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AUSTRIA

REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY SUBMITTED IN THE YEAR 2004[1]

I. OVERVIEW

A. Introduction

1. This report covers the centralized review of the 2004 greenhouse gas (GHG) inventory submission of Austria, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8 of the Conference of the Parties. The review took place from 11 to 16 October 2004 in Bonn, Germany, and was conducted by the following team of nominated experts from the roster of experts: Generalists – Ms. Ruta Bubniene (Lithuania) and Mr. Jan Pretel (Czech Republic), Energy – Mr. Christo Christov (Bulgaria), Mr. Amit Garg (India) and Ms. Kristin Rypdal (Norway), Industrial Processes – Mr. Justin Goodwin (United Kingdom) and Ms. Natalya Parasyuk (Ukraine), Agriculture – Mr. Michael McGettigan (Ireland) and Mr. Vitor Gois (Portugal), Land-use Change and Forestry (LUCF) – Mr. Tomas Hernandez-Tejeda (Mexico) and Mr. Walter Oyhantcabal (Uruguay), Waste – Mr. Sabin Guendehou (Benin) and Ms. Maria Paz Cigaran (Peru). Mr. Michael McGettigan and Ms. Maria Paz Cigaran were the lead reviewers. The review was coordinated by Ms. Rocio Lichte (UNFCCC secretariat).

2. In accordance with the "UNFCCC guidelines for the technical review of greenhouse gas inventories from Annex I Parties", a draft version of this report was communicated to the Government of Austria, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

B. Inventory submission and other sources of information

3. In its 2004 submission, Austria submitted a complete set of common reporting format (CRF) tables for the years 1990–2002 and a national inventory report (NIR). The NIR provides information on methodologies, activity data (AD), emission factors (EFs), recalculations, uncertainties, verification, quality assurance/quality control (QA/QC) procedures and key sources. The full list of materials used during the review is provided in annex 1 to this report.

C. Emission profiles and trends

4. In the year 2002, the most important GHG in Austria was carbon dioxide (CO_2), contributing 82.3 per cent to total[2] national GHG emissions, followed by methane (CH_4) – 8.8 per cent – and nitrous oxide (N_2O) – 6.8 per cent. Perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) taken together contributed 2.1 per cent of total national GHG emissions. The Energy sector accounted for 75.4 per cent of the total GHG emissions, followed by Industrial Processes

[1] In the symbol for this document, 2004 refers to the year in which the inventory was submitted, and not to the year of publication.

[2] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding LUCF, unless otherwise specified.

(11.9 per cent), Agriculture (8.7 per cent) and Waste (3.4 per cent). Total GHG emissions amounted to 84,621 Gg CO_2 equivalent and increased by 8.8 per cent from 1990 to 2002.

D. Key sources

5. Austria reports a tier 1 key source analysis, including both level and trend assessment, as part of its 2004 submission. The key source analyses performed by the Party and the secretariat[3] produced similar results. The 21 key sources identified by the secretariat are included in the total of 43 identified by Austria on a very disaggregated level. Austria uses the detailed list of key source categories to prioritize work within the national inventory improvement programme.

E. Main findings

6. All the required inventory data and methodological information are provided in the CRF and in the NIR, and no inconsistencies have been identified between the CRF and the NIR. Calculation methodologies are well documented in the NIR for most sources and it provides many references to supporting reports as well as detailed descriptions of the overall system of data collection and inventory preparation. From the information available it appears that in recent years Austria has significantly improved its national inventory system, which is producing inventories of high quality. Overall, the Austrian submission is in substantial conformity with the UNFCCC reporting guidelines and the *Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance), although there are some areas for further improvement as outlined in the sections below and the sectoral sections of this report.

F. Cross-cutting topics

Completeness

7. Austria has submitted GHG inventories for the years 1990–2002 using the CRF and a very comprehensive NIR. The NIR includes all information required by the UNFCCC reporting guidelines. The geographic coverage is complete and all major sources and sinks are covered.

8. Since the 2003 submission, completeness in terms of coverage of source categories has increased in that the number of subcategories indicated as "not estimated" ("NE") has decreased. Explanations are provided in the NIR and the CRF to support all "NE" notation key entries. The number of subcategories for which the notation key "included elsewhere" ("IE") is entered has also decreased. Completeness has been improved mainly thanks to recalculations, in particular the revisions of the national energy balance time series, the consideration of new industrial sources, and revisions of the AD in the Waste sector.

Transparency

9. The information presented in the NIR and the CRF is documented in detail, allowing the reviewers to gain a good understanding of how emissions are calculated and of the references and the assumptions made for the various parameters. However, there is room for further improvement regarding transparency in some sectors, as mentioned below.

