario I. The uncertainty in the total N_2O emissions for 2004 decreased from 42 to 25 %. There are three sectors that account for the majority of the N_2O-emissions. These are *Nitric acid production*, *Direct N_2O emissions from agricultural soils* and *Indirect N_2O emissions from nitrogen used in agriculture*. For nitric acid production the uncertainty for activity data decreases from 10 % in the base case to 2 % for this scenario, while the emission factor uncertainty decreases from 50 to 20 %. Therefore the uncertainty in the emission decreases from 51 to 20 %. The uncertainty of the implied emission factors for several categories, within the *Direct N_2O emissions from agricultural soils*, go from 60 % with a normal distribution in the base case to a triangular distribution from -70 to +200 %. The mean increases, because of the asymmetrical distribution and therefore the uncertainty in the emission decreases from 65 to 41 % for 2004. The uncertainty of the emission factor for the indirect N_2O emissions goes from 200 % with a lognormal distribution to a triangular distribution from -90 to +200 %. The uncertainty of the emission for 2004 decreased from 180 to 85 %.

Figure 6.16 Total N_2O emissions for scenario I and the base case

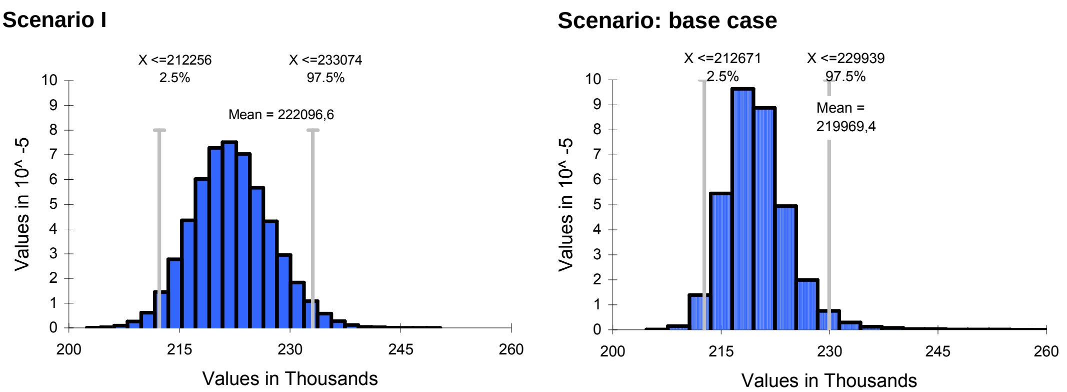


	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
Scenario I	12742	35394	21402	19907	2630	6917428	0,45	3,27
Base case	8460	76267	17985	12875	3779	14284300	1,90	12,93

The uncertainty of the total emission for the Netherlands in 1990 decreased from 5.39 to 4.79 %. The uncertainty in the emission of 2004 decreased from 4.05 to 3.98 %. This means that the uncertainties found in the Dutch Monte Carlo analysis, are similar to the uncertainties based on default IPCC uncertainties for a Tier 2 analysis. The country specific analysis is based on more realistic information than using general IPCC values, which explains the differences found in several sub sections.

Figure 6.17 Total GHG emissions for 2004 for scenario I and the base case

TOTAL GHG EMISSIONS 2004 in Gg CO_2 equivalents



	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
Scenario I	206141	244629	223699	219132	4447	19772200	0,10	3,02
Base case	204664	281686	219969	216021	4456	19860110	1,20	8,46

6.11 Conclusion

In this chapter several scenarios have been discussed. Some of the scenarios resulted in significant changes in the uncertainty of individual sectors, but none of the scenarios resulted in a major increase of the uncertainty in the total Dutch greenhouse gas emissions for the year 2004. The uncertainty in the total emission is quite insensitive to the changes made in the scenarios.

7 Conclusions and Recommendations

1. Results Monte Carlo analysis are in the same order of magnitude as the Tier 1 outcomes

The resulting uncertainties of the Monte Carlo analysis in the total Netherlands CO_2 equivalent emissions and of the total emissions of the different types of gases are in the same order of magnitude as the calculated Tier 1 uncertainties, although a somewhat higher trend uncertainty was found. The present Monte Carlo analysis used the same uncertainty assumptions and level of aggregation as the Tier 1 study, but accounted for correlations and non-Gaussian distributions. Only for the sub sector *CH_4 emissions from solid waste disposal sites* a detailed Tier 2 model has been used, that has not been used for the Tier 1 analyses. This results in a difference of uncertainties, which are discussed below.

Table 7.1 Results of Monte Carlo analysis versus Tier 1 calculated uncertainty values, figures in brackets for Tier 1 represent the reported value used in NIR, this number is higher because of lack of correlations and gaps of knowledge (see Chapter 3)

	Monte Carlo analysis Uncertainty 2σ (%)	Tier 1 analysis Uncertainty 2σ (%)
Total GHG emissions without LUCF	3.9	4.4 (6)
Total GHG emissions with LUCF	4.1	4.5 (6)
Total CO_2 without LUCF	1.5	1.9 (5)
Total CO_2 with LUCF	2.1	2.5 (5)
Total CH_4	15	18 (25)
Total N_2O	42	45 (50)
Total F-gases	28	28 (50)

The calculated Tier 1 uncertainty of the total greenhouse gas emissions in 2004 is slightly higher (0.5 % point without LUCF, 0.4 % point with LUCF), than the uncertainty resulting of the Monte Carlo analysis. This is reflected in the uncertainty of the total emissions for the individual gases, except for F-gases. For F-gases a Tier 1 analysis is used in the Monte Carlo analysis for most sub sectors; the resulting uncertainties of the total F emissions are the same.

The uncertainty in the total CO_2 emissions, which account for about 83 % of total greenhouse gas emissions, in the Monte Carlo analysis is 0.4 % point lower than in the calculated value of the Tier 1 analysis in 2004. This is mainly caused by a lower uncertainty in the sub sector *Commercial and Institutional gas use* (1A4a), for which the activity data is calculated as a difference in the Monte Carlo analysis (§2.4.1) resulting in an uncertainty in the emission of 6 % instead of Tier 1 input 20 %. The uncertainty in the total CH_4 emissions is 3 % point lower in the Monte Carlo analysis (15 %) than in the Tier 1 analysis (18 %). This is mainly caused by the use of the Tier 2 model for the emissions of solid waste disposal, which results in a much smaller uncertainty in the emission (20 %) of 2004 than in the Tier 1 analysis (34 %). Also the uncertainty in the total N_2O emissions is lower in the Monte Carlo analysis (42 %) than in the Tier 1 analysis (45 %). The main reason is the lower uncertainty in the emission of indirect N_2O emissions from nitrogen used in agriculture in the Monte Carlo analysis, since this sub sector is further divided in two separate categories.

Furthermore, we found that the uncertainty for 1990 emissions was slightly higher (about 1.5 percent point) than the uncertainty for 2004 emissions. The difference between 1990 and 2004 can mainly be understood from emission reductions of N_2O and CH_4 that have led to a smaller share of N_2O and CH_4 (with typically high uncertainties in emission factors) in 2004 compared to 1990. The change over time in monitoring uncertainty is a relevant finding also because it invalidates an assumption made in the Environmental Balance 2005, where in the presentation of uncertainty only the projection uncertainty was considered relevant, because it was assumed that the monitoring uncertainty would be equal in the target year (2010) and the reference year (1990). This assumption is not tenable, so we recommend to report both the monitoring uncertainty and the projection uncertainty in future versions of the Environmental Balance.

The resulting distribution for the total Netherlands CO_2 equivalent emissions is positively skewed, which means that there is a small probability that the emission is substantially higher than the reported mean value. In 1990 the 95 % confidence interval ranges for the base case without LUCF from -4.2 % to +6 % (roughly -9 to +13 Mton), for 2004 the 95 % confidence interval ranges from -3.1 % of the mean to +4.3 % (roughly -7 to +9.5 Mton).

2. For the Netherlands inventory, accounting for correlations is more relevant for the uncertainty in the trend than for the uncertainty in the total greenhouse gas emission.

In the Tier 1 analysis as presented in the NIR, the calculated uncertainties for the total emissions of the different greenhouse gases are increased with a correction factor to account for uncertainties not captured in the Tier 1. The argumentation for this correction factor has been that Tier 1 does not account for correlations and asymmetrical distributions and that there are gaps in knowledge which increase the uncertainty in the calculated emission figures. The present Monte Carlo analysis has shown that accounting for correlations and asymmetrical distribution functions does not necessarily lead to a significant increase in uncertainty in total greenhouse gas emissions. Further, we found that accounting for correlations has a stronger influence on the trend uncertainty than on the uncertainty in total greenhouse gas emission. This is caused by correlations between years.

3. Uncertainty assumptions in the Netherlands are well in the range of European studies

The expert judgments and assumptions made for uncertainty ranges in emission factors and activity data for the Netherlands (focusing on the key sources) have been compared to the uncertainty assumptions (and their underpinnings) used in Tier 2 studies by other European countries, in particular: Finland, the United Kingdom, Norway, Austria and Flanders (Belgium). Also the correlations that have been assumed in the various European Tier 2 studies have been mapped and compared. The comparisons of assumed uncertainty ranges lead to some improvements in, (and increased underpinning of) the Netherlands assumptions for the Tier 1, which were also used in the present Monte Carlo study. Although straightforward comparison between European Tier 2 studies is somewhat blurred due to differences in aggregation level at which the assumptions have been made, results show that for CO_2 emissions the Netherlands uncertainty estimates are well in the range of European studies. Another finding is that correlations (covariance and dependencies in the emission calculations) seem somewhat under-addressed in most present day European Tier 2 studies and may require more systematic attention in future Tier 2 studies.

4. Resulting Netherlands uncertainty in total greenhouse gas emissions is in the lower range compared to other European countries

In comparison to other European countries, the overall uncertainty in the Netherlands greenhouse gas emission seems relatively low. This can be explained by the fact that the Netherlands has a higher share of CO_2 emissions compared to most other countries. Since CO_2 emissions factors are relatively well understood and monitored, their uncertainty is quite low and hence the significance of emissions with larger uncertainties (e.g. CH_4 and N_2O) is in the Netherlands smaller than in other countries. Furthermore, some countries (e.g. Norway and the United Kingdom) report very large uncertainty in the total N_2O emissions (respectively 170 and 226 %). These high values influence significantly their uncertainty in the total greenhouse gas emissions.

5. Main contributors to the uncertainties (for the emissions and the trend) are related to N_2O for agriculture (mainly soils)

On the basis of variance decomposition we ranked uncertain inputs of the emission model according to their contribution to variance in the total greenhouse gas emission and in the trend. This reveals that the main contributors to overall uncertainty are related to N_2O emissions from agricultural soils (especially indirect N_2O emissions), the N_2O implied emission factor of Nitric Acid Production, CH_4 from managed solid waste disposal on land, and the implied emission factor of CH_4 from manure management from cattle. These results are well in agreement with the top sources contributing most to total annual uncertainty reported in the NIR 2006. The added value of the Monte Carlo analysis is that while the NIR can only rank the contributing sources in terms of the combined uncertainty, by performing a Monte Carlo analysis it is possible to distinguish whether the most important contributing sources to total uncertainty are found in the activity data or the emission factor of the different sectors. Monte Carlo, hence, provides a more detailed picture that can be used in a later stage to define specific areas where further research can help to decrease uncertainties in the total emissions.

A first screening on the basis of a "back of the envelope" pedigree analysis indicates that for the uncertainty in total GHG emission improvements in our knowledge of emission factors for the categories 4D3 (indirect N_2O emissions from agricultural soils), 4D1 (direct N_2O emissions from agricultural soils), 2G (indirect N_2O from NO_2 from combustion and industrial processes) and 4B1 (Emissions from manure management: cattle) might be given the highest priority. However one also has to consider to what extend improvement of the data quality is easily technically feasible or not. For instance, for the emission factors for indirect N_2O this feasibility is very limited in view of the various efforts already undertaken.

6. A note on methodological uncertainty due to continuous improvement of emission model

The present Monte Carlo study was conducted in parallel with the Tier 1 study at the MNP. As a consequence, while conducting this study we had to cope with continuing changes over time in the emission model (including emission factor values) used by the Emission Registration (ER) at MNP and in the assumptions used for the Tier 1. To keep the research manageable we had to "freeze" the emission model and assumptions at some time, for which we chose the "version 8" (January 2006) of MNP's Tier 1 uncertainty assessment spreadsheet. Since then, some further minor changes have taken place in the Tier 1 emission model and uncertainty assumptions that were not accounted for in the base case for the present Monte Carlo study. We did, however, take the most relevant changes into account in the scenario analysis (mainly the assumed higher uncertainty in the emission factor of natural gas).

The changes in emission figures associated with improvements in the emission model can be seen as an indirect indicator for systematic error in the monitoring scheme. This systematic error stemming from methodological uncertainty can sometimes be significant and can be in the same order of magnitude or greater than the random error stemming from inexactness in the input data of the emission model. We should be aware that Tier 1 and Tier 2 uncertainty assessments only capture the latter, and thus provide an incomplete picture of the uncertainty. Other approaches to QA/QC remain necessary to address uncertainties not captured in a Tier 2 analysis. This point provides an additional argument for the approach taken in the Netherlands Tier 1 practice, where the calculated Tier 1 uncertainty is "manually" increased to account for correlations, non-normal distributions and uncertainty associated with methodological constraints. Although the former argument of correlations for this adjustment was not confirmed by this study, the substantial positive skewness in the results puts extra emphasis on the non-normal distributions argument. We therefore recommend maintaining this practice of "manual" increase of Tier 1 calculation results to account for the various sources and types of uncertainty not captured by Tier 1.

7. Requirements for conducting a full-blown Tier 2 study

In this report we have performed a Monte Carlo analysis of the uncertainties at the same level of aggregation as the Tier 1 and using the same assumptions where possible. Performing a full-blown Tier 2 requires having access to the raw data from which each calculation was made (e.g. by fuel type at the most disaggregate level) and their corresponding uncertainties. This kind of information was not available when carrying out the present research. Activity data and emission factors were calculated by different institutions and only final or intermediate results were sent to ER/MNP (and hence available to us). Also, some of the activity data is considered confidential and to obtain access to it would require signing confidentiality agreements which can constitute a time consuming process, especially if permission of the individual companies is required. Furthermore, not all uncertainties (at a disaggregate level) are reported or known, which would imply that additional workshops with experts in the field are necessary to elicit uncertainty ranges. A full-blown Tier 2 is therefore a time and resource intensive task. Given limitations in time and budget, we recommend continuing to improve uncertainty estimates for each subsector which has a major contribution to the uncertainty of the total GHG emissions, possibly by involving international experts. A next step could be to revising each subsector which has a major contribution to the uncertainty of the total GHG emissions (or by emission type) and perform for those sectors a full-blown Tier 2 analysis.

8. Other recommendations

The Tier 1 assessment could be improved to emulate the Tier 2 results by:

- adjusting the Tier 1 uncertainty inputs for 6A landfills;

- adjusting the Tier 1 uncertainty of activity data for 1A4a commercials;
- reconsidering the Tier 1 uncertainty inputs for 4D indirect N_2O emissions from agricultural sources and discuss with other European countries the reasons for the differences in uncertainty assumptions across countries for this category;

9. Annual Tier 2 analysis not justified, once in four years seems reasonable

Although the present Monte Carlo analysis is not a full-blown Tier 2 (see point 7), the results confirm that for the 2004 inventory, Tier 1 provides a reasonable approximation of the Tier 2 uncertainty in overall greenhouse gas emission and a slight (but not dramatic) underestimation of the trend uncertainty. For future years, as long as the emission model does not change substantially (e.g. emission factors, level of aggregation, methodologies used, and the uncertainty estimates for key parameters) and the share of CO_2 and non-CO_2 gases in future years is not substantially different from 2004, it seems justified to use Tier 1 as main method for uncertainty analysis in the NIR. Because of ongoing emission reduction efforts and changes over time in the fuel mix as well as in the shares of non-CO_2 greenhouse gases, we recommend to repeat a Monte Carlo analysis regularly as part of the QA/QC procedures. Although this remains a somewhat arbitrary choice, a reasonable frequency that balances between the costs and the importance for QA/QC could be once in four years.

8 Acknowledgements

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10 Appendices

INDEX APPENDICES

Reading guide to appendices
In appendix A the results of the Tier 2 simulation of the sub sector landfills (6A) are presented. In appendix B the results of the base case scenario without LUCF (B1) and with LUCF (B2) are listed in the Tier Uncertainty Reporting format of the IPCC Good Practice Guidance.

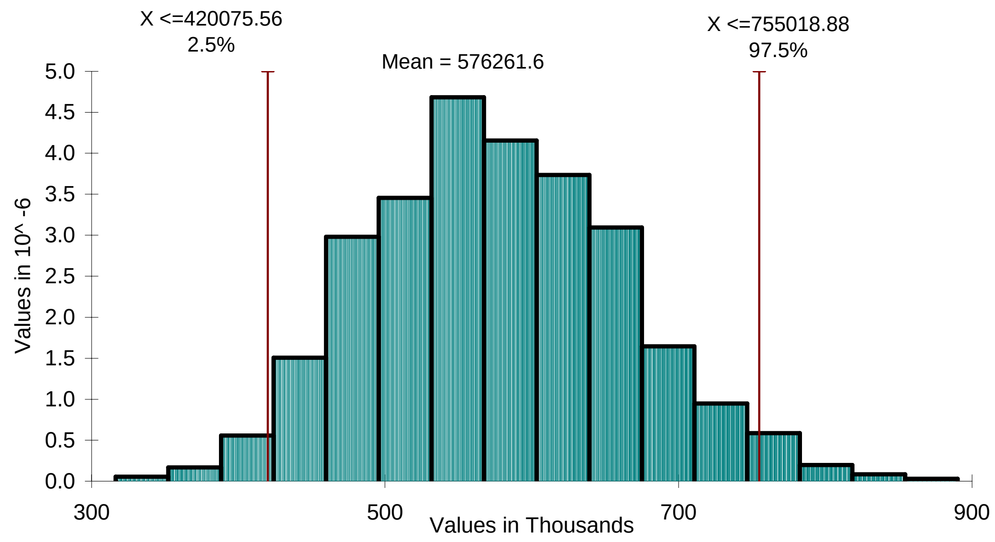
In Appendix C to E the results of the base case with (C) and without LUCF (D) and the results of the scenarios (E) are presented in a format, which is explained in the legend on page 13.

In Appendix F the IPCC default uncertainty values that were used in scenario I are presented. Changed uncertainties are written in blue.

APPENDIX A

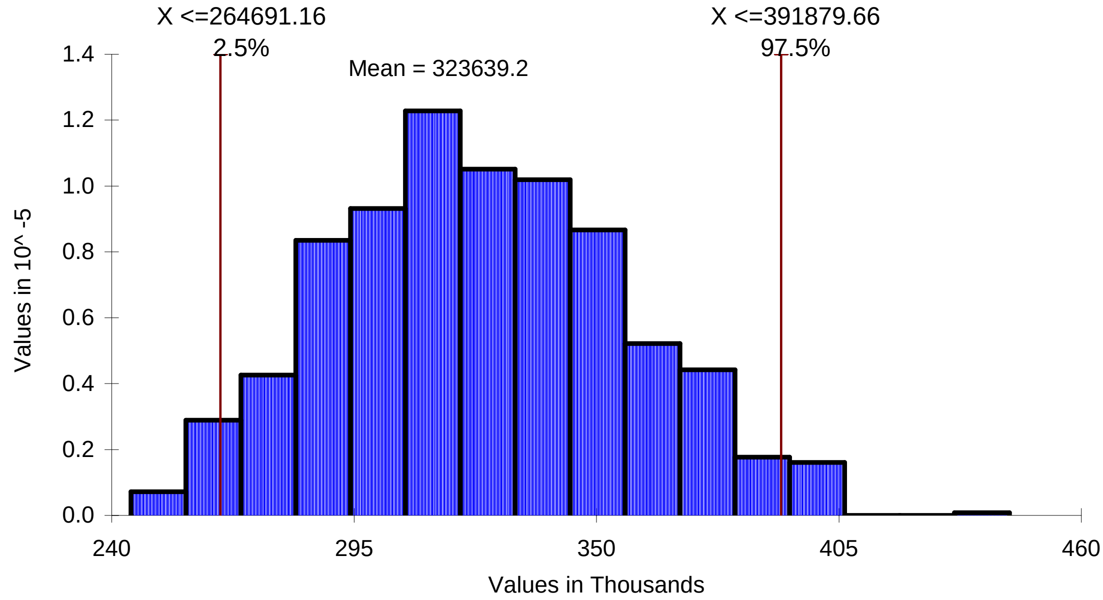
METHANE EMISSIONS FROM LANDFILLS (SECTOR 6A)

CH4 emissions in 1990 (Mg)



	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
PDF	316352.7	890272.6	576261.6	533231.9	86422.73	7468889000	0.2250518	2.910378

CH_4 emissions in 2004 (Mg)



	Minimum	Maximum	Mean	Mode	Std Deviation	Variance	Skewness	Kurtosis
PDF	244371.8	443684	323639.2	352586.8	32855.59	1079490000	0.2150417	2.653155

Appendix B

B1- RESULTS BASE CASE WITHOUT LUCF

IPCC Source category	Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
		(Gg CO2 equivalent)	(Gg CO2 equivalent)	% below (2.5 percentile)	% above (97.5 percentile)	(%)	(%)	Lower % (2.5 percentile)	Upper % (97.5 percentile)
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	206,4	2230,5	-9,8%	9,7%	10,0%	0,9%	0,8%	1,1%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	25775,3	27007,0	-3,5%	3,5%	3,5%	0,6%	0,2%	1,0%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	13183,6	396,9	-36,9%	39,7%	39,2%	5,6%	5,3%	5,8%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	592,6	1749,1	-10,9%	11,1%	11,2%	0,5%	0,4%	0,6%
Stationary combustion : Petroleum Refining: liquids	CO2	9998,5	9552,3	-13,5%	14,4%	14,2%	-0,2%	-1,0%	0,6%
Stationary combustion : Petroleum Refining: gases	CO2	1029,4	2239,1	-1,1%	1,1%	1,1%	0,6%	0,5%	0,6%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0,0	0,7	-19,7%	20,0%	20,1%	0,0%	0,0%	0,0%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	1400,5	1952,9	-20,1%	20,2%	20,6%	0,3%	0,0%	0,5%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	8788,1	7502,2	-5,0%	5,0%	5,1%	-0,6%	-0,8%	-0,4%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	5031,0	4325,0	-13,8%	13,9%	14,2%	-0,3%	-0,6%	-0,1%

IPCC Source category	**Gas**	**Base year emissions**	**Year t emissions**	**Uncertainty in year t emissions as % of emissions in the category**		**Uncertainty introduced on national total in year t**	**% change in emissions between year t and base year**	**Range of likely % change between year t and base year**	
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	18785,3	15212,2	-2,2%	2,2%	2,2%	-1,7%	-1,9%	-1,4%
Stationary combustion : Other Sectors, solids	CO2	189,0	134,1	-48,8%	49,1%	50,0%	0,0%	-0,1%	0,0%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	6573,6	10924,6	-5,8%	5,9%	6,0%	2,0%	1,7%	2,4%
Stationary combustion : Other Sectors, Residential, gases	CO2	18465,8	18553,8	-5,0%	5,0%	5,1%	0,0%	-0,6%	0,6%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	8224,5	6952,8	-9,8%	9,8%	10,1%	-0,6%	-1,1%	-0,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	2520,4	2656,0	-19,5%	19,6%	19,9%	0,1%	-0,3%	0,4%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	1483,2	452,0	-14,9%	15,4%	15,5%	-0,5%	-0,6%	-0,4%
Military use of fuels (1A5 Other)	CO2	566,5	436,9	-19,8%	19,8%	20,1%	-0,1%	-0,1%	0,0%
Mobile combustion: road vehicles: gasoline	CO2	10902,6	13168,0	-2,0%	2,0%	2,0%	1,1%	0,9%	1,2%
Mobile combustion: road vehicles: diesel oil	CO2	11831,7	19541,0	-4,8%	4,9%	5,0%	3,6%	3,0%	4,2%
Mobile combustion: road vehicles: LPG	CO2	2736,8	1130,8	-9,8%	9,9%	10,0%	-0,7%	-0,9%	-0,6%
Mobile combustion: water-borne navigation	CO2	403,0	579,5	-19,6%	19,7%	20,0%	0,1%	0,0%	0,1%
Mobile combustion: aircraft	CO2	41,0	41,0	-35,1%	35,1%	36,0%			
Mobile combustion: other	CO2	90,7	109,2	-4,9%	4,9%	5,0%	0,0%	0,0%	0,0%
CO2 from coke production	CO2	402,5	509,4	-49,1%	48,7%	49,9%	0,0%	-0,1%	0,2%
Fugitive emissions venting/flaring: CO2	CO2	769,2	110,4	-9,2%	9,2%	9,4%	-0,3%	-0,4%	-0,2%
Cement production	CO2	507,1	434,0	-10,8%	11,1%	11,2%	0,0%	-0,1%	0,0%
Limestone and dolomite use	CO2	579,1	747,4	-34,9%	49,6%	44,3%	0,1%	-0,1%	0,2%

IPCC Source category	**Gas**	**Base year emissions**	**Year t emissions**	**Uncertainty in year t emissions as % of emissions in the category**		**Uncertainty introduced on national total in year t**	**% change in emissions between year t and base year**	**Range of likely % change between year t and base year**	
Other minerals	CO2	269,8	358,0	-24,8%	25,2%	25,6%	0,0%	0,0%	0,1%
Ammonia production	CO2	3057,7	3047,5	-2,2%	2,2%	2,2%	0,0%	0,0%	0,0%
Iron and steel production (carbon inputs)	CO2	2513,5	1104,8	-5,7%	5,8%	5,9%	-0,7%	-0,7%	-0,6%
CO2 from aluminium production	CO2	394,5	478,8	-5,3%	5,3%	5,4%	0,0%	0,0%	0,0%
Total CO2		**158974,5**	**179516,0**	**-1,4%**	**1,4%**	1,5%	9,6%	8,0%	11,1%
Emissions from stationary combustion: non-CO2	CH4	517,4	556,3	-31,1%	31,5%	31,9%	0,0%	-0,1%	0,1%
Mobile combustion: other	CH4	0,7	1,1	-58,5%	113,3%	89,9%	0,0%	0,0%	0,0%
Mobile combustion: road vehicles	CH4	157,0	66,8	-48,4%	82,2%	67,1%	0,0%	-0,1%	0,0%
Fugitive emissions venting/flaring	CH4	1252,7	299,2	-23,1%	23,3%	23,6%	-0,4%	-0,6%	-0,3%
Fugitive emissions from oil and gas operations: gas distribution	CH4	255,0	268,9	-39,6%	39,2%	40,1%	0,0%	0,0%	0,0%
Fugitive emissions from oil and gas operations: other	CH4	161,8	149,0	-42,2%	46,0%	44,9%	0,0%	0,0%	0,0%
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	6765,1	5693,0	-20,2%	20,3%	20,6%	-0,5%	-1,1%	0,1%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	439,2	350,3	-49,3%	49,6%	50,4%	0,0%	-0,1%	0,0%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	319,1	285,7	-22,3%	22,5%	22,9%	0,0%	0,0%	0,0%
Emissions from manure management : cattle	CH4	1573,6	1424,1	-64,1%	126,8%	100,1%	-0,1%	-0,8%	0,6%
Emissions from manure management : swine	CH4	1139,3	917,4	-64,3%	126,8%	100,1%	-0,1%	-0,5%	0,2%

IPCC Source category	**Gas**	**Base year emissions**	**Year t emissions**	**Uncertainty in year t emissions as % of emissions in the category**		**Uncertainty introduced on national total in year t**	**% change in emissions between year t and base year**	**Range of likely % change between year t and base year**	
Emissions from manure management : poultry	CH4	242,3	68,6	-65,2%	127,7%	101,2%	-0,1%	-0,2%	0,0%
Emissions from manure management : other	CH4	11,5	16,2	-48,1%	81,2%	66,6%	0,0%	0,0%	0,0%
CH4 emissions from solid waste disposal sites	CH4	12011,8	6759,2	-16,0%	17,1%	20,2%	-2,4%	-3,7%	-1,3%
Emissions from wastewater handling	CH4	289,1	206,2	-156,0%	174,0%	167,4%	0,0%	-0,2%	0,1%
OTHER CH4	CH4	1,2	72,9	-29,4%	33,0%	32,0%	0,0%	0,0%	0,0%
Total CH4		**25468,2**	**17440,2**	**15050,8**	**20249,2**	15,1%	-3,7%	-6,1%	-1,6%

IPCC Source category	**Gas**	**Base year emissions**	**Year t emissions**	**Uncertainty in year t emissions as % of emissions in the category**		**Uncertainty introduced on national total in year t**	**% change in emissions between year t and base year**	**Range of likely % change between year t and base year**	
Emissions from stationary combustion: non-CO2	N2O	214,4	238,7	-45,4%	108,2%	84,8%	0,0%	-0,1%	0,1%
Mobile combustion: other	N2O	1,0	1,9	-59,2%	114,5%	91,1%	0,0%	0,0%	0,0%
Mobile combustion: road vehicles	N2O	270,7	483,9	-39,0%	55,8%	48,7%	0,1%	0,0%	0,2%
Nitric acid production	N2O	6344,9	5627,4	-49,2%	50,4%	50,9%	-0,3%	-0,8%	0,0%
Caprolactam production	N2O	1242,6	760,0	-60,9%	78,5%	71,8%	-0,2%	-0,6%	0,1%
Indirect N2O from non-agricultural sources	N2O	52,1	56,2	-88,0%	276,5%	212,8%	0,0%	0,0%	0,0%
Indirect N2O from NO2 from combustion and industrial processes	N2O	887,0	639,5	-86,4%	263,2%	201,5%	-0,1%	-0,4%	0,0%
Emissions from manure management	N2O	696,7	710,9	-56,1%	103,0%	83,5%	0,0%	-0,4%	0,4%
Direct N2O emissions from agricultural soils	N2O	4600,2	4945,8	-46,9%	79,8%	65,5%	0,2%	-1,2%	1,8%

IPCC Source category	Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Indirect N2O emissions from nitrogen used in agriculture	N2O	4876,8	3295,1	-81,0%	234,1%	180,8%	-0,7%	-4,3%	1,6%
Animal production on agricultural soils	N2O	1308,5	702,9	-64,7%	126,6%	100,6%	-0,3%	-0,8%	0,0%
Emissions from wastewater handling	N2O	513,2	396,9	-36,9%	39,7%	39,2%	-0,1%	-0,2%	0,0%
OTHER N2O	N2O	250,3	133,6	-27,8%	28,4%	28,7%	-0,1%	-0,1%	0,0%
Total N2O		**21261,6**	**17999,0**	**-30,4%**	**49,0%**	42,0%	-1,5%	-5,3%	1,5%

IPCC Source category	Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
PFC from aluminium production	PFC	1900,9	105,6	-16,7%	16,8%	17,1%	-0,8%	-1,0%	-0,7%
HFC-23 emissions from HCFC-22 manufacture	HFC	6243,7	365,6	-17,8%	19,9%	20,0%	-2,7%	-3,6%	-2,0%
Total F-gases		**8734,5**	**2251,6**	**-27,6%**	**27,4%**	28,1%	-3,0%	-3,9%	-2,2%
Total Netherlands (CO2-eq.)		**214434,4**	**217211,1**	**-3,1%**	**4,3%**	**3,9%**	**1,3%**	**-3,4%**	**5,5%**

