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Report of the individual review of the annual submission of Slovakia submitted in 2009*

* In the symbol for this document, 2009 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

I. Executive summary

1. This report covers the in-country review of the 2009 annual submission of Slovakia, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. The review took place from 31 August to 5 September 2009 in Bratislava, Slovakia, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Klaus Radunsky (Austria); energy – Ms. Sumana Bhattacharya (India); industrial processes – Mr. Koen Smekens (Belgium); agriculture – Mr. Mahmoud Medany (Egypt); land use, land-use change and forestry (LULUCF) – Mr. Atsushi Sato (Japan); and waste – Mr. Philip Acquah (Ghana). Mr. Acquah and Mr. Radunsky were the lead reviewers. The review was coordinated by Ms. Ruta Bubniene (UNFCCC secretariat).

2. In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1), a draft version of this report was communicated to the Government of Slovakia, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

3. In 2007, the main greenhouse gas (GHG) in Slovakia was carbon dioxide (CO_2), accounting for 81.2 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by methane (CH_4) (9.7 per cent) and nitrous oxide (N_2O) (8.5 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 0.6 per cent of the overall GHG emissions in the country. The energy sector accounted for 75.7 per cent of the total GHG emissions, followed by industrial processes (12.4 per cent), agriculture (6.9 per cent), waste (4.8 per cent) and solvent and other product use (0.2 per cent). Total GHG emissions amounted to 46,950.67 Gg CO_2 eq and decreased by 35.9 per cent between the base year[2] and 2007.

4. Tables 1 and 2 show GHG emissions by gas and by sector, respectively. Table 1 includes emissions from Annex A sources only and excludes emissions and removals from the LULUCF sector.

5. The inventory is generally in line with 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), the IPCC *Good Practice Guidance for Land Use, Land-use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) and the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines). However, the Party does not yet use higher-tier methods for all key categories where data are available, and the key category analysis and the allocation of emissions to source and/or sink categories do not fully correspond with the requirements of the Revised 1996 IPCC Guidelines.

6. The 2009 inventory submission shows some improvement with regard to completeness, key category analysis, uncertainty analysis, and quality assurance/quality control (QA/QC), and covers all sectors and most categories, with the exception of N_2O from venting and flaring, CO_2 from carbide production, CO_2 from solvent and other product use, and N_2O from degreasing and dry cleaning. Slovakia also did not estimate GHG emissions and/or removals from grassland converted to forest land, from forest land converted to grassland and from forest land converted to other land.

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[1] In this report, the term "total GHG emissions" refers to the aggregated national GHG emissions expressed in terms of CO_2 eq excluding LULUCF, unless otherwise specified.

[2] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions include emissions from Annex A sources only.

Table 1. Total greenhouse gas emissions by gas, 1990–2007[a]

Greenhouse gas	Gg CO_2 eq							Change base year–2007 (%)
	Base year[b]	1990	1995	2000	2005	2006	2007	
CO_2	61 961.87	61 961.87	44 040.87	40 318.76	40 740.65	39 980.64	38 141.33	–38.4
CH_4	4 787.12	4 787.12	4 248.64	4 422.72	4 578.11	4 633.14	4 531.64	–5.3
N_2O	6 234.88	6 234.88	4 158.84	3 582.14	3 846.87	4 071.85	4 008.39	–35.7
HFCs	NA, NO	NA, NO	22.15	75.59	172.34	198.90	226.99	NA
PFCs	271.37	271.37	114.32	11.65	20.25	35.82	24.88	–90.8
SF_6	0.03	0.03	9.91	13.25	16.61	17.15	17.44	56 900.0

Abbreviations: NA = not applicable, NO = not occurring.

[a] Total greenhouse gas emissions includes emissions from Annex A sources only (and excludes emissions and/or removals from the land-use, land-use change and forestry sector).

[b] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions include emissions from Annex A sources only.