Recalculations and time-series consistency

10. Recalculations for 1990–2001 have been performed and explanations are provided in the NIR on a sectoral basis. They are mainly related to emission sources, errors in data transfer or processing in previous

[3] The secretariat 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. Where the Party has performed a key source analysis, the key sources presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key source assessment conducted by the secretariat.

inventories, methodological changes and updating of AD. After recalculations the estimated total national GHG emissions are lower by 0.4 per cent for the year 1990 and by 1.7 per cent for the year 2001. Recalculations have led to general improvement of the accuracy of the inventory. The main reason for the differences compared to the 2003 submission is a slight increase in the figures for CO_2 emissions in the year 1990, while the estimates of emissions in 2001 decreased. The changes are mainly due to revision of the national energy balance time series and of new sources in the Industrial Processes sector (e.g., limestone and dolomite use, soda ash use, calcium carbide production) being taken into consideration. Differences in the estimates of CH_4 emissions are mainly due to revision of AD for the Waste sector.

Uncertainties

11. Tier 1 of the IPCC good practice guidance has been applied to estimate uncertainties, including all sectors, CO_2, CH_4 and N_2O for the years 1990–1997. Uncertainty compilation, the choice of priorities in assessing uncertainties, and the assessment of uncertainties using Monte Carlo analysis are described in detail in the NIR. Emissions of CO_2 have a low uncertainty (about 2 per cent) whereas the uncertainty for N_2O is up to 90 per cent. Since 1999, no improvements have been made in the uncertainty assessment. Moreover, the uncertainties are not quantified for the years 1998–2002. However, it is assumed that the uncertainty has been reduced by the application of improved QA/QC systems. Austria plans to update the uncertainty estimates for all key sources as a part of its 2005 submission.

Verification and quality assurance/quality control approaches

12. The Department for Air Emissions of the Umweltbundesamt, which is the entity responsible for the national GHG inventory in Austria, is currently implementing a Quality Management System (QMS) based on the European Standard EN 45004 which specifies general criteria for the operation of various types of bodies performing inspections; furthermore, the Department of Air Emissions has been seeking accreditation as inspection body which is scheduled to take place in 2004. The QMS covers all the relevant requirements considered in the IPCC good practice guidance. The principles of the QMS are adequately explained in the NIR. As part of the QA/QC activities the Department for Air Emissions established a process which aims at gaining transparency in the analysis of findings from UNFCCC reviews or any other discrepancies found during the compilation of the inventory.

Follow-up to previous reviews

13. The completeness of the inventory has been improved and significant efforts have been made to improve QA/QC systems. In response to the recommendations of earlier reviews, Austria has provided recalculations reflecting the inclusion of additional sources. New AD have improved the quality of the inventory.

G. Areas for further improvement

Identified by the Party

14. Austria indicates that it is working to implement its QMS fully. Source-specific planned improvements are presented in the specific chapters of the NIR, mainly focused on key sources. The improvement programme managed by the Umweltbundesamt is updated on an annual basis.

Identified by the ERT

15. The expert review team (ERT) considers that the Austrian inventory is substantially complete. The NIR provides comprehensive and transparent descriptions of methodologies and data used and the overall structure of the national inventory system. The ERT welcomes the overall effort to produce more accurate emission estimates, focusing on key source categories and further improvement of the QA/QC system. Recommendations related to shortcomings identified in some source/sink categories are presented in the relevant sector sections of this report.

II. ENERGY

A. Sector overview

16. In the year 2002, the Energy sector accounted for 75.4 per cent of the total GHG emissions of Austria. Fuel combustion contributed 74.5 per cent of total national GHG emissions and 88.7 per cent of CO_2 emissions. An increase of 16.3 per cent in emissions from the Combustion sector, from 54.9 Tg in 1990 to 63.8 Tg in 2002, is mainly caused by increasing volumes of transport. Transport accounted for 33.4 per cent of total emissions in the sector in 2002.

17. The inventory addresses all the IPCC sources for the Energy sector and covers all years and all gases. The level of disaggregation is in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC Guidelines). Estimates of emissions of the indirect GHGs and sulphur dioxide (SO_2) are reported in the CRF. All the CRF tables, including the sectoral background tables, are provided.

18. The reporting of the Energy sector is generally transparent. Calculation methodologies are well documented in the NIR. The NIR provides sufficient back-up information to follow the calculations.

19. Recalculations carried out in the Energy sector are well documented in the NIR. They largely follow recommendations from previous reviews. They introduce a significant change in the estimates of total emissions of the sector: the figures for emissions in 1990 have increased by 14.1 per cent and those for 2001 have increased by 9.5 per cent. This is due mainly to an increase in subcategory 1.A.2 Manufacturing Industries and Construction as a result of the reallocation of emissions from Industrial Processes. As a result of this reallocation, the estimates of emissions from Industrial Processes have been revised downwards; this decrease compensated for 90 percent of the increase in the Energy sector. Other recommendations have been addressed in an inventory improvement plan and are being considered for the preparation of the 2003 inventory.