B2-RESULTS BASE CASE WITH LUCF

IPCC Source category	**Gas**	**Base year emissions**	**Year t emissions**	**Uncertainty in year t emissions as % of emissions in the category**		**Uncertainty introduced on national total in year t**	**% change in emissions between year t and base year (relative to 1990 emission)**	**Range of likely % change between year t and base year**	
		(Gg CO2 equivalent)	(Gg CO2 equivalent)	% below (2.5 percentile)	% above (97.5 percentile)	(%)	(%)	Lower % (2.5 percentile)	Upper % (97.5 percentile)
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	206,4	2230,1	-9,9%	9,9%	10,1%	0,9%	0,8%	1,0%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	25778,1	27006,5	-3,4%	3,5%	3,5%	0,6%	0,2%	1,0%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	13184,1	25174,4	-1,1%	1,1%	1,1%	5,5%	5,2%	5,8%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	592,5	1749,8	-10,8%	11,0%	11,1%	0,5%	0,4%	0,6%
Stationary combustion : Petroleum Refining: liquids	CO2	10001,8	9556,4	-13,6%	14,2%	14,2%	-0,2%	-1,0%	0,6%
Stationary combustion : Petroleum Refining: gases	CO2	1029,5	2239,2	-1,1%	1,1%	1,1%	0,6%	0,5%	0,6%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0,0	0,7	-19,6%	19,6%	20,1%	0,0%	0,0%	0,0%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	1401,3	1951,5	-19,9%	20,2%	20,6%	0,3%	0,0%	0,5%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	8787,0	7503,2	-5,0%	5,0%	5,1%	-0,6%	-0,8%	-0,4%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	5035,0	4325,2	-13,9%	14,1%	14,3%	-0,3%	-0,6%	-0,1%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	18785,6	15212,2	-2,2%	2,2%	2,2%	-1,6%	-1,9%	-1,4%
Stationary combustion : Other Sectors, solids	CO2	188,8	134,3	-49,4%	49,3%	50,3%	0,0%	-0,1%	0,0%

IPCC Source category	Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	6572,9	10924,6	-5,9%	5,9%	6,0%	2,0%	1,6%	2,4%
Stationary combustion : Other Sectors, Residential, gases	CO2	18469,8	18556,2	-5,0%	5,0%	5,1%	0,0%	-0,6%	0,6%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	8226,2	6955,6	-9,9%	9,9%	10,1%	-0,6%	-1,1%	-0,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	2522,0	2654,1	-19,8%	19,7%	20,2%	0,1%	-0,3%	0,4%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	1482,5	452,0	-14,9%	15,4%	15,5%	-0,5%	-0,6%	-0,4%
Military use of fuels (1A5 Other)	CO2	566,4	436,5	-19,8%	19,9%	20,2%	-0,1%	-0,1%	0,0%
Mobile combustion: road vehicles: gasoline	CO2	10902,2	13169,0	-2,0%	2,0%	2,0%	1,0%	0,9%	1,2%
Mobile combustion: road vehicles: diesel oil	CO2	11832,8	19539,8	-4,9%	4,9%	5,0%	3,5%	3,0%	4,1%
Mobile combustion: road vehicles: LPG	CO2	2738,3	1131,2	-9,7%	9,8%	10,0%	-0,7%	-0,9%	-0,6%
Mobile combustion: water-borne navigation	CO2	403,0	579,9	-19,6%	19,6%	20,0%	0,1%	0,0%	0,1%
Mobile combustion: aircraft	CO2	41,1	41,1	-35,3%	35,4%	36,2%			
Mobile combustion: other	CO2	90,7	109,2	-4,9%	4,9%	5,0%	0,0%	0,0%	0,0%
CO2 from coke production	CO2	402,5	509,7	-49,1%	48,8%	49,9%	0,0%	-0,1%	0,2%
Fugitive emissions venting/flaring: CO2	CO2	769,1	110,4	-9,1%	9,3%	9,4%	-0,3%	-0,4%	-0,2%
Cement production	CO2	507,0	433,9	-10,8%	11,0%	11,2%	0,0%	0,0%	0,0%
Limestone and dolomite use	CO2	578,5	747,9	-34,8%	49,7%	44,3%	0,1%	-0,1%	0,2%
Other minerals	CO2	269,9	357,8	-24,7%	25,1%	25,5%	0,0%	0,0%	0,1%
Ammonia production	CO2	3058,0	3047,9	-2,2%	2,2%	2,2%	0,0%	0,0%	0,0%

IPCC Source category	Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Iron and steel production (carbon inputs)	CO2	2514,5	1104,5	-5,6%	5,7%	5,8%	-0,6%	-0,7%	-0,6%
CO2 from aluminium production	CO2	394,5	478,7	-5,3%	5,3%	5,4%	0,0%	0,0%	0,0%
5A1. Forest Land remaining Forest Land	CO2	-2505,6	-2287,0	43,4%	-37,9%	41,7%	0,1%	-0,4%	0,6%
5A2. Land converted to Forest Land	CO2	-89,1	-341,9	56,8%	-49,6%	54,1%	-0,1%	-0,2%	0,0%
5B2. Land converted to Cropland	CO2	-35,2	-35,2	58,2%	-51,4%	56,0%			
5C1. Grassland remaining Grassland	CO2	4245,0	4249,2	-51,2%	58,4%	56,1%			
5C2. Land converted to Grassland	CO2	536,3	536,3	-101,4%	109,1%	107,2%			
5E2. Land converted to Settlements	CO2	-151,9	-151,9	58,5%	-51,4%	56,2%			
5F2. Land converted to Other Land	CO2	710,5	710,5	-51,1%	58,8%	56,3%			
5G. Other (liming of soils)	CO2	183,1	86,4	-24,6%	24,7%	25,2%	0,0%	-0,1%	0,0%
Total CO2		**161891,6**	**182290,8**	**-2,0%**	**2,1%**	2,1%	9,4%	7,8%	11,0%
Emissions from stationary combustion: non-CO2	CH4	517,2	557,2	-30,7%	31,6%	31,8%	0,0%	-0,1%	0,1%
Mobile combustion: other	CH4	1,0	1,1	-58,6%	111,9%	89,5%	0,0%	0,0%	0,0%
Mobile combustion: road vehicles	CH4	156,7	66,7	-48,4%	80,4%	66,6%	0,0%	-0,1%	0,0%
Fugitive emissions venting/flaring	CH4	1252,7	299,3	-23,1%	23,4%	23,6%	-0,4%	-0,6%	-0,3%
Fugitive emissions from oil and gas operations: gas distribution	CH4	254,7	268,7	-39,0%	39,3%	39,9%	0,0%	0,0%	0,0%
Fugitive emissions from oil and gas operations: other	CH4	162,2	149,2	-41,9%	45,8%	44,7%	0,0%	0,0%	0,0%
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	6768,1	5685,5	-19,9%	20,5%	20,6%	-0,5%	-1,1%	0,1%

IPCC Source category	Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	439,1	350,0	-49,3%	49,2%	50,3%	0,0%	-0,1%	0,0%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	318,7	285,5	-22,3%	22,4%	23,0%	0,0%	0,0%	0,0%
Emissions from manure management : cattle	CH4	1576,0	1420,2	-64,8%	125,9%	100,5%	-0,1%	-0,8%	0,6%
Emissions from manure management : swine	CH4	1138,7	918,0	-64,8%	123,4%	98,8%	-0,1%	-0,5%	0,2%
Emissions from manure management : poultry	CH4	242,4	68,8	-64,8%	127,5%	101,5%	-0,1%	-0,2%	0,0%
Emissions from manure management : other	CH4	11,5	16,1	-47,8%	80,2%	66,5%	0,0%	0,0%	0,0%
CH4 emissions from solid waste disposal sites	CH4	12011,8	6759,2	-16,0%	17,1%	20,2%	-2,4%	0,6%	-3,7%
Emissions from wastewater handling	CH4	288,6	206,9	-154,7%	172,9%	167,9%	0,0%	-0,2%	0,1%
OTHER CH4	CH4	1,2	72,9	-30,0%	32,9%	32,2%	0,0%	0,0%	0,0%
Total CH4		**25468,2**	**17440,2**	**-13,7%**	**16,1%**	15,1%	-3,7%	-6,1%	-1,6%
Emissions from stationary combustion: non-CO2	N2O	214,4	238,5	-45,7%	108,6%	85,8%	0,0%	-0,1%	0,1%
Mobile combustion: other	N2O	1,0	1,9	-59,2%	113,2%	91,1%	0,0%	0,0%	0,0%
Mobile combustion: road vehicles	N2O	270,5	484,2	-38,8%	55,6%	48,5%	0,1%	0,0%	0,2%
Nitric acid production	N2O	6326,1	5615,7	-49,7%	50,5%	51,1%	-0,3%	-0,8%	0,1%
Caprolactam production	N2O	1243,2	759,3	-61,2%	78,5%	71,7%	-0,2%	-0,6%	0,1%

IPCC Source category	Gas	Base year emissions	Year t emissions	Uncertainty in year t emissions as % of emissions in the category		Uncertainty introduced on national total in year t	% change in emissions between year t and base year	Range of likely % change between year t and base year	
Indirect N2O from non-agricultural sources	N2O	51,8	56,0	-87,7%	278,8%	211,5%	0,0%	0,0%	0,0%
Indirect N2O from NO2 from combustion and industrial processes	N2O	885,7	638,9	-86,3%	265,8%	206,7%	-0,1%	-0,4%	0,0%
Emissions from manure management	N2O	695,0	709,1	-56,1%	105,6%	84,0%	0,0%	-0,4%	0,4%
Direct N2O emissions from agricultural soils	N2O	4600,3	4940,2	-46,3%	79,3%	65,0%	0,2%	-1,3%	1,7%
Indirect N2O emissions from nitrogen used in agriculture	N2O	4858,2	3294,2	-81,0%	236,5%	180,4%	-0,7%	-4,1%	1,6%
Animal production on agricultural soils	N2O	1311,5	703,2	-64,9%	127,8%	100,4%	-0,3%	-0,8%	0,0%
Emissions from wastewater handling	N2O	512,8	397,5	-37,1%	39,8%	39,2%	-0,1%	-0,1%	0,0%
OTHER N2O	N2O	249,8	133,4	-27,6%	28,1%	28,6%	-0,1%	-0,1%	0,0%
Total N2O		**21230,6**	**17985,5**	**-30,4%**	**49,8%**	42,0%	-1,5%	-5,1%	1,5%
PFC from aluminium production	PFC	1900,8	105,7	-16,8%	16,7%	17,1%	-0,8%	-1,0%	-0,7%
HFC-23 emissions from HCFC-22 manufacture	HFC	6241,3	365,5	-17,8%	20,1%	20,0%	-2,7%	-3,5%	-2,0%
Total F-gases		**8731,9**	**2253,0**	**-27,9%**	**27,9%**	28,4%	-3,0%	-3,9%	-2,2%
Total Netherlands (CO2-eq.)		**217322,3**	**219969,4**	**-3,3%**	**4,5%**	4,1%	1,3%	-3,3%	5,4%

LEGEND APPENDICES C, D, E

Values on this page are an example and not real ones

Explanation of columns (emissions) number refers to the circles

1 Tier 1 total greenhouse gas emissions in base year (Gg CO_2 equivalent)
2 Tier 1 total greenhouse gas emissions in 2004 (Gg CO_2 equivalent)
3 Tier 1 uncertainty (2σ) in activity data (%)
4 Tier 1 uncertainty (2σ) in emission factor (%)
5 Tier 1 uncertainty (2σ) in emission (%)
6 Monte Carlo analysis: Mean emission in base year (Gg CO_2 equivalent)
7 Monte Carlo analysis: Standard deviation σ in base year (Gg CO_2 equivalent)
8 Monte Carlo analysis: Base year emission at 2.5 percentile (Gg CO_2 equivalent)
9 Monte Carlo analysis: Base year emission at 97.5 percentile (Gg CO_2 equivalent)
10 Monte Carlo analysis: 2 times standard deviation (2σ) in base year (%)
11 Monte Carlo analysis: Mean emission in 2004 (Gg CO_2 equivalent)
12 Monte Carlo analysis: Standard deviation σ in 2004 (Gg CO_2 equivalent)
13 Monte Carlo analysis: 2004 emission at 2.5 % percentile (Gg CO_2 equivalent)
14 Monte Carlo analysis: 2004 emission at 97.5 % percentile (Gg CO_2 equivalent)
15 Monte Carlo analysis: 2 times standard deviation (2σ) in 2004 (%)

Explanation of columns (trends) number refers the circles

16 Tier 1 trend uncertainty (%)
17 Monte Carlo analysis: Relative trend (change in % of base year emissions)
18 Monte Carlo analysis: Standard deviation of relative trend (change in % of base year emissions)
19 Monte Carlo analysis: Relative trend at 2.5 percentile (change in % of base year emissions)
20 Monte Carlo analysis: Relative trend at 97.5 percentile (change in % of base year emissions)
21 Monte Carlo analysis: 2 times standard deviation of relative trend (change in % of base year emissions)
22 Monte Carlo analysis: Absolute trend (in Gg CO_2 equivalents)
23 Monte Carlo analysis: Standard deviation of absolute trend (in Gg CO2 equivalents)
24 Monte Carlo analysis: Absolute trend at 2.5 percentile (in Gg CO2 equivalents)
25 Monte Carlo analysis: Absolute trend at 97.5 percentile (in Gg CO2 equivalents)
26 Monte Carlo analysis: 2 times standard deviation of absolute trend (%)

Results of Monte Carlo analysis

Tier 1 analysis

BASE CASE SCENARIO WITHOUT LUCF

Source category	Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	(1) 206	(2) 230	(3) %	(4) %	(5) 0%	(6) 06	(7) 10	(8) 186	(9) 227	(10) %	(11) 231	(12) 11	(13) 12	(14) 447	(15) 0%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	776	004	,0%	,0%	,2%										
Stationary combustion : Public Electricity and Heat Production: gases	CO2	13 184	25 174	0,5%	1,0%	1,1%	13184	74	13039	13327	1,1%	25174	141	24895	25449	1,1%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	592	1 750	10,0%	5,0%	11,2%	1749	98	1559	1943	11,2%	1749	98	1559	1943	11,2%
Total CO2		**158 587**	**179 397**			**1,9%**	**158975**	**1199**	**156660**	**161351**	1,5%	**179516**	**1318**	**176955**	**182112**	1,5%
						-> 5%										
Total Netherlands (CO2-eq.)		**213493**	**217077**			**4,5%**	**214434**	**5660**	**205693**	**227374**	5,3%	**217211**	**4232**	**210430**	**226654**	3,9%

bold text in blue between different gas categories: reported Tier 1 uncertainty for the gas category, if correlations and knowledge gaps are taken into account

blue text in Monte Carlo results: activity data and emission factor do not change between base year and 2004, results are same for both years

grey background in trends: no changes between 1990 and 2004

pink background: sub sectors treated as Tier 1 (§2.4.2 of the main report)

Source category	Gas	TIER-1 trend unc.	Trend (to MEAN	Trend (to STD	Trend (to 2,5%	Trend (to 97,5%	Trend (to 2-STD	Trend MEAN	Trend STD	Trend 2,5%	Trend 97,5%	Trend 2-STD
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	(16) 1%	(17) 9%	(18) %	(19) %	(20) 1%	(21) 1%	(22) 24	(23) 107	(24) 816	(25) 231	(26) 5%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	0,2%	0,6%	2%	2%	0%	0,4%	232	429	382	2070	9,7%
Stationary combustion : Public Electricity and Heat Production: gases	CO2											
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2											

APPENDIX C

BASE CASE SCENARIO WITHOUT LUCF

							1990					2004				
Source category	**Gas**	**Tier 1 CO2-eq. 90/95**	**Tier 1 CO2-eq. 2004**	**Tier 1 AD unc**	**Tier 1 EF unc**	**Tier 1 EM unc**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	206	2 230	0,5%	10,0%	10,0%	206	10	186	227	10,0%	2231	111	2012	2447	10,0%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	25 776	27 004	1,0%	3,0%	3,2%	25775	333	25127	26431	2,6%	27007	477	26074	27946	3,5%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	13 184	25 174	0,5%	1,0%	1,1%	13184	74	13039	13327	1,1%	25174	141	24895	25449	1,1%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	592	1 750	10,0%	5,0%	11,2%	593	33	528	658	11,2%	1749	98	1559	1943	11,2%
Stationary combustion : Petroleum Refining: liquids	CO2	9 999	9 556	10,0%	10,0%	14,1%	9999	710	8644	11410	14,2%	9552	676	8265	10929	14,2%
Stationary combustion : Petroleum Refining: gases	CO2	1 029	2 239	0,5%	1,0%	1,1%	1029	6	1018	1041	1,1%	2239	13	2214	2264	1,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0	1	20,0%	2,0%	20,1%						1	0	1	1	20,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	1 401	1 953	20,0%	5,0%	20,6%	1401	145	1120	1687	20,7%	1953	201	1561	2348	20,6%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	8 788	7 502	1,0%	5,0%	5,1%	8788	223	8352	9228	5,1%	7502	191	7126	7877	5,1%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	5 195	4 384	2,0%	10,0%	10,2%	5031	259	4530	5543	10,3%	4325	306	3728	4927	14,2%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	18 785	15 212	2,0%	1,0%	2,2%	18785	210	18375	19200	2,2%	15212	170	14879	15547	2,2%
Stationary combustion : Other Sectors, solids	CO2	189	134	50,0%	5,0%	50,2%	189	48	96	282	50,5%	134	34	69	200	50,0%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	6 571	10 921	20,0%	1,0%	20,0%	6574	207	6176	6985	6,3%	10925	328	10288	11572	6,0%
Stationary combustion : Other Sectors, Residential, gases	CO2	18 466	18 555	5,0%	1,0%	5,1%	18466	469	17544	19385	5,1%	18554	474	17628	19484	5,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	8 226	6 955	10,0%	1,0%	10,0%	8225	412	7406	9032	10,0%	6953	350	6270	7637	10,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	2 522	2 656	20,0%	2,0%	20,1%	2520	253	2023	3017	20,1%	2656	265	2138	3178	19,9%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	1 479	451	20,0%	2,0%	20,1%	1483	107	1276	1696	14,5%	452	35	385	522	15,5%
Military use of fuels (1A5 Other)	CO2	566	437	20,0%	2,0%	20,1%	566	57	454	679	20,2%	437	44	351	523	20,1%
Mobile combustion: road vehicles: gasoline	CO2	10 902	13 168	2,0%	0,4%	2,0%	10903	111	10684	11118	2,0%	13168	135	12905	13434	2,0%
Mobile combustion: road vehicles: diesel oil	CO2	11 832	19 542	5,0%	0,2%	5,0%	11832	295	11254	12414	5,0%	19541	486	18594	20497	5,0%
Mobile combustion: road vehicles: LPG	CO2	2 738	1 131	10,0%	0,2%	10,0%	2737	137	2468	3007	10,0%	1131	57	1020	1242	10,0%
Mobile combustion: water-borne navigation	CO2	403	580	20,0%	0,2%	20,0%	403	40	324	482	20,0%	580	58	466	693	20,0%
Mobile combustion: aircraft	CO2	41	41	50,0%	0,5%	50,0%	41	7	27	55	35,9%	41	7	27	55	36,0%
Mobile combustion: other	CO2	91	109	50,0%	0,2%	50,0%	91	2	86	95	5,0%	109	3	104	115	5,0%
CO2 from coke production	CO2	403	509	50,0%	2,0%	5,0%	403	100	207	600	49,9%	509	127	259	758	49,9%
Fugitive emissions venting/flaring: CO2	CO2	769	110	50,0%	2,0%	50,0%	769	88	599	942	22,8%	110	5	100	121	9,4%
Cement production	CO2	507	434	5,0%	10,0%	11,2%	507	28	452	563	11,1%	434	24	387	482	11,2%
Limestone and dolomite use	CO2	440	563	25,0%	5,0%	25,5%	579	130	376	868	44,8%	747	166	487	1118	44,3%
Other minerals	CO2	269	358	25,0%	5,0%	25,5%	270	34	203	338	25,5%	358	46	269	448	25,6%
Ammonia production	CO2	3 058	3 048	2,0%	1,0%	2,2%	3058	34	2991	3126	2,2%	3048	34	2981	3115	2,2%
Other chemical product manufacture	CO2	588	606	50,0%	50,0%	70,7%										
Iron and steel production (carbon inputs)	CO2	2 514	1 105	3,0%	5,0%	5,8%	2513	73	2371	2659	5,8%	1105	32	1041	1169	5,9%
CO2 from aluminium production	CO2	395	479	2,0%	5,0%	5,4%	395	11	374	415	5,4%	479	13	454	504	5,4%
Other industrial: CO2	CO2	347	342	5,0%	20,0%	20,6%										
Indirect CO2 from solvents/product use	CO2	316	160	25,0%	10,0%	26,9%										
Total CO2		**158 587**	**179 397**			**1,9%**	**158975**	**1199**	**156660**	**161351**	1,5%	**179516**	**1318**	**176955**	**182112**	1,5%
						-> 5%										

BASE CASE SCENARIO WITHOUT LUCF

							1990					2004				
Source category	**Gas**	**Tier 1 CO2-eq. 90/95**	**Tier 1 CO2-eq. 2004**	**Tier 1 AD unc**	**Tier 1 EF unc**	**Tier 1 EM unc**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Emissions from stationary combustion: non-CO2	CH4	518	557	3,0%	50,0%	50,1%	517	87	349	689	33,5%	556	89	384	731	31,9%
Mobile combustion: other	CH4	1	1	50,0%	100,0%	111,8%	1	0	0	2	100,9%	1	1	0	2	89,9%
Mobile combustion: road vehicles	CH4	157	67	3,0%	60,0%	60,1%	157	50	84	278	63,9%	67	22	34	122	67,1%
Fugitive emissions venting/flaring	CH4	1 252	299	2,0%	25,0%	25,1%	1253	147	964	1543	23,5%	299	35	230	369	23,6%
Fugitive emissions from oil and gas operations: gas distribution	CH4	255	268	2,0%	50,0%	50,0%	255	47	163	347	36,7%	269	54	162	374	40,1%
Fugitive emissions from oil and gas operations: other	CH4	162	149	20,0%	50,0%	53,9%	162	34	98	231	42,0%	149	33	86	217	44,9%
Other industrial: CH4	CH4	297	309	10,0%	50,0%	51,0%										
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	6 767	5 688	5,0%	20,0%	20,6%	6765	699	5414	8154	20,7%	5693	587	4546	6848	20,6%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	439	351	5,0%	50,0%	50,2%	439	110	225	656	50,2%	350	88	178	524	50,4%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	319	286	5,0%	30,0%	30,4%	319	44	234	405	27,4%	286	33	222	350	22,9%
Emissions from manure management : cattle	CH4	1 574	1 421	10,0%	100,0%	100,5%	1574	787	552	3533	100,0%	1424	713	512	3229	100,1%
Emissions from manure management : swine	CH4	1 141	919	10,0%	100,0%	100,5%	1139	569	406	2586	99,9%	917	459	328	2080	100,1%
Emissions from manure management : poultry	CH4	243	69	10,0%	100,0%	100,5%	242	122	86	547	100,9%	69	35	24	156	101,2%
Emissions from manure management : other	CH4	12	16	10,0%	100,0%	100,5%	12	4	6	21	68,6%	16	5	8	29	66,6%
CH4 emissions from solid waste disposal sites	CH4	12 011	6 775	30,0%	15,0%	33,5%	12012	1763	9262	14981	29,4%	6759	684	5677	7915	20,2%
Emissions from wastewater handling	CH4	290	206	20,0%	25,0%	32,0%	289	142	24	584	98,4%	206	173	-115	565	167,4%
OTHER CH4	CH4	1	72	20,0%	25,0%	32,0%	1	0	1	1	24,9%	73	12	51	97	32,0%
Total CH4		**25 437**	**17 453**			**18%**	**25464**	**2382**	**21043**	**30988**	18,7%	**17444**	**1315**	**15069**	**20237**	15,1%
						-> 25%										
Emissions from stationary combustion: non-CO2	N2O	215	238	3,0%	50,0%	50,1%	214	104	111	480	96,6%	239	101	130	497	84,8%
Mobile combustion: other	N2O	1	2	50,0%	100,0%	111,8%	1	1	0	2	101,9%	2	1	1	4	91,1%
Mobile combustion: road vehicles	N2O	271	485	5,0%	50,0%	50,2%	271	63	168	415	46,8%	484	118	295	754	48,7%
Nitric acid production	N2O	6 330	5 617	10,0%	50,0%	51,0%	6345	1616	3224	9540	50,9%	5627	1432	2859	8462	50,9%
Caprolactam production	N2O	1 240	759	50,0%	50,0%	70,7%	1243	445	482	2209	71,6%	760	273	297	1356	71,8%
Other industrial: N2O	N2O	3	7	50,0%	50,0%	70,7%										
Indirect N2O from non-agricultural sources	N2O	52	56	50,0%	200,0%	206,2%	52	55	6	197	211,4%	56	60	7	211	212,8%
Indirect N2O from NO2 from combustion and industrial processes	N2O	883	637	15,0%	200,0%	200,6%	887	896	120	3229	201,9%	640	644	87	2323	201,5%
Emissions from manure management	N2O	694	710	10,0%	100,0%	100,5%	697	276	321	1381	79,2%	711	297	312	1443	83,5%
Direct N2O emissions from agricultural soils	N2O	4 597	4 941	10,0%	60,0%	60,8%	4600	1402	2537	7940	60,9%	4946	1621	2628	8893	65,5%
Indirect N2O emissions from nitrogen used in agriculture	N2O	4 861	3 298	50,0%	200,0%	206,2%	4877	4242	975	16057	174,0%	3295	2980	627	11008	180,8%
Animal production on agricultural soils	N2O	1 308	704	10,0%	100,0%	100,5%	1308	656	458	2962	100,3%	703	353	248	1593	100,6%
Emissions from wastewater handling	N2O	513	397	20,0%	50,0%	53,9%	513	94	332	701	36,6%	397	78	250	554	39,2%
OTHER N2O	N2O	250	133	20,0%	50,0%	53,9%	250	55	147	363	44,0%	134	19	97	172	28,7%
Total N2O		**21 219**	**17 985**			**45%**	**21262**	**4907**	**14650**	**33232**	46,2%	**17999**	**3781**	**12536**	**26813**	42,0%
						-> 50%										
SF6 emissions from SF6 use	SF6	301	324	50,0%	25,0%	55,9%										
PFC from aluminium production	PFC	1 901	106	2,0%	20,0%	20,1%	1901	159	1590	2213	16,7%	106	9	88	123	17,1%
PFC emissions from PFC use	PFC	37	179	5,0%	25,0%	25,5%										
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC	240	1 179	10,0%	50,0%	51,0%										
HFC-23 emissions from HCFC-22 manufacture	HFC	5 759	354	10,0%	10,0%	14,1%	6244	901	4719	8091	28,8%	366	37	301	438	20,0%
HFC by-product emissions from HFC manufacture	HFC	12	99	10,0%	20,0%	22,4%										
Total F-gases		**8 250**	**2 242**			**28%**	**8735**	**921**	**7151**	**10622**	21,1%	**2252**	**316**	**1630**	**2868**	28,1%
		-> 50% for HFCs ,PFCs and SF6														
Total Netherlands (CO2-eq.)		**213493**	**217077**			4,5%	**214434**	**5660**	**205693**	**227374**	5,3%	**217211**	**4232**	**210430**	**226654**	3,9%
						-> 6%										

APPENDIX C

BASE CASE SCENARIO WITHOUT LUCF

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	**Gas**	**TIER-1 trend unc.**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	0,1%	0,9%	0,1%	0,8%	1,1%	0,1%	2024	107	1816	2231	10,5%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	0,2%	0,6%	0,2%	0,2%	1,0%	0,4%	1232	429	382	2070	69,7%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	0,1%	5,6%	0,1%	5,3%	5,8%	0,3%	11990	93	11807	12171	1,6%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	0,1%	0,5%	0,1%	0,4%	0,6%	0,1%	1157	104	956	1361	17,9%
Stationary combustion : Petroleum Refining: liquids	CO2	0,6%	-0,2%	0,4%	-1,0%	0,6%	0,8%	-446	846	-2104	1221	379,1%
Stationary combustion : Petroleum Refining: gases	CO2	0,0%	0,6%	0,0%	0,5%	0,6%	0,0%	1210	9	1193	1227	1,4%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	1	1	20,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	0,3%	0,3%	0,1%	0,0%	0,5%	0,2%	552	240	76	1019	87,1%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	0,1%	-0,6%	0,1%	-0,8%	-0,4%	0,2%	-1286	213	-1703	-868	33,1%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	0,1%	-0,3%	0,1%	-0,6%	-0,1%	0,3%	-706	291	-1277	-136	82,4%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	0,2%	-1,7%	0,1%	-1,9%	-1,4%	0,2%	-3573	242	-4049	-3098	13,5%
Stationary combustion : Other Sectors, solids	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-55	58	-169	60	212,8%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	1,4%	2,0%	0,2%	1,7%	2,4%	0,4%	4351	382	3608	5104	17,6%
Stationary combustion : Other Sectors, Residential, gases	CO2	0,6%	0,0%	0,3%	-0,6%	0,6%	0,6%	88	652	-1187	1360	1481,9%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	0,5%	-0,6%	0,3%	-1,1%	-0,1%	0,5%	-1272	538	-2323	-214	84,7%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	0,3%	0,1%	0,2%	-0,3%	0,4%	0,3%	136	366	-578	858	539,5%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	0,1%	-0,5%	0,1%	-0,6%	-0,4%	0,1%	-1031	112	-1254	-814	21,8%
Military use of fuels (1A5 Other)	CO2	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-130	72	-270	12	111,0%
Mobile combustion: road vehicles: gasoline	CO2	0,2%	1,1%	0,1%	0,9%	1,2%	0,2%	2265	171	1935	2607	15,1%
Mobile combustion: road vehicles: diesel oil	CO2	0,6%	3,6%	0,3%	3,0%	4,2%	0,6%	7709	568	6598	8825	14,7%
Mobile combustion: road vehicles: LPG	CO2	0,1%	-0,7%	0,1%	-0,9%	-0,6%	0,1%	-1606	148	-1898	-1316	18,5%
Mobile combustion: water-borne navigation	CO2	0,1%	0,1%	0,0%	0,0%	0,1%	0,1%	176	70	38	315	79,8%
Mobile combustion: aircraft	CO2											
Mobile combustion: other	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	18	4	12	25	38,4%
CO2 from coke production	CO2	0,2%	0,0%	0,1%	-0,1%	0,2%	0,2%	107	162	-212	424	303,3%
Fugitive emissions venting/flaring: CO2	CO2	0,0%	-0,3%	0,0%	-0,4%	-0,2%	0,1%	-659	88	-832	-488	26,6%
Cement production	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-73	17	-107	-40	46,7%
Limestone and dolomite use	CO2	0,1%	0,1%	0,1%	-0,1%	0,2%	0,2%	168	173	-166	529	206,1%
Other minerals	CO2	0,1%	0,0%	0,0%	0,0%	0,1%	0,1%	88	57	-24	198	128,5%
Ammonia production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-10	43	-94	75	848,2%
Other chemical product manufacture	CO2											
Iron and steel production (carbon inputs)	CO2	0,0%	-0,7%	0,0%	-0,7%	-0,6%	0,1%	-1409	68	-1544	-1276	9,7%
CO2 from aluminium production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	84	7	71	97	15,6%
Other industrial: CO2	CO2											
Indirect CO2 from solvents/product use	CO2											
Total CO2			9,6%	0,8%	8,0%	11,1%	1,6%	20541	1546	17502	23580	15,1%

