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# SLOVAKIA

# 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 Slovakia, 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 Slovakia for comment prior to its publication.

### B. Inventory submission and other sources of information

3. In its 2004 submission, Slovakia submitted an almost complete set of common reporting format (CRF) tables for the years 2001 and 2002 and a national inventory report (NIR) providing general information on methodologies, activity data (AD), emission factors (EFs), recalculations and key sources. A brief description of uncertainties, verification and quality assurance/quality control (QA/QC) procedures is provided in the NIR. 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 Slovakia was carbon dioxide ($CO_2$), contributing 83.0 per cent to total[2] national GHG emissions, followed by methane ($CH_4$) – 9.2 per cent, and nitrous oxide ($N_2O$) – 7.5 per cent. Perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride ($SF_6$) taken together contributed 0.3 per cent of the total national GHG emissions. The Energy sector accounted for 79.5 per cent of the total, followed by Industry (8.2 per cent), Agriculture (8.1 per cent) and Waste (4.2 per cent). Total GHG emissions amounted to 51,145 Gg $CO_2$ equivalent and

[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.

decreased by 29.4 per cent from 1990 to 2002, which is broadly similar to the trends reported by the majority of Parties with economies in transition (EIT Parties).

## D. Key sources

5. Slovakia reports a tier 1 key source analysis for both level and trend assessment in its 2004 submission. The reference approach $CO_2$ estimates are used for combustion sources and Slovakia's list of key sources therefore differs from that determined by the secretariat.[3] Slovakia identifies 15 key sources on the basis of the level assessment and 17 key sources on the basis of the trend assessment, while the secretariat identified 17 key sources in its level assessment. Except for Iron and Steel Industry and Manure Management, all of them are also on the Party's list. The most important key source categories are $CO_2$ emissions from the combustion of solid and gaseous fuels, $CO_2$ from road transport and $N_2O$ emissions from agricultural soils.

## E. Main findings

6. The NIR provides only brief descriptions of the methodologies used in most of the sectors. The country-specific methodologies and assumptions underlying some major emission sources are not adequately described and generally not well documented (there are no supporting references). Sufficiently transparent descriptions of the overall data collection system and the process of inventory preparation are also lacking. The NIR states that the sectoral approach cannot be used reliably to quantify emissions from fuel combustion, and the total emissions and trend tables for Slovakia therefore use $CO_2$ estimates from the reference approach. Other tables are based on the sectoral approach estimates. Slovakia's 2004 submission lacks inventory data according to the CRF for 1990 as well as for 1991–2000.

## F. Cross-cutting topics

### Completeness

7. Slovakia has submitted GHG inventories for the years 2001 and 2002 using the CRF. Trend data for the period 1990–2000 are also available. However, Slovakia has not provided a full CRF for 1990–2000. All major sources and sinks as well as the relevant GHGs ($CO_2$, $CH_4$, $N_2O$, HFCs, PFCs and $SF_6$) and the indirect GHGs nitrogen oxide ($NO_X$), carbon monoxide (CO), non-methane volatile organic compound (NMVOC), and sulphur oxide ($SO_X$) are covered, but not all the CRF tables contain data, and notation keys are not always used, thus leaving unexplained data gaps. The categories that are reported as "included elsewhere" ("IE") are explained in CRF table 9. The NIR also includes information on key sources, methodologies, uncertainty assessment, QA/QC, institutional arrangements and emission trends. In some cases the information is not fully complete or transparent. The Party is advised to harmonize the national database of sources with the CRF categories and to provide a complete CRF time series for 1990–2000. In order to facilitate progress on this work, the Party is advised to improve its institutional arrangements and strengthen its resources for preparation of the national inventory.

### Transparency

8. The national GHG inventory in general and the information on the Energy sector in particular (it accounts for the greater part of total national emissions) are not sufficiently transparent. The NIR does not document calculation methodologies and EFs sufficiently, nor does it provide sufficient background information to make it possible to replicate the majority of the calculations. The NIR of Slovakia's future submissions therefore needs to be more thorough and to include more AD as well as detailed explanations of methodologies used and any recalculations undertaken in order to improve transparency. The expert

[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.

review team (ERT) recommends closer adherence to the UNFCCC reporting guidelines in developing the NIR. In several CRF tables (e.g., tables 3, 4a and 4.B(a)) data gaps have been identified which are due to lack of data or of notation key entries. Slovakia is advised to use the notation keys in the correct way.

Recalculations and time-series consistency

9. The Party reports recalculations for 2000 (covering only the industrial processes sector) and 2001 in the NIR and the CRF tables. They were undertaken mainly as a result of improved statistical information on AD becoming available and some changes in methodologies. The difference of 1.2 per cent for the 2001 inventory compared with previous estimates has been caused mainly by the recalculations for fuel combustion activities in the Energy sector, metal production and waste incineration. The rationales and explanation for these recalculations are provided in CRF table 8b and in the NIR in the relevant sector chapters.