B. Reference and sectoral approaches

Comparison of the reference approach with the sectoral approach and international statistics

20. The differences between the sectoral and reference approaches are compared and explained in the NIR. Comparing the reference approach estimates against those from the sectoral approach the differences vary between –1.18 per cent and +2.04 per cent for the total CO_2 emissions over the time series. The negative differences for the emissions from solid fuels (–3.9 per cent for the year 1990 and –4.7 per cent for 2002) need further consideration. For the period 1996–2001, the difference is positive and as high as +7.6 per cent.

International bunker fuels

21. Given the geographical location of the Party, no emissions are reported for marine bunker fuels. The consumption of aviation bunker fuels reported in the CRF differs from that reported by the International Energy Agency (IEA) by less than 5 per cent. The split between national and domestic aviation has been calculated based on aircraft movements and fuel calculated for international aviation has been adjusted so that total fuel corresponds to total fuel sales. There is nevertheless a discrepancy of 6 per cent in 2002 between total fuel use for aviation reported in the CRF and that given by IEA. In its response to the draft of this report, Austria stated that the split between national and international aviation for 2001 and 2002 would be recalculated for 2005 on the basis of the national energy balance.

C. Key sources

1.A.2 Manufacturing industries and construction

22. Significant inter-annual variations of CO_2 emissions are observed between 1999 and 2000 as well as between 2001 and 2002 in the subcategories of 1.A.2 as a result of differences in the way in which

natural gas consumption as reported by the national energy statistics is divided between the sectors. The ERT would recommend Austria to improve the sectoral division of natural gas consumption and also check that emission sources are fully accounted for. Austria indicated that energy statistics for 2002 are preliminary and would be corrected for the next submission.

1.A.1.a Public electricity and heat production

23. The Party has explained that the fluctuations in emissions in this subcategory are due to changes in the amount of hydropower generation. However, for 1990–2002, CO_2 emissions increased by 7.1 per cent while total electricity generation increased by 27.2 per cent, gross electricity production from combustible fuels (in GWh) increased by 8.6 per cent and heat production by combustible fuels (in PJ) increased by 94 per cent. The Party has shown that fuel switching in favour of gas, biomass and wastes in heat production explains the large differences between the increase in CO_2 emissions and the increase in energy consumption.

1.A.2.a Iron and steel production

24. Estimated CO_2 emissions from energy use increased by 24.7 per cent between 2001 and 2002. This does not correspond to the data on fuel consumption, according to which consumption of solid fuels decreased by 7.2 per cent, consumption of liquid fuels increased by 15.5 per cent and consumption of gaseous fuels decreased by 6.3 per cent. Furthermore, process CO_2 emissions under 2.C.1 Iron and Steel Production decreased by 6 per cent during the same period, whereas production increased by 6.2 per cent. Some of these discrepancies may be due to inconsistencies in the allocation of emissions between the two sectors even though a reallocation of these emissions has taken place as part of the latest recalculations. If indeed some allocation problems persist, the ERT recommends a proper allocation of these emissions between the two sectors together with an appropriate explanation of these issues in Austria's next NIR. Austria indicated its intention to correct this for its next submission.

1.A.3.b Road transport — gasoline – N_2O

25. Implied emission factors (IEFs) (in kg/TJ) increased until 1994 and decreased after 1996. Emissions have been calculated using the CORINAIR methodology but country-specific EFs. The NIR only gives a general explanation of this trend. The ERT recommends that the Party explain the basis for the N_2O EFs used for different inventory years and how the average IEF has been affected by changes in technologies since 1990.

1.A.3.e Other transport – gas – CO_2

26. The CO_2 emissions reported for pipeline transport (gas turbine compressors) vary considerably from year to year. The Party has explained that the reason is the annual differences in international gas transfer. It is recommended that the Party document in the NIR the basis for the determination of gas consumption and specifically explain the emission trend, for example, by showing the annual volumes of gas transfer.

D. Non-key sources

1.A Fuel combustion

27. The CH_4 time series for solid fuel in 1.A.1 Energy Industries seems to be inconsistent as a result of significant variation in the EF between 1990 and 2000. An explanation of this variation should be provided in the NIR.

28. For 1.A.1.c Manufacture of Solid Fuels and Other Energy Industries, data are provided for 1990–1995 only; for 1996–2002 no AD or emission estimates have been provided ("0" is reported in the CRF). As the statistics do not report these data, the ERT would encourage Austria to collect the data from the producers or complete the time series using methods of the IPCC good practice guidance. Moreover gaseous fuel combustion in 1.A.1.c is approximately 14 per cent of total gas throughput in

2002 and appears to be rather high. The ERT recommends the Party to verify the data reported. In its response to the draft of this report Austria explained the increase of natural consumption for pipeline compressors with the increase of natural gas transferred through Austria but not accounted for as imports/exports in the national energy balance, and indicated its intention to provide additional information in its next NIR.

