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REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY OF THE NETHERLANDS SUBMITTED IN THE YEAR 2002[1]

Centralized review

I. OVERVIEW

A. Introduction

1. The Conference of the Parties (COP), by its decisions 6/CP.5 and 34/CP.7, requested the secretariat to conduct individual reviews of greenhouse gas (GHG) inventories submitted by Parties included in Annex I to the Convention (Annex I Parties), according to the "UNFCCC guidelines for the technical review of GHG inventories from Annex I Parties, hereinafter referred to as the UNFCCC review guidelines."[2] The principal objectives[3] of the review of the GHG inventories are to ensure that the COP has adequate information on GHG inventories and GHG emission trends, and to examine the information submitted by Annex I Parties in accordance with the UNFCCC reporting guidelines[4] for consistency with those guidelines.

2. The centralized review of the Netherlands took place from 9 to 13 September 2002. It was carried out by a team of nominated experts (expert review team – ERT) from the roster of experts, working at the headquarters of the UNFCCC secretariat in Bonn. The assignments of the experts were as follows: generalists – Mr. Bernd Gugele (European Community) and Mr. Marius Țăranu (Republic of Moldova); energy – Mr. Lambert Schneider (Germany) and Mr. Mohammad Soltanieh (Iran), industrial processes – Ms. Deborah Shafer (USA) and Mr. Mauro Meirelles de Oliveira Santos (Brazil); agriculture – Ms. Anna Romanovskaya (Russian Federation) and Mr. Tomoyuki Aizawa (Japan); land-use change and forestry – Mr. Aquiles Neuenschwander (Chile) and Mr. Daniel Martino (Uruguay); waste – Mr. Davor Vešligaj (Croatia) and Mr. Jens E. Frøiland Jensen (Norway). Mr. Jens E. Frøiland Jensen and Mr. Marius Țăranu were the lead reviewers for this centralized review. The review was coordinated by Ms. Astrid Olsson and Ms. Sevdalina Todorova-Brankova (UNFCCC secretariat).

3. In accordance with the UNFCCC review guidelines, a draft version of this report was communicated to the Government of the Netherlands, which provided comments that were considered and incorporated, as appropriate, in the final version of this report.

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[1] In the symbol for this document, 2002 refers to the year in which the inventory was submitted, and not to the year of publication. The number (3) indicates that this is a centralized review report.

[2] For the UNFCCC review guidelines and decision 6/CP.5 see document FCCC/CP/1999/7, pages 109 to 114 and 121 to 122, respectively.

[3] For the objectives of the review of GHG inventories see document FCCC/CP/1999/7, page 109, paragraph 2.

[4] The guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories (FCCC/P/1999/7), are referred to in this report as the UNFCCC reporting guidelines.

B. Inventory submission and other sources of information

4. In its 2002 submission, the Netherlands submitted common reporting format (CRF) tables for the years 1990–2000. The Netherlands submitted a national inventory report (NIR) in 2002 providing information on methodologies used, activity data and emission factors. The submission was received in the secretariat on 12 April 2002.

5. The 2002 status report and the draft 2002 synthesis and assessment (S&A) report, together with the previous status reports and S&A reports and the reports of the desk and centralized review of the Dutch 2000 GHG inventory,[5] were made available to the ERT. The country provided additional information and clarification during the review upon request from experts. The Party's responses are taken into consideration in this report. The full list of materials used during the review is provided in annex I to this report.

C. Emission profile, trends and key sources

6. In the year 2000, the most important GHG in the Netherlands was carbon dioxide (CO_2), which in 2000 accounted for 80.0 per cent of total[6] national GHG emissions expressed in CO_2 equivalent, followed by methane (CH_4), 9.5 per cent, and nitrous oxide (N_2O), 7.8 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) contributed 2.7 per cent of the overall GHG emissions in the country. By source, energy accounts for 81.1 per cent of the total emissions, agriculture 7.4 per cent, industrial processes 6.6 per cent, waste 4.2 per cent, solvent and other product use 0.1 per cent and other sectors 0.6 per cent.

7. Over the period 1990–2000, CO_2 emissions without land-use change and forestry (LUCF) grew by 8.7 per cent, driven mainly by the growth of emissions from energy industries (+14.7 per cent), transport (+20.7 per cent) and manufacturing industries (+2.7 per cent). CH_4 emissions decreased significantly, by some 23.9 per cent, driven by the reducing of emissions from solid waste disposal on land (–28.2 per cent), enteric fermentation (–20.5 per cent), fugitive emissions from fuels (–26.6 per cent) and manure management (–14.6 per cent). In 2000, N_2O emissions were some 2.8 per cent above the 1990 level , mainly because of the significant increase of emissions from agricultural soils (+10.6 per cent). Emissions of HFCs, PFCs and SF_6 accounted for 2.7 per cent of total GHG emissions and decreased by 18 per cent between 1990 and 2000. For HFC, PFC and SF_6 emissions, 1995 is considered a base year. The ERT notes that the level of these emissions in 2000 was below the level of the base year by some 30 per cent. Total GHG emissions (without CO_2 from LUCF) increased by 3.1 per cent between 1990 and 2000.

8. The Netherlands used the IPCC tier 1 and tier 2 approaches to identify its key sources using level and trend assessment and uncertainty information in determining its preliminary key sources as part of its 2002 submission. General agreement with the independent basic preliminary key source analysis performed by the secretariat[7] was noted except for one source: the secretariat's category "CO_2 stationary combustion – other fuels" was not found in the key source analysis of the Netherlands, although it accounts for 14.5 per cent of total emissions. Instead, the Dutch categories "CO_2 stationary combustion – oil and coal" are much larger than they are in the secretariat's approach. It is assumed that the Netherlands allocated the emissions from "Other fuels" to oil and coal. It is unclear why this allocation is made for the key source analysis but not in the CRF itself. Therefore, the key source analysis seems to be slightly inconsistent with the CRF. The ERT notes that table 7.5 in the NIR provides a useful

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[5] See documents FCCC/WEB/IRI(1)/2000/NLD and FCCC/WEB/IRI(3)/2000/NLD.