Uncertainties

10. Tier 1 of 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) has been applied to estimate uncertainties quantitatively. The analysis has been carried out across all sectors and all gases for the years 2001 and 2002. Uncertainties of 10 per cent for the level estimates and almost 3 per cent for the trend estimates are reported. The estimated levels cover uncertainties related to the quality of the statistical AD and EFs and the use of less advanced methodologies.

Verification and quality assurance/quality control approaches

11. The NIR describes a simple QA/AC procedure, whereby the emission estimates elaborated for individual sectors by external consultants are checked and recalculated by the institutions responsible for the GHG inventory preparation (in particular, the Division of Air Quality of the Slovak Hydrometeorological Institute (SHMI)). External reviewers are regularly invited to comment on the inventory results. The AD for major sources are compared with national statistics and with the previous year's data. The energy balance from the national energy statistics is compared with summary fuel consumption reported by sources, and fuel consumption in the Transport sector based on the COPERT model results is compared with amounts of fuels sold. As the ERT noticed some inaccuracy in AD and inconsistencies in the EFs used (e.g. Energy and Agriculture sectors) as well as inconsistencies within the CRF tables and between the CRF and the NIR, the Party is urged to develop its QA/QC procedures further.

Follow-up to previous reviews

12. Compared with the findings of previous reviews, the transparency of the inventory has improved only slightly. Significant effort has been put into improving uncertainty assessment.

## G. Areas for further improvement

Identified by the Party

13. The NIR identifies only a few areas for further improvement. The main emphasis is put on time-series consistency and transparency in the choice of methodology and AD. The database for the AD in the Energy sector and fuel combustion should be improved in the Party's next submission.

Identified by the ERT

14. The ERT considers that the Party's inventory is not yet sufficiently complete (e.g., the CRF tables for 1990–1999 are missing) and that the NIR does not provide comprehensive and transparent descriptions of methodologies used or describe the overall structure of the national inventory system. The preparation of complete time series of CRFs from the year 1990 and an extended NIR should be of the highest priority for the Party and would greatly enhance the transparency and completeness of the inventory.

15. The ERT recommends the Party to improve its formal QA/QC procedures and enhance its institutional arrangements and inventory capacity in order to achieve full time-series reporting which includes the application of the sectoral approach in the Energy sector. These issues should be included in the emission inventory improvement plan in order to achieve closer adherence with the UNFCCC reporting guidelines and reduce inconsistencies between and in the CRF and the NIR. Recommended improvements related to specific 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 79.8 per cent of total national GHG emissions and for 91.4 per cent of $CO_2$ emissions (based on the reference approach data). $CO_2$ emissions from the sector decreased by 29 per cent compared to the year 1990 thanks to decreasing emissions from stationary combustion. Total emissions from the sector decreased by 1 per cent between 2001 and 2002 due to a decrease in emissions from stationary combustion, while emissions from transportation increased steadily over the three years 2000–2002; for 2002 the annual increase reached 14.2 per cent. Transport contributed 11.2 per cent of total national GHG emissions in 2002.

17. All the main IPCC sources for the Energy sector are included and all gases are covered. 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 precursor gases and sulphur dioxide ($SO_2$) are reported in the CRF. The sectoral background tables are essentially complete for 2001 and 2002 (a full CRF was presented for these years only). The reference approach is used to calculate the total emissions of the Energy sector for table 10 Emissions Trends and is applied for the key source analysis.

18. The reporting of the Energy sector is not sufficiently transparent. Calculation methodologies and EFs are not documented in the NIR and the NIR therefore does not provide sufficient background information to enable the ERT to replicate the calculations.

19. Recalculations in the Energy sector are mentioned in the NIR, but the CRF only reports recalculations for 2001. The 2001 emissions estimates have been recalculated due to correction of the statistical information for stationary combustion, and the 1990–2001 emissions estimates have been recalculated to account for a change in the methodology for estimating the emissions from road transport (from the COPERT II to the COPERT III model) and new AD on the distribution of natural gas. As a result of the recalculations, the estimates for emissions in the Energy sector in 2001 have increased by 1.3 per cent. The 1990–2001 time series has been recalculated for the Transport category and for fugitive emissions, but the recalculation results are reported for 2001 only.

20. There are no changes in the uncertainty assessment of the Energy sector compared to the previous submission. Special attention should be paid to uncertainty estimates and QA/QC procedures in the calculation of AD and EFs both for the national statistical data and in the independent data collection system that is used for the sectoral approach.