1.B.2 Oil and natural gas – CH_4 and CO_2

29. There is a general lack of transparency in the emissions reported within this category. For venting and flaring, and in the case of refineries as well, some of the combustion emissions are included in fugitive losses. The NIR only provides partial information on the EFs and methods used. This makes it difficult to assess the quality of the reporting of emissions. Furthermore, the reason for changes in the IEFs over time is not given.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

30. In the year 2002, the Industrial Processes sector accounted for 11.9 per cent of total national GHG emissions, compared to 12.9 per cent in 1990. CO_2 emissions represented 74.6 per cent of emissions in the sector in 2002 (mostly from metal and cement production). Emissions of N_2O from nitric acid production accounted for 8 per cent of emissions in the sector, actual emissions of fluorinated gases (F-gases) for 10.5 per cent and SF_6 emissions for 6.7 per cent. In the period 1990–2002, industrial processes emissions remained almost constant, mainly because of a decrease of 11 per cent in N_2O emissions from nitric acid production, compensated by a 17 per cent increase in F-gases. Compared to the 2001 inventory several sources have been added, the most important of which include CO_2 emissions from 2.A.3 Limestone and Dolomite Use, 2.A.4 Soda Ash Use, 2.B.4 Calcium Carbide Production, 2.C.3 Aluminium Production and 2.C.1 Iron and Steel.

31. For industrial processes and solvents, in addition to the four key sources identified by the secretariat (nitric acid production, cement production, lime production and ozone depleting substance (ODS) substitutes) Austria identifies 11 more key sources, including iron and steel at 4.8 per cent of the 2002 national total. In addition, CO_2 from solvents is also identified by the Party as a key source but not by the secretariat.

32. Regarding completeness, CO_2 emissions from soda ash production, asphalt roofing, road paving with asphalt and ferroalloys have not been estimated ("NE" is reported). Austria has indicated that CO_2 emissions from asphalt roofing and road paving with asphalt will be estimated for the 2005 submission by also accounting for the carbon content of non-methane volatile organic compound (NMVOC) emissions as CO_2 emissions. Soda ash is only produced in the Solvay Process, which is theoretically CO_2-neutral. However, excess carbon is produced by calcining limestone with coke. Investigations will be made to find out if these emissions are accounted for in the Energy sector or if this coke is considered as non-energy use in the national energy balance.

33. The combustion-related CO_2 emissions from the categories 2.A.1 Cement Production and 2.C.1 Iron and Steel have been allocated to the Energy sector. The CO_2 emissions from 2.D.2 Food and Drink Production have been reallocated to biogenic emissions.

34. The transparency of the reporting on the Industrial Processes sector could be improved, particularly the description in the NIR of methods used for F-gas emissions and for the allocation of energy and process emissions in the Cement and Iron and Steel production categories. Responding to the draft of this report, Austria stated its intention to improve transparency of the corresponding chapters in the NIR.

B. Key sources

2.A.1 Cement production – CO_2

35. Austria applies the IPCC good practice guidance tier 2 method by using plant-specific data. However, the AD reported for clinker production are constant for the period 1998–2002 as no additional statistical data are available. Austria states in the NIR that cement production remained stable from 1999 to 2001. The ERT notes that it is unlikely that the production and therefore emissions were exactly the same for these years and recommends that this time series be brought up to date with more recent plant-specific AD. Work has been done, for this submission, to split the energy component of the cement emissions and allocate these to the Energy sector. However, no explanation of the method used to split process and energy emissions has been provided. The ERT encourages the Party to document the methodology used for splitting the energy and process emissions more clearly.

2.A.2 Lime production – CO_2

36. Emissions have been estimated using a country-specific method based on detailed production data from all lime production plants for the period 1990–2002. However, the CO_2 estimate for 2002 has been calculated using the IEF of 2001 due to lack of reported emissions data. There is no explanation of why these data were not available in time for the submission. The ERT encourages Austria to secure timely annual reporting of emissions (or specific information on calcium (Ca) or magnesium (Mg) content), as well as production data from industry.

2.A.7 Other – Magnesia sinter production – CO_2

37. Plant-specific data for all years have been collected, enabling recalculation of the full time series at tier 2. This recalculation has resulted in a small difference in emission values.

2.B.1 Ammonia production – CO_2

38. Between 1994 and 1995 the CO_2 IEF increased by 15.1 per cent, which appears large for an inter-annual variation. As stated in the NIR (page 132), the IEF depends on plant utilization and on how often the production process was interrupted, for instance, because of change of the catalyst. The ERT considers that this is a reasonable explanation for the change in IEF.

2.B.2 Nitric acid production – N_2O and CO_2

39. Emissions of N_2O decreased by 17.4 per cent between 2000 and 2001. At the same time, the N_2O IEF decreased by about 13 per cent (from 0.006 to 0.005) between those years. As stated in the NIR (page 134), the IEF decreased due to efforts made by the company involved to reduce emissions: a catalyst now being tested has been introduced. The ERT considers that this is a reasonable explanation and that the NIR methodology is clear.