[6] Total national GHG emissions refer to aggregate emissions of CO_2, CH_4, N_2O, PFCs, HFCs and SF_6, all expressed in terms of CO_2 equivalent, excluding CO_2 emissions/removals from LUCF.

[7] The UNFCCC had identified, for each individual Party, those source categories which are key sources in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance. Key sources according to the tier 1 trend assessment were also identified for those Parties providing a full CRF for the year 1990. They may differ from the key sources identified by the Party itself.

overview and encourages the Party to further elaborate conclusions and future improvements based on the findings of the key source analysis.

D. General assessment of inventory

9. The national inventory submitted by the Netherlands is generally in conformity with the UNFCCC reporting guidelines. The methodology used to estimate GHG emissions was broadly consistent with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*, hereinafter referred to as IPCC Guidelines and the *IPCC GoodPractice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*, hereinafter referred to as the IPCC good practice guidance. Areas for further improvement are identified in paragraphs 16 and 17 below and in sections II–VI for sector-specific aspects.

1. Completeness

10. The Netherlands submitted inventory data for the years 1990–2000 using the CRF including all gases requested (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6, as well as precursor gases (nitrogen oxide (NO_X,) carbon monoxide (CO), non-methane volatile organic compound (NMVOC) and sulphur dioxide (SO_2)) and almost all tables requested (except table 4.B(b), which was provided only for the years 1991–1994; tables 5.B to 5.D were filled in with notation keys only) of the UNFCCC reporting guidelines. However, for the years 1991–1994 data are provided only on a totally or partly aggregated level in several tables in the Energy sector (tables 1.A and 1.B.2).

2. Transparency

11. The NIR for the Netherlands adheres well to the UNFCCC reporting guidelines. It includes annual information from the base year 1990 to the 2000 inventory year, a description of a first assessment of key sources and their uncertainty, documentation of methods, data sources and emission factors applied, and a description of the quality assurance system and the verification activities performed on the data. The ERT notes also that the NIR submitted includes some appendixes containing: methodological information, energy balance, temperature adjustments, IPCC table 7A and recalculation and completeness tables, these enhance considerably the transparency of the Dutch inventory. The transparency of the NIR could be improved by providing summary sections of the various studies which have been provided as part of the NIR (see annex I of the NIR). The transparency of the CRF tables could be enhanced if the Netherlands used notation keys in a more consistent manner.

3. Recalculations

12. Recalculated tables 8(a) and 8(b) from the CRF were provided for 1990–1999. In addition, a detailed section on reasons for the recalculations is provided in the NIR. The effect of the recalculations for the base year was a reduction of 2.51 per cent in the total inventory in terms of CO_2 equivalent – if LUCF is included and of 2.53 per cent if this sector is excluded. The main reasons for recalculations were:

(a) Elimination of statistical differences in the energy balances of 1990 and 1995–1998, including an improvement in the fuel consumption data in the chemical industry (under Energy);

(b) Improvements to and completion of the forestry data set (LUCF);

(c) Revision of the emission factors for N_2O emissions from transport and from nitric acid production;

(d) Revision of the emission factor for PFC emissions from aluminium production;

(e) Improvements to the method of calculating emission calculation method for HFC-23 emissions from HCFC-22 production and new leakage fractions for the refrigeration sector;

(f) Addition of an SF_6 source (production of sound-proof double-glazed windows).

4. Uncertainties

13. The Netherlands performed an IPCC tier 1 uncertainty analysis and the results are presented in the NIR, both at a summary level and at the individual source category level. The results of the uncertainty analysis have been used for the tier 2 key source determination. The ERT notes that the uncertainty in total national annual CO_2 equivalent emissions is about 5 per cent, adjusted for the correlation that exists between source categories. The uncertainty in the trend of total emissions is about ±3 per cent, based on the IPCC tier 1 trend uncertainty assessment. The Party does not explain why the trends in uncertainties of total GHG emissions and of CO_2 emissions are exactly the same (i.e. ±3 per cent). In its response to the draft version of this report the Party states that it is due to rounding. In table 7 of the CRF qualitative estimates of the uncertainty are reported for GHG source and sink categories.

5. Quality assurance/quality control

14. The Netherlands' NIR includes a detailed explanation of the quality assurance/quality control (QA/QC) procedures applied by the Party for the NIR/CRF process. This includes many aspects of QA/QC as outlined in the IPCC good practice guidance, such as a formal QA system, documentation of methodologies, an inventory improvement programme, external reviews and the use of QC phases. Although there are no regular external reviews in the Netherlands, a number of external reviews have been conducted in recent years. Verification is also through inventory review under the UNFCCC.

6. Issues related to previous reviews

15. The Netherlands addressed most of the issues and problems identified during previous reviews. Thus, the Dutch inventory submission is more complete. The notation keys were used widely and more appropriately in the sectoral report tables, but a wider use of notation keys would enhance transparency. The NIR also provides additional essential data on methods, activity data collection and emission factors used.

7. Areas for further improvement

16. The Netherlands has noted the following areas for further improvement in an inventory improvement programme:

(a) Improve specific data, emission factors etc.;

(b) Develop protocols for monitoring CO_2 emissions, non-CO_2 emissions and sinks, with a clear and updated description of methods, procedures, working process and responsibilities;

(c) Improve the QA/QC procedures;

(d) Improve uncertainty management, including a tier 2 uncertainty assessment.

17. In addition to the issues mentioned in paragraph 16 the ERT noted the following with regard to future inventories. The Party may wish to:

(a) Continue the process of recalculations for 1991–1994 and 1996–1997;

(b) Further improve the process of using notation keys and filling in the documentation boxes as appropriate in the CRF tables;

(c) Compile or develop country-specific solutions/methods for filling in gaps in activity data and emissions data, especially in key source categories, for 1991–1994;

(d) Conduct regular third party reviews or public reviews regarding the GHG emissions and national emission inventory;

(e) Improve the transparency of the NIR by providing relevant summary information from the additional reports which are listed in annex 1 of the NIR and are considered to be part of the official Dutch submission.