BASE CASE SCENARIO WITHOUT LUCF

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	**Gas**	**TIER-1 trend unc.**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Emissions from stationary combustion: non-CO2	CH4	0,0%	0,0%	0,0%	-0,1%	0,1%	0,1%	39	86	-131	207	443,1%
Mobile combustion: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0	0	0	1	94,3%
Mobile combustion: road vehicles	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-90	44	-195	-22	97,4%
Fugitive emissions venting/flaring	CH4	0,1%	-0,4%	0,1%	-0,6%	-0,3%	0,1%	-953	133	-1216	-692	28,0%
Fugitive emissions from oil and gas operations: gas distribution	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	14	14	-13	41	200,8%
Fugitive emissions from oil and gas operations: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-13	36	-84	58	567,2%
Other industrial: CH4	CH4											
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	0,2%	-0,5%	0,3%	-1,1%	0,1%	0,6%	-1072	669	-2383	241	124,9%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-89	74	-235	56	167,6%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-33	16	-65	-4	94,0%
Emissions from manure management : cattle	CH4	0,1%	-0,1%	0,4%	-0,8%	0,6%	0,7%	-150	776	-1804	1379	1038,4%
Emissions from manure management : swine	CH4	0,1%	-0,1%	0,2%	-0,5%	0,2%	0,4%	-222	395	-1142	472	356,2%
Emissions from manure management : poultry	CH4	0,1%	-0,1%	0,1%	-0,2%	0,0%	0,1%	-174	110	-448	-31	127,1%
Emissions from manure management : other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5	4	-2	14	176,1%
CH4 emissions from solid waste disposal sites	CH4	1,4%	-2,4%	0,6%	-3,7%	-1,3%	1,2%	-5247	1278	-7936	-2909	48,7%
Emissions from wastewater handling	CH4	0,0%	0,0%	0,1%	-0,2%	0,1%	0,2%	-83	188	-446	293	453,4%
OTHER CH4	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	72	12	51	96	32,2%
Total CH4			-3,7%	1,1%	-6,2%	-1,6%	2,2%	-8019	2455	-13541	-3371	61,2%
Emissions from stationary combustion: non-CO2	N2O	0,0%	0,0%	0,0%	-0,1%	0,1%	0,1%	24	80	-137	179	662,1%
Mobile combustion: other	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	0	2	90,8%
Mobile combustion: road vehicles	N2O	0,1%	0,1%	0,0%	0,0%	0,2%	0,1%	213	104	36	448	98,1%
Nitric acid production	N2O	0,4%	-0,3%	0,2%	-0,8%	0,0%	0,4%	-718	471	-1750	104	131,1%
Caprolactam production	N2O	0,3%	-0,2%	0,2%	-0,6%	0,1%	0,4%	-483	392	-1326	223	162,3%
Other industrial: N2O	N2O											
Indirect N2O from non-agricultural sources	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	4	28	-44	62	1398,9%
Indirect N2O from NO2 from combustion and industrial processes	N2O	0,3%	-0,1%	0,1%	-0,4%	0,0%	0,3%	-247	277	-954	-25	223,8%
Emissions from manure management	N2O	0,0%	0,0%	0,2%	-0,4%	0,4%	0,4%	14	405	-782	854	5680,6%
Direct N2O emissions from agricultural soils	N2O	0,3%	0,2%	0,7%	-1,2%	1,8%	1,5%	346	1607	-2696	3767	930,3%
Indirect N2O emissions from nitrogen used in agriculture	N2O	1,9%	-0,7%	1,5%	-4,3%	1,6%	3,0%	-1582	3368	-9682	3520	425,8%
Animal production on agricultural soils	N2O	0,3%	-0,3%	0,2%	-0,8%	0,0%	0,4%	-606	473	-1790	38	156,1%
Emissions from wastewater handling	N2O	0,1%	-0,1%	0,0%	-0,2%	0,0%	0,1%	-116	104	-323	89	179,5%
OTHER N2O	N2O	0,0%	-0,1%	0,0%	-0,1%	0,0%	0,0%	-117	44	-209	-35	75,9%
Total N2O			-1,5%	1,7%	-5,3%	1,5%	3,4%	-3263	3839	-11900	3145	235,3%
SF6 emissions from SF6 use	SF6											
PFC from aluminium production	PFC	0,2%	-0,8%	0,1%	-1,0%	-0,7%	0,1%	-1795	155	-2098	-1492	17,2%
PFC emissions from PFC use	PFC											
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC											
HFC-23 emissions from HCFC-22 manufacture	HFC		-2,7%	0,4%	-3,6%	-2,0%	0,8%	-5869	898	-7718	-4342	30,6%
HFC by-product emissions from HFC manufacture	HFC											
Total F-gases			-3,0%	0,4%	-3,9%	-2,2%	0,9%	-6483	972	-8474	-4778	30,0%
Total Netherlands (CO2-eq.)		**3,3%**	**1,3%**	**2,3%**	**-3,4%**	**5,5%**	**4,5%**	**2777**	**4931**	**-7650**	**11529**	**355,1%**

APPENDIX D

BASE CASE SCENARIO WITH LUCF

							1990					2004				
Source category	**Gas**	**Tier 1 CO2-eq. 90/95**	**Tier 1 CO2-eq. 2004**	**Tier 1 AD unc**	**Tier 1 EF unc**	**Tier 1 EM unc**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	206	2 230	0,5%	10,0%	10,0%	206	10	186	227	10,0%	2230	112	2009	2451	10,1%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	25 776	27 004	1,0%	3,0%	3,2%	25778	334	25126	26432	2,6%	27006	473	26076	27938	3,5%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	13 184	25 174	0,5%	1,0%	1,1%	13184	74	13041	13328	1,1%	25174	141	24899	25450	1,1%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	592	1 750	10,0%	5,0%	11,2%	592	33	529	658	11,2%	1750	97	1561	1942	11,1%
Stationary combustion : Petroleum Refining: liquids	CO2	9 999	9 556	10,0%	10,0%	14,1%	10002	705	8651	11414	14,1%	9556	678	8259	10915	14,2%
Stationary combustion : Petroleum Refining: gases	CO2	1 029	2 239	0,5%	1,0%	1,1%	1029	6	1018	1041	1,1%	2239	12	2215	2264	1,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0	1	20,0%	2,0%	20,1%						1	0	1	1	20,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	1 401	1 953	20,0%	5,0%	20,6%	1401	145	1119	1688	20,7%	1951	201	1564	2346	20,6%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	8 788	7 502	1,0%	5,0%	5,1%	8787	224	8348	9226	5,1%	7503	190	7131	7877	5,1%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	5 195	4 384	2,0%	10,0%	10,2%	5035	257	4533	5541	10,2%	4325	309	3723	4934	14,3%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	18 785	15 212	2,0%	1,0%	2,2%	18786	209	18375	19198	2,2%	15212	170	14880	15549	2,2%
Stationary combustion : Other Sectors, solids	CO2	189	134	50,0%	5,0%	50,2%	189	48	96	283	50,5%	134	34	68	200	50,3%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	6 571	10 921	20,0%	1,0%	20,0%	6573	207	6170	6984	6,3%	10925	326	10284	11565	6,0%
Stationary combustion : Other Sectors, Residential, gases	CO2	18 466	18 555	5,0%	1,0%	5,1%	18470	469	17546	19394	5,1%	18556	473	17636	19490	5,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	8 226	6 955	10,0%	1,0%	10,0%	8226	413	7411	9032	10,0%	6956	350	6269	7644	10,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	2 522	2 656	20,0%	2,0%	20,1%	2522	253	2028	3017	20,1%	2654	268	2128	3178	20,2%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	1 479	451	20,0%	2,0%	20,1%	1483	107	1276	1696	14,4%	452	35	385	522	15,5%
Military use of fuels (1A5 Other)	CO2	566	437	20,0%	2,0%	20,1%	566	57	455	677	20,0%	437	44	350	523	20,2%
Mobile combustion: road vehicles: gasoline	CO2	10 902	13 168	2,0%	0,4%	2,0%	10902	111	10683	11121	2,0%	13169	134	12907	13431	2,0%
Mobile combustion: road vehicles: diesel oil	CO2	11 832	19 542	5,0%	0,2%	5,0%	11833	296	11252	12417	5,0%	19540	491	18577	20501	5,0%
Mobile combustion: road vehicles: LPG	CO2	2 738	1 131	10,0%	0,2%	10,0%	2738	136	2472	3007	10,0%	1131	57	1021	1242	10,0%
Mobile combustion: water-borne navigation	CO2	403	580	20,0%	0,2%	20,0%	403	40	324	482	19,9%	580	58	466	694	20,0%
Mobile combustion: aircraft	CO2	41	41	50,0%	0,5%	50,0%	41	7	27	56	35,9%	41	7	27	56	36,2%
Mobile combustion: other	CO2	91	109	50,0%	0,2%	50,0%	91	2	86	95	5,0%	109	3	104	115	5,0%
CO2 from coke production	CO2	403	509	50,0%	2,0%	5,0%	402	102	204	602	50,5%	510	127	260	758	49,9%
Fugitive emissions venting/flaring: CO2	CO2	769	110	50,0%	2,0%	50,0%	769	88	597	942	22,8%	110	5	100	121	9,4%
Cement production	CO2	507	434	5,0%	10,0%	11,2%	507	28	452	563	11,2%	434	24	387	482	11,2%
Limestone and dolomite use	CO2	440	563	25,0%	5,0%	25,5%	578	130	375	871	44,9%	748	166	487	1119	44,3%
Other minerals	CO2	269	358	25,0%	5,0%	25,5%	270	34	203	338	25,6%	358	46	269	447	25,5%
Ammonia production	CO2	3 058	3 048	2,0%	1,0%	2,2%	3058	34	2992	3125	2,2%	3048	34	2982	3115	2,2%
Other chemical product manufacture	CO2	588	606	50,0%	50,0%	70,7%										
Iron and steel production (carbon inputs)	CO2	2 514	1 105	3,0%	5,0%	5,8%	2514	73	2372	2659	5,8%	1105	32	1042	1168	5,8%
CO2 from aluminium production	CO2	395	479	2,0%	5,0%	5,4%	395	11	374	416	5,4%	479	13	454	504	5,4%
Other industrial: CO2	CO2	347	342	5,0%	20,0%	20,6%										
Indirect CO2 from solvents/product use	CO2	316	160	25,0%	10,0%	26,9%										
5A1. Forest Land remaining Forest Land	CO2	-2 505	-2 289	25,0%	61,8%	67,0%	-2506	483	-3525	-1624	38,6%	-2287	477	-3279	-1421	41,7%
5A2. Land converted to Forest Land	CO2	-89	-342	25,0%	57,9%	63,0%	-89	21	-134	-50	48,1%	-342	92	-536	-172	54,1%
5B2. Land converted to Cropland	CO2	-35	-35	25,0%	50,0%	55,9%	-35	10	-56	-17	56,0%	-35	10	-56	-17	56,0%
5C1. Grassland remaining Grassland	CO2	4 246	4 246	25,0%	50,0%	55,9%	4245	1196	2050	6718	56,4%	4249	1192	2072	6730	56,1%
5C2. Land converted to Grassland	CO2	536	536	25,0%	61,2%	66,1%	536	287	-8	1121	107,2%	536	287	-8	1121	107,2%
5E2. Land converted to Settlements	CO2	-151	-151	25,0%	50,0%	55,9%	-152	43	-241	-74	56,2%	-152	43	-241	-74	56,2%
5F2. Land converted to Other Land	CO2	710	710	25,0%	50,0%	55,9%	711	200	348	1128	56,3%	711	200	348	1128	56,3%
5G. Other (liming of soils)	CO2	183	86	25,0%	1,0%	25,0%	183	11	162	205	12,0%	86	11	65	108	25,2%
Total CO2		**161 482**	**182 158**			**2,5%**	**161892**	**1787**	**158463**	**165466**	2,2%	**182291**	**1881**	**178649**	**186045**	2,1%
						-> 5%										

BASE CASE SCENARIO WITH LUCF

Source category	Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Emissions from stationary combustion: non-CO2	CH4	518	557	3,0%	50,0%	50,1%	517	87	351	692	33,5%	557	89	386	733	31,8%
Mobile combustion: other	CH4	1	1	50,0%	100,0%	111,8%	1	1	0	2	102,1%	1	0	0	2	89,5%
Mobile combustion: road vehicles	CH4	157	67	3,0%	60,0%	60,1%	157	50	84	278	63,9%	67	22	34	120	66,6%
Fugitive emissions venting/flaring	CH4	1 252	299	2,0%	25,0%	25,1%	1253	148	963	1544	23,6%	299	35	230	369	23,6%
Fugitive emissions from oil and gas operations: gas distribution	CH4	255	268	2,0%	50,0%	50,0%	255	46	164	346	36,5%	269	54	164	374	39,9%
Fugitive emissions from oil and gas operations: other	CH4	162	149	20,0%	50,0%	53,9%	162	34	98	233	42,1%	149	33	87	217	44,7%
Other industrial: CH4	CH4	297	309	10,0%	50,0%	51,0%										
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	6 767	5 688	5,0%	20,0%	20,6%	6768	697	5417	8145	20,6%	5685	586	4556	6851	20,6%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	439	351	5,0%	50,0%	50,2%	439	110	224	657	50,2%	350	88	177	522	50,3%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	319	286	5,0%	30,0%	30,4%	319	44	233	404	27,5%	286	33	222	349	23,0%
Emissions from manure management : cattle	CH4	1 574	1 421	10,0%	100,0%	100,5%	1576	788	558	3562	100,0%	1420	714	501	3209	100,5%
Emissions from manure management : swine	CH4	1 141	919	10,0%	100,0%	100,5%	1139	567	406	2576	99,7%	918	454	323	2051	98,8%
Emissions from manure management : poultry	CH4	243	69	10,0%	100,0%	100,5%	242	122	85	548	100,3%	69	35	24	157	101,5%
Emissions from manure management : other	CH4	12	16	10,0%	100,0%	100,5%	12	4	6	21	69,0%	16	5	8	29	66,5%
CH4 emissions from solid waste disposal sites	CH4	12 011	6 775	30,0%	15,0%	33,5%	12012	1763	9262	14981	29,4%	6759	684	5677	7915	20,2%
Emissions from wastewater handling	CH4	290	206	20,0%	25,0%	32,0%	289	142	25	581	98,6%	207	174	-113	565	167,9%
OTHER CH4	CH4	1	72	20,0%	25,0%	32,0%	1	0	1	1	25,1%	73	12	51	97	32,2%
Total CH4		**25 437**	**17 453**			**18%**	**25468**	**2373**	**21060**	**30883**	18,6%	**17440**	**1315**	**15051**	**20249**	15,1%
						-> 25%										
Emissions from stationary combustion: non-CO2	N2O	215	238	3,0%	50,0%	50,1%	214	104	110	481	96,7%	239	102	130	498	85,8%
Mobile combustion: other	N2O	1	2	50,0%	100,0%	111,8%	1	1	0	2	102,1%	2	1	1	4	91,1%
Mobile combustion: road vehicles	N2O	271	485	5,0%	50,0%	50,2%	271	63	169	417	46,9%	484	118	296	753	48,5%
Nitric acid production	N2O	6 330	5 617	10,0%	50,0%	51,0%	6326	1617	3182	9506	51,1%	5616	1434	2827	8452	51,1%
Caprolactam production	N2O	1 240	759	50,0%	50,0%	70,7%	1243	447	479	2220	71,9%	759	272	295	1355	71,7%
Other industrial: N2O	N2O	3	7	50,0%	50,0%	70,7%										
Indirect N2O from non-agricultural sources	N2O	52	56	50,0%	200,0%	206,2%	52	54	6	197	209,3%	56	59	7	212	211,5%
Indirect N2O from NO2 from combustion and industrial processes	N2O	883	637	15,0%	200,0%	200,6%	886	911	121	3237	205,7%	639	660	88	2337	206,7%
Emissions from manure management	N2O	694	710	10,0%	100,0%	100,5%	695	277	318	1379	79,8%	709	298	311	1458	84,0%
Direct N2O emissions from agricultural soils	N2O	4 597	4 941	10,0%	60,0%	60,8%	4600	1420	2514	8046	61,7%	4940	1605	2652	8859	65,0%
Indirect N2O emissions from nitrogen used in agriculture	N2O	4 861	3 298	50,0%	200,0%	206,2%	4858	4271	973	15744	175,8%	3294	2971	625	11085	180,4%
Animal production on agricultural soils	N2O	1 308	704	10,0%	100,0%	100,5%	1311	660	458	2965	100,7%	703	353	247	1602	100,4%
5A1. Forest Land remaining Forest Land	N2O	7	7	25,0%	20,0%	32,0%										
Emissions from wastewater handling	N2O	513	397	20,0%	50,0%	53,9%	513	95	330	703	36,9%	398	78	250	556	39,2%
OTHER N2O	N2O	250	133	20,0%	50,0%	53,9%	250	55	146	363	44,3%	133	19	97	171	28,6%
Total N2O		**21 226**	**17 992**			**45%**	**21231**	**4961**	**14607**	**32998**	46,7%	**17985**	**3779**	**12521**	**26947**	42,0%
						-> 50%										
SF6 emissions from SF6 use	SF6	301	324	50,0%	25,0%	55,9%										
PFC from aluminium production	PFC	1 901	106	2,0%	20,0%	20,1%	1901	159	1591	2213	16,7%	106	9	88	123	17,1%
PFC emissions from PFC use	PFC	37	179	5,0%	25,0%	25,5%										
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC	240	1 179	10,0%	50,0%	51,0%										
HFC-23 emissions from HCFC-22 manufacture	HFC	5 759	354	10,0%	10,0%	14,1%	6241	899	4715	8083	28,8%	366	37	301	439	20,0%
HFC by-product emissions from HFC manufacture	HFC	12	99	10,0%	20,0%	22,4%										
Total F-gases		**8 250**	**2 242**			**28%**	**8732**	**919**	**7154**	**10620**	21,1%	**2253**	**320**	**1624**	**2881**	28,4%
		-> 50% for HFCs ,PFCs and SF6														
Total Netherlands (CO2-eq.)		**216394**	**219845**			**4,5%**	**217322**	**5862**	**208046**	**230370**	5,4%	**219969**	**4456**	**212671**	**229940**	4,1%
						-> 6%										

APPENDIX D

BASE CASE SCENARIO WITH LUCF

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	**Gas**	**TIER-1 trend unc.**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	0,1%	0,9%	0,1%	0,8%	1,0%	0,1%	2024	107	1812	2234	10,6%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	0,2%	0,6%	0,2%	0,2%	1,0%	0,4%	1228	428	389	2068	69,6%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	0,1%	5,5%	0,1%	5,2%	5,8%	0,3%	11990	93	11809	12175	1,6%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	0,1%	0,5%	0,0%	0,4%	0,6%	0,1%	1157	103	958	1360	17,8%
Stationary combustion : Petroleum Refining: liquids	CO2	0,6%	-0,2%	0,4%	-1,0%	0,6%	0,8%	-445	843	-2114	1209	378,7%
Stationary combustion : Petroleum Refining: gases	CO2	0,0%	0,6%	0,0%	0,5%	0,6%	0,0%	1210	9	1193	1227	1,4%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	1	1	20,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	0,3%	0,3%	0,1%	0,0%	0,5%	0,2%	550	240	79	1023	87,3%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	0,1%	-0,6%	0,1%	-0,8%	-0,4%	0,2%	-1284	213	-1703	-867	33,2%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	0,1%	-0,3%	0,1%	-0,6%	-0,1%	0,3%	-710	294	-1284	-139	82,8%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	0,2%	-1,6%	0,1%	-1,9%	-1,4%	0,2%	-3573	241	-4047	-3099	13,5%
Stationary combustion : Other Sectors, solids	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-55	58	-169	59	213,0%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	1,4%	2,0%	0,2%	1,6%	2,4%	0,4%	4352	381	3601	5100	17,5%
Stationary combustion : Other Sectors, Residential, gases	CO2	0,6%	0,0%	0,3%	-0,6%	0,6%	0,6%	86	653	-1196	1362	1510,6%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	0,5%	-0,6%	0,2%	-1,1%	-0,1%	0,5%	-1271	541	-2330	-202	85,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	0,3%	0,1%	0,2%	-0,3%	0,4%	0,3%	132	366	-587	849	553,6%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	0,1%	-0,5%	0,1%	-0,6%	-0,4%	0,1%	-1030	112	-1253	-814	21,8%
Military use of fuels (1A5 Other)	CO2	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-130	72	-271	11	110,1%
Mobile combustion: road vehicles: gasoline	CO2	0,2%	1,0%	0,1%	0,9%	1,2%	0,2%	2267	171	1931	2601	15,1%
Mobile combustion: road vehicles: diesel oil	CO2	0,6%	3,5%	0,3%	3,0%	4,1%	0,6%	7707	572	6588	8829	14,8%
Mobile combustion: road vehicles: LPG	CO2	0,1%	-0,7%	0,1%	-0,9%	-0,6%	0,1%	-1607	148	-1899	-1318	18,4%
Mobile combustion: water-borne navigation	CO2	0,1%	0,1%	0,0%	0,0%	0,1%	0,1%	177	71	39	314	79,8%
Mobile combustion: aircraft	CO2											
Mobile combustion: other	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	18	4	12	25	38,5%
CO2 from coke production	CO2	0,2%	0,0%	0,1%	-0,1%	0,2%	0,2%	107	163	-213	426	303,8%
Fugitive emissions venting/flaring: CO2	CO2	0,0%	-0,3%	0,0%	-0,4%	-0,2%	0,1%	-659	88	-832	-486	26,7%
Cement production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-73	17	-107	-40	46,9%
Limestone and dolomite use	CO2	0,1%	0,1%	0,1%	-0,1%	0,2%	0,2%	169	173	-161	530	204,7%
Other minerals	CO2	0,1%	0,0%	0,0%	0,0%	0,1%	0,1%	88	56	-23	197	128,0%
Ammonia production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-10	43	-95	74	854,1%
Other chemical product manufacture	CO2											
Iron and steel production (carbon inputs)	CO2	0,0%	-0,6%	0,0%	-0,7%	-0,6%	0,1%	-1410	68	-1544	-1277	9,6%
CO2 from aluminium production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	84	7	71	97	15,6%
Other industrial: CO2	CO2											
Indirect CO2 from solvents/product use	CO2											
5A1. Forest Land remaining Forest Land	CO2	0,4%	0,1%	0,2%	-0,4%	0,6%	0,5%	219	532	-833	1257	487,2%
5A2. Land converted to Forest Land	CO2	0,1%	-0,1%	0,0%	-0,2%	0,0%	0,1%	-253	89	-440	-91	70,5%
5B2. Land converted to Cropland	CO2											
5C1. Grassland remaining Grassland	CO2											
5C2. Land converted to Grassland	CO2											
5E2. Land converted to Settlements	CO2											
5F2. Land converted to Other Land	CO2											
5G. Other (liming of soils)	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-97	15	-127	-67	32,0%
Total CO2			9,4%	0,8%	7,8%	11,0%	1,6%	20399	1632	17204	23622	16,0%

BASE CASE SCENARIO WITH LUCF

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	**Gas**	**TIER-1 trend unc.**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Emissions from stationary combustion: non-CO2	CH4	0,0%	0,0%	0,0%	-0,1%	0,1%	0,1%	40	87	-131	211	433,3%
Mobile combustion: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0	0	0	1	94,4%
Mobile combustion: road vehicles	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-90	44	-194	-23	97,6%
Fugitive emissions venting/flaring	CH4	0,1%	-0,4%	0,1%	-0,6%	-0,3%	0,1%	-953	134	-1217	-691	28,1%
Fugitive emissions from oil and gas operations: gas distribution	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	14	14	-13	42	201,3%
Fugitive emissions from oil and gas operations: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-13	36	-85	58	556,3%
Other industrial: CH4	CH4											
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	0,2%	-0,5%	0,3%	-1,1%	0,1%	0,6%	-1083	664	-2387	222	122,8%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-89	74	-235	55	166,6%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-33	16	-65	-4	94,4%
Emissions from manure management : cattle	CH4	0,1%	-0,1%	0,4%	-0,8%	0,6%	0,7%	-156	772	-1806	1367	990,7%
Emissions from manure management : swine	CH4	0,1%	-0,1%	0,2%	-0,5%	0,2%	0,4%	-221	392	-1131	468	355,0%
Emissions from manure management : poultry	CH4	0,1%	-0,1%	0,1%	-0,2%	0,0%	0,1%	-174	110	-448	-31	126,4%
Emissions from manure management : other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5	4	-2	14	176,5%
CH4 emissions from solid waste disposal sites	CH4	1,4%	-2,4%	0,6%	-3,7%	-1,3%	1,2%	-5247	1278	-7936	-2909	48,7%
Emissions from wastewater handling	CH4	0,0%	0,0%	0,1%	-0,2%	0,1%	0,2%	-82	188	-445	293	461,1%
OTHER CH4	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	72	12	50	95	32,4%
Total CH4			-3,7%	1,1%	-6,1%	-1,6%	2,2%	-8028	2453	-13451	-3390	61,1%
Emissions from stationary combustion: non-CO2	N2O	0,0%	0,0%	0,0%	-0,1%	0,1%	0,1%	24	82	-141	180	678,0%
Mobile combustion: other	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	0	2	90,6%
Mobile combustion: road vehicles	N2O	0,1%	0,1%	0,0%	0,0%	0,2%	0,1%	214	105	36	447	97,8%
Nitric acid production	N2O	0,4%	-0,3%	0,2%	-0,8%	0,1%	0,4%	-710	469	-1728	116	132,1%
Caprolactam production	N2O	0,3%	-0,2%	0,2%	-0,6%	0,1%	0,4%	-484	395	-1340	228	163,4%
Other industrial: N2O	N2O											
Indirect N2O from non-agricultural sources	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	4	27	-43	62	1286,8%
Indirect N2O from NO2 from combustion and industrial processes	N2O	0,3%	-0,1%	0,1%	-0,4%	0,0%	0,2%	-247	275	-963	-25	223,0%
Emissions from manure management	N2O	0,0%	0,0%	0,2%	-0,4%	0,4%	0,4%	14	407	-794	855	5786,1%
Direct N2O emissions from agricultural soils	N2O	0,3%	0,2%	0,7%	-1,3%	1,7%	1,5%	340	1606	-2758	3764	945,4%
Indirect N2O emissions from nitrogen used in agriculture	N2O	1,9%	-0,7%	1,5%	-4,1%	1,6%	2,9%	-1564	3414	-9191	3483	436,5%
Animal production on agricultural soils	N2O	0,3%	-0,3%	0,2%	-0,8%	0,0%	0,4%	-608	473	-1780	39	155,6%
5A1. Forest Land remaining Forest Land	N2O											
Emissions from wastewater handling	N2O	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-115	105	-321	88	181,6%
OTHER N2O	N2O	0,0%	-0,1%	0,0%	-0,1%	0,0%	0,0%	-116	44	-209	-34	76,5%
Total N2O			-1,5%	1,7%	-5,1%	1,5%	3,4%	-3245	3898	-11493	3174	240,3%
SF6 emissions from SF6 use	SF6											
PFC from aluminium production	PFC	0,2%	-0,8%	0,1%	-1,0%	-0,7%	0,1%	-1795	154	-2100	-1494	17,2%
PFC emissions from PFC use	PFC											
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC											
HFC-23 emissions from HCFC-22 manufacture	HFC	0,3%	-2,7%	0,4%	-3,5%	-2,0%	0,8%	-5869	898	-7718	-4342	30,6%
HFC by-product emissions from HFC manufacture	HFC											
Total F-gases			-3,0%	0,4%	-3,9%	-2,2%	0,9%	-6479	971	-8457	-4775	30,0%
	-> 50% f											
Total Netherlands (CO2-eq.)		**3,3%**	**1,3%**	**2,3%**	**-3,3%**	**5,4%**	**4,5%**	**2647**	**5016**	**-7582**	**11513**	**379,0%**

APPENDIX E

RESULTS OF SCENARIOS

SCENARIO A

Source category		Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Stationary combustion : Public Electricity and Heat Production: gase	basecase	CO2	13 184	25 174	0,5%	1,0%	1,1%	13184	74	13041	13328	1,1%	25174	141	24899	25450	1,1%
Stationary combustion : Public Electricity and Heat Production: gase	A1triang	CO2	13 184	25 174	0,5%	1,0%	1,1%	13184	73	13040	13328	1,1%	25343	222	24977	25807	1,8%
Stationary combustion : Public Electricity and Heat Production: gase	A2unif	CO2	13 184	25 174	0,5%	1,0%	1,1%	13183	74	13038	13329	1,1%	25426	298	24924	25933	2,3%
Stationary combustion : Petroleum Refining: gase	basecase	CO2	1 029	2 239	0,5%	1,0%	1,1%	1029	6	1018	1041	1,1%	2239	12	2215	2264	1,1%
Stationary combustion : Petroleum Refining: gase	A1triang	CO2	1 029	2 239	0,5%	1,0%	1,1%	1029	6	1018	1041	1,1%	2254	20	2221	2295	1,8%
Stationary combustion : Petroleum Refining: gase	A2unif	CO2	1 029	2 239	0,5%	1,0%	1,1%	1029	6	1018	1041	1,1%	2262	26	2217	2306	2,3%
Stationary combustion : Manufacturing Industries and Construction, gase	basecase	CO2	18 785	15 212	2,0%	1,0%	2,2%	18786	209	18375	19198	2,2%	15212	170	14880	15549	2,2%
Stationary combustion : Manufacturing Industries and Construction, gase	A1triang	CO2	18 785	15 212	2,0%	1,0%	2,2%	18786	210	18375	19198	2,2%	15315	201	14938	15724	2,6%
Stationary combustion : Manufacturing Industries and Construction, gase	A2unif	CO2	18 785	15 212	2,0%	1,0%	2,2%	18784	210	18377	19197	2,2%	15364	233	14922	15809	3,0%
Stationary combustion : Other Sectors: Commercial/Institutional, gase	basecase	CO2	6 571	10 921	20,0%	1,0%	20,0%	6573	207	6170	6984	6,3%	10925	326	10284	11565	6,0%
Stationary combustion : Other Sectors: Commercial/Institutional, gase	A1triang	CO2	6 571	10 921	20,0%	1,0%	20,0%	6573	208	6170	6983	6,3%	10998	341	10339	11680	6,2%
Stationary combustion : Other Sectors: Commercial/Institutional, gase	A2unif	CO2	6 571	10 921	20,0%	1,0%	20,0%	6573	208	6174	6985	6,3%	11034	351	10357	11732	6,4%
Stationary combustion : Other Sectors, Residential, gase	basecase	CO2	18 466	18 555	5,0%	1,0%	5,1%	18470	469	17546	19394	5,1%	18556	473	17636	19490	5,1%
Stationary combustion : Other Sectors, Residential, gase	A1triang	CO2	18 466	18 555	5,0%	1,0%	5,1%	18465	471	17549	19395	5,1%	18678	493	17721	19658	5,3%
Stationary combustion : Other Sectors, Residential, gase	A2unif	CO2	18 466	18 555	5,0%	1,0%	5,1%	18465	472	17534	19395	5,1%	18741	515	17729	19755	5,5%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gase	basecase	CO2	8 226	6 955	10,0%	1,0%	10,0%	8226	413	7411	9032	10,0%	6956	350	6269	7644	10,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gase	A1triang	CO2	8 226	6 955	10,0%	1,0%	10,0%	8226	415	7416	9036	10,1%	7003	354	6311	7697	10,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gase	A2unif	CO2	8 226	6 955	10,0%	1,0%	10,0%	8225	414	7412	9035	10,1%	7024	359	6319	7734	10,2%
Total CO2	**basecase**		**161 482**	**182 158**			**2,5%**	**161892**	**1787**	**158463**	**165466**	2,2%	**182291**	**1881**	**178649**	**186045**	2,1%
Total CO2	**A1triang**		**161 482**	**182 158**			**2,5%**	**161894**	**1800**	**158406**	**165478**	2,2%	**182834**	**1943**	**179100**	**186715**	2,1%
Total CO2	**A2unif**		**161 482**	**182 158**			**2,5%**	**161866**	**1792**	**158424**	**165453**	2,2%	**183070**	**2057**	**179085**	**187153**	2,2%
Total Netherlands (CO2-eq.)	**basecase**		**216394**	**219845**			**4,5%**	**217322**	**5862**	**208046**	**230370**	5,4%	**219969**	**4456**	**212671**	**229940**	4,1%
Total Netherlands (CO2-eq.)	**A1triang**		**216394**	**219845**			**4,5%**	**217338**	**5857**	**208069**	**230532**	5,4%	**220530**	**4470**	**213163**	**230491**	4,1%
Total Netherlands (CO2-eq.)	**A2unif**		**216394**	**219845**			**4,5%**	**217240**	**5778**	**208043**	**230217**	5,3%	**220767**	**4534**	**213245**	**230794**	4,1%