40. Austria reports minor process emissions of CO_2 from nitric acid production, whereas the IPCC Guidelines do not identify such a source of CO_2. The ERT welcomes Austria's providing an adequate description of the nature of these emissions and the method used to estimate them.

2.F Consumption of halocarbons and SF_6 – HFCs, PFCs and SF_6

41. Both actual and potential emissions of individual F-gases are reported, potential emissions of PFCs being included for the first time in the 2002 inventory. However, 2000 is the last year for which estimates of HFC, PFC and SF_6 emissions have been made, and Austria therefore retains the 2000 values for the 2001 and 2002 inventories. This approach could very likely result in an underestimation of HFC emissions in 2002, based on the trend up to 2000. Country-specific methodologies are used for all subcategories within 2.F but only general descriptions of these methodologies and their underlying assumptions are given in the NIR. Austria plans to update the emissions for F-gases for the 2005 submission. The ERT suggests that Austria take this opportunity to acquire the necessary information for

all years and to improve the transparency of reporting for all relevant sources of these gases. The Party is encouraged to apply extrapolation methods as necessary, in accordance with the UNFCCC reporting guidelines, to avoid reporting the same estimate of emissions in succeeding years.

IV. AGRICULTURE

A. Sector overview

42. In the year 2002, total emissions from the Agriculture sector were 7,402 Gg CO_2 equivalent and accounted for 8.8 per cent of total national GHG emissions. CH_4 accounted for 54 per cent of sectoral emissions and N_2O for 46 per cent. Emissions in 2002 were 12.4 per cent lower than in 1990. There were five key sources in agriculture, accounting for 10 per cent of total emissions in 2002. All relevant source categories and GHGs are reported. The notation key "not occurring" ("NO") is used for 4.C Rice Cultivation and 4.E Prescribed Burning of Savannas. Emissions of N_2O from sludge spreading, previously reported in category 6.A, are now included under 4.D Agricultural soils. Reporting for the sector is consistent and complete for all years, and the AD, EF and other information pertaining to methodologies, recalculations and uncertainties are well documented in the NIR.

B. Key sources

4.A.1 Enteric fermentation – Cattle– CH_4

43. The tier 2 method is used for cattle, which contributed 3.4 per cent of total GHG emissions in 2002 and 94 per cent of total CH_4 emissions from enteric fermentation. Cattle populations are based on counts made in December, but information provided during the review shows that this does not lead to the exclusion of significant numbers of animals that exist for part of the year. There is good agreement between the data on cattle populations in the CRF and those in the Food and Agriculture Organization of the United Nations (FAO) statistics. A decline in cattle numbers of 35 per cent from 1990 to 2002 should be explained in the NIR.

44. Austria uses a gross energy intake model based largely on annual milk yield as the basis for developing the tier 2 EF for dairy cattle using the IPCC good practice guidance equations. The value varies from 89 kg CH_4/head in 1990 to 103 kg CH_4/head in 2002, which is typical of European Union (EU) member states. References to the reports describing the approach are given. Typical diets and associated gross energy values for both conventional and organic farming are presented to support the EFs used for non-dairy cattle. Data disaggregated by age and sex are given in the NIR. The same EFs are used for all years and vary from 75 kg CH_4/head for suckling cows to 33 kg CH_4/head for animals reared in conventional systems. The weighted EF of 53 kg CH_4/head is typical of European countries.

4.B Manure management – Cattle and swine – CH_4

45. The tier 2 method is used in accordance with the IPCC good practice guidance. The volatile solids (VS) production by dairy cattle is related to milk yield and to other country-specific data in two referenced reports, and default values of methane-producing capacity (B_O) and methane conversion factor (MCF) are applied. For the other categories of cattle, VS excretion is based on the digestibility, gross energy and ash content of the typical diets as used in the determination of the EFs for enteric fermentation, taking into account conventional and organic farming practice. The distribution of manures among the various manure management systems is based on a survey reported in 1995 and is fixed for the entire time series.

46. Swine are characterized as breeding sows and fattening pigs, but the NIR states that the EF for the former account for emissions from nursery and growing pigs, and this introduces some lack of transparency and comparability. Austria is encouraged to improve transparency regarding the characterization of the swine population so that the EFs for individual categories are fully transparent. Default values of B_O and MCF are applied for swine and constant VS excretion rates are estimated on the basis of national studies which are referenced.

4.B Manure management – Cattle – N_2O.