II. ENERGY

A. Sector overview

18. The Energy sector contributed in 2000 81.1 per cent of total GHG emissions in the Netherlands (without LUCF). In the Energy sector, fuel combustion was the main source with 97.5 per cent of GHG emissions, while fugitive emissions made a relatively small contribution (2.5 per cent). Emissions from Energy industries are the largest source within the Energy sector (33.7 per cent), followed by Manufacturing industries and construction (24.5 per cent), Transport (20.4 per cent) and Others (19.0 per cent). In 2000, GHG emissions in the Energy sector were 8.3 per cent above the 1990 level. International bunker fuels are a very important source of GHG emissions in the Netherlands. CO_2 emissions from international bunkers amounted in 2000 to 53,500 Gg, which corresponds to nearly one-third of national CO_2 emissions from energy combustion.

19. The sectoral approach to estimating emissions from fuel combustion in the Netherlands is a country-specific – combined top–down and bottom–up approach, which is different from those of most other countries. In some subsectors (e.g. Public electricity and heat production, Petroleum refining and Manufacturing industries and construction) data on CO_2 emissions are partly collected directly from emitters (individual companies). The remaining emissions are calculated based on "standard" emission factors and the remaining fuel consumption calculated by comparing with energy statistics. If there are large deviations (more than 5 per cent) between the top–down and the bottom–up approaches, deviations are capped at 5 per cent according to the national energy statistics. Apparently, the quality of the data from companies is not always satisfactory. Some emissions data reported from industrial emitters appear to be incomplete and cannot be assigned to specific fuel types. In these cases, emissions are allocated under "Other fuels" in the relevant categories.

20. The ERT recommends that this methodological approach be thoroughly reviewed during an in-country visit since a number of questions regarding its consistency arise. Since the approach selected is very specific, it would be helpful if a more detailed description could be provided in the NIR, for example, regarding the "standard" emission factors, the necessary application of corrections due to differences larger than 5 per cent.

21. A first consequence of the incomplete reporting from individual companies is the lack or misallocation of activity data regarding fuel consumption in the CRF tables. This results in meaningless implied emission factors (IEFs) for CO_2: for instance, the IEF for CO_2 for "Other fuels" in the energy sector was 3.918 t/TJ in 1994 but 587 t/TJ in 2000. If individual companies report CO_2 emissions but not the fuel type, the problem arises that verification and review of the quality of the information, including underlying emission factors, are not possible - which reduces the comparability and transparency of estimates - and fuel consumption of different fuel types cannot be allocated appropriately to the relevant IPCC sectors. The misallocation of fuel types and quantities within the subsectors and between the subsectors also leads to problems regarding the estimation and review of CH_4 and N_2O emissions since emission factors for CH_4 and N_2O depend significantly on the sector and technology. The NIR is not very clear on how CH_4 and N_2O emissions from fuel combustion have been calculated and how this problem has been addressed. The Netherlands in its response to the draft version of this report, explained that in cases where company-specific CO_2 emissions and associated fuel consumption resulted in an IEF that is an outlier compared to the national default values, those plant-specific data were not reported under liquid/solid/gaseous fuels of that subsector. Instead, the liquid/solid/gaseous fuel consumption and associated CO_2, CH_4 and N_2O emissions were moved to "Other fuels" to ensure that the remaining fuel/emissions reported under these three fossil fuel types are consistent and provide meaningful IEFs for CO_2. However, this procedure does not remove additional inconsistencies in plant-

specific data that can be found in the CH_4 and N_2O emissions, in fact, the IEFs of CH_4 and N_2O may even show greater inconsistencies. The Netherlands agree that this is a problem in the dataset originating from the inclusion of emissions individually reported by companies that are not always internally consistent and complete, but since CO_2 emissions are by far the largest from this sector, the emphasis in the correction process was given to the CO_2-fuel data relation.

22. The CRF tables in the Energy sector are partly complete. Activity data on fuel consumption are partly missing, in particular for "Other fuels". Significant reporting problems exist for the years 1991–1994, where activity data are widely not available: emissions are only estimated on an aggregated level and emissions are mostly reported only under "Other fuels". This applies to practically all fuel combustion sectors (except 1.A.3 Transport and 1.A.5 Other), as well as to fugitive emissions from fuels. The ERT recommends that the completeness of the inventory for the Energy sector be improved, in particular regarding the estimation of the years 1991–1994, the allocation of emissions to specific fuel types and the use of notation keys.

23. The NIR provides generally detailed information, in particular regarding emission trends and general approaches. The ERT recommends that the Party provide more detailed information regarding underlying assumptions (e.g., emission factors) and regarding the implementation of IPCC methodologies. Several recalculations have been carried out in the Energy sector as part of an inventory improvement programme. Generally, recalculations are documented very well and transparently in the NIR.

B. Key sources

1. Stationary combustion

24. The IEFs for CO_2 appear in many cases not to be consistent. This is true of both their consistency over time and their specific values and applies in particular to "Other fuels" (see paragraph 21 above), but also to liquid and solid fuels. For example, in Energy industries the CO_2 IEF for liquid fuels varies between 59 t/TJ in 1997 to 75 t/TJ in 1999, and for solid fuels it varies between 98 t/TJ in 1997 and 107 t/TJ in 1999. In Manufacturing industries the CO_2 IEF varies for liquid fuels between 43 t/TJ in 1998 and 77 t/TJ in 1999, and that for solid fuels between 92 t/TJ in 1999 and 148 t/TJ in 1997. These inconsistencies may be due to the reporting problems related to activity data and emissions mentioned above. To improve the transparency and comparability of the estimates, the ERT recommends that the Netherlands check and complement the relevant activity data and provide in the NIR underlying emission factors for CO_2, CH_4 and N_2O for all relevant activities and sectors. In its response to the draft version of this report, the Party agrees with the conclusions of the ERT team, however a specification was made, the IEF's for the solid and liquid fuels are biased by the allocation of derived fuels to these fuels.