### B. Reference and sectoral approaches

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

21. The $CO_2$ emissions from fuel combustion were calculated using the reference approach and the sectoral approach. Comparing the reference approach estimates against those from the sectoral approach, there is a difference of 2.1 per cent between the two approaches for the year 2002 (with the reference approach estimates being lower than the sectoral approach estimates). Significant differences exist between $CO_2$ emissions for solid fuels (48.3 per cent) and gaseous fuels (11.4 per cent). They are compensated by the contribution of other fuels. The ERT would recommend the Party as far as possible to distribute the other fuels between the three main categories.

22. Fuel consumption calculated by the reference and by the sectoral approach differs by 10 per cent for 2002. The Party has explained that the reason is that energy use for the sectoral approach is based on data reported from individual plants (bottom-up) while the reference approach uses data from the Statistical Office of Slovakia. The ERT would recommend QA/QC of the inventory energy use based on bottom–up information to better explain differences between the national energy balance and individual plant data, as well as a check for completeness and possible double counting of total fuel use.

23. $CO_2$ emissions from biomass decreased by 20 per cent between 2001 and 2002. The Party explained that the reason for this is that emissions from liquid biomass were not included in 2002 due to changes in the collection of statistical data. The ERT would recommend the Party to ensure consistency in the time series by collecting the data or using the extrapolation methods of the IPCC good practice guidance.

International bunker fuels

24. Because of its geographical location, Slovakia is not expected to have marine bunker fuel. The Party has nevertheless made the assumption that 20 per cent of the fuel sold for shipping is used by domestic shipping and the remainder is bunker fuel. However, according to the IPCC Guidelines (Reporting instructions), bunker fuels should only be reported for marine use (i.e., seagoing ships) and not for inland waterways. Aviation emissions have been allocated 25 per cent to domestic aviation and 75 per cent to international aviation on the basis of a survey of the six largest airports. This is considered to be a more appropriate allocation than the International Energy Agency (IEA) data, where all fuel is allocated as international. However, the large difference of 78 per cent between total aviation fuel (domestic and international) in the CRF and IEA is not explained. The ERT would recommend an explanation in the NIR of the reason for this large difference and of the basis for the determination of total aviation energy consumption reported in the CRF.

## C. Key sources

General

25. The ERT identified several apparently inconsistent implied emission factors (IEFs) for transport and stationary combustion sources. The Party provided a general explanation – that EFs are dependent on the net calorific value (NCV) of fuels published by the Statistical Office of Slovakia. The ERT would recommend the Party to explain in the NIR the EFs used, how they are dependent on the NCV values and why the NCV values change from one year to another.

1.A.1 Energy industries

26. The estimates of $CO_2$ emissions for 2001 for this subcategory differ significantly between the 2003 and 2004 submissions. The Party has only provided CRFs for 2001 and 2002 in its 2004 submission and has provided contradictory explanations in the recalculation table for Energy (table 8.b) and in the NIR. It is therefore difficult to verify the reasons for the inter-annual variation and the validity of the recalculation for 2001. The ERT would recommend the Party to provide CRFs for all the years and also explain the inter-annual variations in the latter years of the time series.

27. The IEF for $CO_2$ emissions from other fuels varies from 49.5 t/TJ (for 1.A.5) to 208.6 t/TJ (1.A.1c). Detailed consumption data and definitions of the fuels covered by this category are not provided to allow assessment of this variation. The ERT recommends a more transparent and detailed treatment of this category and encourages the Party to explain the variation in IEFs.

1.A.2a Iron and steel production

28. $CO_2$ emissions from energy combustion and those from industrial processes (2.C.1 Pig Iron Production) have been fully reported under 1.A.2a, while those for steel production have been separately reported. The methodology for separation, the AD and the EFs are not reported. The ERT would

recommend the Party to provide a more detailed and transparent separation of energy-related and process emissions from iron and steel production and to allocate emissions in the correct way.

1.A.2f Other

29. The details of the industries covered by this subcategory are not indicated. As emissions of 3,263 Gg $CO_2$ are reported for 2002, the ERT recommends the Party to provide information on the relevant sources.

1.A.3b Road transportation – $CO_2$

30. $CO_2$ emissions from road transportation increased by 15 per cent between 2001 and 2002. The ERT would encourage the Party to explain in the NIR the reason for this rather large change.

1.B.1a Coal mining and handling activities – $CH_4$

31. The $CH_4$ IEF appears to be very high considering that part of its mining activity is brown coal underground mines, from which emissions would normally be low. The Party has already identified this as a potential overestimation. The ERT would recommend the Party to derive country-specific EFs for this category along with mine-specific AD or to reconsider the choice of default EFs.