	Scenario		TIER-1 trend uncertainty	Relative Trend (to 1990 emissions) (%) MEAN	STD	2,5%	97,5%	2-STD	Absolute Trend (CO2-eq) MEAN	STD	2,5%	97,5%	2-STD
Stationary combustion : Public Electricity and Heat Production: gase	basecase	CO2	0,1%	5,5%	0,1%	5,2%	5,8%	0,3%	11990	93	11809	12175	1,6%
Stationary combustion : Public Electricity and Heat Production: gase	A1triang	CO2	0,1%	5,6%	0,2%	5,2%	5,9%	0,3%	12159	203	11818	12583	3,3%
Stationary combustion : Public Electricity and Heat Production: gase	A2unif	CO2	0,1%	5,6%	0,2%	5,3%	6,0%	0,4%	12243	274	11769	12720	4,5%
Stationary combustion : Petroleum Refining: gase	basecase	CO2	0,0%	0,6%	0,0%	0,5%	0,6%	0,0%	1210	9	1193	1227	1,4%
Stationary combustion : Petroleum Refining: gase	A1triang	CO2	0,0%	0,6%	0,0%	0,5%	0,6%	0,0%	1225	18	1194	1262	3,0%
Stationary combustion : Petroleum Refining: gase	A2unif	CO2	0,0%	0,6%	0,0%	0,5%	0,6%	0,0%	1232	25	1190	1274	4,0%
Stationary combustion : Manufacturing Industries and Construction, gase	basecase	CO2	0,2%	-1,6%	0,1%	-1,9%	-1,4%	0,2%	-3573	241	-4047	-3099	13,5%
Stationary combustion : Manufacturing Industries and Construction, gase	A1triang	CO2	0,2%	-1,6%	0,1%	-1,9%	-1,3%	0,3%	-3471	269	-3996	-2938	15,5%
Stationary combustion : Manufacturing Industries and Construction, gase	A2unif	CO2	0,2%	-1,6%	0,1%	-1,8%	-1,3%	0,3%	-3421	287	-3981	-2858	16,8%
Stationary combustion : Other Sectors: Commercial/Institutional, gase	basecase	CO2	1,4%	2,0%	0,2%	1,6%	2,4%	0,4%	4352	381	3601	5100	17,5%
Stationary combustion : Other Sectors: Commercial/Institutional, gase	A1triang	CO2	1,4%	2,0%	0,2%	1,7%	2,4%	0,4%	4424	395	3653	5206	17,9%
Stationary combustion : Other Sectors: Commercial/Institutional, gase	A2unif	CO2	1,4%	2,1%	0,2%	1,7%	2,4%	0,4%	4461	403	3678	5256	18,1%
Stationary combustion : Other Sectors, Residential, gase	basecase	CO2	0,6%	0,0%	0,3%	-0,6%	0,6%	0,6%	86	653	-1196	1362	1510,6%
Stationary combustion : Other Sectors, Residential, gase	A1triang	CO2	0,6%	0,1%	0,3%	-0,5%	0,7%	0,6%	213	674	-1117	1533	632,6%
Stationary combustion : Other Sectors, Residential, gase	A2unif	CO2	0,6%	0,1%	0,3%	-0,5%	0,8%	0,6%	277	685	-1060	1625	495,0%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gase	basecase	CO2	0,5%	-0,6%	0,2%	-1,1%	-0,1%	0,5%	-1271	541	-2330	-202	85,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gase	A1triang	CO2	0,5%	-0,6%	0,2%	-1,1%	-0,1%	0,5%	-1223	542	-2294	-158	88,7%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gase	A2unif	CO2	0,5%	-0,6%	0,3%	-1,0%	-0,1%	0,5%	-1201	546	-2269	-129	91,0%
Total CO2	**basecase**			9,4%	0,8%	7,8%	11,0%	1,6%	20399	1632	17204	23622	16,0%
Total CO2	**A1triang**			9,6%	0,9%	8,0%	11,3%	1,7%	20939	1735	17564	24345	16,6%
Total CO2	**A2unif**			9,8%	0,9%	8,0%	11,6%	1,8%	21204	1832	17607	24794	17,3%
Total Netherlands (CO2-eq.)	**basecase**		**3,3%**	**1,3%**	**2,3%**	**-3,3%**	**5,4%**	**4,5%**	**2647**	**5016**	**-7582**	**11513**	**379,0%**
Total Netherlands (CO2-eq.)	**A1triang**		**3,3%**	**1,5%**	**2,3%**	**-3,1%**	**5,7%**	**4,5%**	**3192**	**4970**	**-7092**	**12018**	**311,4%**
Total Netherlands (CO2-eq.)	**A2unif**		**3,3%**	**1,7%**	**2,3%**	**-3,0%**	**5,9%**	**4,5%**	**3528**	**4973**	**-6757**	**12466**	282,0%

SCENARIO B

Source category		Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Stationary combustion : Public Electricity and Heat Production: waste incineration	basecase	CO2	592	1 750	10,0%	5,0%	11,2%	592	33	529	658	11,2%	1750	97	1561	1942	11,1%
Stationary combustion : Public Electricity and Heat Production: waste incineration	B	CO2	592	1 750	10,0%	5,0%	11,2%	592	33	528	658	11,2%	1751	195	1383	2146	22,3%
Total CO2	**basecase**		**161 482**	**182 158**			**2,5%**	**161892**	**1787**	**158463**	**165466**	2,2%	**182291**	**1881**	**178649**	**186045**	2,1%
Total CO2	**B**		**161 482**	**182 158**			**2,5%**	**161874**	**1797**	**158440**	**165492**	2,2%	**182284**	**1876**	**178661**	**186017**	2,1%
Total Netherlands (CO2-eq.)	**basecase**		**216394**	**219845**			**4,5%**	**217322**	**5862**	**208046**	**230370**	5,4%	**219969**	**4456**	**212671**	**229940**	4,1%
Total Netherlands (CO2-eq.)	**B**		**216394**	**219845**			**4,5%**	**217297**	**5825**	**208159**	**230394**	5,4%	**219980**	**4482**	**212826**	**229872**	4,1%

	Scenario		TIER-1 trend uncertainty	Relative Trend (to 1990 emissions) (%) MEAN	STD	2,5%	97,5%	2-STD	Absolute Trend (CO2-eq) MEAN	STD	2,5%	97,5%	2-STD
Stationary combustion : Public Electricity and Heat Production: waste incineration	basecase	CO2	0,1%	0,5%	0,0%	0,4%	0,6%	0,1%	1157	103	958	1360	17,8%
Stationary combustion : Public Electricity and Heat Production: waste incineration	B	CO2	0,1%	0,5%	0,1%	0,4%	0,7%	0,2%	1159	198	783	1559	34,1%
Total CO2	**basecase**			9,4%	0,8%	7,8%	11,0%	1,6%	20399	1632	17204	23622	16,0%
Total CO2	**B**			9,4%	0,8%	7,8%	11,0%	1,7%	20410	1643	17165	23605	16,1%
Total Netherlands (CO2-eq.)	**basecase**		**3,3%**	**1,3%**	**2,3%**	**-3,3%**	**5,4%**	**4,5%**	**2647**	**5016**	**-7582**	**11513**	**379,0%**
Total Netherlands (CO2-eq.)	**B**		**3,3%**	1,3%	2,3%	-3,4%	5,4%	4,5%	2682	4981	-7623	11401	371,4%

SCENARIO C

Source category		Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Stationary combustion : Petroleum Refining: liquids	basecase	CO2	9 999	9 556	10,0%	10,0%	14,1%	10002	705	8651	11414	14,1%	9556	678	8259	10915	14,2%
Stationary combustion : Petroleum Refining: liquids	C	CO2	9 999	9 556	10,0%	10,0%	14,1%	9998	709	8651	11433	14,2%	9553	1069	7517	11711	22,4%
Total CO2	**basecase**		**161 482**	**182 158**			**2,5%**	**161892**	**1787**	**158463**	**165466**	2,2%	**182291**	**1881**	**178649**	**186045**	2,1%
Total CO2	**C**		**161 482**	**182 158**			**2,5%**	**161865**	**1795**	**158429**	**165460**	2,2%	**182270**	**2048**	**178358**	**186357**	2,2%
Total Netherlands (CO2-eq.)	**basecase**		**216394**	**219845**			**4,5%**	**217322**	**5862**	**208046**	**230370**	5,4%	**219969**	**4456**	**212671**	**229940**	4,1%
Total Netherlands (CO2-eq.)	**C**		**216394**	**219845**			**4,5%**	**217308**	**5794**	**208140**	**230505**	5,3%	**220001**	**4566**	**212457**	**230053**	4,2%

	Scenario		TIER-1 trend uncertainty	Relative Trend (to 1990 emissions) (%) MEAN	STD	2,5%	97,5%	2-STD	Absolute Trend (CO2-eq) MEAN	STD	2,5%	97,5%	2-STD
Stationary combustion : Petroleum Refining: liquids	basecase	CO2	0,6%	-0,2%	0,4%	-1,0%	0,6%	0,8%	-445	843	-2114	1209	378,7%
Stationary combustion : Petroleum Refining: liquids	C	CO2	0,6%	-0,2%	0,5%	-1,2%	0,8%	1,0%	-445	1081	-2531	1714	485,7%
Total CO2	**basecase**			9,4%	0,8%	7,8%	11,0%	1,6%	20399	1632	17204	23622	16,0%
Total CO2	**C**			9,4%	0,9%	7,7%	11,1%	1,8%	20405	1772	16914	23885	17,4%
Total Netherlands (CO2-eq.)	**basecase**		3,3%	1,3%	2,3%	-3,3%	5,4%	4,5%	2647	5016	-7582	11513	379,0%
Total Netherlands (CO2-eq.)	**C**		3,3%	1,3%	2,2%	-3,3%	5,5%	4,5%	2693	4948	-7579	11591	367,4%

SCENARIO D

Source category		Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Fugitive emissions from oil and gas operations: gas distribution	basecase	CH4	255	268	2,0%	50,0%	50,0%	255	46	164	346	36,5%	269	54	164	374	39,9%
Fugitive emissions from oil and gas operations: gas distribution	D	CH4	255	268	2,0%	50,0%	50,0%	238	46	147	323	38,7%	251	53	146	347	42,3%
Total CH4	**basecase**		**25 437**	**17 453**			**18,0%**	**25468**	**2373**	**21060**	**30883**	18,6%	**17440**	**1315**	**15051**	**20249**	15,1%
Total CH4	**D**		**25 437**	**17 453**			**18,0%**	**25450**	**2360**	**21017**	**30911**	18,5%	**17422**	**1314**	**15006**	**20242**	15,1%
Total Netherlands (CO2-eq.)	**basecase**		**216394**	**219845**			**4,5%**	**217322**	**5862**	**208046**	**230370**	5,4%	**219969**	**4456**	**212671**	**229940**	4,1%
Total Netherlands (CO2-eq.)	**D**		**216394**	**219845**			**4,5%**	**217282**	**5832**	**208044**	**230295**	5,4%	**219943**	**4461**	**212651**	**229735**	4,1%

	Scenario		TIER-1 trend uncertainty	Relative Trend (to 1990 emissions) (%) MEAN	STD	2,5%	97,5%	2-STD	Absolute Trend (CO2-eq) MEAN	STD	2,5%	97,5%	2-STD
Fugitive emissions from oil and gas operations: gas distribution	basecase	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	14	14	-13	42	201,3%
Fugitive emissions from oil and gas operations: gas distribution	D	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	13	14	-14	39	211,7%
Total CH4	**basecase**			-3,7%	1,1%	-6,1%	-1,6%	2,2%	-8028	2453	-13451	-3390	61,1%
Total CH4	**D**			-3,7%	1,1%	-6,1%	-1,6%	2,2%	-8028	2439	-13475	-3383	60,8%
Total Netherlands (CO2-eq.)	**basecase**		3,3%	1,3%	2,3%	-3,3%	5,4%	4,5%	2647	5016	-7582	11513	379,0%
Total Netherlands (CO2-eq.)	**D**		3,3%	1,3%	2,3%	-3,4%	5,4%	4,5%	2661	5004	-7702	11502	376,1%

SCENARIO E

Source category		Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Stationary combustion : Public Electricity and Heat Production: solids	basecase	N2O	101	97	1,0%	200,0%	200,0%	101	101	14	365	200,4%	98	98	13	350	200,2%
Stationary combustion : Public Electricity and Heat Production: solids	E	N2O	101	97	1,0%	200,0%	200,0%	135	63	28	264	93,6%	130	61	27	255	94,0%
Emissions from stationary combustion: non-CO2	basecase	N2O	215	238	3,0%	50,0%	50,1%	214	104	110	481	96,7%	239	102	130	498	85,8%
Emissions from stationary combustion: non-CO2	E	N2O	215	238	3,0%	50,0%	50,1%	248	67	133	386	54,1%	271	68	154	410	50,2%
Total N2O	**basecase**		**21 226**	**17 992**			**45,0%**	**21231**	**4961**	**14607**	**32998**	46,7%	**17985**	**3779**	**12521**	**26947**	42,0%
Total N2O	**E**		**21 226**	**17 992**			**45,0%**	**21259**	**4919**	**14629**	**33027**	46,3%	**18011**	**3781**	**12593**	**26819**	42,0%
Total Netherlands (CO2-eq.)	**basecase**		**216394**	**219845**			**4,5%**	**217322**	**5862**	**208046**	**230370**	5,4%	**219969**	**4456**	**212671**	**229940**	4,1%
Total Netherlands (CO2-eq.)	**E**		**216394**	**219845**			**4,5%**	**217327**	**5814**	**208072**	**230437**	5,4%	**219972**	**4460**	**212735**	**229801**	4,1%

	Scenario		TIER-1 trend uncertainty	Relative Trend (to 1990 emissions) (%) MEAN	STD	2,5%	97,5%	2-STD	Absolute Trend (CO2-eq) MEAN	STD	2,5%	97,5%	2-STD
Emissions from stationary combustion: non-CO2	basecase	N2O	0,0%	0,0%	0,0%	-0,1%	0,1%	0,1%	24	82	-141	180	678,0%
Emissions from stationary combustion: non-CO2	E	N2O	0,0%	0,0%	0,0%	0,0%	0,1%	0,0%	23	49	-73	120	429,5%
Total N2O	**basecase**			-1,5%	1,7%	-5,1%	1,5%	3,4%	-3245	3898	-11493	3174	240,3%
Total N2O	**E**			-1,5%	1,7%	-5,2%	1,5%	3,4%	-3247	3854	-11747	3148	237,4%
Total Netherlands (CO2-eq.)	**basecase**		3,3%	1,3%	2,3%	-3,3%	5,4%	4,5%	2647	5016	-7582	11513	379,0%
Total Netherlands (CO2-eq.)	**E**		3,3%	1,3%	2,2%	-3,3%	5,4%	4,5%	2645	4958	-7578	11416	374,9%

SCENARIO F1

Source category	Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	206	2 230	0,5%	10,0%	10,0%	206	10	186	227	10,0%	2230	111	2013	2446	10,0%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	25 776	27 004	1,0%	3,0%	3,2%	25777	333	25124	26425	2,6%	27004	476	26077	27944	3,5%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	13 184	25 174	0,5%	1,0%	1,1%	13184	73	13040	13327	1,1%	25175	139	24903	25448	1,1%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	592	1 750	10,0%	5,0%	11,2%	592	33	529	659	11,2%	1750	98	1562	1945	11,2%
Stationary combustion : Petroleum Refining: liquids	CO2	9 999	9 556	10,0%	10,0%	14,1%	9999	710	8643	11413	14,2%	9556	675	8264	10913	14,1%
Stationary combustion : Petroleum Refining: gases	CO2	1 029	2 239	0,5%	1,0%	1,1%	1029	6	1018	1041	1,1%	2239	12	2215	2264	1,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0	1	20,0%	2,0%	20,1%						1	0	1	1	20,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	1 401	1 953	20,0%	5,0%	20,6%	1401	145	1120	1688	20,7%	1953	201	1561	2348	20,6%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	8 788	7 502	1,0%	5,0%	5,1%	8787	225	8347	9231	5,1%	7503	191	7130	7880	5,1%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	5 195	4 384	2,0%	10,0%	10,2%	5033	257	4527	5535	10,2%	4326	305	3730	4927	14,1%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	18 785	15 212	2,0%	1,0%	2,2%	18785	210	18376	19200	2,2%	15213	170	14882	15549	2,2%
Stationary combustion : Other Sectors, solids	CO2	189	134	50,0%	5,0%	50,2%	189	48	96	284	50,4%	134	34	68	202	50,5%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	6 571	10 921	20,0%	1,0%	20,0%	6572	206	6171	6978	6,3%	10924	330	10286	11578	6,0%
Stationary combustion : Other Sectors, Residential, gases	CO2	18 466	18 555	5,0%	1,0%	5,1%	18469	472	17549	19395	5,1%	18557	471	17642	19485	5,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	8 226	6 955	10,0%	1,0%	10,0%	8227	413	7422	9041	10,0%	6955	349	6269	7642	10,0%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	2 522	2 656	20,0%	2,0%	20,1%	2522	254	2024	3019	20,1%	2657	266	2138	3181	20,1%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	1 479	451	20,0%	2,0%	20,1%	1482	107	1278	1695	14,4%	452	35	384	521	15,4%
Military use of fuels (1A5 Other)	CO2	566	437	20,0%	2,0%	20,1%	566	57	454	679	20,2%	437	44	351	524	20,3%
Mobile combustion: road vehicles: gasoline	CO2	10 902	13 168	2,0%	0,4%	2,0%	10902	110	10686	11119	2,0%	13169	134	12906	13432	2,0%
Mobile combustion: road vehicles: diesel oil	CO2	11 832	19 542	5,0%	0,2%	5,0%	11831	297	11256	12416	5,0%	19539	488	18578	20504	5,0%
Mobile combustion: road vehicles: LPG	CO2	2 738	1 131	10,0%	0,2%	10,0%	2737	137	2467	3007	10,0%	1131	57	1019	1242	10,0%
Mobile combustion: water-borne navigation	CO2	403	580	20,0%	0,2%	20,0%	403	40	325	482	19,9%	580	58	466	694	20,0%
Mobile combustion: aircraft	CO2	41	41	50,0%	0,5%	50,0%	41	7	27	56	35,9%	41	7	26	56	36,2%
Mobile combustion: other	CO2	91	109	50,0%	0,2%	50,0%	91	2	86	95	5,0%	109	3	104	115	5,0%
CO2 from coke production	CO2	403	509	50,0%	2,0%	5,0%	403	100	207	601	49,8%	509	128	259	762	50,2%
Fugitive emissions venting/flaring: CO2	CO2	769	110	50,0%	2,0%	50,0%	769	88	598	941	22,8%	110	5	100	121	9,3%
Cement production	CO2	507	434	5,0%	10,0%	11,2%	507	28	453	563	11,2%	434	24	387	482	11,1%
Limestone and dolomite use	CO2	440	563	25,0%	5,0%	25,5%	580	129	377	868	44,5%	748	165	488	1115	44,2%
Other minerals	CO2	269	358	25,0%	5,0%	25,5%	270	34	203	338	25,4%	358	45	269	447	25,3%
Ammonia production	CO2	3 058	3 048	2,0%	1,0%	2,2%	3058	34	2992	3125	2,2%	3048	34	2981	3114	2,2%
Other chemical product manufacture	CO2	588	606	50,0%	50,0%	70,7%										
Iron and steel production (carbon inputs)	CO2	2 514	1 105	3,0%	5,0%	5,8%	2515	73	2373	2660	5,8%	1105	32	1043	1168	5,8%
CO2 from aluminium production	CO2	395	479	2,0%	5,0%	5,4%	395	11	374	416	5,4%	479	13	453	504	5,4%
Other industrial: CO2	CO2	347	342	5,0%	20,0%	20,6%										
Indirect CO2 from solvents/product use	CO2	316	160	25,0%	10,0%	26,9%										
5A1. Forest Land remaining Forest Land	CO2	-2 505	-2 289	25,0%	61,8%	67,0%	-2504	483	-3514	-1628	38,5%	-2288	476	-3282	-1422	-41,6%
5A2. Land converted to Forest Land	CO2	-89	-342	25,0%	57,9%	63,0%	-89	21	-134	-50	47,9%	-342	92	-534	-174	-54,1%
5B2. Land converted to Cropland	CO2	-35	-35	25,0%	50,0%	55,9%	-35	10	-56	-17	56,4%	-35	10	-56	-17	-56,4%
5C1. Grassland remaining Grassland	CO2	4 246	4 246	25,0%	50,0%	55,9%	4251	1190	2060	6741	56,0%	4243	1195	2063	6761	56,3%
5C2. Land converted to Grassland	CO2	536	536	25,0%	61,2%	66,1%	537	288	-8	1123	107,2%	537	288	-8	1123	107,2%
5E2. Land converted to Settlements	CO2	-151	-151	25,0%	50,0%	55,9%	-151	42	-239	-73	56,2%	-151	42	-239	-73	-56,2%
5F2. Land converted to Other Land	CO2	710	710	25,0%	50,0%	55,9%	710	200	343	1127	56,4%	710	200	343	1127	56,4%
5G. Other (liming of soils)	CO2	183	86	25,0%	1,0%	25,0%	183	11	162	205	12,0%	86	11	65	108	25,2%
Total CO2		**161 482**	**182 158**			2,5%	**161878**	**1795**	**158440**	**165450**	2,2%	**182288**	**1867**	**178712**	**186032**	2,0%
						-> 5%										

SCENARIO F1

Source category	Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Emissions from stationary combustion: non-CO2	CH4	518	557	3,0%	50,0%	50,1%	517	87	349	691	33,7%	557	88	385	732	31,7%
Mobile combustion: other	CH4	1	1	50,0%	100,0%	111,8%	1	1	0	2	101,9%	1	0	0	2	88,9%
Mobile combustion: road vehicles	CH4	157	67	3,0%	60,0%	60,1%	157	50	84	276	63,8%	67	118	295	756	354,1%
Fugitive emissions venting/flaring	CH4	1 252	299	2,0%	25,0%	25,1%	1253	148	964	1543	23,6%	300	35	231	369	23,6%
Fugitive emissions from oil and gas operations: gas distribution	CH4	255	268	2,0%	50,0%	50,0%	256	46	165	348	36,4%	270	54	165	375	39,8%
Fugitive emissions from oil and gas operations: other	CH4	162	149	20,0%	50,0%	53,9%	162	34	99	232	41,9%	149	33	87	216	44,4%
Other industrial: CH4	CH4	297	309	10,0%	50,0%	51,0%										
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	6 767	5 688	5,0%	20,0%	20,6%	6764	697	5401	8147	20,6%	5688	587	4547	6842	20,6%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	439	351	5,0%	50,0%	50,2%	439	110	223	655	50,2%	350	88	178	523	50,3%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	319	286	5,0%	30,0%	30,4%	319	44	234	406	27,6%	286	33	221	351	23,1%
Emissions from manure management : cattle	CH4	1 574	1 421	10,0%	100,0%	100,5%	1576	793	558	3561	100,6%	1418	710	500	3197	100,1%
Emissions from manure management : swine	CH4	1 141	919	10,0%	100,0%	100,5%	1143	573	408	2581	100,3%	920	458	326	2072	99,5%
Emissions from manure management : poultry	CH4	243	69	10,0%	100,0%	100,5%	242	121	85	547	100,2%	69	35	24	156	101,0%
Emissions from manure management : other	CH4	12	16	10,0%	100,0%	100,5%	12	4	6	21	69,4%	16	5	8	29	66,7%
CH4 emissions from solid waste disposal sites	CH4	12 011	6 775	30,0%	15,0%	33,5%	12012	1763	9262	14981	29,4%	6759	684	5677	7915	20,2%
Emissions from wastewater handling	CH4	290	206	20,0%	25,0%	32,0%	290	142	28	588	98,2%	206	173	-112	564	167,8%
OTHER CH4	CH4	1	72	20,0%	25,0%	32,0%	1	0	1	1	25,1%	73	12	51	97	32,2%
Total CH4		**25 437**	**17 453**			**18%**	**25460**	**2371**	**21031**	**30915**	18,6%	**17440**	**1305**	**15050**	**20217**	15,0%
						-> 25%										
Emissions from stationary combustion: non-CO2	N2O	215	238	3,0%	50,0%	50,1%	214	103	111	477	96,3%	238	101	130	500	84,7%
Mobile combustion: other	N2O	1	2	50,0%	100,0%	111,8%	1	1	0	2	101,9%	2	1	1	4	90,9%
Mobile combustion: road vehicles	N2O	271	485	5,0%	50,0%	50,2%	271	63	169	418	46,8%	485	118	295	756	48,7%
Nitric acid production	N2O	6 330	5 617	10,0%	50,0%	51,0%	6345	1620	3197	9549	51,1%	5628	1437	2837	8504	51,1%
Caprolactam production	N2O	1 240	759	50,0%	50,0%	70,7%	1241	446	480	2218	71,9%	761	273	296	1361	71,7%
Other industrial: N2O	N2O	3	7	50,0%	50,0%	70,7%										
Indirect N2O from non-agricultural sources	N2O	52	56	50,0%	200,0%	206,2%	52	54	6	198	207,0%	56	58	7	212	206,1%
Indirect N2O from NO2 from combustion and industrial processes	N2O	883	637	15,0%	200,0%	200,6%	881	884	121	3209	200,6%	636	637	89	2321	200,0%
Emissions from manure management	N2O	694	710	10,0%	100,0%	100,5%	692	272	317	1357	78,5%	710	299	311	1457	84,1%
Direct N2O emissions from agricultural soils	N2O	4 597	4 941	10,0%	60,0%	60,8%	4604	1409	2539	7983	61,2%	4938	1592	2654	8815	64,5%
Indirect N2O emissions from nitrogen used in agriculture	N2O	4 861	3 298	50,0%	200,0%	206,2%	4883	4253	968	16013	174,2%	3299	3065	614	11108	185,8%
Animal production on agricultural soils	N2O	1 308	704	10,0%	100,0%	100,5%	1309	657	459	2978	100,4%	703	355	249	1598	100,9%
5A1. Forest Land remaining Forest Land	N2O	7	7	25,0%	20,0%	32,0%										
Emissions from wastewater handling	N2O	513	397	20,0%	50,0%	53,9%	513	94	332	700	36,7%	397	78	249	553	39,2%
OTHER N2O	N2O	250	133	20,0%	50,0%	53,9%	251	55	147	364	44,1%	134	19	97	171	28,6%
Total N2O		**21 226**	**17 992**			**45%**	**21268**	**4922**	**14635**	**33203**	46,3%	**18002**	**3841**	**12555**	**26781**	42,7%
						-> 50%										
SF6 emissions from SF6 use	SF6	301	324	50,0%	25,0%	55,9%										
PFC from aluminium production	PFC	1 901	106	2,0%	20,0%	20,1%	1900	158	1590	2209	16,7%	106	9	88	123	17,1%
PFC emissions from PFC use	PFC	37	179	5,0%	25,0%	25,5%										
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC	240	1 179	10,0%	50,0%	51,0%										
HFC-23 emissions from HCFC-22 manufacture	HFC	5 759	354	10,0%	10,0%	14,1%										
HFC by-product emissions from HFC manufacture	HFC	12	99	10,0%	20,0%	22,4%										
Total F-gases		**8 250**	**2 242**			**28%**	**8730**	**924**	**7147**	**10610**	21,2%	**2256**	**318**	**1631**	**2875**	28,2%
		-> 50% for HFCs ,PFCs and SF6														
Total Netherlands (CO2-eq.)		**216394**	**219845**			**4,5%**	**217336**	**5810**	**208089**	**230425**	5,3%	**219985**	**4486**	**212689**	**229747**	4,1%
						-> 6%										

SCENARIO F1

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	**Gas**	**TIER-1 trend unc.**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	0,1%	0,9%	0,1%	0,8%	1,0%	0,1%	2024	104	1821	2225	10,2%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	0,2%	0,6%	0,2%	0,3%	0,9%	0,3%	1227	345	559	1906	56,3%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	0,1%	5,5%	0,1%	5,2%	5,8%	0,3%	11991	92	11810	12172	1,5%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	0,1%	0,5%	0,0%	0,4%	0,6%	0,1%	1158	104	956	1363	17,9%
Stationary combustion : Petroleum Refining: liquids	CO2	0,6%	-0,2%	0,4%	-0,9%	0,5%	0,7%	-443	772	-1950	1074	349,0%
Stationary combustion : Petroleum Refining: gases	CO2	0,0%	0,6%	0,0%	0,5%	0,6%	0,0%	1210	9	1193	1226	1,4%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2											
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	0,3%	0,3%	0,1%	0,0%	0,5%	0,2%	552	241	79	1025	87,3%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	0,1%	-0,6%	0,1%	-0,7%	-0,4%	0,1%	-1283	159	-1595	-973	24,8%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	0,1%	-0,3%	0,1%	-0,5%	-0,1%	0,2%	-707	214	-1125	-286	60,7%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	0,2%	-1,6%	0,1%	-1,9%	-1,4%	0,2%	-3573	242	-4047	-3098	13,5%
Stationary combustion : Other Sectors, solids	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-55	58	-170	59	212,1%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	1,4%	2,0%	0,2%	1,6%	2,4%	0,4%	4352	385	3601	5109	17,7%
Stationary combustion : Other Sectors, Residential, gases	CO2	0,6%	0,0%	0,3%	-0,6%	0,6%	0,6%	88	658	-1201	1374	1492,3%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	0,5%	-0,6%	0,2%	-1,1%	-0,1%	0,5%	-1271	538	-2324	-221	84,7%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	0,3%	0,1%	0,2%	-0,3%	0,4%	0,3%	135	367	-583	857	543,2%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	0,1%	-0,5%	0,1%	-0,6%	-0,4%	0,1%	-1031	112	-1254	-815	21,8%
Military use of fuels (1A5 Other)	CO2	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-130	72	-271	13	110,8%
Mobile combustion: road vehicles: gasoline	CO2	0,2%	1,0%	0,1%	0,9%	1,2%	0,2%	2267	171	1934	2601	15,1%
Mobile combustion: road vehicles: diesel oil	CO2	0,6%	3,5%	0,3%	3,0%	4,1%	0,6%	7709	569	6589	8827	14,8%
Mobile combustion: road vehicles: LPG	CO2	0,1%	-0,7%	0,1%	-0,9%	-0,6%	0,1%	-1606	149	-1897	-1314	18,5%
Mobile combustion: water-borne navigation	CO2	0,1%	0,1%	0,0%	0,0%	0,1%	0,1%	176	70	38	315	79,9%
Mobile combustion: aircraft	CO2											
Mobile combustion: other	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	18	4	11	25	38,5%
CO2 from coke production	CO2	0,2%	0,0%	0,1%	-0,1%	0,2%	0,1%	106	163	-212	424	307,3%
Fugitive emissions venting/flaring: CO2	CO2	0,0%	-0,3%	0,0%	-0,4%	-0,2%	0,1%	-659	88	-831	-487	26,7%
Cement production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-73	17	-107	-40	46,8%
Limestone and dolomite use	CO2	0,1%	0,1%	0,1%	-0,1%	0,2%	0,1%	168	150	-114	486	178,8%
Other minerals	CO2	0,1%	0,0%	0,0%	0,0%	0,1%	0,1%	88	56	-21	197	127,2%
Ammonia production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-10	43	-95	74	855,1%
Other chemical product manufacture	CO2											
Iron and steel production (carbon inputs)	CO2	0,0%	-0,6%	0,0%	-0,7%	-0,6%	0,1%	-1410	62	-1533	-1291	8,7%
CO2 from aluminium production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	84	7	71	97	15,6%
Other industrial: CO2	CO2											
Indirect CO2 from solvents/product use	CO2											
5A1. Forest Land remaining Forest Land	CO2	0,4%	0,1%	0,2%	-0,3%	0,5%	0,4%	216	466	-709	1132	430,9%
5A2. Land converted to Forest Land	CO2	0,1%	-0,1%	0,0%	-0,2%	0,0%	0,1%	-253	88	-436	-93	69,4%
5B2. Land converted to Cropland	CO2											
5C1. Grassland remaining Grassland	CO2											
5C2. Land converted to Grassland	CO2											
5E2. Land converted to Settlements	CO2											
5F2. Land converted to Other Land	CO2											
5G. Other (liming of soils)	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-97	15	-127	-66	31,9%
Total CO2			9,4%	0,8%	7,9%	10,9%	1,5%	20410	1526	17412	23395	15,0%