25. The Netherlands has allocated emissions from coke ovens in the Energy sector under category 1.A.2. Recognizing the difficulties in data collection, the ERT encourages the Netherlands to develop methodologies which allow it to allocate emissions in accordance with the IPCC Guidelines under Energy for combustion emissions and Industrial processes for process emissions. However, in the response to this draft report the Netherlands states that this recommendation does not seem very applicable, since non-combustion emissions from coke production should be reported under Fugitive emissions from fuels.

2. Fugitive emissions

26. The CH_4 IEF for emissions from oil production (approximately 118 kg/PJ in 2000) is lower than the range in the IPCC Guidelines (300–5,000 kg/PJ) and the times series of IEFs shows some inconsistency (e.g., a lower emission factor of about 70 kg/PJ in 1995). The time series of IEFs for CH_4 emissions from transmission of natural gas also show values which vary significantly (between 934 and

2,672 kg/PJ). The ERT recommends that the consistency of these estimates be checked and encourages the Netherlands to provide estimates for emissions from venting and flaring separately.

C. Non-key sources

1. Stationary combustion

27. Several IEFs for CH_4 and N_2O are not consistent in the time series and show values which are out of the range reported by other Parties or recommended in the IPCC Guidelines. Moreover, very little information is provided regarding the methodologies and underlying assumptions in the NIR. The ERT recommends that the Party improve the documentation (e.g., by providing assumed emission factors) and check the consistency of emission estimates for CH_4 and N_2O.

2. Mobile combustion

28. N_2O emissions from road transportation have been recalculated, reflecting the results of relevant research. The recalculations are described in a comprehensive manner, and emissions and IEFs appear to be consistent with the research results described in the NIR.

3. Fugitive emissions

29. The CO_2 IEF of fugitive emissions from oil production increases significantly over time from approximately 88,000 kg/PJ in 1990 to 605,000 kg/PJ in 2000. The ERT recommends that the Party check the consistency of these estimates and provide explanations in the NIR.

D. Reference and sectoral approaches

30. CO_2 emissions from fuel combustion were calculated using the reference approach and the sectoral approach. For the year 2000 the difference between the two approaches is 2.57 per cent. CO_2 emissions have been recalculated for the sectoral approach for all years and for the reference approach for the years 1990 and 1995–1998. This recalculation increases the differences between the two approaches, most significantly in 1990 (previously –0.6 per cent, now 1.5 per cent) and in 1997 (previously –0.4 per cent, now 3.5 per cent). The Netherlands explains in the NIR that the figures from the reference approach for most years are considered provisional, since the carbon content of crude oil and other liquid fuels is very sensitive to overall emissions and has not yet been determined, only estimated.

31. Data reported in the CRF and to the International Energy Agency (IEA) mostly correspond well. Apparent fuel consumption using the reference approach is 1.1 per cent higher in 2000 than that reported to the IEA. However, for several liquid fuels, in particular crude oil, the exports and imports reported differ significantly between the reference approach and data reported to the IEA. Both imports and exports of liquid fuels are some 1,800,000 TJ higher in the reference approach. The ERT recommends that the differences be analysed and checked. In its response to the draft version of this report the Party states that the differences in data sets might be due to different submission dates and the provisional character of the most recent data.

E. Bunker fuels

32. In the CRF tables, CH_4 and N_2O emissions from international bunker fuels are not estimated and no explanations for that are provided either in the NIR or in the CRF tables. Regarding the methodology used for separating emissions from international bunkers and from domestic transport, the information provided in chapter 6 of the NIR is rather general. Fuel consumption of gasoline for aviation is only reported for the year 1990, and consumption of lubricants only reported for the years 1990, 1995 and 1998–2000. In other years, notation keys have mostly not been used. The ERT encourages the Netherlands to estimate CH_4 and N_2O emissions from bunker fuels, to describe the methodology used to

separate international from domestic emissions more thoroughly and to improve the reporting where necessary.

F. Feedstocks and non-energy use of fuels

33. The Netherlands estimates feedstocks and non-energy use of fuels. The assumptions applied to estimate the fraction of fuels used as feedstocks is documented, being based on national energy statistics. However, the ERT recommends that additional information be provided for the underlying assumptions in the NIR.

III. INDUSTRIAL PROCESSES AND SOLVENTS USE

A. Sector overview

34. In 2000, industrial process emissions accounted for 6.6 per cent of total CO_2 equivalent emissions (without LUCF), less than in 1990 (7.8 per cent). N_2O emissions (all from nitric acid production) represented 49.8 per cent of the sector's emissions in 2000. Emissions of fluorinated gases accounted for 40.3 per cent and those of CO_2 only 9.5 per cent of the sector's CO_2 equivalent emissions. In the period 1990–2000, Industrial processes CO_2 equivalent emissions fell by 12.6 per cent, mainly due to a decrease of 18.2 per cent in fluorinated gases and a decrease of 5.8 per cent in N_2O emissions. For Industrial processes the Party has identified the same key sources as those found by the secretariat. In its response to the draft version of this report the Netherlands notes that almost all feedstock emissions are included in the Energy sector.

B. Key sources

1. Nitric acid production – N_2O

35. For some years, 1991–1992 and 1995–1996, no activity data are reported. In its response to the 2001 S&A report, the Netherlands stated that the activity data for these years were not provided in the CRF because they are confidential. The ERT recommends that the Party clarify this in the CRF by using the notation key "C" for all the years where this is the case. Although the Party has observed that inter-annual changes of 10 per cent in the production level are not unusual, the Party still needs to explain the reason for the observed emission increases and decreases of around 30 per cent in its time series. In addition, the ERT recommends that the Party explain why its emission factors are significantly above the IPCC value.