47. The country-specific nitrogen (N) excretion rates for cattle are significantly lower than the IPCC default values for European countries and those of other Parties. The figures for excretion of N by cattle are based on milk yield and other information taken from national studies and other referenced reports as used in deriving the CH_4 EFs for enteric fermentation and manure management. These references do not fully justify the adoption of 65 and 34 kg N/head for dairy cattle and other cattle, respectively, and the values appear to be inconsistent with the corresponding VS excretion and CH_4 EFs used by Austria for manure management. The NIR makes no reference to the N content of the typical diets presented for cattle or to the proportion of N lost from different types of forage. As N excretion rates have a major bearing on N_2O emissions, these low country-specific values should be documented more thoroughly.

48. Although detailed information by animal waste management system (AWMS) is available and is used in the emission estimates, all N_2O emissions in category 4.B are reported under liquid systems. The IEF is apparently a weighted average of the IPCC default values for liquid systems, solid storage and other systems. To improve transparency, the ERT encourages the Party to report separately under the three systems applicable in the country.

49. Austria reports recalculations that address inconsistencies and errors detected in the 2003 review regarding the reporting of nitrogen per AWMS in tables 4.B(a), 4.B(b) and 4.D. However, there is still a lack of clarity and a possible underestimate in the accounting of N excreted by swine in table 4.B(b) in all years, because multiplication of total swine population by the rate of N excretion gives a greater amount of N excreted than is reported by AWMS, which could also affect N_2O emissions from agricultural soils (4.D). Further information gained during the review confirmed that N excretion by swine is not underestimated but the weighted N excretion rate reported for swine in table 4.B(b) is incorrect. By using the appropriate weighting of suitable N-excretion rates for the chosen swine categories, Austria will achieve the necessary accuracy and transparency in Table 4.B(b) and maintain consistency regarding the reporting of CH_4 emissions from manure management.

4.D.1 Agricultural soils – Direct N_2O

50. The tier 1 method is used and all nitrogen inputs are taken into account. However, the definition of the parameter $Frac_{GASM}$ is different from that of the IPCC Guidelines, which results in a lack of transparency in the estimation of direct and indirect N_2O emissions. According to the IPCC good practice guidance, the value of 0.177 for $Frac_{GASM}$ given in table 4.D should represent the total ammonia (NH_3) and nitrogen oxide (NO_X) losses based on the total N excretion by animals, while in the estimation of F_{AW}, as described in the NIR, $Frac_{GASM}$ is the proportion of N volatilized only during the spreading of animal wastes. Austria should clarify the rationale for the modified version of the IPCC good practice guidance equation used for estimating F_{AW} and the way in which $Frac_{GASM}$ is used.

51. The ERT encourages Austria to specify in the documentation box in table 4.D that emissions from sewage sludge are included under synthetic fertilizers. The NIR should also state that F_{SN} includes the nitrogen contribution from sludge applied to agricultural soils. The ERT recommends Austria to provide in the NIR more detailed documentation of the country-specific methodology that is used to estimate emissions from N-fixing crops for comparison with the methodology given in the IPCC good practice guidance.

4.D.3 Agricultural soils – Indirect N_2O

52. Austria's adaptation of the IPCC equation for estimating nitrogen input from atmospheric deposition underestimates this input because neither N volatilized in housing and storage nor that from animal waste excretion at pasture is taken into account. The Party should re-examine the methodology being used to estimate this component of N_2O emissions and the relationship to direct emissions through $Frac_{GASM}$ so that all emissions are fully accounted for in accordance with the IPCC good practice guidance. Responding to the draft of this report, Austria stated that total volatilized N and the IPCC definition of $Frac_{GASM}$ will be used for calculating indirect emissions for the next submission.

53. The NIR gives no basis for the use of the default value of 0.3 for $Frac_{LEACH}$ in Austria. Nitrogen inputs may be too low to justify the use of this default value and the Party may wish to assess its suitability as part of its future inventory development. Responding to the draft of this report, Austria indicated its intention to re-examine the suitability of this default value for its 2006 submission.

C. Non-key sources

4.A Enteric fermentation – Deer – CH_4

54. Activity data are reported for deer but emissions of CH_4 from enteric fermentation are reported as "NE". Nevertheless, N_2O emissions from manure management and animal production are estimated for this animal type after 1993. To ensure consistency and completeness, all emissions relating to the chosen animal categories should be reported for all years.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

55. Emissions and removals in LUCF are reported only for category 5.A Changes in forest and other woody biomass stocks. The NIR states that emissions and removals for categories 5.B Forest and grassland conversion and 5.C Abandonment of managed lands are indirectly included in category 5.A, based on a number of assumptions. Category 5.D Emissions and removals from soil is not reported because of lack of data.

56. The annual data required for estimating emissions and removals in category 5.A are not available after 1996. Austria therefore reports the same net removals value for all years 1997–2002, which is based on the forest inventory data for the period 1992–1996. For the next submission an update of the data in this sector is expected, based on a new forest inventory. The LUCF sector represented net CO_2 removals of 7,633 Gg in 2002, offsetting 11 per cent of Austria's total GHG emissions. From 1990 to 2002, net removals decreased by 17.2 per cent.