1.B.2 Fugitive emissions from fuel – Oil and natural gas – $CH_4$

32. Fugitive emissions from the transport of gas and the production, transport and refining of oil have been reported in a transparent manner in the CRF. Emissions from venting and flaring have also been reported separately. According to the NIR, emissions have been estimated using IPCC tier 1 methods and expert judgment. Given that this is a key source the ERT would encourage the Party to better explain in the NIR the basis for the calculations and the assumptions made.

## D. Non-key sources

1.C International bunkers (aviation and marine) – $CO_2$

33. Emissions from bunker fuels are not reported for the years 1990–1993. The Party has explained that the reason is lack of consistent data for these years. The ERT would encourage the Party to complete the time series using appropriate methods from the IPCC good practice guidance.

1.A.3e Other transport – $CO_2$

34. Emissions from pipeline compressors are reported as "not occurring" ("NO"). However, fugitive emissions are reported from this source. The ERT would recommend the Party to clarify in its next submissions whether there are $CO_2$ emissions from this source.

1.A.3a Civil aviation – $CO_2$

35. According to the NIR, 25 per cent of the aviation fuel (kerosene) is allocated as domestic and the rest is assigned to bunkers. However, this is not consistent with the data reported in the CRF, where 667 TJ out of a total of 1,176 TJ are reported as domestic.

1.A.3a Civil aviation – $CH_4$ and $N_2O$

36. No $CH_4$ or $N_2O$ emissions are reported from civil aviation. The ERT would recommend including these emissions in the next submission, for example, using IPCC default EFs.

## III. INDUSTRIAL PROCESSES AND SOLVENT USE

### A. Sector overview

37. In the year 2002, the Industrial Processes sector accounted for 8.2 per cent of total national GHG emissions. $CO_2$ represented 74.2 per cent of sectoral emissions, the major share of $CO_2$ emissions (81.3 per cent) coming from mineral production. The key sources include $CO_2$ emissions from cement and lime production, limestone and dolomite use and iron and steel production, and $N_2O$ emissions from nitric acid. The latter two sources have been added since the 2001 inventory was submitted.

38. The allocation of emissions for several subcategories of Industrial Processes differs markedly from that required by the IPCC Guidelines. Slovakia's allocation does not follow the transparency and comparability principles of the CRF and thus limits the identification of key sources and review of the inventory in respect of both the Industrial Processes and the Energy sectors. The ERT encourages Slovakia to separate energy and process-related emissions and to allocate them to their respective sectors according to the disaggregation given by the CRF. The NIR should describe how the separation is achieved.

39. The Statistical Office of Slovakia has updated the AD on the production of mineral products. Emissions of $CO_2$ from cement and lime production have been recalculated on the basis of this information. In addition, the $N_2O$ EFs for nitric acid production have been changed, which results in an increase in the estimated emissions. $CO_2$ emissions from aluminium production and from the production of steel from pig iron are the only emissions reported under category 2.C.1 Metal Production. It is stated that consistent recalculations for the full time series have been undertaken for both sources but the changes and the reasons for them are not entirely clear (e.g., the previous estimate is given as zero in the case of recalculations for 2001). The ERT recommends that Slovakia provide clearer explanations in the NIR about the methodology for estimating emissions for these sources and make all recalculations more transparent using the CRF and the NIR.

### B. Key sources

2.A.1 Cement production – $CO_2$

40. The NIR states that clinker production is not known and that $CO_2$ emissions are therefore based on cement production. However, clinker production is entered under AD in CRF table 2(I).A-G and the EF is reported as 0.506 tonne $CO_2$/tonne clinker. The NIR does not explain how the amount of clinker is derived from data on cement production but CRF table 9 states that the proportion is 75 per cent. While the EF is close to the IPCC default for clinker, it suggests an average lime (CaO) content of 64 per cent rather than the value of 77 per cent given in the 2002 NIR. The ERT recommends that Slovakia provide all background data used to obtain the EF specified in the NIR and a description of how the clinker amount is derived to support the emissions estimate reported.

2.A.3 Limestone and dolomite use – $CO_2$

41. The NIR states that emissions of $CO_2$ in category 2.A.3 refer to the use of limestone and dolomite in the production of glass, calcium carbide and iron and steel. Table 9 does not give an explanation of the notation key "IE" used in the case of iron and steel. Tier 1 methods are used to calculate emissions from this key source and the IPCC default EF is reduced to 427 kg/t to account for a calcium carbonate ($CaCO_3$) content of 97 per cent. The ERT recommends that Slovakia provide information on how the AD are obtained and confirm that dolomite is not used.