Table 2. Greenhouse gas emissions by sector, 1990–2007

Sector	Gg CO_2 eq							Change base year–2007 (%)
	Base year[a]	1990	1995	2000	2005	2006	2007	
Energy	59 883.66	59 883.66	42 542.01	38 532.40	38 181.05	37 351.21	35 531.78	–40.7
Industrial processes	5 261.27	5 261.27	4 431.47	4 634.66	5 616.41	5 942.42	5 825.32	10.7
Solvent and other product use	17.05	17.05	30.99	20.14	86.35	82.43	79.95	368.9
Agriculture	7 035.53	7 035.53	4 388.57	3 487.13	3 234.94	3 178.39	3 244.56	–53.9
LULUCF	NA	–2 388.50	–2 684.09	–2 386.20	–849.56	–3 028.72	–3 196.44	NA
Waste	1 057.78	1 057.78	1 201.68	1 749.79	2 256.09	2 383.05	2 269.07	114.5
Other	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	NA	70 866.79	49 910.64	46 037.91	48 525.27	45 908.78	43 754.23	NA
Total (without LULUCF)	73 255.28	73 255.28	52 594.73	48 424.11	49 374.84	48 937.51	46 950.67	–35.9

Abbreviations: LULUCF = land use, land-use change and forestry, NA = not applicable.

[a] "Base year" refers to the base year under the Kyoto Protocol, which is 1990 for all gases. The base year emissions include emissions from Annex A sources only.

The expert review team (ERT) identified a need for further improvements, in particular in the following areas: completeness, consistency and quality of the national inventory report (NIR) as well as robustness of archiving and QA/QC. The Party acknowledged these issues at the time of the review and expressed its intention to address them in its next annual submission.

7. The ERT found that the completeness of the annual submission could be improved with regard to the Party's reporting of a number of non-LULUCF categories as not estimated ("NE"), especially those categories that are included in either the Revised 1996 IPCC Guidelines or the IPCC good practice guidance, and for which estimation methods are prescribed therein. In response to the ERT question raised during the review, Slovakia provided estimates for several categories which had been reported as "NE" and expressed its intention to report these in its next annual submission.

8. The Party has submitted, in part, on a voluntary basis supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol in accordance with Part I of the annex to decision 15/CMP.1. The Party did not submit on a voluntary basis information on the minimization of adverse impacts in accordance with Article 3, paragraph 14, of the Kyoto Protocol. While using the Standard Independent Assessment Report (SIAR)[3] to review the annual submission, the ERT noted that the Party had not provided all of the information that should be made publicly available in accordance with paragraphs 44–48 in section II.E of the annex to decision 13/CMP.1. However, during the review, Slovakia made the information on holdings and transactions publicly available and made further plans to enhance access to this information.

9. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1; however, the ERT identified the need to strengthen the national system, in particular with regard to the LULUCF sector and reporting of activities under Article 3, paragraph 3, of the Kyoto Protocol. The ERT welcomes plans by the Party to shift some responsibility related to the national system from the single national entity to the High-Level Committee on Climate Energy Package and its expert group.

10. The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant decisions of the Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol (CMP).

11. In the course of the review, the ERT formulated a number of recommendations relating to the completeness of the annual submission, transparency in and further improvement to the NIR, and strengthening of the national system, including archiving. In addition, the ERT highlighted the urgent need to address the shortcomings in reporting in the LULUCF sector in order to allow the Party to report and account emissions in accordance with the IPCC good practice guidance for LULUCF. The ERT encourages Slovakia to explore the possibility of structuring its reporting, in its next annual submission, following the annotated outline of the NIR, and the guidance contained therein, that can be found on the UNFCCC website.[4]

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[3] The SIAR, Parts I and II, is prepared by an independent assessor in line with decision 16/CP.10 (paras. 5 (a), 6 (c) and 6 (k)), under the auspices of the administrator of the international transaction log using procedures agreed during meetings of the Registry System Administrators Forum. Part I is a completeness check of the submitted information relating to the accounting of Kyoto Protocol units (including the standard electronic format tables and their comparison report) and to national registries. Part II contains a substantive assessment of the submitted information and identifies any potential problem regarding information on the accounting of Kyoto Protocol units and the national registry. The SIAR is not publicly available.

[4] <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/reporting_requirements/application/pdf/annotated_nir_outline.pdf>.

II. Overview

A. Annual submission and other sources of information

12. The 2009 annual inventory submission was submitted on 14 April 2009; it contains a complete set of common reporting format (CRF) tables for the period 1990–2007. The NIR was submitted on 14 April 2009 and resubmitted on 27 May 2009 and it includes a separate annex containing a detailed key category analysis. The Party also submitted, in part, on a voluntary basis information required under Article 7, paragraph 1, of the Kyoto Protocol, including: accounting of Kyoto Protocol units, and information on changes in the national system and in the national registry. The standard electronic format (SEF) tables were submitted on 14 April 2009. The annual submission was submitted in accordance with decision 15/CMP.1. The Party indicated that the 2009 submission is also its voluntary submission under the Kyoto Protocol.