57. The procedure for QA/QC is well established and defined by the Party. The calculation of uncertainties takes into consideration the statistical uncertainty of the forest inventory, the calculation of annual data, and the conversion and expansion factors. However, the estimates for changes in forest and other woody biomass stocks still contain a high degree of uncertainty. The Party will improve the estimations of uncertainties through the Monte Carlo simulations.

58. In the response to the draft of this report, Austria stated that the LUCF sector is under revision to incorporate the good practice guidance on Land use, land-use change and forestry (LULUCF) and that there would be more complete sub-sector reporting for this sector in the 2005 submission.

B. Sink and source categories

5.A Changes in forest and other woody biomass stocks

59. National methodologies are consistent with the IPCC Guidelines but are considered to give more reliable estimates. The main basis for the data is the measured forest parameters and harvest data obtained in the last forest inventory. Averages of annual growth increment and harvest for the periods of the forest inventory are converted to annual values using indices that account for relative variation in individual years. The mean values determined in this way for the forest inventory for the period 1992–1996 are the basis of the emissions/removals reported for the years after 1996. The country-specific values used for the average annual growth rates are in line with the IPCC default values. Austria has not included the removals due to the 2000 ha of forest plantations because the associated carbon stock changes are assumed to be negligible.

5.B Forest and grassland conversion and 5.C Abandonment of managed lands

60. The assumption that emissions and removals associated with categories 5.B and 5.C are accounted for in category 5.A because the national forest inventory accounts for all relevant biomass increments and removals needs further substantiation by Austria. In the interests of comparability, the Party is recommended to report separately the biomass losses due to forest conversion and those resulting from the conversion of managed lands to forests, instead of including them under category 5.A.

VI. WASTE

A. Sector overview

61. In the year 2002, the Waste sector contributed 3.8 per cent to total national GHG emissions. In 1990 the figure was 5.9 per cent. The decrease of 28.9 per cent in total emissions from the sector from 1990 to 2002 is mainly due to the decrease in emissions of CH_4 from solid waste disposal sites (SWDS) and in emissions of CO_2 from waste incineration. Emissions of CH_4, which contributed 97.3 per cent to the emissions from the sector in 2002, have decreased by 32.6 per cent since 1990 because of the reduced amount of landfilled waste and increasing recovery of landfill gas.

62. Austria has provided all CRF tables for all years from 1990 to 2002 covering all source categories and gases relevant to the Waste sector. Information gaps were identified in category 6.B Waste-water Handling, since activity data are reported as NA and most of the background data are reported as "NE" even though CH_4 emissions are reported. In its response to the draft of this report, Austria explained that the methodology used does not facilitate the reporting of the activity data requested by the CRF and that it plans to revise the national methodology for the 2006 submission. The ERT noted important improvements since the 2003 submission: these include the updating of AD for SWDS and the provision of explanations on documentation requested in the previous review.

63. Austria has performed recalculations for the whole time series for SWDS (due to the updating of AD, quantities of municipal solid waste (MSW), degradable organic carbon (DOC) and CH_4 recovery) and compost production (due to the reallocation of sludge spreading to category 4.D.1 in the Agriculture sector). The recalculations resulted in a decrease in the figures for emissions from the sector of 35.5 per cent for 2001. Though the NIR provides clear explanations, the ERT recommends that regarding this recalculation Austria provide, in next submission, a description on the differences in AD and DOC compared with the previous submission, the reasons for them, or the amount of emissions reallocated that has led to this large reduction.

64. The ERT noted that Austria plans to review some methodologies and emissions factors used to estimate emissions from waste-water handling and waste incineration.

B. Key sources

Solid waste disposal sites – CH_4

65. The method used for calculating the emissions from SWDS is country-specific. It separates waste into two categories, "residual waste" and "non-residual waste" for both of which country-specific AD and parameters are applied. The quantities of residual and non-residual wastes have been obtained from different referenced studies. The Party has made progress with regard to AD as it has collected and updated some additional data. However, it would be more appropriate to use extrapolation techniques for those years where no data are available (i.e., non-residual wastes before 1998) as recommended by the previous review, instead of considering it as constant (NIR, page 227, paragraph 8.2.1.3).

66. The methodology used is well documented with a clear explanation. However, even though Austria has provided additional information on waste composition as requested by the ERT, it was not possible to replicate the calculations for biodegradable organic carbon for directly deposited wastes (table 194 of the NIR). The ERT encourages Austria to further document and reference in the NIR the following parameters and information: degradation constant used k=0.035; the composition of wastes

through the years for residual wastes and its relation to DOC reported; and the composition of non-residual wastes and its relation to the half-life periods used.