2.C.1 Iron and steel production – $CO_2$

42. Emissions of $CO_2$ reported under 2.C.1 refer to steel production from pig iron only. Emissions from coke used in pig iron production are included in the Energy sector while those from limestone use are assigned to category 2.A.3. There is a lack of clarity on the EF used to estimate emissions from steel production. The ERT recommends that Slovakia provide information on the background data and document the methods used in order to increase transparency. The ERT also suggests that Slovakia include

process emissions from coke used to produce pig iron under category 2.C.1 according to the IPCC good practice guidance.

2.B.2 Nitric acid production – $N_2O$

43. A thorough analysis of the technology in Slovak plants has been made, resulting in an increase in the EFs of $N_2O$ from nitric acid production, from 5.43 kg/t to 5.57 kg/t, applicable from 1996 as a result of $NO_X$ emission control measures. However, this information does not explain the use of the EFs of 1.44 kg/t for this source in 2001 (which is contradicted by table 8(b) of the 2002 CRF) and 1.18 kg/t in 2000, as given in the 2003 submission. The value of 5.57 kg/t is used for 2001 in the 2004 submission and table 8(b) states that consistent data are available from 1990. However, it is unclear what EF is used in the year 1990.

### C. Non-Key sources

2.B.1 Ammonia production

44. All emissions from ammonia production are assigned to the combustion of gaseous fuels in subcategory 1.A.2c Chemicals and for this reason Slovakia's treatment of this important source cannot be properly assessed. The ERT noted from table 1.A(d) that the value of 0.33 is used for the fraction of carbon stored in natural gas feedstocks. Ammonia production is often a major user of natural gas feedstocks and, according to the IPCC Guidelines, the appropriate carbon storage factor is normally zero. Process emissions from ammonia production should be allocated to category 2.B.1 and the issue of associated carbon storage should be re-examined to ensure that emissions are estimated in accordance with the IPCC Guidelines.

2.C.3 Aluminium production – $CO_2$ and PFC

45. The IEFs for tetrafluoromethane ($CF_4$) (0.014) and hexafluoroethane ($C_2F_6$) (0.0014) are among the lowest among reporting Parties and significantly lower than the IPCC defaults (by about one to two orders of magnitude). This issue has been addressed by the Party in response to the previous Synthesis and Assessment report. Slovakia has indicated that the technological process in Slovak plants is highly advanced, using pre-bake anodes, and therefore the $CF_4$ and $C_2F_6$ IEFs are among the lowest values. The method is described in the Country Study Report. The ERT suggests that Slovakia clarify the source of data used for the calculations in the NIR.

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

46. HFCs, PFCs and $SF_6$ are not produced in Slovakia. The Party reports actual and potential emissions relating to the consumption of HFCs, PFCs and $SF_6$ but the relevant sectoral background data tables are not completed. The NIR gives an outline of data collection methods but provides no description of the methodologies used to quantify emissions. The ERT recommends that Slovakia provide full information on the estimation methods used and ensure that the CRF tables are completed to improve the transparency of its reporting.

3 Solvent and other product use – $CO_2$ and $N_2O$

47. No AD or estimates of $CO_2$ or $N_2O$ emissions are reported for this source category. However, NMVOC emissions are reported. The ERT recommends that Slovakia provide information on emissions of $CO_2$ and $N_2O$.

## IV. AGRICULTURE

### A. Sector overview

48. In the year 2002, total emissions from the Agriculture sector in Slovakia were 4,129.4 Gg $CO_2$ equivalent and accounted for 8 per cent of total national GHG emissions. Within the sector, category 4.A accounted for 25.2 per cent of emissions and category 4.D for 58.2 per cent. The emissions from the sector

in 2002 show a 48.8 per cent decrease compared to the 1990 values. Slovakia includes categories 4.A, 4.B and 4.D as key sources in its list of key sources for 2002. All emission sources and gases relevant for Slovakia are covered in these categories. There is complete reporting in the CRF for the sector for 2002. All sources in 4.C, 4.E and 4.F are reported as "NO". The use of notation keys has improved since the previous submission.

49. The NIR provides only a brief description of this sector. The methodologies and assumptions are not explained and generally not documented, which is particularly relevant for the sources for which the Party uses country-specific methodologies or EFs, as it does in the case of $CH_4$ from manure management and direct $N_2O$ emissions from soils, including nitrogen (N)-fixing crops and crop residues. Although Slovakia provided more information on methodologies during the review process the description of country-specific methodologies is still insufficient. The ERT encourages Slovakia to incorporate in the NIR the key elements of the national reports referred to on agriculture to facilitate review in future.

50. Cattle numbers and synthetic fertilizer usage decreased substantially from 1990 to 2002 according to the NIR, and this is consistent with the Food and Agriculture Organization of the United Nations (FAO) statistics. Although this is typical of EIT Parties, some discussion and explanation should be provided in the NIR.