2. Aluminium production – PFCs

36. The ERT noted that the transparency of these estimates could be improved. The method for estimating PFC emissions is described as being based on "measured data reported by producing companies". However, this does not clarify whether the Netherlands' estimates of PFC emissions from aluminium smelting are based on (1) production data and default emission factors, (2) production data, the frequency and duration of anode effects, and default slope factors, or (3) production, the frequency and duration of anode effects, and smelter-specific slope factors. This has not been fully clarified in the Netherlands' response to the ERT's questions; the Netherlands stated that one producer had developed "plant-specific emission factors", but did not indicate whether these were slope factors which were used in conjunction with anode effect data (as well as production data) or were simply emission factors related to production. The former would be a tier 3 approach, while the latter would be a variant of the less accurate tier 1 approach. The ERT recommends that the Netherlands explain its methodology more thoroughly.

3. Production of halocarbons and SF_6

37. The transparency of the Netherlands' estimates of emissions from this source category could be improved in a number of ways. The method for estimating HFC-23 emissions is described only as being

based on "measured data reported by producing companies", with no description of what is being measured. Activity data for HFC-22 manufacture are not provided and consequently no emission factor for this process can be estimated. Although, according to the Party in its response to this draft review report, the activity data are confidential, this is not indicated in either the NIR or the CRF. The trend in HFC-23 emissions implies that the combustion efficiency of the thermal afterburner is an atypically low 70 per cent (the norm is 95–99 per cent), but this figure is not explained in the NIR. In response to questions from the ERT, the Netherlands indicated that the afterburner failed to perform to its theoretical efficiency because it was off-line some of the time. HFC emissions from two other processes are presented in table 2(I) (under line E.1 and in line E.3), but these sources are not described or explained. The ERT recommends that the Netherlands explain more fully its method for estimating HFC-23 emissions, including its method for accounting for abatement by the thermal afterburner. If activity data are confidential, the Netherlands should indicate this in both the NIR and the CRF through the use of the "C" notation key. In addition, the ERT recommends that the Netherlands explain the nature of the other sources within this category.

C. Non-key sources

1. Cement production – CO_2

38. The inter-annual changes for some years are high, both for emissions (from 30 up to 50 per cent) and for IEFs. The ERT recommends that the Party explain these large variations.

2. Asphalt roofing – CO_2

39. CO_2 emissions are reported as NE (not estimated); no activity data are provided. The ERT recommends that the Party explain in the completeness table (table 9) why emissions from this sector are not estimated. In its response to the draft version of this report the Party states that this is due to the following reasons: the emissions are negligible and this is not identified as a possible source of CO_2 in the IPCC Guidelines; therefore no default IPCC emission factor is available for this negligible source.

3. Road paving with asphalt – CO_2

40. CO_2 emissions are reported as NE; no activity data are provided. The ERT recommends that the Party explain in the completeness table (table 9) why emissions from this sector are not estimated. In the response to the draft version of this report the Netherlands states that this is due to the fact that this kind of emissions are negligible and that they are not identified as a possible source of CO_2 in the IPCC Guidelines; no default IPCC emission factor is available for this source.

4. Other (mineral products) – CO_2

41. CO_2 emissions from lime production, limestone and dolomite use and soda ash are reported as IE (included elsewhere). In the documentation box the Party states that these emissions are included in the source category "Other – misc". This information is not provided in the completeness table (table 9). The ERT encourages the Netherlands to try to estimate these emissions for each source category. If this is not possible, the Netherlands should continue to provide information on this matter in the documentation box, including a reference to the NIR, where more information should be included, and in the completeness table 9 of the CRF.

5. Chemical industry – CO_2, CH_4 and N_2O

42. In the chemical industry, emissions of CO_2, CH_4 and N_2O are reported as IE for some source categories. The documentation box states that CO_2 emissions are included in the Energy sector, CH_4 emissions are allocated to the source category "Other – misc" and N_2O emissions are aggregated for reasons of confidentiality. The ERT recommends that the Party indicate more clearly in the completeness table and in the documentation boxes where emissions marked IE are included, and in the NIR include more detailed explanations as to why emissions cannot be separated for the different source

categories. The ERT also encourages the Netherlands to try to allocate the CH_4 emissions to the different source categories.

6. Iron and steel production

43. According to United Nations data, there is pig iron production in the Netherlands, but annual production is not provided in the CRF. Only CO_2 emissions are reported, and then as IE. The documentation box provides the information that these emissions are included in the Energy sector. The ERT recommends that the Party clarify if there is pig iron production in the Netherlands. The ERT also encourages the Netherlands to try to allocate the emissions from the iron and steel industry in the Industrial processes sector for process emissions and in the Energy sector for the fuel combustion emissions. If this is not possible, it should be clearly indicated in the CRF and the NIR.

7. Metal production

44. Emissions (CO_2, CH_4 and N_2O) from ferroalloys production and aluminium production are reported as IE. The documentation box provides the information that these emissions are included in the Energy sector. There are CO_2 emissions reported for metal production in the source category "Other" but no information is provided on what is included in this source category. The ERT recommends the Netherlands to allocate the process emissions from metal production to the Industrial processes sector and to specify the CO_2 emissions reported.

8. Consumption of halocarbons and SF_6

45. The transparency of these estimates could be improved by presenting activity (HFC bank [PFCs are rarely used in A/C&R (air conditioning and refrigeration)-equipment]) estimates for A/C&R-equipment, by identifying the source of the "Other" emissions in line F.8 in table 2(I)s2 of the CRF, and by designating emissions from electrical equipment, semiconductors and double-glazed windows as confidential ("C") rather than leaving these spaces blank in the CRF. Currently, SF_6 emissions show an unexplained drop of 46 per cent between 1990 and 1991. The ERT recommends that the Netherlands verify this decline and, if it is genuine, examine and explain the cause.