SCENARIO F1

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	**Gas**	**TIER-1 trend unc.**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Emissions from stationary combustion: non-CO2	CH4	0,0%	0,0%	0,0%	0,0%	0,1%	0,1%	40	63	-85	163	315,1%
Mobile combustion: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0	0	0	1	93,6%
Mobile combustion: road vehicles	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-90	37	-179	-36	81,9%
Fugitive emissions venting/flaring	CH4	0,1%	-0,4%	0,1%	-0,6%	-0,3%	0,1%	-953	124	-1196	-712	25,9%
Fugitive emissions from oil and gas operations: gas distribution	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	14	14	-13	42	198,5%
Fugitive emissions from oil and gas operations: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-13	29	-71	43	439,6%
Other industrial: CH4	CH4											
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	0,2%	-0,5%	0,2%	-0,9%	0,0%	0,5%	-1076	503	-2068	-96	93,6%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-89	51	-190	10	115,3%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-33	16	-66	-4	93,9%
Emissions from manure management : cattle	CH4	0,1%	-0,1%	0,3%	-0,6%	0,4%	0,5%	-158	566	-1381	907	716,3%
Emissions from manure management : swine	CH4	0,1%	-0,1%	0,1%	-0,4%	0,1%	0,2%	-223	271	-873	205	242,9%
Emissions from manure management : poultry	CH4	0,1%	-0,1%	0,0%	-0,2%	0,0%	0,1%	-173	99	-423	-48	114,6%
Emissions from manure management : other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5	3	-1	12	140,9%
CH4 emissions from solid waste disposal sites	CH4	1,4%	-2,4%	0,6%	-3,7%	-1,3%	1,2%	-5247	1278	-7936	-2909	48,7%
Emissions from wastewater handling	CH4	0,0%	0,0%	0,1%	-0,2%	0,1%	0,2%	-84	168	-405	252	400,2%
OTHER CH4	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	72	12	50	96	32,4%
Total CH4			-3,7%	1,0%	-6,0%	-1,7%	2,1%	-8021	2327	-13331	-3553	58,0%
Emissions from stationary combustion: non-CO2	N2O	0,0%	0,0%	0,0%	0,0%	0,1%	0,0%	24	54	-83	126	450,3%
Mobile combustion: other	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	0	2	90,3%
Mobile combustion: road vehicles	N2O	0,1%	0,1%	0,0%	0,0%	0,2%	0,1%	214	86	74	410	80,2%
Nitric acid production	N2O	0,4%	-0,3%	0,2%	-0,8%	0,1%	0,4%	-717	472	-1740	112	131,6%
Caprolactam production	N2O	0,3%	-0,2%	0,2%	-0,6%	0,1%	0,4%	-480	394	-1320	231	164,3%
Other industrial: N2O	N2O											
Indirect N2O from non-agricultural sources	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	4	27	-45	62	1331,9%
Indirect N2O from NO2 from combustion and industrial processes	N2O	0,3%	-0,1%	0,1%	-0,4%	0,0%	0,2%	-245	271	-953	-24	221,2%
Emissions from manure management	N2O	0,0%	0,0%	0,2%	-0,4%	0,4%	0,4%	18	403	-768	867	4457,2%
Direct N2O emissions from agricultural soils	N2O	0,3%	0,2%	0,6%	-0,9%	1,4%	1,1%	335	1241	-2004	2972	741,7%
Indirect N2O emissions from nitrogen used in agriculture	N2O	1,9%	-0,7%	1,2%	-3,6%	0,9%	2,4%	-1584	2739	-8106	2018	346,0%
Animal production on agricultural soils	N2O	0,3%	-0,3%	0,2%	-0,7%	-0,1%	0,4%	-606	386	-1598	-120	127,3%
5A1. Forest Land remaining Forest Land	N2O											
Emissions from wastewater handling	N2O	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-116	94	-300	69	161,9%
OTHER N2O	N2O	0,0%	-0,1%	0,0%	-0,1%	0,0%	0,0%	-117	44	-209	-36	75,9%
Total N2O			-1,5%	1,4%	-4,5%	0,8%	2,7%	-3266	3147	-10229	1642	192,7%
SF6 emissions from SF6 use	SF6											
PFC from aluminium production	PFC	0,2%	-0,8%	0,1%	-1,0%	-0,7%	0,1%	-1795	152	-2092	-1498	16,9%
PFC emissions from PFC use	PFC											
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC											
HFC-23 emissions from HCFC-22 manufacture	HFC	0,3%	-2,7%	0,4%	-3,5%	-2,0%	0,8%	-5869	898	-7718	-4342	30,6%
HFC by-product emissions from HFC manufacture	HFC											
Total F-gases			-3,0%	0,4%	-3,9%	-2,2%	0,9%	-6474	977	-8450	-4747	30,2%
	-> 50% f											
Total Netherlands (CO2-eq.)		**3,3%**	**1,3%**	**2,0%**	**-2,8%**	**4,8%**	**3,9%**	**2649**	**4323**	**-6468**	**10296**	**326,4%**

SCENARIO F2

							1990					2004				
Source category	**Gas**	**Tier 1 CO2-eq. 90/95**	**Tier 1 CO2-eq. 2004**	**Tier 1 AD unc**	**Tier 1 EF unc**	**Tier 1 EM unc**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	206	2 230	0,5%	10,0%	10,0%	206	10	186	250	10,0%	2230	112	2011	2645	10,0%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	25 776	27 004	1,0%	3,0%	3,2%	25776	335	25123	27146	2,6%	27002	471	26077	29002	3,5%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	13 184	25 174	0,5%	1,0%	1,1%	13185	74	13040	13502	1,1%	25175	141	24901	25815	1,1%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	592	1 750	10,0%	5,0%	11,2%	592	33	528	755	11,2%	1749	98	1559	2158	11,2%
Stationary combustion : Petroleum Refining: liquids	CO2	9 999	9 556	10,0%	10,0%	14,1%	9999	708	8647	13329	14,2%	9552	676	8260	12785	14,1%
Stationary combustion : Petroleum Refining: gases	CO2	1 029	2 239	0,5%	1,0%	1,1%	1029	6	1018	1053	1,1%	2239	13	2214	2295	1,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0	1	20,0%	2,0%	20,1%						1	0	1	1	20,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	1 401	1 953	20,0%	5,0%	20,6%	1401	146	1117	2045	20,8%	1952	202	1562	2841	20,6%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	8 788	7 502	1,0%	5,0%	5,1%	8788	224	8348	9720	5,1%	7502	192	7125	8272	5,1%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	5 195	4 384	2,0%	10,0%	10,2%	5031	258	4524	6072	10,3%	4324	307	3721	5512	14,2%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	18 785	15 212	2,0%	1,0%	2,2%	18785	211	18374	19736	2,2%	15212	170	14880	15937	2,2%
Stationary combustion : Other Sectors, solids	CO2	189	134	50,0%	5,0%	50,2%	189	48	95	394	50,4%	134	34	68	266	50,1%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	6 571	10 921	20,0%	1,0%	20,0%	6574	208	6175	7458	6,3%	10923	329	10288	12395	6,0%
Stationary combustion : Other Sectors, Residential, gases	CO2	18 466	18 555	5,0%	1,0%	5,1%	18465	473	17536	20342	5,1%	18556	474	17623	20558	5,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	8 226	6 955	10,0%	1,0%	10,0%	8226	415	7414	10008	10,1%	6956	351	6266	8420	10,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	2 522	2 656	20,0%	2,0%	20,1%	2522	252	2028	3572	20,0%	2655	267	2131	3797	20,1%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	1 479	451	20,0%	2,0%	20,1%	1483	107	1277	1938	14,4%	452	35	385	620	15,5%
Military use of fuels (1A5 Other)	CO2	566	437	20,0%	2,0%	20,1%	567	57	455	800	20,2%	437	44	351	613	20,1%
Mobile combustion: road vehicles: gasoline	CO2	10 902	13 168	2,0%	0,4%	2,0%	10903	111	10686	11400	2,0%	13168	136	12903	13723	2,1%
Mobile combustion: road vehicles: diesel oil	CO2	11 832	19 542	5,0%	0,2%	5,0%	11831	295	11248	13052	5,0%	19543	489	18582	21717	5,0%
Mobile combustion: road vehicles: LPG	CO2	2 738	1 131	10,0%	0,2%	10,0%	2737	137	2468	3353	10,0%	1131	56	1020	1355	10,0%
Mobile combustion: water-borne navigation	CO2	403	580	20,0%	0,2%	20,0%	403	40	325	577	19,9%	580	58	467	821	20,0%
Mobile combustion: aircraft	CO2	41	41	50,0%	0,5%	50,0%	41	7	26	70	36,2%	41	7	26	70	36,2%
Mobile combustion: other	CO2	91	109	50,0%	0,2%	50,0%	91	2	86	101	5,0%	109	3	104	120	5,0%
CO2 from coke production	CO2	403	509	50,0%	2,0%	5,0%	403	101	205	796	49,9%	509	128	261	1040	50,1%
Fugitive emissions venting/flaring: CO2	CO2	769	110	50,0%	2,0%	50,0%	769	87	597	1137	22,7%	110	5	100	133	9,3%
Cement production	CO2	507	434	5,0%	10,0%	11,2%	507	28	453	635	11,2%	434	24	387	532	11,2%
Limestone and dolomite use	CO2	440	563	25,0%	5,0%	25,5%	579	130	377	1238	44,8%	748	166	488	1503	44,3%
Other minerals	CO2	269	358	25,0%	5,0%	25,5%	270	35	203	413	25,6%	358	46	268	572	25,6%
Ammonia production	CO2	3 058	3 048	2,0%	1,0%	2,2%	3058	34	2991	3209	2,2%	3048	34	2981	3190	2,2%
Other chemical product manufacture	CO2	588	606	50,0%	50,0%	70,7%										
Iron and steel production (carbon inputs)	CO2	2 514	1 105	3,0%	5,0%	5,8%	2514	73	2373	2813	5,8%	1104	32	1042	1233	5,8%
CO2 from aluminium production	CO2	395	479	2,0%	5,0%	5,4%	395	11	374	438	5,4%	479	13	453	532	5,4%
Other industrial: CO2	CO2	347	342	5,0%	20,0%	20,6%										
Indirect CO2 from solvents/product use	CO2	316	160	25,0%	10,0%	26,9%										
5A1. Forest Land remaining Forest Land	CO2	-2 505	-2 289	25,0%	61,8%	67,0%	-2504	483	-3519	-580	38,6%	-2289	478	-3286	-693	41,7%
5A2. Land converted to Forest Land	CO2	-89	-342	25,0%	57,9%	63,0%	-89	21	-134	-10	48,2%	-342	92	-536	-33	53,9%
5B2. Land converted to Cropland	CO2	-35	-35	25,0%	50,0%	55,9%	-35	10	-56	-1	56,2%	-35	10	-56	-1	56,2%
5C1. Grassland remaining Grassland	CO2	4 246	4 246	25,0%	50,0%	55,9%	4254	1194	2060	10366	56,2%	4244	1190	2066	10559	56,1%
5C2. Land converted to Grassland	CO2	536	536	25,0%	61,2%	66,1%	537	289	-9	2123	107,7%	537	289	-9	2123	107,7%
5E2. Land converted to Settlements	CO2	-151	-151	25,0%	50,0%	55,9%	-152	43	-240	5	56,1%	-152	43	-240	5	56,1%
5F2. Land converted to Other Land	CO2	710	710	25,0%	50,0%	55,9%	710	200	345	1711	56,2%	710	200	345	1711	56,2%
5G. Other (liming of soils)	CO2	183	86	25,0%	1,0%	25,0%	183	11	162	229	12,0%	86	11	65	130	25,1%
Total CO2		**161 482**	**182 158**			**2,5%**	**161874**	**1791**	**158394**	**171525**	2,2%	**182273**	**1875**	**178655**	**191214**	2,1%
						-> 5%										

SCENARIO F2

Source category	Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Emissions from stationary combustion: non-CO2	CH4	518	557	3,0%	50,0%	50,1%	517	87	350	1024	33,6%	557	88	386	941	31,6%
Mobile combustion: other	CH4	1	1	50,0%	100,0%	111,8%	1	1	0	6	101,6%	1	1	0	8	89,6%
Mobile combustion: road vehicles	CH4	157	67	3,0%	60,0%	60,1%	157	50	84	546	63,9%	67	22	34	284	66,7%
Fugitive emissions venting/flaring	CH4	1 252	299	2,0%	25,0%	25,1%	1253	148	965	1933	23,6%	299	35	231	442	23,5%
Fugitive emissions from oil and gas operations: gas distribution	CH4	255	268	2,0%	50,0%	50,0%	255	47	163	437	36,6%	268	54	163	489	40,1%
Fugitive emissions from oil and gas operations: other	CH4	162	149	20,0%	50,0%	53,9%	162	34	98	352	42,1%	149	34	86	340	45,2%
Other industrial: CH4	CH4	297	309	10,0%	50,0%	51,0%										
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	6 767	5 688	5,0%	20,0%	20,6%	6769	695	5422	10209	20,5%	5685	582	4555	8170	20,5%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	439	351	5,0%	50,0%	50,2%	440	110	223	883	50,2%	351	88	179	729	50,3%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	319	286	5,0%	30,0%	30,4%	319	44	233	516	27,5%	286	33	221	424	23,0%
Emissions from manure management : cattle	CH4	1 574	1 421	10,0%	100,0%	100,5%	1572	784	556	9103	99,8%	1428	717	502	9460	100,5%
Emissions from manure management : swine	CH4	1 141	919	10,0%	100,0%	100,5%	1145	574	405	6946	100,3%	920	464	323	5543	100,9%
Emissions from manure management : poultry	CH4	243	69	10,0%	100,0%	100,5%	242	122	85	1548	100,5%	69	34	24	463	100,1%
Emissions from manure management : other	CH4	12	16	10,0%	100,0%	100,5%	12	4	6	48	68,7%	16	5	8	74	66,6%
CH4 emissions from solid waste disposal sites	CH4	12 011	6 775	30,0%	15,0%	33,5%	12012	1763	9262	14981	29,4%	6759	684	5677	7915	20,2%
Emissions from wastewater handling	CH4	290	206	20,0%	25,0%	32,0%	290	142	27	973	98,1%	205	173	-115	945	168,7%
OTHER CH4	CH4	1	72	20,0%	25,0%	32,0%	1	0	1	2	25,0%	73	12	51	131	32,1%
Total CH4		**25 437**	**17 453**			**18%**	**25474**	**2367**	**21024**	**37928**	18,6%	**17441**	**1322**	**15036**	**26389**	15,2%
						-> 25%										
Emissions from stationary combustion: non-CO2	N2O	215	238	3,0%	50,0%	50,1%	214	102	111	2453	95,0%	239	104	130	3143	86,6%
Mobile combustion: other	N2O	1	2	50,0%	100,0%	111,8%	1	1	0	6	101,6%	2	1	1	11	90,8%
Mobile combustion: road vehicles	N2O	271	485	5,0%	50,0%	50,2%	271	63	169	727	46,6%	485	118	296	1377	48,7%
Nitric acid production	N2O	6 330	5 617	10,0%	50,0%	51,0%	6333	1619	3197	13095	51,1%	5620	1434	2845	12209	51,0%
Caprolactam production	N2O	1 240	759	50,0%	50,0%	70,7%	1242	442	485	3830	71,2%	760	272	296	2276	71,5%
Other industrial: N2O	N2O	3	7	50,0%	50,0%	70,7%										
Indirect N2O from non-agricultural sources	N2O	52	56	50,0%	200,0%	206,2%	53	57	6	1367	215,7%	56	60	7	1245	212,0%
Indirect N2O from NO2 from combustion and industrial processes	N2O	883	637	15,0%	200,0%	200,6%	893	918	122	20276	205,4%	645	662	88	14159	205,5%
Emissions from manure management	N2O	694	710	10,0%	100,0%	100,5%	692	275	314	3942	79,5%	712	298	313	4287	83,8%
Direct N2O emissions from agricultural soils	N2O	4 597	4 941	10,0%	60,0%	60,8%	4597	1413	2532	18647	61,5%	4950	1612	2631	20794	65,1%
Indirect N2O emissions from nitrogen used in agriculture	N2O	4 861	3 298	50,0%	200,0%	206,2%	4861	4292	970	124607	176,6%	3309	3006	624	58873	181,7%
Animal production on agricultural soils	N2O	1 308	704	10,0%	100,0%	100,5%	1303	655	459	7559	100,6%	703	355	249	4958	100,9%
5A1. Forest Land remaining Forest Land	N2O	7	7	25,0%	20,0%	32,0%										
Emissions from wastewater handling	N2O	513	397	20,0%	50,0%	53,9%	513	94	331	899	36,8%	397	78	249	759	39,4%
OTHER N2O	N2O	250	133	20,0%	50,0%	53,9%	250	55	147	498	44,1%	133	19	96	220	28,6%
Total N2O		**21 226**	**17 992**			**45%**	**21234**	**4964**	**14574**	**141515**	46,8%	**18026**	**3809**	**12523**	**76660**	42,3%
						-> 50%										
SF6 emissions from SF6 use	SF6	301	324	50,0%	25,0%	55,9%										
PFC from aluminium production	PFC	1 901	106	2,0%	20,0%	20,1%	1900	158	1592	2593	16,7%	106	9	88	148	17,1%
PFC emissions from PFC use	PFC	37	179	5,0%	25,0%	25,5%										
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC	240	1 179	10,0%	50,0%	51,0%										
HFC-23 emissions from HCFC-22 manufacture	HFC	5 759	354	10,0%	10,0%	14,1%	6241	901	4704	8727	28,9%	366	37	300	467	20,0%
HFC by-product emissions from HFC manufacture	HFC	12	99	10,0%	20,0%	22,4%										
Total F-gases		**8 250**	**2 242**			**28%**	**8730**	**921**	**7150**	**11575**	21,1%	**2251**	**318**	**1623**	**3514**	28,3%
		-> 50% for HFCs ,PFCs and SF6														
Total Netherlands (CO2-eq.)		**216394**	**219845**			**4,5%**	**217313**	**5850**	**208054**	**341369**	5,4%	**219991**	**4461**	**212643**	**277852**	4,1%
						-> 6%										

SCENARIO F2

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	**Gas**	**TIER-1 trend unc.**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	0,1%	0,9%	0,1%	0,8%	1,0%	0,1%	2024	111	1807	2241	11,0%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	0,2%	0,6%	0,2%	0,1%	1,1%	0,5%	1226	536	175	2276	87,4%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	0,1%	5,5%	0,1%	5,2%	5,8%	0,3%	11991	93	11810	12175	1,6%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	0,1%	0,5%	0,0%	0,4%	0,6%	0,1%	1157	103	957	1361	17,8%
Stationary combustion : Petroleum Refining: liquids	CO2	0,6%	-0,2%	0,4%	-1,1%	0,7%	0,9%	-448	957	-2322	1425	427,6%
Stationary combustion : Petroleum Refining: gases	CO2	0,0%	0,6%	0,0%	0,5%	0,6%	0,0%	1210	9	1193	1227	1,4%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	1	1	20,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	0,3%	0,3%	0,1%	0,0%	0,5%	0,2%	552	242	82	1031	87,8%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	0,1%	-0,6%	0,1%	-0,8%	-0,3%	0,3%	-1286	281	-1841	-739	43,7%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	0,1%	-0,3%	0,2%	-0,7%	0,0%	0,4%	-706	382	-1452	47	108,3%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	0,2%	-1,6%	0,1%	-1,9%	-1,4%	0,2%	-3573	242	-4044	-3097	13,6%
Stationary combustion : Other Sectors, solids	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-55	58	-169	58	211,4%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	1,4%	2,0%	0,2%	1,6%	2,4%	0,4%	4349	385	3604	5106	17,7%
Stationary combustion : Other Sectors, Residential, gases	CO2	0,6%	0,0%	0,3%	-0,5%	0,6%	0,6%	91	657	-1195	1373	1448,8%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	0,5%	-0,6%	0,2%	-1,1%	-0,1%	0,5%	-1270	540	-2332	-223	84,9%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	0,3%	0,1%	0,2%	-0,3%	0,4%	0,3%	133	366	-586	845	549,5%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	0,1%	-0,5%	0,1%	-0,6%	-0,4%	0,1%	-1031	112	-1255	-814	21,8%
Military use of fuels (1A5 Other)	CO2	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-130	72	-270	12	111,0%
Mobile combustion: road vehicles: gasoline	CO2	0,2%	1,0%	0,1%	0,9%	1,2%	0,2%	2265	172	1930	2602	15,2%
Mobile combustion: road vehicles: diesel oil	CO2	0,6%	3,6%	0,3%	3,0%	4,1%	0,6%	7712	571	6596	8825	14,8%
Mobile combustion: road vehicles: LPG	CO2	0,1%	-0,7%	0,1%	-0,9%	-0,6%	0,1%	-1606	148	-1894	-1316	18,4%
Mobile combustion: water-borne navigation	CO2	0,1%	0,1%	0,0%	0,0%	0,1%	0,1%	176	71	38	315	80,0%
Mobile combustion: aircraft	CO2	0,0%										
Mobile combustion: other	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	18	4	12	25	38,4%
CO2 from coke production	CO2	0,2%	0,0%	0,1%	-0,1%	0,2%	0,1%	106	162	-212	424	305,2%
Fugitive emissions venting/flaring: CO2	CO2	0,0%	-0,3%	0,0%	-0,4%	-0,2%	0,1%	-659	88	-830	-486	26,6%
Cement production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-73	17	-107	-40	46,8%
Limestone and dolomite use	CO2	0,1%	0,1%	0,1%	-0,1%	0,3%	0,2%	169	203	-217	588	240,7%
Other minerals	CO2	0,1%	0,0%	0,0%	0,0%	0,1%	0,1%	88	56	-23	199	128,3%
Ammonia production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-10	43	-95	75	849,8%
Other chemical product manufacture	CO2	0,2%										
Iron and steel production (carbon inputs)	CO2	0,0%	-0,6%	0,0%	-0,7%	-0,6%	0,1%	-1410	78	-1564	-1259	11,0%
CO2 from aluminium production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	84	7	71	97	15,6%
Other industrial: CO2	CO2	0,0%										
Indirect CO2 from solvents/product use	CO2	0,0%										
5A1. Forest Land remaining Forest Land	CO2	0,4%	0,1%	0,3%	-0,5%	0,6%	0,6%	215	606	-984	1395	564,7%
5A2. Land converted to Forest Land	CO2	0,1%	-0,1%	0,0%	-0,2%	0,0%	0,1%	-253	91	-443	-85	71,9%
5B2. Land converted to Cropland	CO2	0,0%										
5C1. Grassland remaining Grassland	CO2	0,7%										
5C2. Land converted to Grassland	CO2	0,1%										
5E2. Land converted to Settlements	CO2	0,0%										
5F2. Land converted to Other Land	CO2	0,1%										
5G. Other (liming of soils)	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-97	15	-127	-67	31,7%
Total CO2			9,4%	0,9%	7,7%	11,2%	1,8%	20398	1770	16942	23876	17,4%

SCENARIO F2

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	**Gas**	**TIER-1 trend unc.**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Emissions from stationary combustion: non-CO2	CH4	0,0%	0,0%	0,1%	-0,1%	0,1%	0,1%	40	114	-183	263	572,8%
Mobile combustion: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0	0	0	1	94,2%
Mobile combustion: road vehicles	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-90	53	-212	-3	117,8%
Fugitive emissions venting/flaring	CH4	0,1%	-0,4%	0,1%	-0,6%	-0,3%	0,1%	-953	148	-1244	-663	31,1%
Fugitive emissions from oil and gas operations: gas distribution	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	14	14	-13	42	202,2%
Fugitive emissions from oil and gas operations: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-13	45	-102	75	700,5%
Other industrial: CH4	CH4	0,0%										
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	0,2%	-0,5%	0,4%	-1,3%	0,3%	0,8%	-1085	865	-2804	604	159,4%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-89	75	-235	57	168,6%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-33	16	-66	-4	93,9%
Emissions from manure management : cattle	CH4	0,1%	-0,1%	0,5%	-1,0%	0,9%	0,9%	-144	1014	-2286	1882	1403,9%
Emissions from manure management : swine	CH4	0,1%	-0,1%	0,2%	-0,5%	0,2%	0,4%	-225	400	-1144	478	354,9%
Emissions from manure management : poultry	CH4	0,1%	-0,1%	0,1%	-0,2%	0,0%	0,1%	-174	124	-478	0	142,5%
Emissions from manure management : other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5	4	-2	14	177,3%
CH4 emissions from solid waste disposal sites	CH4	1,4%	-2,4%	0,6%	-3,7%	-1,3%	1,2%	-5247	1278	-7936	-2909	48,7%
Emissions from wastewater handling	CH4	0,0%	0,0%	0,1%	-0,2%	0,2%	0,2%	-85	217	-506	345	511,5%
OTHER CH4	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	72	12	50	96	32,3%
Total CH4			-3,7%	1,2%	-6,1%	-1,4%	2,3%	-8032	2591	-13612	-3028	64,5%
Emissions from stationary combustion: non-CO2	N2O	0,0%	0,0%	0,0%	-0,1%	0,1%	0,1%	25	83	-136	184	666,0%
Mobile combustion: other	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	0	2	90,6%
Mobile combustion: road vehicles	N2O	0,1%	0,1%	0,1%	0,0%	0,2%	0,1%	214	129	-16	497	121,0%
Nitric acid production	N2O	0,4%	-0,3%	0,2%	-0,8%	0,1%	0,4%	-712	473	-1756	112	132,9%
Caprolactam production	N2O	0,3%	-0,2%	0,2%	-0,6%	0,1%	0,4%	-482	391	-1325	220	162,5%
Other industrial: N2O	N2O	0,0%										
Indirect N2O from non-agricultural sources	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	4	28	-45	61	1481,1%
Indirect N2O from NO2 from combustion and industrial processes	N2O	0,3%	-0,1%	0,1%	-0,4%	0,0%	0,3%	-249	280	-975	-25	224,9%
Emissions from manure management	N2O	0,0%	0,0%	0,2%	-0,4%	0,4%	0,4%	20	405	-782	862	4007,0%
Direct N2O emissions from agricultural soils	N2O	0,3%	0,2%	0,9%	-1,6%	2,1%	1,9%	353	2028	-3614	4600	1149,0%
Indirect N2O emissions from nitrogen used in agriculture	N2O	1,9%	-0,7%	1,5%	-4,1%	1,6%	2,9%	-1552	3386	-9383	3505	436,3%
Animal production on agricultural soils	N2O	0,3%	-0,3%	0,2%	-0,8%	0,0%	0,4%	-600	470	-1780	47	156,9%
5A1. Forest Land remaining Forest Land	N2O	0,0%										
Emissions from wastewater handling	N2O	0,1%	-0,1%	0,1%	-0,2%	0,1%	0,1%	-116	119	-351	118	205,4%
OTHER N2O	N2O	0,0%	-0,1%	0,0%	-0,1%	0,0%	0,0%	-117	44	-210	-35	76,1%
Total N2O			-1,5%	1,8%	-5,2%	1,7%	3,5%	-3208	4061	-11890	3576	253,2%
SF6 emissions from SF6 use	SF6											
PFC from aluminium production	PFC	0,2%	-0,8%	0,1%	-1,0%	-0,7%	0,2%	-1794	158	-2104	-1487	17,6%
PFC emissions from PFC use	PFC											
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC											
HFC-23 emissions from HCFC-22 manufacture	HFC	0,3%	-2,7%	0,4%	-3,5%	-2,0%	0,8%	-5869	898	-7718	-4342	30,6%
HFC by-product emissions from HFC manufacture	HFC											
Total F-gases			-3,0%	0,4%	-3,9%	-2,2%	0,9%	-6480	971	-8450	-4776	30,0%
	-> 50% f											
Total Netherlands (CO2-eq.)		**3,3%**	**1,3%**	**2,4%**	**-3,5%**	**5,7%**	**4,7%**	**2678**	**5231**	**-8013**	**12196**	**390,6%**

SCENARIO G

							1990					2004				
Source category	**Gas**	**Tier 1 CO2-eq. 90/95**	**Tier 1 CO2-eq. 2004**	**Tier 1 AD unc**	**Tier 1 EF unc**	**Tier 1 EM unc**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	206	2 230	0,5%	10,0%	10,0%	206	10	186	227	10,0%	2230	111	2010	2448	10,0%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	25 776	27 004	1,0%	3,0%	3,2%	25777	332	25132	26428	2,6%	27001	470	26073	27920	3,5%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	13 184	25 174	0,5%	1,0%	1,1%	13184	74	13038	13330	1,1%	25175	141	24897	25450	1,1%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	592	1 750	10,0%	5,0%	11,2%	592	33	528	658	11,2%	1750	97	1563	1944	11,1%
Stationary combustion : Petroleum Refining: liquids	CO2	9 999	9 556	10,0%	10,0%	14,1%	9998	707	8642	11424	14,2%	9552	675	8256	10907	14,1%
Stationary combustion : Petroleum Refining: gases	CO2	1 029	2 239	0,5%	1,0%	1,1%	1029	6	1018	1041	1,1%	2239	13	2215	2264	1,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0	1	20,0%	2,0%	20,1%	0					1	0	1	1	20,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	1 401	1 953	20,0%	5,0%	20,6%	1400	144	1121	1685	20,6%	1953	202	1561	2351	20,7%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	8 788	7 502	1,0%	5,0%	5,1%	8786	255	8289	9292	5,8%	7502	220	7077	7936	5,9%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	5 195	4 384	2,0%	10,0%	10,2%	5033	257	4532	5540	10,2%	4326	306	3725	4927	14,2%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	18 785	15 212	2,0%	1,0%	2,2%	18785	211	18370	19200	2,2%	15212	170	14881	15546	2,2%
Stationary combustion : Other Sectors, solids	CO2	189	134	50,0%	5,0%	50,2%	189	47	96	282	50,0%	134	34	68	201	50,7%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	6 571	10 921	20,0%	1,0%	20,0%	6573	207	6170	6985	6,3%	10925	329	10288	11578	6,0%
Stationary combustion : Other Sectors, Residential, gases	CO2	18 466	18 555	5,0%	1,0%	5,1%	18467	472	17543	19402	5,1%	18555	474	17628	19485	5,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	8 226	6 955	10,0%	1,0%	10,0%	8225	412	7415	9033	10,0%	6951	351	6266	7642	10,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	2 522	2 656	20,0%	2,0%	20,1%	2523	254	2027	3021	20,1%	2657	267	2132	3179	20,1%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	1 479	451	20,0%	2,0%	20,1%	1482	107	1277	1696	14,4%	452	35	384	521	15,5%
Military use of fuels (1A5 Other)	CO2	566	437	20,0%	2,0%	20,1%	567	57	455	679	20,2%	436	44	351	522	20,1%
Mobile combustion: road vehicles: gasoline	CO2	10 902	13 168	2,0%	0,4%	2,0%	10902	154	10603	11207	2,8%	13168	186	12805	13537	2,8%
Mobile combustion: road vehicles: diesel oil	CO2	11 832	19 542	5,0%	0,2%	5,0%	11830	319	11205	12455	5,4%	19537	525	18513	20570	5,4%
Mobile combustion: road vehicles: LPG	CO2	2 738	1 131	10,0%	0,2%	10,0%	2739	141	2463	3014	10,3%	1131	58	1018	1244	10,2%
Mobile combustion: water-borne navigation	CO2	403	580	20,0%	0,2%	20,0%	403	40	324	482	19,9%	580	58	468	692	19,8%
Mobile combustion: aircraft	CO2	41	41	50,0%	0,5%	50,0%	41	7	27	56	36,2%	41	7	27	56	36,1%
Mobile combustion: other	CO2	91	109	50,0%	0,2%	50,0%	91	2	86	95	5,0%	109	3	104	115	5,0%
CO2 from coke production	CO2	403	509	50,0%	2,0%	5,0%	402	101	204	600	50,2%	510	127	262	761	49,9%
Fugitive emissions venting/flaring: CO2	CO2	769	110	50,0%	2,0%	50,0%	769	87	600	942	22,8%	110	5	100	121	9,3%
Cement production	CO2	507	434	5,0%	10,0%	11,2%	507	28	452	563	11,2%	434	24	387	482	11,2%
Limestone and dolomite use	CO2	440	563	25,0%	5,0%	25,5%	578	129	376	868	44,7%	748	165	490	1117	44,2%
Other minerals	CO2	269	358	25,0%	5,0%	25,5%	270	34	203	337	25,4%	358	46	269	448	25,6%
Ammonia production	CO2	3 058	3 048	2,0%	1,0%	2,2%	3058	34	2991	3125	2,2%	3048	34	2982	3115	2,2%
Other chemical product manufacture	CO2	588	606	50,0%	50,0%	70,7%										
Iron and steel production (carbon inputs)	CO2	2 514	1 105	3,0%	5,0%	5,8%	2514	73	2372	2658	5,8%	1105	32	1042	1168	5,8%
CO2 from aluminium production	CO2	395	479	2,0%	5,0%	5,4%	395	11	374	416	5,4%	479	13	454	504	5,4%
Other industrial: CO2	CO2	347	342	5,0%	20,0%	20,6%										
Indirect CO2 from solvents/product use	CO2	316	160	25,0%	10,0%	26,9%										
5A1. Forest Land remaining Forest Land	CO2	-2 505	-2 289	25,0%	61,8%	67,0%	-2503	482	-3508	-1628	38,5%	-2288	478	-3285	-1412	41,8%
5A2. Land converted to Forest Land	CO2	-89	-342	25,0%	57,9%	63,0%	-89	21	-134	-50	47,9%	-342	92	-534	-174	53,8%
5B2. Land converted to Cropland	CO2	-35	-35	25,0%	50,0%	55,9%	-35	10	-56	-17	56,1%	-35	10	-56	-17	56,1%
5C1. Grassland remaining Grassland	CO2	4 246	4 246	25,0%	50,0%	55,9%	4252	1200	2057	6767	56,4%	4244	1201	2060	6737	56,6%
5C2. Land converted to Grassland	CO2	536	536	25,0%	61,2%	66,1%	535	286	-4	1122	106,7%	535	286	-4	1122	106,7%
5E2. Land converted to Settlements	CO2	-151	-151	25,0%	50,0%	55,9%	-152	43	-241	-73	56,5%	-152	43	-241	-73	56,5%
5F2. Land converted to Other Land	CO2	710	710	25,0%	50,0%	55,9%	711	200	340	1126	56,4%	711	200	340	1126	56,4%
5G. Other (liming of soils)	CO2	183	86	25,0%	1,0%	25,0%	183	11	162	205	12,0%	86	11	65	108	24,9%
Total CO2		**161 482**	**182 158**			**2,5%**	**161873**	**1803**	**158422**	**165503**	2,2%	**182267**	**1892**	**178632**	**186083**	2,1%
						-> 5%										