67. As a result of the updating of AD (quantity of solid wastes disposed in landfills, kg DOC/kg wastes, CH_4 recovery), emissions have been recalculated. This has led to an important reduction in the figures for emissions (57 per cent in 1990 and 59 per cent in 2001) which needs further explanation. The fraction of DOC in MSW decreases continuously, presenting a reduction of 40 per cent in 2001 compared to 1990, while the composition of wastes reported in the CRF is constant through the years. This trend is different from that of any other Annex I Party. The ERT encourages Austria to review these figures for its next submission.

68. As stated in previous review reports, Austria uses an oxidation factor of 0.2 (double the recommended IPCC maximum default value of 0.1). The Party made references to recent studies and expert judgement and stated that this figure seemed to be more appropriate to the landfill management practices in Austria. The ERT encourages Austria to reconsider using the IPCC default value for its next submission.

C. Non-key sources

Waste-water handling – CH_4 and N_2O

69. The methodology used for CH_4 emissions from domestic and industrial waste water, based on an IEF calculated for 1993 and held constant for all years, is not in line with the IPCC good practice guidance. In developing the already planned improvement of the methodology, Austria should consider the use of the check method described in the IPCC good practice guidance for domestic and commercial waste water and the use of default data (for Chemical Oxygen Demand (COD)) and expert judgement (IPCC good practice guidance page 5.20, decision tree) for industrial waste water, until country-specific data are available.

70. The N_2O IEF (0.00075) for human sewage is the lowest among reporting Parties (out of the range of IPCC good practice guidance 0.002–0.12). Austria has planned to improve the methodology for its next submission.

Waste incineration – CO_2

71. Documentation on the allocation of CO_2 emissions from the incineration of waste oil with and without energy recovery has been improved. However, the ERT recommends that Austria specify in the NIR or in the documentation box of table 6.C the quantities of waste oil that are specifically incinerated for energy recovery and those that are not.

ANNEX 1: MATERIALS USED DURING THE REVIEW

A. Support materials used during the review

2003 and 2004 Inventory submissions of Austria. 2004 submission including a set of CRF tables for 1990–2002 and an NIR.

UNFCCC secretariat (2003). "Report of the individual review of the greenhouse gas inventory of Austria submitted in the year 2003 (Centralized review)." FCCC/WEB/IRI(3)/2003/AUT (available on the secretariat web site http://unfccc.int/national_reports/annex_i_ghg_inventories/inventory_review_reports/items/626.php).

UNFCCC secretariat. "2004 Status report for Austria" (available on the secretariat web site http://unfccc.int/national_reports/annex_i_ghg_inventories/inventory_review_reports/items/2994.php).

UNFCCC secretariat. "Synthesis and assessment report of the greenhouse gas inventories submitted in 2004. Part I": FCCC/WEB/SAI/2004 (available on the secretariat web site http://unfccc.int/resource/webdocs/sai/2004.pdf) and Part II – the section on *Austria* (unpublished).

UNFCCC secretariat. Review findings for Austria (unpublished).

Austria's comments on the draft "Synthesis and assessment report of the greenhouse gas inventories submitted in 2004" (unpublished).

UNFCCC secretariat. "Handbook for review of national GHG inventories". Draft 2004 (unpublished).

UNFCCC secretariat. "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories", "Part II: UNFCCC reporting guidelines on national communications" and "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention." FCCC/CP/1999/7 (available on the secretariat web site http://unfccc.int/resource/docs/cop5/07.pdf).

UNFCCC secretariat. "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" and "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention." FCCC/CP/2002/8 (available on the secretariat web site http://unfccc.int/resource/docs/cop8/08.pdf).

UNFCCC secretariat. Database search tool – *Locator* (unpublished).

IPCC. *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000* (available on the following web site: 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 on the following web site: http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm).

B. Additional materials

Responses to questions during the review were received from Ms. Manuela Wieser (Umweltbundesamt) including additional material on the methodology and assumptions used.

Gruber, L. and Steinwidder, A. (1996). Einfluss der Fuetterung auf die Stickstoff- und Phosphorausscheidung landwirtschaftlicher Nutztiere (Influence of nutrition and phosphorys excretaion of livestock - Model calculations on the basis of a literature review). Article in *Die Bodenkultur*, Austrian Journal of Agricultural Research, December.

Data on residual waste composition in Austria. Taken from: Rolland, C. and M. Scheibengraf, (2003). Biologisch abbaubarer Kohlenstoff im Restmüll, Bericht BE 236, Umweltbundesamt, Wien.

Data on Non residual waste composition: Construction site wastes and bulky wastes composition taken from: Baumeler, A., P. H. Brunner, R. Fehringer, A. Kisliakova and E. Schachermayer (1998).

Reduktion von Treibhausgasen durch Optimierung der Abfallwirtschaft: Schriftenreihe der Energieforschungsgemeinschaft im Verband der E-Werke Österreichs.

Background data on cattle populations 1980–2002 and NH_3 emissions from livestock (spreadsheets, unpublished).

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