9. Other – CO_2

46. CO_2 emissions are reported in the source category "Other – misc". The ERT recommends that the Party identify the source categories that are included in this section. The ERT also encourages the Netherlands to try to allocate these emissions to the correct source categories.

D. Solvent and other product use

47. NMVOC emissions from paint application for the year 1997 seem to be high compared to the activity data given. The ERT recommends that the Party provide information regarding the calculations in the NIR. In addition, the ERT recommends that the Party provide emissions and activity data for paint application for all years. Information on the activity data and the IEF for N_2O are provided in table 3A–D. CO_2 and NMVOC emissions are reported in the source category "Other – misc". The ERT encourages the Netherlands to allocate these emissions to source categories. If this is not possible, information should be provided on what sources are included in the "Other – misc" source category. In its response to the draft version of this report the Netherlands explains that the activity data provided for paint application (for 1997 only) was inserted accidentally and should be ignored. Moreover, with respect to providing information in the NIR on the NMVOC estimation, the Netherlands does not consider providing more information on precursor gases than the emissions to be relevant for reporting under the UNFCCC.

IV. AGRICULTURE

A. Sector overview

48. The Agriculture sector accounted for 8.3 per cent of total national GHG emissions in 2000, reaching 16,110 CO_2 Gg equivalent. Over the period 1990–2000, emissions decreased by 32 per cent. Consistent time series from 1990 to 2000 are reported. The methodology used is a combination of the IPCC Guidelines and the IPCC good practice guidance (tier 1 and tier 2) and country-specific methods. Some tables provided in the CRF – table 4, all sectoral background data tables except tables 4.C Rice cultivation, 4.E Prescribed burning of savannas and 4.F Field burning of agricultural residues, table Summary 1.A and table summary 2 – include blank cells relating to the agricultural sector. Emissions from rice cultivation, prescribed burning of savannas and field burning of agricultural residues are reported as NO (not occurring). In the trend table, CO_2 emissions from 4.E Prescribed burning of savannas are reported for 1990, 1995 and 1998–2000, although Parties are not expected to report any CO_2 emissions from this source category. Also, CH_4 emissions from 4.D Agricultural soils are reported in 1992 as IE, but for all other years as NE. The CRF and the NIR give limited information on the methodology used, which reduces the transparency. The ERT also notes that the NIR provides references to other reports. However, some data indicated in the references have ranges or are indicated using different units, so that identification of the data used in the inventory is difficult. The NIR provides data sources of all activity data and major changes in data collection. Emission factors used are default values, tier 2 and country-specific values. General QA/QC is provided in the NIR in detail and source-specific QA/QC is indicated in the relevant section.

B. Key sources

1. Enteric fermentation – CH_4

49. Livestock population characterization covered all main livestock classes, and more detailed data on cattle, which are disaggregated to detailed sub-classes, are provided in the NIR. The source of these data is national statistics. Emission factors for cattle are country-specific based on the tier 2 method and those of other livestock are default value. The value of all cattle's detailed emission factors and assumptions are indicated in the NIR and in the references.[8] The ERT recommends the Netherlands to provide the additional information in the CRF (e.g. milk production, weight and other information) to enhance the transparency of the inventory. The reason for the fluctuation in the IEF is indicated in the NIR.

2. Manure management – CH_4

50. A country-specific method is used but no details, e.g., on formula, volatile solids (VS), maximum methane producing capacity (Bo) and share of animal waste management system (AWMS)) is provided in the CRF or NIR. Presumably, swine are disaggregated to more detailed types in order to estimate the emissions accurately. Assessment is very difficult because of the lack of methodological description in the NIR. Many data are indicated in references provided by the Netherlands, but some data, such as share of AWMS, are missing. According to the comments of the Party, in response to a request by the ERT, these data are not part of the official statistics or surveys. The Party may wish to add in the NIR the relevant information on the assumptions made and the calculation process for this source in order to ensure its transparency. CH_4 emissions from horses were reported as NO (not occurring). The IEFs of dairy cattle and swine are lower and those of non-dairy cattle and sheep are higher than the averages of other Annex I Parties.[9] The ERT recommends that the Netherlands provide relevant explanations in the NIR and the CRF and detailed information in the references submitted as additional materials.

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[8] Additional Materials submitted by Netherlands: *Methane The Other Greenhouse Gas Research And Policy In The Netherlands* (RIVM: Report no. 481507001 (1993)).

[9] See http://unfccc.int/program/mis/ghg/sai02seci.pdf (S&A Report 2002 part I, Agriculture p. 73).

3. Agricultural soils – direct N_2O

51. A country-specific method is used. The detailed method is provided in the reference (Kroeze 1994). However, the emission factors in the reference have ranges and the single value applied to the inventory is not identified. According to the CRF, the Netherlands seems to use the middle of the data range provided in the reference. The emission factor for "N-fixing crops" is indicated in the reference with a different unit [kg N_2O–N/ha/year] from the emission factor used in the inventory [kg N_2O–N/kg dry biomass]. This does not enhance the transparency of the inventory. The ERT recommends that the Netherlands provide a description of the methodology and country-specific emission factors in the NIR in order to facilitate replication and assessment.

4. Agricultural soils – other N_2O

52. This source includes emissions from the cultivation of histosols and from crop residues left in the fields. A country-specific method is used and a country-specific system allocation is applied. The NIR provides assumptions and describes how this type of emission is allocated to other sources. More detailed information is included in the reference (Kroeze 1994).[10] However, emission factors in the reference have ranges and the single value applied to the inventory is not identified. Values of activity data are not provided in the NIR or the reference. Data provided in the CRF table 4.D Agricultural soils show equal background emissions over the period 1990–2000 (4.71 Gg N_2O). However, amounts of residues and emissions from them could vary significantly. The ERT recommends that the Netherlands provide the rationale for reporting the same emission for the whole time series. The ERT also recommends that the Netherlands provide additional information on methodology, emission factors, and information on activity data collection in the NIR.