## B. Key sources

4.A Enteric fermentation – $CH_4$

51. Cattle account for 90 per cent of $CH_4$ emissions from enteric fermentation. Statistical data appear to be taken from FAO. The tier 1 method is used with a combination of country-specific and default EFs. Slovakia has adopted the Western Europe default value of EF for dairy cattle on the basis that milk yields have increased to levels typical of European Union (EU) member states. Although milk yield as reported in the additional information in table 4.A has increased from 12.75 kg/day in 2001 to 13.42 kg/day in 2002, the IEF for dairy cattle remains constant (100 kg/head/year). The IEF for dairy cattle in 1990 was 93 kg/head/year. In the case of non-dairy cattle, the Eastern Europe default value of 56 kg/head/year is applied. Because dairy and non-dairy cattle produce the bulk of $CH_4$ emissions in this key source, the Party is recommended to apply the tier 2 method as soon as possible.

4.B Manure management – $N_2O$

52. Slovakia uses the Western Europe default N excretion rate for dairy cattle and country-specific N excretion rates for non-dairy cattle, swine (by age and sex classes) and poultry. The ERT recommends better documentation for this choice of N excretion rates.

53. There are some inconsistencies between the swine numbers reported in table 4.B(a) and 4.B(b): the number of pigs in table 4.B(a) is higher than the sum of all pigs in table 4.B(b). Although a possible explanation is the exclusion of piglets less than 20 kg in weight from 4.B(b), more information should be provided.

4.D Agricultural soils – Direct $N_2O$

54. It is not possible to trace the calculation of $F_{AW}$, the nitrogen in animal manures applied to soils, as reported in table 4.D, using the information on animal waste management system (AWMS) in table 4.B(b) and the values of $Frac_{GRAZ}$, $Frac_{FUEL}$ (reported as "NO") and $Frac_{GASM}$. There is no information available in the NIR to support the value of $F_{AW}$ reported in table 4.D.

55. The default values of $Frac_{GASF}$ and $Frac_{GASM}$ were reported for 2001 and it appears that they have again been used to estimate $N_{dep}$, the amount of nitrogen deposition from ammonia ($NH_3$) and $NO_X$, in the calculations for 2002. The ERT concludes that the value of 0.24 given for $Frac_{GASM}$ in table 4.D for 2002 is erroneous.

56. There is an inconsistency regarding $Frac_{GRAZ}$ between tables 4.B(b) and 4.D. The proportion of nitrogen excreted in pasture range and paddock in 2002, calculated from the data in table 4.B(b), is 0.123, while $Frac_{GRAZ}$ in table 4.D is reported as 0.057. This is also the value reported for 2001.

57. $N_2O$ emissions from crop residues account for half of the direct soil emissions in Slovakia. This is highly unusual and is not typical of other Annex I Parties. The estimates of emissions from this source, as well as those from N fixation, are based on country-specific methods that are not described in the NIR, although a number of national reports are referenced. Furthermore, the fractions $Frac_{NCRBF}$ and $Frac_{NCRO}$ are apparently not estimated by the country-specific method ("not estimated" ("NE") is reported in table 4.D). Slovakia has modified the original CRF table 4.D by changing the units of AD for reporting N-fixing crops and crop residues from kg dry biomass/yr to "kg/yr". The units for the IEFs have been modified accordingly but the default value of 0.0125 is retained in both cases, which further reduces transparency. It is not evident if the reported AD refer to crop yields (in dry biomass or wet basis) or to N inputs. The ERT recommends that the Party re-examine its methodological approach to this source of $N_2O$, as the emissions appear to be overestimated. Slovakia should include the pertinent information on crop type, N contents and other supporting information from the reference material in a future NIR.

58. The NIR gives no basis for the country-specific value of 0.14 used for $Frac_{LEACH}$ in Slovakia, and further information from Slovakia provided during the review does not clearly explain it. Although the ERT considers that the value of 0.14 could be appropriate to Slovakia for the more recent years given the low nitrogen inputs (approximately 70 kg/ha of agricultural area based on table 4.B(b) and the FAO statistics), the chosen value of $Frac_{LEACH}$ may not be suitable in the year 1990 when N inputs were much higher. Nevertheless the ERT recommends that the Party describe the supporting rationale for adopting 0.14 in the NIR.

### C. Non-key sources

4.B Manure management – $CH_4$

59. The IEFs for dairy cattle (4 kg/hd/yr) and for non-dairy cattle (3.8 kg/hd/yr) are not default values for either Western or Eastern Europe. The Party does not document or explain its choice of these IEFs. Moreover, both values have changed since the 2003 submission (the IEF for dairy cattle in the 2003 submission was the IPCC default for cool Eastern Europe).

60. Estimates for emissions for this sector have been revised following the downward revision of the EF for cattle. Slovakia has only provided CRF tables for 2001 and 2002, and should submit CRF tables for the full time series.