SCENARIO G

							1990					2004				
Source category	**Gas**	**Tier 1 CO2-eq. 90/95**	**Tier 1 CO2-eq. 2004**	**Tier 1 AD unc**	**Tier 1 EF unc**	**Tier 1 EM unc**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Emissions from stationary combustion: non-CO2	CH4	518	557	3,0%	50,0%	50,1%	517	86	352	689	33,2%	557	88	385	729	31,6%
Mobile combustion: other	CH4	1	1	50,0%	100,0%	111,8%	1	1	0	2	102,9%	1	1	0	2	89,8%
Mobile combustion: road vehicles	CH4	157	67	3,0%	60,0%	60,1%	156	50	83	279	63,8%	67	22	35	121	66,7%
Fugitive emissions venting/flaring	CH4	1 252	299	2,0%	25,0%	25,1%	1252	148	965	1542	23,6%	300	35	231	368	23,3%
Fugitive emissions from oil and gas operations: gas distribution	CH4	255	268	2,0%	50,0%	50,0%	255	47	164	346	36,5%	269	54	164	375	40,0%
Fugitive emissions from oil and gas operations: other	CH4	162	149	20,0%	50,0%	53,9%	162	34	98	232	42,4%	149	33	87	218	44,8%
Other industrial: CH4	CH4	297	309	10,0%	50,0%	51,0%										
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	6 767	5 688	5,0%	20,0%	20,6%	6767	702	5408	8153	20,7%	5688	585	4546	6835	20,6%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	439	351	5,0%	50,0%	50,2%	439	110	223	655	50,2%	351	88	178	524	50,3%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	319	286	5,0%	30,0%	30,4%	319	44	233	405	27,6%	286	33	221	350	23,1%
Emissions from manure management : cattle	CH4	1 574	1 421	10,0%	100,0%	100,5%	1571	785	557	3538	99,9%	1426	712	508	3202	99,9%
Emissions from manure management : swine	CH4	1 141	919	10,0%	100,0%	100,5%	1143	574	404	2570	100,3%	919	456	327	2063	99,1%
Emissions from manure management : poultry	CH4	243	69	10,0%	100,0%	100,5%	242	121	85	547	100,5%	69	34	24	156	99,9%
Emissions from manure management : other	CH4	12	16	10,0%	100,0%	100,5%	12	4	6	21	68,5%	16	5	8	29	66,8%
CH4 emissions from solid waste disposal sites	CH4	12 011	6 775	30,0%	15,0%	33,5%	12012	1763	9262	14981	29,4%	6759	684	5677	7915	20,2%
Emissions from wastewater handling	CH4	290	206	20,0%	25,0%	32,0%	289	142	25	582	98,4%	206	174	-116	565	168,8%
OTHER CH4	CH4	1	72	20,0%	25,0%	32,0%	1	0	1	1	25,0%	73	12	51	97	32,1%
Total CH4		**25 437**	**17 453**			**18%**	**25460**	**2368**	**21028**	**30933**	18,6%	**17444**	**1318**	**15046**	**20271**	15,1%
						-> 25%										
Emissions from stationary combustion: non-CO2	N2O	215	238	3,0%	50,0%	50,1%	215	104	111	484	97,2%	239	103	130	500	86,5%
Mobile combustion: other	N2O	1	2	50,0%	100,0%	111,8%	1	1	0	2	102,9%	2	1	1	4	91,9%
Mobile combustion: road vehicles	N2O	271	485	5,0%	50,0%	50,2%	270	127	107	589	93,9%	483	235	183	1071	97,1%
Nitric acid production	N2O	6 330	5 617	10,0%	50,0%	51,0%	6334	1622	3208	9523	51,2%	5621	1441	2850	8467	51,3%
Caprolactam production	N2O	1 240	759	50,0%	50,0%	70,7%	1243	444	483	2210	71,5%	761	272	301	1358	71,6%
Other industrial: N2O	N2O	3	7	50,0%	50,0%	70,7%										
Indirect N2O from non-agricultural sources	N2O	52	56	50,0%	200,0%	206,2%	52	56	6	197	213,7%	56	60	7	212	213,1%
Indirect N2O from NO2 from combustion and industrial processes	N2O	883	637	15,0%	200,0%	200,6%	887	900	123	3212	203,0%	640	649	89	2315	202,6%
Emissions from manure management	N2O	694	710	10,0%	100,0%	100,5%	694	274	319	1370	79,0%	711	300	313	1458	84,3%
Direct N2O emissions from agricultural soils	N2O	4 597	4 941	10,0%	60,0%	60,8%	4616	1423	2534	8027	61,7%	4952	1625	2627	8888	65,6%
Indirect N2O emissions from nitrogen used in agriculture	N2O	4 861	3 298	50,0%	200,0%	206,2%	4841	4170	965	15633	172,3%	3311	3045	623	11171	183,9%
Animal production on agricultural soils	N2O	1 308	704	10,0%	100,0%	100,5%	1309	660	460	2957	100,8%	706	356	247	1606	101,0%
5A1. Forest Land remaining Forest Land	N2O	7	7	25,0%	20,0%	32,0%										
Emissions from wastewater handling	N2O	513	397	20,0%	50,0%	53,9%	513	94	333	701	36,7%	397	78	250	554	39,2%
OTHER N2O	N2O	250	133	20,0%	50,0%	53,9%	250	55	147	362	44,0%	133	19	96	171	28,5%
Total N2O		**21 226**	**17 992**			**45%**	**21236**	**4860**	**14632**	**32963**	45,8%	**18027**	**3834**	**12545**	**26964**	42,5%
						-> 50%										
SF6 emissions from SF6 use	SF6	301	324	50,0%	25,0%	55,9%										
PFC from aluminium production	PFC	1 901	106	2,0%	20,0%	20,1%	1901	159	1588	2214	16,8%	106	9	88	123	17,1%
PFC emissions from PFC use	PFC	37	179	5,0%	25,0%	25,5%										
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC	240	1 179	10,0%	50,0%	51,0%										
HFC-23 emissions from HCFC-22 manufacture	HFC	5 759	354	10,0%	10,0%	14,1%	6239	901	4712	8097	28,9%	366	37	301	439	20,0%
HFC by-product emissions from HFC manufacture	HFC	12	99	10,0%	20,0%	22,4%										
Total F-gases		**8 250**	**2 242**			**28%**	**8729**	**921**	**7156**	**10618**	21,1%	**2254**	**317**	**1633**	**2882**	28,2%
	-> 50% for HFCs ,PFCs and SF6															
Total Netherlands (CO2-eq.)		**216394**	**219845**			**4,5%**	**217298**	**5770**	**208061**	**230285**	5,3%	**219992**	**4488**	**212669**	**229860**	4,1%
						-> 6%										

SCENARIO G

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	**Gas**	**TIER-1 trend unc.**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	0,1%	0,9%	0,1%	0,8%	1,0%	0,1%	2024	107	1813	2233	10,5%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	0,2%	0,6%	0,2%	0,2%	0,9%	0,4%	1224	424	395	2053	69,2%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	0,1%	5,5%	0,1%	5,2%	5,8%	0,3%	11990	93	11807	12172	1,6%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	0,1%	0,5%	0,0%	0,4%	0,6%	0,1%	1157	103	959	1363	17,8%
Stationary combustion : Petroleum Refining: liquids	CO2	0,6%	-0,2%	0,4%	-1,0%	0,6%	0,8%	-446	847	-2112	1209	379,8%
Stationary combustion : Petroleum Refining: gases	CO2	0,0%	0,6%	0,0%	0,5%	0,6%	0,0%	1210	9	1193	1227	1,4%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	1	1	20,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	0,3%	0,3%	0,1%	0,0%	0,5%	0,2%	553	242	80	1028	87,5%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	0,1%	-0,6%	0,1%	-0,8%	-0,3%	0,2%	-1284	268	-1809	-758	41,7%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	0,1%	-0,3%	0,1%	-0,6%	-0,1%	0,3%	-707	290	-1275	-138	82,1%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	0,2%	-1,6%	0,1%	-1,9%	-1,4%	0,2%	-3573	243	-4048	-3096	13,6%
Stationary combustion : Other Sectors, solids	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-55	58	-168	60	213,3%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	1,4%	2,0%	0,2%	1,6%	2,4%	0,4%	4353	385	3605	5109	17,7%
Stationary combustion : Other Sectors, Residential, gases	CO2	0,6%	0,0%	0,3%	-0,6%	0,6%	0,6%	88	655	-1203	1367	1488,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	0,5%	-0,6%	0,2%	-1,1%	-0,1%	0,5%	-1275	539	-2320	-210	84,6%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	0,3%	0,1%	0,2%	-0,3%	0,4%	0,3%	134	367	-580	851	547,8%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	0,1%	-0,5%	0,1%	-0,6%	-0,4%	0,1%	-1030	112	-1254	-812	21,8%
Military use of fuels (1A5 Other)	CO2	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-130	72	-271	10	110,3%
Mobile combustion: road vehicles: gasoline	CO2	0,2%	1,0%	0,1%	0,9%	1,2%	0,2%	2266	172	1930	2602	15,2%
Mobile combustion: road vehicles: diesel oil	CO2	0,6%	3,5%	0,3%	3,0%	4,1%	0,6%	7707	576	6573	8837	15,0%
Mobile combustion: road vehicles: LPG	CO2	0,1%	-0,7%	0,1%	-0,9%	-0,6%	0,1%	-1608	150	-1902	-1314	18,6%
Mobile combustion: water-borne navigation	CO2	0,1%	0,1%	0,0%	0,0%	0,1%	0,1%	176	70	40	313	79,0%
Mobile combustion: aircraft	CO2											
Mobile combustion: other	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	18	4	12	25	38,4%
CO2 from coke production	CO2	0,2%	0,0%	0,1%	-0,1%	0,2%	0,1%	107	162	-211	423	301,4%
Fugitive emissions venting/flaring: CO2	CO2	0,0%	-0,3%	0,0%	-0,4%	-0,2%	0,1%	-659	88	-831	-489	26,6%
Cement production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-73	17	-107	-40	47,0%
Limestone and dolomite use	CO2	0,1%	0,1%	0,1%	-0,1%	0,2%	0,2%	170	173	-159	534	203,3%
Other minerals	CO2	0,1%	0,0%	0,0%	0,0%	0,1%	0,1%	88	56	-23	199	128,8%
Ammonia production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-10	43	-95	75	846,7%
Other chemical product manufacture	CO2											
Iron and steel production (carbon inputs)	CO2	0,0%	-0,6%	0,0%	-0,7%	-0,6%	0,1%	-1409	68	-1544	-1278	9,7%
CO2 from aluminium production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	84	7	71	97	15,6%
Other industrial: CO2	CO2											
Indirect CO2 from solvents/product use	CO2											
5A1. Forest Land remaining Forest Land	CO2	0,4%	0,1%	0,2%	-0,4%	0,6%	0,5%	215	533	-842	1259	495,7%
5A2. Land converted to Forest Land	CO2	0,1%	-0,1%	0,0%	-0,2%	0,0%	0,1%	-253	89	-439	-91	70,3%
5B2. Land converted to Cropland	CO2											
5C1. Grassland remaining Grassland	CO2											
5C2. Land converted to Grassland	CO2											
5E2. Land converted to Settlements	CO2											
5F2. Land converted to Other Land	CO2											
5G. Other (liming of soils)	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-97	15	-127	-66	31,8%
Total CO2			9,4%	0,8%	7,8%	11,0%	1,6%	20394	1635	17168	23575	16,0%

SCENARIO G

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	**Gas**	**TIER-1 trend unc.**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Emissions from stationary combustion: non-CO2	CH4	0,0%	0,0%	0,0%	-0,1%	0,1%	0,1%	39	86	-129	206	434,0%
Mobile combustion: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0	0	0	1	94,2%
Mobile combustion: road vehicles	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-90	44	-195	-23	97,6%
Fugitive emissions venting/flaring	CH4	0,1%	-0,4%	0,1%	-0,6%	-0,3%	0,1%	-952	134	-1215	-693	28,1%
Fugitive emissions from oil and gas operations: gas distribution	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	14	14	-13	42	201,1%
Fugitive emissions from oil and gas operations: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-13	36	-85	59	573,3%
Other industrial: CH4	CH4											
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	0,2%	-0,5%	0,3%	-1,1%	0,1%	0,6%	-1080	673	-2394	234	124,7%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-89	74	-235	55	166,9%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-33	16	-66	-4	94,7%
Emissions from manure management : cattle	CH4	0,1%	-0,1%	0,4%	-0,8%	0,6%	0,7%	-145	770	-1778	1357	1060,7%
Emissions from manure management : swine	CH4	0,1%	-0,1%	0,2%	-0,5%	0,2%	0,4%	-224	397	-1135	462	353,4%
Emissions from manure management : poultry	CH4	0,1%	-0,1%	0,1%	-0,2%	0,0%	0,1%	-173	110	-449	-30	126,9%
Emissions from manure management : other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5	4	-2	14	174,6%
CH4 emissions from solid waste disposal sites	CH4	1,4%	-2,4%	0,6%	-3,7%	-1,3%	1,2%	-5247	1278	-7936	-2909	48,7%
Emissions from wastewater handling	CH4	0,0%	0,0%	0,1%	-0,2%	0,1%	0,2%	-84	189	-449	294	451,4%
OTHER CH4	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	72	12	50	96	32,3%
Total CH4			-3,7%	1,1%	-6,1%	-1,5%	2,2%	-8016	2452	-13476	-3292	61,2%
Emissions from stationary combustion: non-CO2	N2O	0,0%	0,0%	0,0%	-0,1%	0,1%	0,1%	24	82	-141	179	684,0%
Mobile combustion: other	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	0	2	91,1%
Mobile combustion: road vehicles	N2O	0,1%	0,1%	0,1%	-0,1%	0,3%	0,2%	213	213	-111	730	200,2%
Nitric acid production	N2O	0,4%	-0,3%	0,2%	-0,8%	0,1%	0,4%	-712	470	-1744	110	132,0%
Caprolactam production	N2O	0,3%	-0,2%	0,2%	-0,6%	0,1%	0,4%	-482	393	-1324	224	162,9%
Other industrial: N2O	N2O											
Indirect N2O from non-agricultural sources	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	4	28	-45	62	1394,1%
Indirect N2O from NO2 from combustion and industrial processes	N2O	0,3%	-0,1%	0,1%	-0,4%	0,0%	0,2%	-246	275	-960	-25	223,0%
Emissions from manure management	N2O	0,0%	0,0%	0,2%	-0,4%	0,4%	0,4%	17	405	-780	860	4691,5%
Direct N2O emissions from agricultural soils	N2O	0,3%	0,2%	0,7%	-1,2%	1,7%	1,5%	336	1602	-2711	3740	952,9%
Indirect N2O emissions from nitrogen used in agriculture	N2O	1,9%	-0,7%	1,4%	-4,0%	1,7%	2,9%	-1530	3332	-9144	3605	435,7%
Animal production on agricultural soils	N2O	0,3%	-0,3%	0,2%	-0,8%	0,0%	0,4%	-604	472	-1776	36	156,2%
5A1. Forest Land remaining Forest Land	N2O											
Emissions from wastewater handling	N2O	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-117	105	-323	89	179,4%
OTHER N2O	N2O	0,0%	-0,1%	0,0%	-0,1%	0,0%	0,0%	-116	44	-209	-35	76,1%
Total N2O			-1,5%	1,7%	-5,0%	1,5%	3,3%	-3209	3814	-11479	3225	237,7%
SF6 emissions from SF6 use	SF6											
PFC from aluminium production	PFC	0,2%	-0,8%	0,1%	-1,0%	-0,7%	0,1%	-1796	155	-2100	-1491	17,3%
PFC emissions from PFC use	PFC											
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC											
HFC-23 emissions from HCFC-22 manufacture	HFC	0,3%	-2,7%	0,4%	-3,5%	-2,0%	0,8%	-5869	898	-7718	-4342	30,6%
HFC by-product emissions from HFC manufacture	HFC											
Total F-gases			-3,0%	0,4%	-3,9%	-2,2%	0,9%	-6476	975	-8454	-4760	30,1%
	-> 50% f											
Total Netherlands (CO2-eq.)		**3,3%**	**1,3%**	**2,2%**	**-3,3%**	**5,4%**	**4,5%**	**2694**	**4922**	**-7404**	**11565**	**365,4%**

SCENARIO H1

							1990					2004				
Source category	**Gas**	**Tier 1 CO2-eq. 90/95**	**Tier 1 CO2-eq. 2004**	**Tier 1 AD unc**	**Tier 1 EF unc**	**Tier 1 EM unc**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	206	2 230	0,5%	10,0%	10,0%	206	10	186	226	10,0%	2230	112	2013	2452	10,0%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	25 776	27 004	1,0%	3,0%	3,2%	25779	332	25130	26429	2,6%	27006	475	26074	27939	3,5%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	13 184	25 174	0,5%	1,0%	1,1%	13184	73	13039	13328	1,1%	25342	224	24976	25809	1,8%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	592	1 750	10,0%	5,0%	11,2%	592	33	528	658	11,2%	1750	195	1377	2140	22,3%
Stationary combustion : Petroleum Refining: liquids	CO2	9 999	9 556	10,0%	10,0%	14,1%	9995	704	8647	11400	14,1%	9559	1065	7535	11714	22,3%
Stationary combustion : Petroleum Refining: gases	CO2	1 029	2 239	0,5%	1,0%	1,1%	1029	6	1018	1041	1,1%	2254	20	2221	2295	1,8%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0	1	20,0%	2,0%	20,1%						1	0	1	1	20,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	1 401	1 953	20,0%	5,0%	20,6%	1401	144	1119	1685	20,5%	1952	202	1560	2348	20,7%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	8 788	7 502	1,0%	5,0%	5,1%	8787	257	8288	9294	5,9%	7502	219	7075	7937	5,8%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	5 195	4 384	2,0%	10,0%	10,2%	5032	256	4535	5537	10,2%	4324	306	3723	4925	14,2%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	18 785	15 212	2,0%	1,0%	2,2%	18785	209	18377	19200	2,2%	15314	201	14938	15721	2,6%
Stationary combustion : Other Sectors, solids	CO2	189	134	50,0%	5,0%	50,2%	189	48	95	283	50,6%	134	34	68	201	50,5%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	6 571	10 921	20,0%	1,0%	20,0%	6573	207	6174	6985	6,3%	10995	339	10342	11671	6,2%
Stationary combustion : Other Sectors, Residential, gases	CO2	18 466	18 555	5,0%	1,0%	5,1%	18465	470	17555	19389	5,1%	18679	496	17714	19661	5,3%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	8 226	6 955	10,0%	1,0%	10,0%	8227	412	7420	9031	10,0%	7000	355	6307	7697	10,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	2 522	2 656	20,0%	2,0%	20,1%	2522	253	2027	3022	20,1%	2656	266	2131	3176	20,0%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	1 479	451	20,0%	2,0%	20,1%	1482	107	1275	1698	14,5%	452	35	384	522	15,6%
Military use of fuels (1A5 Other)	CO2	566	437	20,0%	2,0%	20,1%	567	57	454	679	20,2%	437	44	351	523	20,1%
Mobile combustion: road vehicles: gasoline	CO2	10 902	13 168	2,0%	0,4%	2,0%	10901	155	10598	11207	2,8%	13168	186	12805	13536	2,8%
Mobile combustion: road vehicles: diesel oil	CO2	11 832	19 542	5,0%	0,2%	5,0%	11831	318	11207	12455	5,4%	19539	527	18507	20566	5,4%
Mobile combustion: road vehicles: LPG	CO2	2 738	1 131	10,0%	0,2%	10,0%	2738	140	2462	3014	10,3%	1131	58	1018	1245	10,3%
Mobile combustion: water-borne navigation	CO2	403	580	20,0%	0,2%	20,0%	404	40	324	483	20,0%	580	58	465	694	20,0%
Mobile combustion: aircraft	CO2	41	41	50,0%	0,5%	50,0%	41	7	27	56	36,2%	41	7	27	56	36,0%
Mobile combustion: other	CO2	91	109	50,0%	0,2%	50,0%	91	2	86	95	5,0%	109	3	104	115	5,0%
CO2 from coke production	CO2	403	509	50,0%	2,0%	5,0%	403	101	205	601	50,2%	508	127	260	755	50,0%
Fugitive emissions venting/flaring: CO2	CO2	769	110	50,0%	2,0%	50,0%	770	88	598	942	22,7%	110	5	100	120	9,4%
Cement production	CO2	507	434	5,0%	10,0%	11,2%	507	28	452	563	11,2%	434	24	387	482	11,2%
Limestone and dolomite use	CO2	440	563	25,0%	5,0%	25,5%	579	129	375	865	44,5%	747	166	486	1118	44,3%
Other minerals	CO2	269	358	25,0%	5,0%	25,5%	270	34	203	339	25,5%	358	46	269	448	25,4%
Ammonia production	CO2	3 058	3 048	2,0%	1,0%	2,2%	3058	34	2991	3125	2,2%	3048	34	2981	3114	2,2%
Other chemical product manufacture	CO2	588	606	50,0%	50,0%	70,7%										
Iron and steel production (carbon inputs)	CO2	2 514	1 105	3,0%	5,0%	5,8%	2514	73	2372	2658	5,8%	1105	32	1042	1168	5,8%
CO2 from aluminium production	CO2	395	479	2,0%	5,0%	5,4%	395	11	374	416	5,4%	479	13	454	504	5,4%
Other industrial: CO2	CO2	347	342	5,0%	20,0%	20,6%										
Indirect CO2 from solvents/product use	CO2	316	160	25,0%	10,0%	26,9%										
5A1. Forest Land remaining Forest Land	CO2	-2 505	-2 289	25,0%	61,8%	67,0%	-2510	486	-3527	-1623	38,7%	-2290	475	-3278	-1423	41,5%
5A2. Land converted to Forest Land	CO2	-89	-342	25,0%	57,9%	63,0%	-89	21	-134	-50	48,0%	-342	92	-535	-173	54,0%
5B2. Land converted to Cropland	CO2	-35	-35	25,0%	50,0%	55,9%	-35	10	-56	-17	56,4%	-35	10	-56	-17	56,4%
5C1. Grassland remaining Grassland	CO2	4 246	4 246	25,0%	50,0%	55,9%	4246	1193	2079	6742	56,2%	4238	1192	2054	6700	56,2%
5C2. Land converted to Grassland	CO2	536	536	25,0%	61,2%	66,1%	535	288	-9	1124	107,5%	535	288	-9	1124	107,5%
5E2. Land converted to Settlements	CO2	-151	-151	25,0%	50,0%	55,9%	-151	43	-241	-73	56,2%	-151	43	-241	-73	56,2%
5F2. Land converted to Other Land	CO2	710	710	25,0%	50,0%	55,9%	710	201	346	1126	56,5%	710	201	346	1126	56,5%
5G. Other (liming of soils)	CO2	183	86	25,0%	1,0%	25,0%	183	11	162	205	11,9%	86	11	65	108	25,1%
Total CO2		**161 482**	**182 158**			**2,5%**	**161858**	**1812**	**158372**	**165479**	2,2%	**182794**	**2141**	**178651**	**187079**	2,3%
						-> 5%										

SCENARIO H1

							1990					2004				
Source category	**Gas**	**Tier 1 CO2-eq. 90/95**	**Tier 1 CO2-eq. 2004**	**Tier 1 AD unc**	**Tier 1 EF unc**	**Tier 1 EM unc**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Emissions from stationary combustion: non-CO2	CH4	518	557	3,0%	50,0%	50,1%	519	86	352	690	33,3%	557	89	385	732	31,9%
Mobile combustion: other	CH4	1	1	50,0%	100,0%	111,8%	1	1	0	2	102,1%	1	0	0	2	89,2%
Mobile combustion: road vehicles	CH4	157	67	3,0%	60,0%	60,1%	157	50	84	278	64,1%	67	22	35	120	66,5%
Fugitive emissions venting/flaring	CH4	1 252	299	2,0%	25,0%	25,1%	1252	148	961	1542	23,7%	299	35	230	368	23,6%
Fugitive emissions from oil and gas operations: gas distribution	CH4	255	268	2,0%	50,0%	50,0%	238	46	147	323	38,4%	251	53	147	347	42,1%
Fugitive emissions from oil and gas operations: other	CH4	162	149	20,0%	50,0%	53,9%	162	34	98	231	42,1%	149	33	86	217	44,8%
Other industrial: CH4	CH4	297	309	10,0%	50,0%	51,0%										
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	6 767	5 688	5,0%	20,0%	20,6%	6771	699	5399	8147	20,6%	5689	587	4543	6848	20,6%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	439	351	5,0%	50,0%	50,2%	439	110	224	655	50,1%	351	88	179	525	50,0%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	319	286	5,0%	30,0%	30,4%	319	44	234	406	27,5%	286	33	222	351	23,0%
Emissions from manure management : cattle	CH4	1 574	1 421	10,0%	100,0%	100,5%	1572	791	555	3562	100,6%	1421	714	498	3239	100,5%
Emissions from manure management : swine	CH4	1 141	919	10,0%	100,0%	100,5%	1141	571	399	2581	100,1%	924	462	332	2095	100,1%
Emissions from manure management : poultry	CH4	243	69	10,0%	100,0%	100,5%	243	123	85	551	101,7%	69	35	24	156	100,4%
Emissions from manure management : other	CH4	12	16	10,0%	100,0%	100,5%	12	4	6	21	68,7%	16	5	8	29	66,0%
CH4 emissions from solid waste disposal sites	CH4	12 011	6 775	30,0%	15,0%	33,5%	12012	1763	9262	14981	29,4%	6759	684	5677	7915	20,2%
Emissions from wastewater handling	CH4	290	206	20,0%	25,0%	32,0%	289	142	29	584	98,3%	205	173	-115	559	168,6%
OTHER CH4	CH4	1	72	20,0%	25,0%	32,0%	1	0	1	1	25,1%	73	12	51	97	32,4%
Total CH4		**25 437**	**17 453**			**18%**	**25450**	**2374**	**21029**	**30902**	18,7%	**17426**	**1323**	**15015**	**20257**	15,2%
						-> 25%										
Emissions from stationary combustion: non-CO2	N2O	215	238	3,0%	50,0%	50,1%	248	67	132	385	54,3%	271	68	153	410	49,9%
Mobile combustion: other	N2O	1	2	50,0%	100,0%	111,8%	1	1	0	2	102,1%	2	1	1	4	91,3%
Mobile combustion: road vehicles	N2O	271	485	5,0%	50,0%	50,2%	271	126	105	587	93,0%	484	236	183	1080	97,5%
Nitric acid production	N2O	6 330	5 617	10,0%	50,0%	51,0%	6334	1613	3229	9559	50,9%	5622	1433	2870	8472	51,0%
Caprolactam production	N2O	1 240	759	50,0%	50,0%	70,7%	1239	446	473	2215	72,0%	756	272	291	1350	72,0%
Other industrial: N2O	N2O	3	7	50,0%	50,0%	70,7%										
Indirect N2O from non-agricultural sources	N2O	52	56	50,0%	200,0%	206,2%	52	55	6	196	211,7%	56	60	7	212	212,9%
Indirect N2O from NO2 from combustion and industrial processes	N2O	883	637	15,0%	200,0%	200,6%	888	891	121	3222	200,7%	640	642	88	2323	200,5%
Emissions from manure management	N2O	694	710	10,0%	100,0%	100,5%	691	275	316	1365	79,5%	712	299	310	1461	84,1%
Direct N2O emissions from agricultural soils	N2O	4 597	4 941	10,0%	60,0%	60,8%	4599	1413	2520	7961	61,5%	4939	1602	2646	8795	64,9%
Indirect N2O emissions from nitrogen used in agriculture	N2O	4 861	3 298	50,0%	200,0%	206,2%	4892	4291	982	16323	175,4%	3305	3029	635	11166	183,3%
Animal production on agricultural soils	N2O	1 308	704	10,0%	100,0%	100,5%	1307	654	459	2932	100,1%	706	357	248	1599	101,0%
5A1. Forest Land remaining Forest Land	N2O	7	7	25,0%	20,0%	32,0%										
Emissions from wastewater handling	N2O	513	397	20,0%	50,0%	53,9%	514	95	331	701	36,9%	397	79	248	556	39,6%
OTHER N2O	N2O	250	133	20,0%	50,0%	53,9%	250	55	146	362	44,1%	133	19	96	171	28,5%
Total N2O		**21 226**	**17 992**			**45%**	**21295**	**4955**	**14656**	**33536**	46,5%	**18038**	**3828**	**12552**	**27094**	42,4%
						-> 50%										
SF6 emissions from SF6 use	SF6	301	324	50,0%	25,0%	55,9%										
PFC from aluminium production	PFC	1 901	106	2,0%	20,0%	20,1%	1901	159	1589	2213	16,7%	106	9	88	123	17,2%
PFC emissions from PFC use	PFC	37	179	5,0%	25,0%	25,5%										
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC	240	1 179	10,0%	50,0%	51,0%										
HFC-23 emissions from HCFC-22 manufacture	HFC	5 759	354	10,0%	10,0%	14,1%	6241	903	4712	8095	28,9%	366	37	301	439	20,1%
HFC by-product emissions from HFC manufacture	HFC	12	99	10,0%	20,0%	22,4%										
Total F-gases		**8 250**	**2 242**			**28%**	**8732**	**923**	**7137**	**10624**	21,1%	**2252**	**317**	**1632**	**2876**	28,2%
	-> 50% for HFCs ,PFCs and SF6															
Total Netherlands (CO2-eq.)		**216394**	**219845**			**4,5%**	**217336**	**5868**	**208072**	**230784**	5,4%	**220510**	**4602**	**212943**	**230746**	4,2%
						-> 6%										