C. Non-key sources

1. Manure management – N_2O

53. A country-specific method is used but no detailed description of it is provided in the CRF or the NIR. Data on the share of AWMS are not included in the NIR, nor are the relevant references, so that the consistency of the division share of AWMS between CH_4 and N_2O could not be assessed. The ERT recommends that a detailed description of the methods used be provided in the NIR.

2. Agricultural soils – animal production

54. The ERT recommends that the Netherlands include in the NIR a detailed description of the methodology used, as well as emission factors, in order to facilitate replication and assessment of the inventory for this source.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

55. The LUCF sector in the Netherlands was net sink of 1,413 Gg CO_2 in 2000, which represents 0.7 per cent of total GHG emissions in 2000 (216,916 Gg CO_2 equivalent). During the period 1990–2000, removal of CO_2 by the LUCF sector varied between 0.5 per cent and 0.9 per cent of total gross GHG emissions, with no clear trend. LUCF net CO_2 uptake decreased by 0.6 per cent between 1990–2000, although in the period 1990–1994 it showed a sharp increase of 36 per cent. In the same time series, a sudden decrease in LUCF net CO_2 uptake was observed between 1993 and 1994 (average 1.9 Gg CO_2) and between 1995 and 2000 (average 1.3 Gg CO_2), associated with an increased rate of felling.

[10] Kroeze, C., 1994: *Nitrous oxide (N2O). Emission Inventory And Options For Control In The Netherlands.* RIVM, Bilthoven. Report no. 773001 004.

56. Only CO_2 removal by "Changes in forests and other woody biomass stocks" is reported by the Netherlands. The rationale for the omission of other sources was not explained. As noted in previous desk and centralized reviews, non-CO_2 gas emissions and CO_2 emissions from agricultural soils are important in the Netherlands, but were not reported. Also, harvested wood may be a significant carbon pool. This lack of completeness affects comparability with data from other countries. However, considering the relatively small size of the LUCF sector in comparison with all other sectors, the data can still be used with relatively good confidence for comparisons.

57. Annex 2 of the Netherlands' 2002 NIR includes a detailed description of methodology for estimating changes in Forest stocks under table 5.A Changes in forest and other woody biomass. This constitutes an improvement over the previous year's NIR, which, as indicated by previous desk and centralized review reports, lacked transparency with respect to provision of the methodology used for estimating this source/sink. The Netherlands used country-specific factors for wood density of coniferous (0.5 tdm/m^3) and broadleaf (0.6 tdm/m^3) trees, and a biomass expansion factor of 1.2 common for both species, while the wood carbon content was the same as the IPCC default (0.5 t C/t dm). Use of these factors results in lower values for wood carbon content as compared with the IPCC default, resulting in a conservative approach in calculating emissions and removals from forest biomass.

58. In the CRF table 5.A a varying dry matter content per hectare was used throughout the 1990–2000 time series for both coniferous and broadleaf forests, with maximum differences of 9 per cent in coniferous and 13 per cent in broadleaf. In the case of carbon uptake per hectare from non-forest trees, a very large variability within the series 1990–2000 was detected, with values ranging from 0.07 t C/ha (1999) to 1.03 t C/ha (1994). Also, there was no reference to the origin of the country-specific emission factors used. Some minor inconsistencies were found in the reporting of felling rates in harvest volumes and areas and in time trends. The ERT recommends that the Netherlands include more detailed information on the above.

B. Sink and source categories

1. Changes in forest and other woody biomass stocks

59. Table 5 was modified in version 2 of the CRF tables for all years to include data for both CO_2 emissions and removals, which had been omitted in version 1. There was a mistake in the placement of these data in table 5 (the columns for CO_2 emissions and removals were reversed). The same mistake was detected in version 2 of table 5 in all reporting years.

60. Carbon removal by non-forest trees is estimated to be 57 Gg C for 2000. This value is derived by assuming a single IEF of 0.53 t C/ha for the total area of non-forest trees (107,000 ha). There is no reference to the origin of this emission factor, and it is not clear why this factor was used to estimate carbon removal for the total area instead of reporting for individual tree categories. It was assumed that this factor could correspond to harvest/losses of about one-fifth of that occurring in forest lands.

61. The headings of the "non-forest tree" section in table 5 (CRF 2002) were modified manually by the Netherlands, and a mistake was detected in the typing of one of the titles (carbon uptake factor: where it says "t C/k ha" it should say "t C/ha"). The same mistake was detected in version 2 of table 5 in all reporting years. A new set of definitions of forest was provided in annex 2 of NIR 2002, based on United Nations Food and Agricultural Organization (FAO) definitions. The corresponding citation was not listed in the "References" section.

62. During the period 1990–2000, the growth rate of coniferous forests ranged between 7.7 m^3/ha/yr and 8.0 m^3/ha/yr (NIR 2002, annex 2, table A.2.3), with the exception of 1990 (8.4 m^3/ha/yr). No explanation is provided for the occurrence of this value. Growth rates of broad-leaved forest trees, on the contrary, showed a smooth increasing trend, from 7.0 m^3/ha/yr in 1990 to 7.9 m^3/ha/yr in 2000. It is also evident from table A.2.3 that there was a sharp increase in annual felling of broadleaf forest trees after 1995. During the period 1990–1994, annual felling was, on average, 460,000 m^3/yr whereas in the period

1995–2000 it jumped to an average of 630,000 m^3/yr. There was no report of a data consistency analysis being carried out, which would have been useful in helping to assess whether these data were a reflection of reality or a consequence of insufficient data. The ERT recommends that the Netherlands include more detailed information on these matters in its future submissions in order to improve transparency and facilitate review.