## V. LAND-USE CHANGE AND FORESTRY

### A. Sector overview

61. The LUCF sector in Slovakia shows net removals of $CO_2$ estimated as 5,278 Gg in 2002, representing 12.4 per cent of total national emissions. Comparison between 2002 and 2001 (5,265 Gg) shows that net removals of $CO_2$ remained almost unchanged for these two years. However, compared to the year 1990, net removals from the sector show an increase of 119 per cent by 2002 (from 2,427 Gg in 1990 to 5,278 Gg in 2002). Furthermore, the analysis of the trend in net $CO_2$ removals indicates some very large fluctuations across the years. For example, the lowest $CO_2$ removals are observed in 1997 (1,411 Gg), whereas between 2000 and 2001 net removals increased from 2,443 Gg to 5,265 Gg which represents an annual increase of 116% between those years. Earlier reviews requested explanations for these fluctuations but only general arguments have been provided in the NIR of the 2004 submission.

62. Slovakia reports emissions and removals of $CO_2$ for temperate forests in 5.A and in 5.B ($CO_2$ emissions in case of the latter). Estimates of $CH_4$, $N_2O$, $NO_X$ and CO emissions are also given for temperate forests in 5.B. The sectoral background data tables are fully completed. For category 5.C the notation key "NO" is used for all subcategories. Emissions of $CO_2$ from liming of agricultural soils and $CO_2$ removals from the cultivation of mineral soils are reported in category 5.D.

63. Given the importance of the LUCF sector for Slovakia, previous reviews identified the need to increase transparency by providing more information in the NIR on the methods and sources of data used. This conclusion is again valid for the present submission, which indicates that there is not a significant improvement from 2003. Uncertainty assessment has not been performed for the LUCF sector.

### B. Source and sink categories

5.A Changes in forest and other woody biomass stocks

64. Category 5.A accounted for 91 per cent of net removals in 2002. The estimates are obtained using IPCC methodologies and national data relating to 1.929 million ha of temperate forests disaggregated into 20 different species. The carbon uptake factors and conversion/expansion factors are a combination of IPCC default and country-specific values. The carbon expansion factors are in line with the IPCC default and those used by some other Parties.

65. The carbon uptake factors of seven species of deciduous trees (Quercus robur, Quercus cerris, Fagus sp., Carpinus sp., Acer sp., Fraxinus sp. and Ulmus sp.) are very close to the IPCC default values and those used by some other Parties. The remaining deciduous species and the coniferous species show very low carbon uptake factors compared with the IPCC values and those used by other Parties. Previous reviews mentioned the need for detailed information regarding methods of assessing $CO_2$ emissions, including how the breakdown of species by area was performed. The pertinent data and explanations should be extracted from the referenced reports and summarized in the NIR to facilitate review in future.

5.B Forest and grassland conversion

66. Table 5.B shows emissions for $CO_2$ and non-$CO_2$ gases related to forest and grassland conversion. However, the area converted annually is not reported for the two relevant forest types (temperate coniferous and temperate broadleaf forests), where the notation key "not applicable" ("NA") is given under On and Off Site Burning. Similarly, the area converted annually under Decay of Above-ground Biomass is not reported for temperate broadleaf forests, where the notation "IE" is given. Furthermore, the entire subcategory mixed-broadleaf coniferous has been reported as "NA". To increase transparency, the areas converted should be given where relevant and the methodology used to calculate annual net loss of biomass and the quantity of biomass left to decay for temperate species should be described in the NIR. The use of "IE" in Table 5.B should be explained and the use of "NO" may have to be considered if biomass burning or decay does not occur for a particular vegetation type. In addition, the connection between Table 5.B and 5.A with respect to $CO_2$ emissions indicated in the documentation box should be clarified.

5.D $CO_2$ emissions and removals from soils

67. $CO_2$ removals from soils in 2002 (616 Gg) were similar to those reported in 2001. However, the year 2000 showed removals of 1,146 Gg of $CO_2$. This component of $CO_2$ removals is determined largely by the cultivation of mineral soils. It is not totally clear which methods and data were used to make these estimations or what the level of uncertainties could be. The Party mentioned that $CO_2$ emissions from intensively managed organic soils are not important. Slovakia is encouraged to provide more information and explanations to support the estimates reported in category 5.D.

## VI. WASTE

### A. Sector overview

68. In the year 2002, the Waste sector contributed 4.1 per cent to the total national GHG emissions. In 1990 the figure was 2.9 per cent. The decrease of 11 per cent in total emissions from the sector from 1990 to 2002 is mainly due to the 26 per cent reduction in emissions from waste-water handling. The trends for solid waste disposal sites (SWDS) $CH_4$ (constant from 1990 to 1994, and then an irregular trend) and for waste-water handling $N_2O$ (between 2001 and 2002 emissions almost doubled) are not fully consistent and need further explanation and documentation (of the AD and EFs used through the years) in the NIR.