SCENARIO H1

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	**Gas**	**TIER-1 trend unc.**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	0,1%	0,9%	0,1%	0,8%	1,0%	0,1%	2024	107	1815	2235	10,6%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	0,2%	0,6%	0,2%	0,2%	1,0%	0,4%	1227	427	394	2068	69,6%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	0,1%	5,6%	0,2%	5,2%	5,9%	0,3%	12158	204	11815	12584	3,4%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	0,1%	0,5%	0,1%	0,4%	0,7%	0,2%	1157	198	780	1555	34,2%
Stationary combustion : Petroleum Refining: liquids	CO2	0,6%	-0,2%	0,5%	-1,2%	0,8%	1,0%	-436	1076	-2523	1723	493,6%
Stationary combustion : Petroleum Refining: gases	CO2	0,0%	0,6%	0,0%	0,5%	0,6%	0,0%	1225	18	1194	1262	3,0%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	1	1	20,1%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	0,3%	0,3%	0,1%	0,0%	0,5%	0,2%	551	241	83	1023	87,3%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	0,1%	-0,6%	0,1%	-0,8%	-0,3%	0,2%	-1285	270	-1812	-760	42,0%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	0,1%	-0,3%	0,1%	-0,6%	-0,1%	0,3%	-708	291	-1277	-139	82,1%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	0,2%	-1,6%	0,1%	-1,9%	-1,3%	0,3%	-3471	270	-3991	-2935	15,5%
Stationary combustion : Other Sectors, solids	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-55	59	-169	60	214,2%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	1,4%	2,0%	0,2%	1,7%	2,4%	0,4%	4422	394	3651	5200	17,8%
Stationary combustion : Other Sectors, Residential, gases	CO2	0,6%	0,1%	0,3%	-0,5%	0,7%	0,6%	214	673	-1104	1532	629,0%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	0,5%	-0,6%	0,2%	-1,1%	-0,1%	0,5%	-1227	541	-2290	-164	88,2%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	0,3%	0,1%	0,2%	-0,3%	0,4%	0,3%	134	366	-582	851	546,3%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	0,1%	-0,5%	0,1%	-0,6%	-0,4%	0,1%	-1030	113	-1256	-813	21,9%
Military use of fuels (1A5 Other)	CO2	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-130	72	-270	11	110,5%
Mobile combustion: road vehicles: gasoline	CO2	0,2%	1,0%	0,1%	0,9%	1,2%	0,2%	2267	172	1931	2607	15,2%
Mobile combustion: road vehicles: diesel oil	CO2	0,6%	3,5%	0,3%	3,0%	4,1%	0,6%	7708	579	6574	8841	15,0%
Mobile combustion: road vehicles: LPG	CO2	0,1%	-0,7%	0,1%	-0,9%	-0,6%	0,1%	-1606	149	-1899	-1313	18,6%
Mobile combustion: water-borne navigation	CO2	0,1%	0,1%	0,0%	0,0%	0,1%	0,1%	176	71	39	314	80,3%
Mobile combustion: aircraft	CO2	0,0%										
Mobile combustion: other	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	18	4	12	25	38,3%
CO2 from coke production	CO2	0,2%	0,0%	0,1%	-0,1%	0,2%	0,1%	105	162	-214	424	309,2%
Fugitive emissions venting/flaring: CO2	CO2	0,0%	-0,3%	0,0%	-0,4%	-0,2%	0,1%	-660	88	-832	-488	26,6%
Cement production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-73	17	-107	-40	46,9%
Limestone and dolomite use	CO2	0,1%	0,1%	0,1%	-0,1%	0,2%	0,2%	168	174	-162	532	206,6%
Other minerals	CO2	0,1%	0,0%	0,0%	0,0%	0,1%	0,1%	88	56	-22	198	127,9%
Ammonia production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-10	43	-94	74	839,3%
Other chemical product manufacture	CO2	0,2%										
Iron and steel production (carbon inputs)	CO2	0,0%	-0,6%	0,0%	-0,7%	-0,6%	0,1%	-1410	68	-1544	-1277	9,7%
CO2 from aluminium production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	84	7	72	97	15,5%
Other industrial: CO2	CO2	0,0%										
Indirect CO2 from solvents/product use	CO2	0,0%										
5A1. Forest Land remaining Forest Land	CO2	0,4%	0,1%	0,2%	-0,4%	0,6%	0,5%	220	535	-831	1276	486,2%
5A2. Land converted to Forest Land	CO2	0,1%	-0,1%	0,0%	-0,2%	0,0%	0,1%	-253	89	-439	-90	70,4%
5B2. Land converted to Cropland	CO2	0,0%										
5C1. Grassland remaining Grassland	CO2	0,7%										
5C2. Land converted to Grassland	CO2	0,1%										
5E2. Land converted to Settlements	CO2	0,0%										
5F2. Land converted to Other Land	CO2	0,1%										
5G. Other (liming of soils)	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-97	15	-127	-66	31,9%
Total CO2			9,6%	0,9%	7,9%	11,5%	1,8%	20936	1875	17286	24636	17,9%

SCENARIO H1

Source category	Gas	TIER-1 trend unc.	Relative Trend (to 1990 emissions) (%) MEAN	STD	2,5%	97,5%	2-STD	Absolute Trend (CO2-eq) MEAN	STD	2,5%	97,5%	2-STD
Emissions from stationary combustion: non-CO2	CH4	0,0%	0,0%	0,0%	-0,1%	0,1%	0,1%	38	87	-131	208	454,3%
Mobile combustion: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0	0	0	1	94,0%
Mobile combustion: road vehicles	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-90	44	-196	-22	98,2%
Fugitive emissions venting/flaring	CH4	0,1%	-0,4%	0,1%	-0,6%	-0,3%	0,1%	-953	134	-1214	-689	28,2%
Fugitive emissions from oil and gas operations: gas distribution	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	13	14	-14	39	211,6%
Fugitive emissions from oil and gas operations: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-13	36	-84	59	562,1%
Other industrial: CH4	CH4	0,0%										
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	0,2%	-0,5%	0,3%	-1,1%	0,1%	0,6%	-1082	669	-2410	219	123,6%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-88	74	-234	57	169,2%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-33	16	-66	-4	94,0%
Emissions from manure management : cattle	CH4	0,1%	-0,1%	0,4%	-0,8%	0,6%	0,7%	-151	777	-1822	1391	1026,2%
Emissions from manure management : swine	CH4	0,1%	-0,1%	0,2%	-0,5%	0,2%	0,4%	-217	398	-1123	482	366,2%
Emissions from manure management : poultry	CH4	0,1%	-0,1%	0,1%	-0,2%	0,0%	0,1%	-174	112	-455	-30	128,3%
Emissions from manure management : other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5	4	-2	14	176,5%
CH4 emissions from solid waste disposal sites	CH4	1,4%	-2,4%	0,6%	-3,7%	-1,3%	1,2%	-5247	1278	-7936	-2909	48,7%
Emissions from wastewater handling	CH4	0,0%	0,0%	0,1%	-0,2%	0,1%	0,2%	-84	188	-448	290	444,6%
OTHER CH4	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	72	12	50	96	32,6%
Total CH4			-3,7%	1,1%	-6,1%	-1,6%	2,2%	-8024	2454	-13482	-3316	61,2%
Emissions from stationary combustion: non-CO2	N2O	0,0%	0,0%	0,0%	0,0%	0,1%	0,0%	23	48	-73	119	419,2%
Mobile combustion: other	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	0	2	91,1%
Mobile combustion: road vehicles	N2O	0,1%	0,1%	0,1%	-0,1%	0,3%	0,2%	213	214	-111	735	200,5%
Nitric acid production	N2O	0,4%	-0,3%	0,2%	-0,8%	0,0%	0,4%	-712	470	-1734	107	132,0%
Caprolactam production	N2O	0,3%	-0,2%	0,2%	-0,6%	0,1%	0,4%	-482	394	-1340	224	163,6%
Other industrial: N2O	N2O	0,0%										
Indirect N2O from non-agricultural sources	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	4	27	-44	62	1378,4%
Indirect N2O from NO2 from combustion and industrial processes	N2O	0,3%	-0,1%	0,1%	-0,4%	0,0%	0,2%	-247	273	-947	-24	221,2%
Emissions from manure management	N2O	0,0%	0,0%	0,2%	-0,4%	0,4%	0,4%	20	404	-777	870	3944,3%
Direct N2O emissions from agricultural soils	N2O	0,3%	0,2%	0,7%	-1,2%	1,7%	1,5%	340	1604	-2717	3772	943,2%
Indirect N2O emissions from nitrogen used in agriculture	N2O	1,9%	-0,7%	1,5%	-4,3%	1,6%	2,9%	-1587	3389	-9780	3456	427,2%
Animal production on agricultural soils	N2O	0,3%	-0,3%	0,2%	-0,8%	0,0%	0,4%	-601	469	-1779	45	155,9%
5A1. Forest Land remaining Forest Land	N2O	0,0%										
Emissions from wastewater handling	N2O	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-117	104	-321	88	178,7%
OTHER N2O	N2O	0,0%	-0,1%	0,0%	-0,1%	0,0%	0,0%	-116	44	-208	-35	76,1%
Total N2O			-1,5%	1,7%	-5,2%	1,5%	3,4%	-3257	3868	-11772	3156	237,5%
SF6 emissions from SF6 use	SF6											
PFC from aluminium production	PFC	0,2%	-0,8%	0,1%	-1,0%	-0,7%	0,1%	-1795	155	-2099	-1491	17,3%
PFC emissions from PFC use	PFC											
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC											
HFC-23 emissions from HCFC-22 manufacture	HFC	0,3%	-2,7%	0,4%	-3,5%	-2,0%	0,8%	-5869	898	-7718	-4342	30,6%
HFC by-product emissions from HFC manufacture	HFC											
Total F-gases			-3,0%	0,4%	-3,9%	-2,2%	0,9%	-6480	975	-8463	-4757	30,1%
	-> 50% f											
Total Netherlands (CO2-eq.)		**3,3%**	**1,5%**	**2,3%**	**-3,3%**	**5,8%**	**4,6%**	**3174**	**5055**	**-7424**	**12288**	**318,5%**

SCENARIO H2

Source category	Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	206	2 230	0,5%	10,0%	10,0%	206	10	186	227	10,0%	2231	111	2013	2447	10,0%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	25 776	27 004	1,0%	3,0%	3,2%	25774	333	25123	26434	2,6%	27003	472	26080	27920	3,5%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	13 184	25 174	0,5%	1,0%	1,1%	13184	74	13040	13329	1,1%	397	78	250	555	39,3%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	592	1 750	10,0%	5,0%	11,2%	592	33	528	658	11,2%	1750	196	1376	2143	22,4%
Stationary combustion : Petroleum Refining: liquids	CO2	9 999	9 556	10,0%	10,0%	14,1%	9998	705	8652	11413	14,1%	9557	1072	7521	11711	22,4%
Stationary combustion : Petroleum Refining: gases	CO2	1 029	2 239	0,5%	1,0%	1,1%	1029	6	1018	1041	1,1%	2254	20	2222	2296	1,8%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0	1	20,0%	2,0%	20,1%	0					1	0	1	1	20,2%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	1 401	1 953	20,0%	5,0%	20,6%	1401	145	1119	1690	20,7%	1954	202	1564	2355	20,6%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	8 788	7 502	1,0%	5,0%	5,1%	8787	256	8289	9293	5,8%	7503	218	7082	7935	5,8%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	5 195	4 384	2,0%	10,0%	10,2%	5034	257	4529	5540	10,2%	4327	306	3728	4930	14,2%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	18 785	15 212	2,0%	1,0%	2,2%	18785	211	18373	19200	2,2%	15314	201	14933	15717	2,6%
Stationary combustion : Other Sectors, solids	CO2	189	134	50,0%	5,0%	50,2%	189	47	97	282	50,1%	134	34	68	200	50,6%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	6 571	10 921	20,0%	1,0%	20,0%	6573	207	6175	6988	6,3%	10997	339	10342	11673	6,2%
Stationary combustion : Other Sectors, Residential, gases	CO2	18 466	18 555	5,0%	1,0%	5,1%	18466	470	17541	19390	5,1%	18677	492	17720	19654	5,3%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	8 226	6 955	10,0%	1,0%	10,0%	8229	412	7419	9036	10,0%	7000	354	6306	7694	10,1%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	2 522	2 656	20,0%	2,0%	20,1%	2523	254	2030	3022	20,1%	2656	267	2131	3179	20,1%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	1 479	451	20,0%	2,0%	20,1%	1482	107	1274	1696	14,4%	452	35	384	522	15,5%
Military use of fuels (1A5 Other)	CO2	566	437	20,0%	2,0%	20,1%	566	57	455	678	20,2%	436	44	351	522	20,1%
Mobile combustion: road vehicles: gasoline	CO2	10 902	13 168	2,0%	0,4%	2,0%	10902	154	10599	11206	2,8%	13168	186	12807	13538	2,8%
Mobile combustion: road vehicles: diesel oil	CO2	11 832	19 542	5,0%	0,2%	5,0%	11833	319	11209	12460	5,4%	19538	524	18522	20580	5,4%
Mobile combustion: road vehicles: LPG	CO2	2 738	1 131	10,0%	0,2%	10,0%	2737	140	2465	3011	10,2%	1132	58	1019	1246	10,3%
Mobile combustion: water-borne navigation	CO2	403	580	20,0%	0,2%	20,0%	403	40	324	482	20,0%	580	58	466	693	20,0%
Mobile combustion: aircraft	CO2	41	41	50,0%	0,5%	50,0%	41	7	26	56	35,9%	41	7	26	56	36,1%
Mobile combustion: other	CO2	91	109	50,0%	0,2%	50,0%	91	2	86	95	5,0%	109	3	104	115	5,0%
CO2 from coke production	CO2	403	509	50,0%	2,0%	5,0%	404	101	206	602	50,0%	509	128	260	760	50,1%
Fugitive emissions venting/flaring: CO2	CO2	769	110	50,0%	2,0%	50,0%	769	88	597	941	22,8%	110	5	100	120	9,4%
Cement production	CO2	507	434	5,0%	10,0%	11,2%	507	28	452	563	11,2%	434	24	387	482	11,2%
Limestone and dolomite use	CO2	440	563	25,0%	5,0%	25,5%	580	129	378	867	44,4%	747	165	489	1115	44,2%
Other minerals	CO2	269	358	25,0%	5,0%	25,5%	270	34	202	338	25,6%	358	46	268	448	25,5%
Ammonia production	CO2	3 058	3 048	2,0%	1,0%	2,2%	3058	34	2991	3125	2,2%	3048	34	2981	3115	2,2%
Other chemical product manufacture	CO2	588	606	50,0%	50,0%	70,7%										
Iron and steel production (carbon inputs)	CO2	2 514	1 105	3,0%	5,0%	5,8%	2514	73	2372	2660	5,8%	1105	32	1042	1169	5,9%
CO2 from aluminium production	CO2	395	479	2,0%	5,0%	5,4%	394	11	374	415	5,4%	479	13	454	504	5,4%
Other industrial: CO2	CO2	347	342	5,0%	20,0%	20,6%										
Indirect CO2 from solvents/product use	CO2	316	160	25,0%	10,0%	26,9%										
Total CO2		**161 482**	**182 158**			**1,9%**	**158984**	**1216**	**156633**	**161384**	1,5%	**180047**	**1669**	**176819**	**183353**	1,9%
						-> 5%										

SCENARIO H2

							1990					2004				
Source category	**Gas**	**Tier 1 CO2-eq. 90/95**	**Tier 1 CO2-eq. 2004**	**Tier 1 AD unc**	**Tier 1 EF unc**	**Tier 1 EM unc**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Emissions from stationary combustion: non-CO2	CH4	518	557	3,0%	50,0%	50,1%	518	87	350	693	33,6%	557	88	386	731	31,7%
Mobile combustion: other	CH4	1	1	50,0%	100,0%	111,8%	1	0	0	2	100,5%	1	1	0	2	89,5%
Mobile combustion: road vehicles	CH4	157	67	3,0%	60,0%	60,1%	156	50	84	276	63,5%	67	22	35	121	66,4%
Fugitive emissions venting/flaring	CH4	1 252	299	2,0%	25,0%	25,1%	1252	147	965	1540	23,5%	299	35	230	368	23,5%
Fugitive emissions from oil and gas operations: gas distribution	CH4	255	268	2,0%	50,0%	50,0%	238	45	147	322	38,2%	251	52	147	347	41,8%
Fugitive emissions from oil and gas operations: other	CH4	162	149	20,0%	50,0%	53,9%	162	34	99	232	42,0%	149	33	87	217	44,9%
Other industrial: CH4	CH4	297	309	10,0%	50,0%	51,0%										
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	6 767	5 688	5,0%	20,0%	20,6%	6763	701	5396	8140	20,7%	5689	587	4559	6857	20,6%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	439	351	5,0%	50,0%	50,2%	439	110	225	657	50,2%	351	88	179	523	50,1%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	319	286	5,0%	30,0%	30,4%	319	44	234	405	27,4%	286	33	221	350	22,9%
Emissions from manure management : cattle	CH4	1 574	1 421	10,0%	100,0%	100,5%	1576	789	560	3568	100,1%	1423	711	504	3225	99,9%
Emissions from manure management : swine	CH4	1 141	919	10,0%	100,0%	100,5%	1142	572	407	2579	100,2%	917	458	325	2055	99,8%
Emissions from manure management : poultry	CH4	243	69	10,0%	100,0%	100,5%	243	123	85	555	101,5%	69	35	24	156	101,2%
Emissions from manure management : other	CH4	12	16	10,0%	100,0%	100,5%	12	4	6	21	68,9%	16	5	8	29	66,3%
CH4 emissions from solid waste disposal sites	CH4	12 011	6 775	30,0%	15,0%	33,5%	12012	1763	9262	14981	29,4%	6759	684	5677	7915	20,2%
Emissions from wastewater handling	CH4	290	206	20,0%	25,0%	32,0%	289	143	27	586	98,8%	206	171	-112	556	166,4%
OTHER CH4	CH4	1	72	20,0%	25,0%	32,0%	1	0	1	1	25,1%	73	12	51	97	32,2%
Total CH4		**25 437**	**17 453**			**18%**	**25444**	**2395**	**20970**	**30966**	18,8%	**17423**	**1312**	**15029**	**20239**	15,1%
						-> 25%										
Emissions from stationary combustion: non-CO2	N2O	215	238	3,0%	50,0%	50,1%	249	67	132	385	54,1%	271	68	152	410	50,2%
Mobile combustion: other	N2O	1	2	50,0%	100,0%	111,8%	1	1	0	2	101,8%	2	1	1	4	90,9%
Mobile combustion: road vehicles	N2O	271	485	5,0%	50,0%	50,2%	271	127	106	588	93,6%	486	238	182	1082	98,1%
Nitric acid production	N2O	6 330	5 617	10,0%	50,0%	51,0%	6336	1618	3203	9552	51,1%	5624	1435	2852	8477	51,0%
Caprolactam production	N2O	1 240	759	50,0%	50,0%	70,7%	1241	448	481	2231	72,2%	761	273	295	1353	71,7%
Other industrial: N2O	N2O	3	7	50,0%	50,0%	70,7%										
Indirect N2O from non-agricultural sources	N2O	52	56	50,0%	200,0%	206,2%	52	57	6	197	218,3%	56	60	7	212	213,2%
Indirect N2O from NO2 from combustion and industrial processes	N2O	883	637	15,0%	200,0%	200,6%	886	873	120	3186	197,2%	640	632	86	2296	197,7%
Emissions from manure management	N2O	694	710	10,0%	100,0%	100,5%	692	273	317	1363	79,0%	711	298	313	1450	83,9%
Direct N2O emissions from agricultural soils	N2O	4 597	4 941	10,0%	60,0%	60,8%	4604	1423	2522	8038	61,8%	4942	1620	2625	8836	65,6%
Indirect N2O emissions from nitrogen used in agriculture	N2O	4 861	3 298	50,0%	200,0%	206,2%	4846	4176	964	15744	172,3%	3283	2970	621	10984	181,0%
Animal production on agricultural soils	N2O	1 308	704	10,0%	100,0%	100,5%	1310	660	467	2985	100,7%	705	360	249	1616	102,1%
Emissions from wastewater handling	N2O	513	397	20,0%	50,0%	53,9%	514	94	333	701	36,8%	397	78	250	555	39,3%
OTHER N2O	N2O	250	133	20,0%	50,0%	53,9%	250	55	147	363	44,4%	133	19	96	172	28,8%
Total N2O		**21 226**	**17 992**			**45%**	**21255**	**4860**	**14649**	**33029**	45,7%	**18017**	**3773**	**12574**	**26898**	41,9%
						-> 50%										
SF6 emissions from SF6 use	SF6	301	324	50,0%	25,0%	55,9%										
PFC from aluminium production	PFC	1 901	106	2,0%	20,0%	20,1%	1900	159	1588	2213	16,8%	106	9	88	123	17,1%
PFC emissions from PFC use	PFC	37	179	5,0%	25,0%	25,5%										
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC	240	1 179	10,0%	50,0%	51,0%										
HFC-23 emissions from HCFC-22 manufacture	HFC	5 759	354	10,0%	10,0%	14,1%	6241	903	4712	8095	28,9%	366	37	301	439	20,1%
HFC by-product emissions from HFC manufacture	HFC	12	99	10,0%	20,0%	22,4%										
Total F-gases		**8 250**	**2 242**			**28%**	**8724**	**923**	**7156**	**10610**	21,2%	**2251**	**319**	**1627**	**2875**	28,3%
		-> 50% for HFCs ,PFCs and SF6														
Total Netherlands (CO2-eq.)		**216394**	**219845**			**4,5%**	**214408**	**5620**	**205553**	**227070**	5,2%	**217738**	**4355**	**210688**	**227414**	4,0%
						-> 6%										

SCENARIO H2

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	**Gas**	**TIER-1 trend unc.**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**	**MEAN**	**STD**	**2,5%**	**97,5%**	**2-STD**
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	0,1%	0,9%	0,1%	0,8%	1,1%	0,1%	2024	106	1816	2232	10,5%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	0,2%	0,6%	0,2%	0,2%	1,0%	0,4%	1229	428	387	2066	69,7%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	0,1%	5,7%	0,2%	5,3%	6,0%	0,3%	12158	204	11816	12584	3,4%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	0,1%	0,5%	0,1%	0,4%	0,7%	0,2%	1158	198	778	1556	34,3%
Stationary combustion : Petroleum Refining: liquids	CO2	0,6%	-0,2%	0,5%	-1,2%	0,8%	1,0%	-441	1084	-2517	1730	491,8%
Stationary combustion : Petroleum Refining: gases	CO2	0,0%	0,6%	0,0%	0,5%	0,6%	0,0%	1225	18	1194	1263	3,0%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	1	1	20,2%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	0,3%	0,3%	0,1%	0,0%	0,5%	0,2%	553	241	81	1026	87,2%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	0,1%	-0,6%	0,1%	-0,8%	-0,4%	0,3%	-1284	267	-1808	-760	41,6%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	0,1%	-0,3%	0,1%	-0,6%	-0,1%	0,3%	-707	291	-1277	-137	82,4%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	0,2%	-1,6%	0,1%	-1,9%	-1,4%	0,3%	-3471	269	-3996	-2938	15,5%
Stationary combustion : Other Sectors, solids	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-55	58	-169	59	210,2%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	1,4%	2,1%	0,2%	1,7%	2,4%	0,4%	4424	394	3655	5201	17,8%
Stationary combustion : Other Sectors, Residential, gases	CO2	0,6%	0,1%	0,3%	-0,5%	0,7%	0,6%	211	671	-1099	1533	636,4%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	0,5%	-0,6%	0,3%	-1,1%	-0,1%	0,5%	-1230	540	-2294	-178	87,9%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	0,3%	0,1%	0,2%	-0,3%	0,4%	0,3%	133	366	-590	848	551,2%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	0,1%	-0,5%	0,1%	-0,6%	-0,4%	0,1%	-1030	112	-1253	-813	21,8%
Military use of fuels (1A5 Other)	CO2	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-130	71	-270	10	110,0%
Mobile combustion: road vehicles: gasoline	CO2	0,2%	1,1%	0,1%	0,9%	1,2%	0,2%	2266	173	1927	2607	15,3%
Mobile combustion: road vehicles: diesel oil	CO2	0,6%	3,6%	0,3%	3,0%	4,2%	0,6%	7706	574	6584	8833	14,9%
Mobile combustion: road vehicles: LPG	CO2	0,1%	-0,7%	0,1%	-0,9%	-0,6%	0,1%	-1606	149	-1897	-1316	18,5%
Mobile combustion: water-borne navigation	CO2	0,1%	0,1%	0,0%	0,0%	0,1%	0,1%	177	71	38	316	80,0%
Mobile combustion: aircraft	CO2	0,0%										
Mobile combustion: other	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	19	4	12	25	38,3%
CO2 from coke production	CO2	0,2%	0,0%	0,1%	-0,1%	0,2%	0,2%	106	163	-213	426	308,3%
Fugitive emissions venting/flaring: CO2	CO2	0,0%	-0,3%	0,0%	-0,4%	-0,2%	0,1%	-659	88	-831	-486	26,6%
Cement production	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-73	17	-107	-40	46,9%
Limestone and dolomite use	CO2	0,1%	0,1%	0,1%	-0,1%	0,2%	0,2%	167	173	-161	529	207,3%
Other minerals	CO2	0,1%	0,0%	0,0%	0,0%	0,1%	0,1%	88	57	-22	199	128,3%
Ammonia production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-10	43	-94	74	852,2%
Other chemical product manufacture	CO2											
Iron and steel production (carbon inputs)	CO2	0,0%	-0,7%	0,0%	-0,7%	-0,6%	0,1%	-1409	68	-1544	-1277	9,7%
CO2 from aluminium production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	84	7	72	97	15,6%
Other industrial: CO2	CO2											
Indirect CO2 from solvents/product use	CO2											
Total CO2			9,8%	0,9%	8,1%	11,6%	1,8%	21063	1797	17561	24621	17,1%

SCENARIO H2

Source category	Gas	TIER-1 trend unc.	Relative Trend (to 1990 emissions) (%) MEAN	STD	2,5%	97,5%	2-STD	Absolute Trend (CO2-eq) MEAN	STD	2,5%	97,5%	2-STD
Emissions from stationary combustion: non-CO2	CH4	0,0%	0,0%	0,0%	-0,1%	0,1%	0,1%	39	87	-132	208	445,8%
Mobile combustion: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0	0	0	1	93,9%
Mobile combustion: road vehicles	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-89	44	-194	-22	97,8%
Fugitive emissions venting/flaring	CH4	0,1%	-0,4%	0,1%	-0,6%	-0,3%	0,1%	-952	133	-1213	-693	27,9%
Fugitive emissions from oil and gas operations: gas distribution	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	13	14	-14	39	210,9%
Fugitive emissions from oil and gas operations: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-13	36	-84	58	553,4%
Other industrial: CH4	CH4											
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	0,2%	-0,5%	0,3%	-1,1%	0,1%	0,6%	-1075	668	-2394	237	124,3%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-88	74	-235	57	168,3%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-33	16	-66	-4	94,1%
Emissions from manure management : cattle	CH4	0,1%	-0,1%	0,4%	-0,8%	0,6%	0,7%	-153	773	-1797	1374	1008,4%
Emissions from manure management : swine	CH4	0,1%	-0,1%	0,2%	-0,5%	0,2%	0,4%	-225	395	-1132	468	351,9%
Emissions from manure management : poultry	CH4	0,1%	-0,1%	0,1%	-0,2%	0,0%	0,1%	-174	111	-455	-31	127,8%
Emissions from manure management : other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5	4	-2	14	176,6%
CH4 emissions from solid waste disposal sites	CH4	1,4%	-2,4%	0,6%	-3,7%	-1,3%	1,2%	-5247	1278	-7936	-2909	48,7%
Emissions from wastewater handling	CH4	0,0%	0,0%	0,1%	-0,2%	0,1%	0,2%	-83	187	-447	289	448,9%
OTHER CH4	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	72	12	50	96	32,4%
Total CH4			-3,7%	1,1%	-6,2%	-1,6%	2,2%	-8021	2463	-13540	-3340	61,4%
Emissions from stationary combustion: non-CO2	N2O	0,0%	0,0%	0,0%	0,0%	0,1%	0,0%	22	48	-73	119	432,6%
Mobile combustion: other	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	0	2	90,6%
Mobile combustion: road vehicles	N2O	0,1%	0,1%	0,1%	-0,1%	0,3%	0,2%	215	217	-110	738	201,5%
Nitric acid production	N2O	0,4%	-0,3%	0,2%	-0,8%	0,1%	0,4%	-712	472	-1744	112	132,6%
Caprolactam production	N2O	0,3%	-0,2%	0,2%	-0,6%	0,1%	0,4%	-481	394	-1338	229	164,0%
Other industrial: N2O	N2O											
Indirect N2O from non-agricultural sources	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	4	27	-44	62	1375,6%
Indirect N2O from NO2 from combustion and industrial processes	N2O	0,3%	-0,1%	0,1%	-0,4%	0,0%	0,2%	-246	265	-946	-25	215,6%
Emissions from manure management	N2O	0,0%	0,0%	0,2%	-0,4%	0,4%	0,4%	18	404	-779	858	4387,1%
Direct N2O emissions from agricultural soils	N2O	0,3%	0,2%	0,8%	-1,3%	1,8%	1,5%	338	1620	-2799	3762	959,8%
Indirect N2O emissions from nitrogen used in agriculture	N2O	1,9%	-0,7%	1,5%	-4,1%	1,6%	2,9%	-1563	3291	-9268	3398	421,1%
Animal production on agricultural soils	N2O	0,3%	-0,3%	0,2%	-0,8%	0,0%	0,4%	-605	473	-1787	34	156,5%
Emissions from wastewater handling	N2O	0,1%	-0,1%	0,0%	-0,2%	0,0%	0,1%	-117	105	-323	89	179,6%
OTHER N2O	N2O	0,0%	-0,1%	0,0%	-0,1%	0,0%	0,0%	-116	45	-210	-35	76,5%
Total N2O			-1,5%	1,7%	-5,2%	1,4%	3,4%	-3238	3797	-11539	3078	234,5%
SF6 emissions from SF6 use	SF6											
PFC from aluminium production	PFC	0,2%	-0,8%	0,1%	-1,0%	-0,7%	0,1%	-1794	155	-2100	-1490	17,3%
PFC emissions from PFC use	PFC											
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC											
HFC-23 emissions from HCFC-22 manufacture	HFC		-2,7%	0,4%	-3,5%	-2,0%	0,8%	-5869	898	-7718	-4342	30,6%
HFC by-product emissions from HFC manufacture	HFC											
Total F-gases			-3,0%	0,4%	-3,9%	-2,2%	0,9%	-6473	974	-8457	-4771	30,1%
Total Netherlands (CO2-eq.)		**3,3%**	**1,6%**	**2,3%**	**-3,1%**	**5,9%**	**4,6%**	**3330**	**4965**	**-7038**	**12298**	**298,2%**