VI. WASTE

A. Sector overview

63. Emissions from the Waste sector represented 4.2 per cent of total GHG emissions in 2000, and there has been a 27 per cent decline in emissions since 1990, mostly as a result of increased landfill gas collection and flaring/utilization. Land disposal of solid waste was the only source category with estimated emissions in this sector. Emissions from waste incineration were reported in the Energy sector. Although not mentioned in the NIR, the First Order Decay method (FOD) with country-specific parameters was used for estimating CH_4 emission from solid waste disposal sites (SWDS). Emissions from other sources were estimated using country-specific emission factors. The assumptions and methodologies used for estimating emissions are briefly described in the NIR. There is a list of national references giving additional information to the NIR. The methodology and emission factors given in the CRF and the NIR are comparable to those of other Parties. All CRF tables from 1990 to 2000 were submitted. Tables were in most cases complete. The methodologies used for estimating emissions in the period 1990–2000 are consistent with the IPCC Guidelines, except for indirect N_2O emissions. Uncertainty assessments were performed in the Waste sector, resulting in 34 per cent for solid waste disposal and 32 per cent for waste-water emissions. Emissions from the Waste sector in the period 1990–1999 were recalculated in the 2002 submission.

B. Key sources

1. Solid waste disposal on land

64. The main parameters being used in the FOD model were documented in the NIR, except for degradable organic carbon (DOC_f), methane correction factor (MCF) and waste composition. Historical data on municipal solid waste (MSW) landfilled were not presented in the NIR, although it is indicated that data on MSW are available from 1945. The daily waste generation rate per capita indicated in the CRF additional information table is 0.01 kg/cap, resulting in only 3.7 kg/cap per year, which appears to be incorrect. Total waste generation in the Netherlands equals 57,600 Gg in 2000 (table 8.27, NIR), therefore daily waste generation equals 10 kg per cap/day. Both these values appear to be inconsistent with the IPCC value for the Netherlands (1.58 kg/cap/day). However, the quantities of SWDS (0.93 kg per cap/day) seem to be correct. The reports of the individual review of the GHG inventory of the Netherlands submitted in the year 2000 (desk review and centralized review), the 2000 and 2001 S&A reports and the draft 2002 S&A report have addressed most of the above issues. The ERT recommends that the Netherlands review, clarify and verify data on waste generation rate, waste quantities and waste composition, and include and justify all IEFs chosen in subsequent inventories.

C. Non-key sources

1. Waste-water handling

65. Emissions from waste-water handling and human sewage were reported under the category "Other" in the CRF tables. No activity data, IEF or additional information were provided. The reports of the individual review of the GHG inventory of the Netherlands submitted in the year 2000 (desk review and centralized review), the 2000 and 2001 S&A reports and the draft 2002 S&A report have addressed these issues. The ERT recommends that the Netherlands provide additional information in order to improve the transparency of the NIR and the CRF.

ANNEX I: MATERIALS USED DURING THE REVIEW

A. Support materials on the CD ROM and the web page for the review

Sources of information used during the review include:

2000, 2001 and 2002 *Inventory submissions of the Netherlands.* 2002 submissions including CRF for years 1990–2000 and an NIR.

UNFCCC secretariat (2002). *Report of the individual review of the greenhouse gas inventory of the Netherlands submitted in the year 2000 (Centralized review)*. FCCC/WEB/IRI(3)/2000/NLD [available at http://unfccc.int/program/mis/ghg/countrep/nldcentrev.pdf].

UNFCCC secretariat (2002). *Report of the individual review of the greenhouse gas inventory of the Netherlands submitted in the year 2000 (Desk review)*. FCCC/WEB/IRI(1)/2000/NLD [available at http://unfccc.int/program/mis/ghg/countrep/nlddeskrev.pdf].

UNFCCC secretariat. *2000 Status reports for the Netherlands* [available at http://unfccc.int/program/mis/ghg/statrep00/nld00.pdf].

UNFCCC secretariat. *2001 Status report for the Netherlands* [available at http://unfccc.int/program/mis/ghg/statrep01/nld01.pdf].

UNFCCC secretariat. *2002 Status report for the Netherlands* [available at http://unfccc.int/program/mis/ghg/statrep02/nld02.pdf].

UNFCCC secretariat. *Synthesis and assessment report of the greenhouse gas inventories submitted in 2000.* FCCC/WEB/SAI/2000 [available at http://unfccc.int/program/mis/ghg/sai2000.pdf].

UNFCCC secretariat. *Synthesis and assessment report of the greenhouse gas inventories submitted in 2001.* FCCC/WEB/SAI/2001 [available at http://unfccc.int/program/mis/ghg/sai2001.pdf].

UNFCCC secretariat. *Draft synthesis and assessment report of the greenhouse gas inventories submitted in 2002* (Part I and Part II – the section on the Netherlands) [unpublished].

The Netherlands's comments on the Draft synthesis and assessment report of the greenhouse gas inventories submitted in 2002 [unpublished].

UNFCCC secretariat. *Key source analysis for the year 2000* [unpublished].

UNFCCC secretariat. *Handbook for review of national GHG inventories*. Draft 2002 [unpublished].

UNFCCC secretariat. *UNFCCC guidelines on reporting and review.* FCCC/CP/1999/7, [available at http://www.unfccc.int/resource/docs/cop5/07.pdf].

UNFCCC secretariat. Database search tool – *Locator* [unpublished].

IPCC. *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories 2000* [available at: http://www.ipcc-nggip.iges.or.jp/public/gp/gpgaum.htm].

IPCC/OECD/IEA. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, Volumes 1–3, 1997* [available at: http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm].

Netherlands National Institute of Public Health and the Environment (RIVM)."Methane the other greenhouse gas research and policy in the Netherlands" RIVM Report no. 481507001 (1993).

Netherlands National Institute of Pubic Health and the Environment (RIVM) "Nitrous oxide (N_2O) emissions inventory and options for control in the Netherlands" RIVM Report no. 773001004 (1994).

B. Additional materials provided by the Party

Responses to questions within the sectors Industrial processes and solvents use, Agriculture, Waste and General assessments during the review were received from Mr. P. W.H.G. Coenen (TNO - MEP - the Netherlands) including additional material on the methodology and assumptions used.

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