69. Slovakia has provided all the CRF sectoral tables for the years 2001 and 2002, covering all source categories and gases. Information gaps were identified in category 6.B Waste-water Handling. However, it is important to notice that reporting in this sector has improved since the 2003 submission.

70. Slovakia has performed recalculations for $CO_2$ and $N_2O$ emissions from waste incineration as a result of applying IPCC EFs, and this has resulted in a decrease of 0.48 per cent and an increase of 11 per cent, respectively, for 2001, but these are not explained in the NIR.

## B. Key sources

Solid waste disposal sites – $CH_4$

71. The IPCC default methodology has been used to estimate emissions from this source. Municipal solid wastes, industrial wastes and agricultural wastes are included. The transparency of the NIR and CRF should be improved through the inclusion of information on all the parameters needed to estimate emissions: the sources of the quantities of industrial and agricultural wastes and their fraction of degradable organic carbon (DOC), the $CH_4$ fraction in landfill gas and the oxidation factor.

72. The value currently reported for the oxidation factor ("1") which according to the response provided by the Party is mistaken needs to be corrected in the additional information of Table 6.A of the CRF by the actual value used, which was "0".

73. Slovakia should review the following parameters and inconsistencies found, and provide an explanation for them in the NIR:

(a) The values of DOC used (0.12 (based on expert judgment) and 0.25 (IPCC Guidelines)) that are applied to municipal, industrial and agricultural wastes, and the sources for these values.

(b) A $CH_4$ generation rate constant (as reported in CRF =0.04, 0.08) is not used for the default method.

(c) The $CH_4$ fraction in landfill gas. This is reported in the CRF as "NE". The IPCC default fraction (0.5) should have been used if a default methodology has been applied.

(d) The value of DOC degraded (0.77). This seems to be mistaken and related to DOCf (Fraction of DOC dissimilated), since the value is identical to the default parameter indicated in the IPCC Guidelines. If this is the case, the number should be revised since the IPCC good practice guidance recommends using a DOCf of 0.5–0.6. DOC degraded in CRF table 6.A should be reported in Gg.

Waste-water handling – $CH_4$

74. The methodologies used are reported to be default and country-specific. A proper explanation should be included in the NIR (no explanation of the methodologies is provided for domestic and commercial waste water, and the explanation provided for industrial waste water is not clear enough). References to the parameters used and reported in the CRF and their sources should be included as well to ensure transparency. Calculation of emissions using the check method for domestic waste water and the default method for industrial waste water should be reported to allow comparison.

## C. Non-key sources

Waste-water handling – $N_2O$

75. $N_2O$ emissions have been calculated using three methods (IPCC, ISI, CORINAIR). The emissions reported come from the ISI methodology, and are only 25 per cent of that given by the IPCC methodology. Slovakia should explain the ISI methodology, document and reference the parameters used, and explain in the NIR why the ISI methodology is more appropriate to its national circumstances.

Waste incineration – $CO_2$ and $N_2O$

76. A description of the methods and data used for this subsector should be included in the NIR. Information on sources on AD used should be provided, indicating the quantities and composition of wastes and EFs included in the Energy sector to allow cross-checking through the years.

77. The percentage of the municipal waste incinerated given in the additional information table of Tables 6.A and 6.C of the CRF and the quantities reported in table 6.C should be cross-checked because they are not consistent, and they should differentiate between biogenic wastes (which should not be added to total $CO_2$ emissions, but reported) and non-biogenic wastes.

# ANNEX 1: MATERIALS USED DURING THE REVIEW

## A. Support materials used during the review

2003 and 2004 Inventory submissions of Slovakia. 2004 submission including a set of CRF tables for 2001–2002 and an NIR.

UNFCCC secretariat (2003). "Report of the individual review of the greenhouse gas inventory of Slovakia submitted in the year 2003 (Centralized review)." FCCC/WEB/IRI(3)/2003/SVK (available on the secretariat web site http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/svkrep03.pdf).

UNFCCC secretariat. "2004 Status report for Slovakia" (available on the secretariat web site http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/svk04.pdf).

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 *Slovakia* (unpublished).

UNFCCC secretariat. Review findings for Slovakia (unpublished).

Slovakia'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. Janka Szemesová (Slovak Hydrometeorological Institute) including additional materials on the methodology and assumptions used.

Siska, Bernard, PhD, Emissions of greenhouse gases ($CH_4$, $N_2O$) and ammonia ($NH_3$) from agricultural sector during years 1990–2002 in Slovakia (with estimates up to year 2004), November 2003.

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