SCENARIO I

Source category	Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	206	2 230	0,5%	10,0%	10,0%	206	7	192	221	7,0%	2231	79	2078	2385	7,1%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	25 776	27 004	1,0%	3,0%	3,2%	25774	786	24243	27317	6,1%	27003	774	25500	28519	5,7%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	13 184	25 174	0,5%	1,0%	1,1%	13182	464	12271	14091	7,0%	25171	887	23445	26908	7,1%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	592	1 750	10,0%	5,0%	11,2%	592	21	552	633	7,1%	1749	62	1628	1871	7,1%
Stationary combustion : Petroleum Refining: liquids	CO2	9 999	9 556	10,0%	10,0%	14,1%	9999	381	9264	10758	7,6%	9558	364	8849	10279	7,6%
Stationary combustion : Petroleum Refining: gases	CO2	1 029	2 239	0,5%	1,0%	1,1%	1029	39	953	1106	7,6%	2239	85	2073	2405	7,6%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0	1	20,0%	2,0%	20,1%	0					1	0	1	1	7,6%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	1 401	1 953	20,0%	5,0%	20,6%	1401	53	1297	1507	7,6%	1953	74	1809	2102	7,6%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	8 788	7 502	1,0%	5,0%	5,1%	8789	334	8138	9447	7,6%	7505	285	6947	8064	7,6%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	5 195	4 384	2,0%	10,0%	10,2%	5033	151	4740	5329	6,0%	4325	157	4019	4631	7,2%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	18 785	15 212	2,0%	1,0%	2,2%	18785	715	17397	20200	7,6%	15211	579	14084	16355	7,6%
Stationary combustion : Other Sectors, solids	CO2	189	134	50,0%	5,0%	50,2%	189	6	177	201	6,6%	134	5	125	144	7,2%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	6 571	10 921	20,0%	1,0%	20,0%	6571	277	6040	7121	8,4%	10921	455	10039	11822	8,3%
Stationary combustion : Other Sectors, Residential, gases	CO2	18 466	18 555	5,0%	1,0%	5,1%	18464	743	17025	19931	8,1%	18554	746	17101	20040	8,0%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	8 226	6 955	10,0%	1,0%	10,0%	8225	332	7582	8883	8,1%	6953	279	6416	7505	8,0%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	2 522	2 656	20,0%	2,0%	20,1%	2521	101	2325	2720	8,0%	2656	107	2449	2868	8,1%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	1 479	451	20,0%	2,0%	20,1%	1479	42	1397	1563	5,7%	451	13	425	477	5,9%
Military use of fuels (1A5 Other)	CO2	566	437	20,0%	2,0%	20,1%	567	60	451	687	21,3%	437	46	347	530	21,2%
Mobile combustion: road vehicles: gasoline	CO2	10 902	13 168	2,0%	0,4%	2,0%	10903	293	10331	11484	5,4%	13167	356	12472	13864	5,4%
Mobile combustion: road vehicles: diesel oil	CO2	11 832	19 542	5,0%	0,2%	5,0%	11831	319	11204	12456	5,4%	19544	527	18513	20576	5,4%
Mobile combustion: road vehicles: LPG	CO2	2 738	1 131	10,0%	0,2%	10,0%	2737	75	2591	2884	5,5%	1131	31	1071	1193	5,5%
Mobile combustion: water-borne navigation	CO2	403	580	20,0%	0,2%	20,0%	402	50	304	502	25,0%	578	72	437	719	24,9%
Mobile combustion: aircraft	CO2	41	41	50,0%	0,5%	50,0%	41	7	27	56	36,2%	41	15	20	77	72,0%
Mobile combustion: other	CO2	91	109	50,0%	0,2%	50,0%	90	2	86	95	5,1%	109	3	103	114	5,2%
CO2 from coke production	CO2	403	509	50,0%	2,0%	5,0%	403	100	208	601	49,8%	508	128	259	758	50,3%
Fugitive emissions venting/flaring: CO2	CO2	769	110	50,0%	2,0%	50,0%	770	91	596	955	23,8%	111	5	101	122	9,8%
Cement production	CO2	507	434	5,0%	10,0%	11,2%	507	26	456	558	10,3%	434	22	390	477	10,2%
Limestone and dolomite use	CO2	440	563	25,0%	5,0%	25,5%	579	130	375	870	45,0%	749	166	490	1119	44,3%
Other minerals	CO2	269	358	25,0%	5,0%	25,5%	269	34	203	338	25,5%	358	46	269	449	25,5%
Ammonia production	CO2	3 058	3 048	2,0%	1,0%	2,2%	3058	111	2841	3277	7,2%	3048	110	2832	3266	7,2%
Other chemical product manufacture	CO2	588	606	50,0%	50,0%	70,7%										
Iron and steel production (carbon inputs)	CO2	2 514	1 105	3,0%	5,0%	5,8%	2514	177	2175	2867	14,1%	1105	79	954	1265	14,3%
CO2 from aluminium production	CO2	395	479	2,0%	5,0%	5,4%	395	11	374	416	5,4%	479	13	454	504	5,4%
Other industrial: CO2	CO2	347	342	5,0%	20,0%	20,6%										
Indirect CO2 from solvents/product use	CO2	316	160	25,0%	10,0%	26,9%										
5A1. Forest Land remaining Forest Land	CO2	-2 505	-2 289	25,0%	61,8%	67,0%	-2504	481	-3499	-1624	38,4%	-2289	477	-3291	-1420	41,7%
5A2. Land converted to Forest Land	CO2	-89	-342	25,0%	57,9%	63,0%	-89	21	-134	-50	48,0%	-343	92	-535	-175	53,9%
5B2. Land converted to Cropland	CO2	-35	-35	25,0%	50,0%	55,9%	-35	10	-56	-17	56,4%	-35	10	-56	-17	56,1%
5C1. Grassland remaining Grassland	CO2	4 246	4 246	25,0%	50,0%	55,9%	4247	1190	2073	6728	56,1%	4242	1195	2058	6735	56,3%
5C2. Land converted to Grassland	CO2	536	536	25,0%	61,2%	66,1%	535	288	-9	1124	107,5%	535	287	-6	1122	107,3%
5E2. Land converted to Settlements	CO2	-151	-151	25,0%	50,0%	55,9%	-151	43	-241	-73	56,2%	-151	42	-240	-74	56,1%
5F2. Land converted to Other Land	CO2	710	710	25,0%	50,0%	55,9%	710	201	346	1126	56,5%	710	200	345	1126	56,2%
5G. Other (liming of soils)	CO2	183	86	25,0%	1,0%	25,0%	183	11	162	205	12,0%	86	11	65	108	25,1%
Total CO2		**161 482**	**182 158**			2,5%	**161860**	**2946**	**156156**	**167674**	3,6%	**182269**	**3317**	**175839**	**188820**	3,6%
						-> 5%										

SCENARIO I

Source category	Gas	Tier 1 CO2-eq. 90/95	Tier 1 CO2-eq. 2004	Tier 1 AD unc	Tier 1 EF unc	Tier 1 EM unc	1990 MEAN	1990 STD	1990 2,5%	1990 97,5%	1990 2-STD	2004 MEAN	2004 STD	2004 2,5%	2004 97,5%	2004 2-STD
Emissions from stationary combustion: non-CO2	CH4	518	557	3,0%	50,0%	50,1%	518	165	288	928	63,9%	770	91	596	955	23,8%
Mobile combustion: other	CH4	1	1	50,0%	100,0%	111,8%	1	1	0	2	103,6%	1	0	1	2	65,5%
Mobile combustion: road vehicles	CH4	157	67	3,0%	60,0%	60,1%	157	167	28	577	213,1%	67	72	11	253	216,0%
Fugitive emissions venting/flaring	CH4	1 252	299	2,0%	25,0%	25,1%	1252	308	666	1874	49,2%	299	73	159	447	48,8%
Fugitive emissions from oil and gas operations: gas distribution	CH4	255	268	2,0%	50,0%	50,0%	577	181	287	966	62,9%	609	210	294	1063	69,0%
Fugitive emissions from oil and gas operations: other	CH4	162	149	20,0%	50,0%	53,9%	162	47	92	275	57,9%	149	47	81	262	62,9%
Other industrial: CH4	CH4	297	309	10,0%	50,0%	51,0%										
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	6 767	5 688	5,0%	20,0%	20,6%	6774	954	5013	8731	28,2%	5681	805	4176	7324	28,3%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	439	351	5,0%	50,0%	50,2%	439	63	322	569	28,5%	350	50	258	452	28,3%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	319	286	5,0%	30,0%	30,4%	319	41	243	402	25,7%	285	31	228	348	21,4%
Emissions from manure management : cattle	CH4	1 574	1 421	10,0%	100,0%	100,5%	1576	223	1162	2033	28,3%	1421	201	1046	1834	28,2%
Emissions from manure management : swine	CH4	1 141	919	10,0%	100,0%	100,5%	1141	163	840	1476	28,6%	919	130	678	1185	28,2%
Emissions from manure management : poultry	CH4	243	69	10,0%	100,0%	100,5%	243	34	178	314	28,4%	69	10	51	89	28,2%
Emissions from manure management : other	CH4	12	16	10,0%	100,0%	100,5%	12	1	9	14	19,5%	16	2	13	19	18,8%
CH4 emissions from solid waste disposal sites	CH4	12 011	6 775	30,0%	15,0%	33,5%	12019	1774	8776	15732	29,4%	6763	694	5488	8170	20,2%
Emissions from wastewater handling	CH4	290	206	20,0%	25,0%	32,0%	290	142	28	583	98,0%	206	172	-113	562	167,7%
OTHER CH4	CH4	1	72	20,0%	25,0%	32,0%	1	0	1	1	25,0%	73	12	51	97	32,1%
Total CH4		**25 437**	**17 453**			**18%**	**25837**	**2476**	**21169**	**31745**	19,2%	**17776**	**1284**	**15287**	**20401**	14,4%
						-> 25%										
Emissions from stationary combustion: non-CO2	N2O	215	238	3,0%	50,0%	50,1%	790	247	394	1314	62,6%	883	255	456	1420	57,8%
Mobile combustion: other	N2O	1	2	50,0%	100,0%	111,8%	1	1	0	2	103,6%	2	1	1	4	93,1%
Mobile combustion: road vehicles	N2O	271	485	5,0%	50,0%	50,2%	271	228	63	829	168,8%	486	418	105	1558	171,7%
Nitric acid production	N2O	6 330	5 617	10,0%	50,0%	51,0%	6329	635	5085	7577	20,1%	5616	563	4518	6726	20,1%
Caprolactam production	N2O	1 240	759	50,0%	50,0%	70,7%	1239	248	757	1724	40,0%	759	152	463	1056	40,0%
Other industrial: N2O	N2O	3	7	50,0%	50,0%	70,7%										
Indirect N2O from non-agricultural sources	N2O	52	56	50,0%	200,0%	206,2%	52	55	6	197	212,0%	56	58	7	210	208,7%
Indirect N2O from NO2 from combustion and industrial processes	N2O	883	637	15,0%	200,0%	200,6%	889	900	121	3224	202,6%	642	650	87	2306	202,4%
Emissions from manure management	N2O	694	710	10,0%	100,0%	100,5%	694	139	464	1009	40,2%	710	151	464	1053	42,7%
Direct N2O emissions from agricultural soils	N2O	4 597	4 941	10,0%	60,0%	60,8%	5823	1371	3502	8686	47,1%	6039	1245	3832	8622	41,2%
Indirect N2O emissions from nitrogen used in agriculture	N2O	4 861	3 298	50,0%	200,0%	206,2%	7282	2982	2575	14032	81,9%	4845	2065	1643	9549	85,3%
Animal production on agricultural soils	N2O	1 308	704	10,0%	100,0%	100,5%	1530	415	829	2387	54,2%	820	223	443	1280	54,3%
5A1. Forest Land remaining Forest Land	N2O	7	7	25,0%	20,0%	32,0%										
Emissions from wastewater handling	N2O	513	397	20,0%	50,0%	53,9%	513	94	331	703	36,7%	398	78	250	557	39,3%
OTHER N2O	N2O	250	133	20,0%	50,0%	53,9%	250	21	208	292	17,1%	133	12	111	157	17,6%
Total N2O		**21 226**	**17 992**			**45%**	**25672**	**3520**	**19701**	**33357**	27,4%	**21402**	**2630**	**16852**	**27050**	24,6%
						-> 50%										
SF6 emissions from SF6 use	SF6	301	324	50,0%	25,0%	55,9%										
PFC from aluminium production	PFC	1 901	106	2,0%	20,0%	20,1%	1901	159	1588	2214	16,8%	106	9	88	123	17,1%
PFC emissions from PFC use	PFC	37	179	5,0%	25,0%	25,5%										
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC	240	1 179	10,0%	50,0%	51,0%										
HFC-23 emissions from HCFC-22 manufacture	HFC	5 759	354	10,0%	10,0%	14,1%	6236	898	4715	8072	28,8%	366	36	301	439	19,9%
HFC by-product emissions from HFC manufacture	HFC	12	99	10,0%	20,0%	22,4%										
Total F-gases		**8 250**	**2 242**			**28%**	**8728**	**918**	**7144**	**10604**	21,0%	**2251**	**317**	**1629**	**2874**	28,2%
	-> 50% for HFCs ,PFCs and SF6															
Total Netherlands (CO2-eq.)		**216394**	**219845**			**4,5%**	**222097**	**5316**	**212256**	**233074**	4,8%	**223699**	**4447**	**215225**	**232616**	4,0%
						-> 6%										

SCENARIO I

			Relative Trend (to 1990 emissions) (%)					Absolute Trend (CO2-eq)				
Source category	Gas	TIER-1 trend unc.	MEAN	STD	2,5%	97,5%	2-STD	MEAN	STD	2,5%	97,5%	2-STD
Stationary combustion: Public Electricity and Heat Production: liquids	CO2	0,1%	0,9%	0,0%	0,8%	1,0%	0,1%	2024	75	1878	2172	7,5%
Stationary combustion : Public Electricity and Heat Production: solids	CO2	0,2%	0,6%	0,1%	0,3%	0,8%	0,2%	1229	251	736	1720	40,9%
Stationary combustion : Public Electricity and Heat Production: gases	CO2	0,1%	5,4%	0,2%	5,0%	5,8%	0,4%	11989	442	11136	12858	7,4%
Stationary combustion : Public Electricity and Heat Production: waste incineration	CO2	0,1%	0,5%	0,0%	0,5%	0,6%	0,1%	1157	66	1028	1285	11,3%
Stationary combustion : Petroleum Refining: liquids	CO2	0,6%	-0,2%	0,2%	-0,6%	0,2%	0,4%	-441	401	-1235	339	181,7%
Stationary combustion : Petroleum Refining: gases	CO2	0,0%	0,5%	0,0%	0,5%	0,6%	0,0%	1209	56	1101	1320	9,3%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: liquids	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	1	1	7,6%
Stationary combustion : Manuf. of Solid Fuels and Other En. Ind.: gases	CO2	0,3%	0,2%	0,0%	0,2%	0,3%	0,0%	552	41	474	634	14,8%
Stationary combustion : Manufacturing Industries and Construction, liquids	CO2	0,1%	-0,6%	0,2%	-0,9%	-0,3%	0,3%	-1284	335	-1944	-626	52,2%
Stationary combustion : Manufacturing Industries and Construction, solids	CO2	0,1%	-0,3%	0,1%	-0,5%	-0,2%	0,2%	-708	174	-1051	-367	49,2%
Stationary combustion : Manufacturing Industries and Construction, gases	CO2	0,2%	-1,6%	0,2%	-2,0%	-1,3%	0,3%	-3574	384	-4342	-2829	21,5%
Stationary combustion : Other Sectors, solids	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-55	6	-66	-43	21,6%
Stationary combustion : Other Sectors: Commercial/Institutional, gases	CO2	1,4%	2,0%	0,1%	1,7%	2,2%	0,3%	4350	330	3715	5005	15,2%
Stationary combustion : Other Sectors, Residential, gases	CO2	0,6%	0,0%	0,2%	-0,4%	0,5%	0,5%	90	524	-936	1116	1164,2%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, gases	CO2	0,5%	-0,6%	0,1%	-0,8%	-0,4%	0,2%	-1272	220	-1707	-845	34,6%
Stationary combustion : Other Sectors, Agriculture/Forestry/Fisheries, liquids	CO2	0,3%	0,1%	0,0%	0,0%	0,1%	0,1%	135	97	-56	326	144,3%
Stationary combustion : Other Sectors, liquids excl. From 1A4c	CO2	0,1%	-0,5%	0,0%	-0,5%	-0,4%	0,0%	-1029	38	-1103	-955	7,4%
Military use of fuels (1A5 Other)	CO2	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-129	73	-273	12	112,6%
Mobile combustion: road vehicles: gasoline	CO2	0,2%	1,0%	0,2%	0,6%	1,4%	0,4%	2264	430	1423	3112	38,0%
Mobile combustion: road vehicles: diesel oil	CO2	0,6%	3,5%	0,3%	2,9%	4,0%	0,5%	7712	577	6580	8841	15,0%
Mobile combustion: road vehicles: LPG	CO2	0,1%	-0,7%	0,0%	-0,8%	-0,6%	0,1%	-1606	76	-1756	-1457	9,5%
Mobile combustion: water-borne navigation	CO2	0,1%	0,1%	0,0%	0,0%	0,2%	0,1%	176	88	5	348	99,5%
Mobile combustion: aircraft	CO2											
Mobile combustion: other	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	18	4	11	25	38,6%
CO2 from coke production	CO2	0,2%	0,0%	0,1%	-0,1%	0,2%	0,1%	104	162	-212	421	311,3%
Fugitive emissions venting/flaring: CO2	CO2	0,0%	-0,3%	0,0%	-0,4%	-0,2%	0,1%	-659	92	-844	-485	27,8%
Cement production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-73	8	-89	-59	21,0%
Limestone and dolomite use	CO2	0,1%	0,1%	0,1%	-0,1%	0,2%	0,2%	170	174	-162	532	205,0%
Other minerals	CO2	0,1%	0,0%	0,0%	0,0%	0,1%	0,1%	89	56	-22	200	127,5%
Ammonia production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-10	43	-95	75	867,0%
Other chemical product manufacture	CO2											
Iron and steel production (carbon inputs)	CO2	0,0%	-0,6%	0,1%	-0,8%	-0,5%	0,2%	-1410	175	-1761	-1073	24,8%
CO2 from aluminium production	CO2	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	84	7	72	97	15,6%
Other industrial: CO2	CO2											
Indirect CO2 from solvents/product use	CO2											
5A1. Forest Land remaining Forest Land	CO2	0,4%	0,1%	0,2%	-0,4%	0,6%	0,5%	215	534	-837	1263	497,0%
5A2. Land converted to Forest Land	CO2	0,1%	-0,1%	0,0%	-0,2%	0,0%	0,1%	-253	89	-440	-93	70,1%
5B2. Land converted to Cropland	CO2											
5C1. Grassland remaining Grassland	CO2											
5C2. Land converted to Grassland	CO2											
5E2. Land converted to Settlements	CO2											
5F2. Land converted to Other Land	CO2											
5G. Other (liming of soils)	CO2	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-97	15	-127	-66	31,9%
Total CO2			9,2%	0,7%	7,9%	10,5%	1,3%	20410	1416	17648	23201	13,9%

SCENARIO I

Source category	Gas	TIER-1 trend unc.	Relative Trend (to 1990 emissions) (%) MEAN	STD	2,5%	97,5%	2-STD	Absolute Trend (CO2-eq) MEAN	STD	2,5%	97,5%	2-STD
Emissions from stationary combustion: non-CO2	CH4	0,0%	0,0%	0,1%	-0,1%	0,2%	0,1%	40	166	-298	383	831,0%
Mobile combustion: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0	0	0	1	92,8%
Mobile combustion: road vehicles	CH4	0,0%	0,0%	0,1%	-0,2%	0,0%	0,1%	-90	155	-461	76	343,5%
Fugitive emissions venting/flaring	CH4	0,1%	-0,4%	0,1%	-0,7%	-0,2%	0,3%	-953	283	-1529	-416	59,3%
Fugitive emissions from oil and gas operations: gas distribution	CH4	0,0%	0,0%	0,0%	0,0%	0,1%	0,1%	32	69	-86	192	439,3%
Fugitive emissions from oil and gas operations: other	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,0%	-13	49	-111	86	753,6%
Other industrial: CH4	CH4											
CH4 emissions from enteric fermentation in domestic livestock: cattle	CH4	0,2%	-0,5%	0,5%	-1,5%	0,5%	1,0%	-1092	1086	-3243	994	198,9%
CH4 emissions from enteric fermentation in domestic livestock: swine	CH4	0,0%	0,0%	0,0%	-0,1%	0,0%	0,1%	-89	64	-215	36	143,9%
CH4 emissions from enteric fermentation in domestic livestock: other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	-33	37	-108	37	222,2%
Emissions from manure management : cattle	CH4	0,1%	-0,1%	0,1%	-0,3%	0,2%	0,2%	-155	261	-670	351	335,8%
Emissions from manure management : swine	CH4	0,1%	-0,1%	0,1%	-0,3%	0,0%	0,1%	-222	166	-554	99	149,7%
Emissions from manure management : poultry	CH4	0,1%	-0,1%	0,0%	-0,1%	-0,1%	0,0%	-174	33	-242	-112	38,3%
Emissions from manure management : other	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	5	2	2	8	67,1%
CH4 emissions from solid waste disposal sites	CH4	1,4%										
Emissions from wastewater handling	CH4	0,0%	0,0%	0,1%	-0,2%	0,1%	0,2%	-84	187	-447	290	443,7%
OTHER CH4	CH4	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	72	12	50	96	32,3%
Total CH4			-3,6%	1,2%	-6,2%	-1,4%	2,3%	-8062	2684	-14149	-2983	66,6%
Emissions from stationary combustion: non-CO2	N2O	0,0%	0,0%	0,1%	-0,1%	0,2%	0,2%	93	183	-276	460	392,9%
Mobile combustion: other	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	1	0	0	2	99,5%
Mobile combustion: road vehicles	N2O	0,1%	0,1%	0,2%	-0,1%	0,5%	0,4%	216	395	-306	1159	365,8%
Nitric acid production	N2O	0,4%	-0,3%	0,0%	-0,4%	-0,2%	0,1%	-713	111	-941	-508	31,0%
Caprolactam production	N2O	0,3%	-0,2%	0,0%	-0,3%	-0,1%	0,1%	-480	97	-672	-293	40,4%
Other industrial: N2O	N2O											
Indirect N2O from non-agricultural sources	N2O	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	4	27	-45	61	1432,4%
Indirect N2O from NO2 from combustion and industrial processes	N2O	0,3%	-0,1%	0,1%	-0,4%	0,0%	0,2%	-247	275	-951	-25	222,4%
Emissions from manure management	N2O	0,0%	0,0%	0,1%	-0,2%	0,2%	0,2%	16	204	-383	426	2532,0%
Direct N2O emissions from agricultural soils	N2O	0,3%	0,1%	0,6%	-1,1%	1,3%	1,2%	216	1361	-2496	2829	1259,1%
Indirect N2O emissions from nitrogen used in agriculture	N2O	1,9%	-1,1%	1,1%	-3,5%	0,9%	2,2%	-2437	2512	-7930	2046	206,2%
Animal production on agricultural soils	N2O	0,3%	-0,3%	0,1%	-0,6%	-0,1%	0,3%	-709	299	-1340	-201	84,3%
5A1. Forest Land remaining Forest Land	N2O											
Emissions from wastewater handling	N2O	0,1%	-0,1%	0,0%	-0,1%	0,0%	0,1%	-116	105	-321	90	180,9%
OTHER N2O	N2O	0,0%	-0,1%	0,0%	-0,1%	0,0%	0,0%	-116	24	-163	-69	41,0%
Total N2O			-1,9%	1,3%	-4,6%	0,5%	2,6%	-4270	2928	-10439	1126	137,2%
SF6 emissions from SF6 use	SF6											
PFC from aluminium production	PFC	0,2%	-0,8%	0,1%	-0,9%	-0,7%	0,1%	-1795	155	-2100	-1492	17,3%
PFC emissions from PFC use	PFC											
Emissions from substitutes for ozone depleting substances (ODS substitutes): HFC	HFC											
HFC-23 emissions from HCFC-22 manufacture	HFC	0,3%	-2,6%	0,4%	-3,5%	-2,0%	0,8%					
HFC by-product emissions from HFC manufacture	HFC											
Total F-gases			-2,9%	0,4%	-3,8%	-2,2%	0,9%	-6476	972	-8437	-4763	30,0%
	-> 50% f											
Total Netherlands (CO2-eq.)		**3,3%**	**0,7%**	**2,0%**	**-3,2%**	**4,5%**	**3,9%**	**1602**	**4330**	**-7319**	**9817**	**540,6%**

APPENDIX F

Scenario I – IPCC default uncertainties

Sector	Changes in Blue							
	Activity data		Emission factors					
			CO_2		CH_4		N_2O	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
1A- FUEL COMBUSTION								
1.A.1-Energy industries								
a. Public electricity and heat production								
Liquid fuels	1.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
Solid fuels					100.0	Log-Normal	10 - 1000	Triangular
Coke Oven and BF gas	1.0	Normal	7.0	Normal				
Others (steenkool)	1.0	Normal	7.0	Normal				
Gaseous fuels	1.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
Biomass	20.0	Normal	---		100.0	Log-Normal	10 - 1000	Triangular
Other fuels	1.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
b. Petroleum refining								
Liquid fuels	3.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
Solid fuels	3.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
Gaseous fuels	3.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
c. Manufacture of solid fuels and other energy industries								
Liquid fuels	3.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
Solid fuels	3.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
Gaseous fuels	3.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
1.A.2-Manufacturing Industries and construction								
Liquid fuels	3.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
Solid fuels					100.0	Log-Normal	10 - 1000	Triangular
Coke Oven and BF gas	3.0	Normal	7.0	Normal				
Others (steenkool)	3.0	Normal	7.0	Normal				
Gaseous fuels	3.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
Biomass	20.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
Other fuels	10.0	Normal	7.0	Normal	100.0	Log-Normal	10 - 1000	Triangular
1.A.3-Transport								
a. Civil aviation								
Aviation Gasoline	100.0	Log-Normal	5.0	Normal	82.0	Log-Normal	116.0	Log-Normal
Jet Kerosene	100.0	Log-Normal	5.0	Normal	82.0	Log-Normal	116.0	Log-Normal
Sector	**Activity data**		**Emission factors**					
			CO_2		CH_4		N_2O	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
b. Road Transportation								
Gasoline	5.0	Normal	2.0	Normal	250.0	Log-Normal	250.0	Log-Normal

Diesel oil	5.0	Normal	2.0	Normal	250.0	Log-Normal	250.0	Log-Normal
Liquefied petroleum gases (LPG)	5.0	Normal	2.0	Normal	250.0	Log-Normal	250.0	Log-Normal
c. Railways								
Liquid fuels	5.0	Normal	98 – 101	Triangular	40 – 250	Triangular	50 – 300	Triangular
d. Navigation								
Residual oil	25.0	Normal	3.0	Normal	50.0	Log-Normal	60.0	Log-Normal
Gas and diesel oil	25.0	Normal	1.5	Normal	50.0	Log-Normal	60.0	Log-Normal
1.A.4-Other sectors								
Liquid fuels	4.0	Normal			100.0	Log-Normal	10 - 1000	Triangular
Solid fuels	4.0	Normal			100.0	Log-Normal	10 - 1000	Triangular
Gaseous fuels	4.0	Normal			100.0	Log-Normal	10 - 1000	Triangular
Biomass	4.0	Normal			100.0	Log-Normal	10 - 1000	Triangular
Other fuels								
a. Commercial/institutional								
Liquid fuels			7.0	Normal				
Solid fuels			7.0	Normal				
Gaseous fuels			7.0	Normal				
b. Residential								
Liquid fuels	4.0	Normal	7.0	Normal				
Solid fuels	4.0	Normal	7.0	Normal				
Gaseous fuels	4.0	Normal	7.0	Normal				
Biomass	4.0	Normal						
c. Agriculture/forestry/fisheries								
Liquid fuels	4.0	Normal	7.0	Normal				
Solid fuels	4.0	Normal	7.0	Normal				
Gaseous fuels	4.0	Normal	7.0	Normal				
1.A.4-Others (not-specified elsewhere)								
b. Mobile (Military use)								
Liquid fuels	20.0	Normal	7.0	Normal				

Sector	**Activity data**		**Emission factors**					
			CO_2		**CH_4**		**N_2O**	
	2σ (%)	**PDF**	**2σ (%)**	**PDF**	**2σ (%)**	**PDF**	**2σ (%)**	**PDF**
1B- NON-COMBUSTION OR FUGITIVE RELATED SOURCES								
1.B.1.b Solid fuel transformation	50.0	Normal	2.0	Normal	50.0	Normal		
1.B.2 Fugitive emissions from venting and flaring								
a. Oil								
Refining and storage	5.0	Normal			100.0	Log-Normal		
b. Natural gas								
Transmission	15.0	Normal			75.0	Log-Normal		
Distribution			80 – 500	Triangular				
Pipes of green cast iron	15.0	Normal			80 – 500	Triangular		
Pipes of another material	15.0	Normal			80 – 500	Triangular		
c.Venting								
Oil	15.0				25.0	Normal		
Combined	15.0		50.0	Normal	50.0	Normal		
Flaring								
Oil	15.0				50.0	Normal		
Gas	15.0				25.0	Normal		

Sector	**Activity data**		**Emission factors**					
			CO_2		**CH_4**		**N_2O**	
	2σ (%)	**PDF**	**2σ (%)**	**PDF**	**2σ (%)**	**PDF**	**2σ (%)**	**PDF**
2A- MINERAL PRODUCTS								
2.A.1- ***Cement production***	2.0	Normal	10.0					
2.A.3- ***Limestone and dolomite use***	25.0	Normal	5.0					
2.A.7- ***Others (soda ash and gas production)***	25.0	Normal	5.0					
2B- CHEMICAL INDUSTRY								
2.B.1- ***Ammonia production***	2.0	Normal	7.0	Normal				
2.B.2- ***Nitric acid production***	2.0	Normal					20.0	Normal
2.B.5- ***Others***								
Caprolactam	2.0	Normal					40.0	Normal
2C- METAL PRODUCTION								
2.B.1- ***Iron and steel production***	10.0	Normal	10.0	Normal				
2.B.3- ***Aluminum production***	2.0	Normal	5.0	Normal				
2D- OTHER								
Fireworks and candles	50.0	Normal					50.0	Log-Normal
Indirect N_2O from combustion and industrial processes	15.0	Normal					200.0	Log-Normal
Indirect N_2O from non agricultural NH_3 sources	50.0	Normal					200.0	Log-Normal

Emissions of PCF, SF_6 and HFC

Sector	Activity data		Emission factors					
			CF_4		C_2F_6		HFC23	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF	Min-max	
PFCs AND SF_6 FROM METAL PRODUCTION								
PFCs from aluminum production	2.0	Normal	20.0	Normal	20.0	Normal		
PRODUCTION OF HALOCARBONS AND SF6								
By product emissions								
HFC-23	2.0	Normal					Min:20%	Triangular
							Max:30%	Triangular

Total solvents and other product use

Sector	Activity data		Carbon fractions		N_20 emission factors	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
3-TOTAL SOLVENTS AND OTHER PRODUCT USE						
3A. Paint application	25.0	Normal	10.0	Normal		
3B. Degreasing and dry cleaning	25.0	Normal	10.0	Normal		
3D. Other	25.0	Normal	10.0	Normal		
Use of N20 for anesthesia	20.0	Normal			1.0	Normal
N2O from aerosol cans	20.0	Normal			1.0	Normal

Agriculture

Sector	Activity data		CH_4 emission factors		Emission factor per animal waste management system N_2O	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
4-AGRICULTURE						
4A. Enteric fermentation						
Cattle	20.0	Normal	20.0	Normal		
Sheep	20.0	Normal	20.0	Normal		
Goats	20.0	Normal	20.0	Normal		
Horses	20.0	Normal	20.0	Normal		
Swine	20.0	Normal	20.0	Normal		

Sector	Activity data		CH_4 emission factors		Emission factor per animal waste management system N_2O	
	2σ (%)	PDF	2σ (%)	PDF	2σ (%)	PDF
4B. Manure management						
Cattle	20.0	Normal	20.0	Normal		
Sheep	20.0	Normal	20.0	Normal		
Goats	20.0	Normal	20.0	Normal		
Horses	20.0	Normal	20.0	Normal		
Swine	20.0	Normal	20.0	Normal		
Poultry	20.0	Normal	20.0	Normal		
Nitrogen excretion per animal waste management						
Liquid system	10.0	Normal			100.0	Log-Normal
Solid storage and dry lot	10.0	Normal			100.0	Log-Normal
4C. Agricultural soils						
1. Direct soil emissions						
Synthetic fertilizers	10.0	Normal			-70 to +200 %	Triangular
Animal manure applied to solids	10.0	Normal			-50 to +100 %	Triangular
N-fixing crops	5.0	Normal			-70 to +200 %	Triangular
Cultivation of histosols	10.0	Normal			100.0	Log-Normal
2. Pasture, Range and Paddock manure	10.0	Normal			-50 to +100 %	Triangular
3. Indirect emissions						
Atmospheric deposition	50.0	Normal			-80 to +400 %	Triangular
Nitrogen leaching and run-off	50.0	Normal			-90 to +200 %	Log-Normal
4. Other						
Sludge application on land	20.0	Normal			50.0	Normal