13. In addition, the ERT used the SIAR, Parts I and II, to review information on the accounting of Kyoto Protocol units (including the SEF tables and their comparison report) and on the national registry.

14. During the review, Slovakia provided the ERT with additional information. The information concerned is not part of the annual submission but is in many cases referenced in the NIR. The full list of materials used during the review is provided in the annex to this report.

Completeness of inventory

15. The inventory covers all source and sink categories for the period 1990–2007 and is complete in terms of years and geographical coverage. The completeness of reporting has increased since the previous submission; for example, CH_4 and N_2O emissions from composting of waste have been included for the first time. However, there are still significant gaps in the reporting of categories (e.g. N_2O from venting and flaring, CO_2 from carbide production, CO_2 from solvent and other product use, N_2O from degreasing and dry cleaning, and GHG emissions and/or removals from grassland converted to forest land, from forest land converted to grassland and from forest land converted to other land).

16. CRF table 8(b) has been completed for the first time; however, Slovakia explained to the ERT during the review that CRF table 7 has not been completed owing to a lack of resources. The ERT strongly encourages Slovakia to further improve the completeness of its inventory submission by providing estimates for all categories of emissions that occur in the country and for which methodologies are available in the Revised 1996 IPCC Guidelines, and to provide a completed CRF table 7 in its next annual submission.

17. In response to a question raised by the ERT, the Party provided estimates of the following emissions: N_2O from venting and flaring of natural gas and oil (see para. 64 below), CO_2 from carbide production (see para. 89 below) and CO_2 from solvent and other product use (see para. 92 below) for the period 1990–2007. Slovakia indicated its intention to report in its next annual submission the emissions of fluorinated gases (F-gases) from consumption of HFCs and PFCs (see para. 86 below) and direct N_2O emissions from use of N_2O in industrial, medical and other applications (see para. 92 below). As regards the reporting of activities under Article 3, paragraph 3, of the Kyoto Protocol, Slovakia responded that data for the estimation of net carbon stock change in dead organic matter (DOM) in grassland converted to forest land and in forest land converted to other land are not available for the years prior to 2004 (see para. 119 below).

18. The ERT recommends that Slovakia improve the completeness of its next annual submission, especially for those categories in which emissions are known to occur in the country and for which methodologies to estimate emissions are available in the Revised 1996 IPCC Guidelines and/or in the IPCC good practice guidance. The ERT encourages the Party to explore approaches available in

scientific literature in order to estimate emissions for categories that do not have methodologies prescribed in the Revised 1996 IPCC Guidelines or the IPCC good practice guidance, with a view to enhancing, to the extent possible, the completeness and accuracy of its inventory. The ERT also recommends that the Party, when reporting emissions data for the first time for a given category, ensure that these data are provided for the entire inventory time-series and that the choice of methods and emission factors (EFs) is clearly explained in the NIR.

B. A description of the institutional arrangements for inventory preparation, including the legal and procedural arrangements for inventory planning, preparation and management

1. Overview

19. The ERT concluded that the national system and the institutional arrangements continued to perform their required functions. The ERT noted that the national system has the capacity to identify areas of land subject to LULUCF activities under Article 3, paragraph 3, of the Kyoto Protocol, and that the Party intends to provide information on these land areas in its next annual submission.

20. The ERT noted that the national system for the LULUCF sector currently does not have sufficient capacity to carry out inventory planning, preparation and management in a timely manner. The ERT also noted the recent improvements in the national system (additional functions assigned to the High-Level Committee on Climate Energy Package and its expert group), the recruitment of additional staff in the Slovak Hydrometeorological Institute (SHMU) responsible for reporting emissions from the LULUCF sector and the willingness of the Party to address issues identified in previous review reports. The Party informed the ERT that the improvements in institutional arrangements for the reporting of LULUCF categories under the Convention and the Kyoto Protocol will ensure consistency of future inventory submissions with the IPCC good practice guidance for LULUCF and the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines).

21. During the review, Slovakia explained the national system and the institutional arrangements for the preparation of the inventory. SHMU has overall responsibility for the national inventory, but other agencies, organizations and bodies are also involved in the preparation of the inventory. The Party explained changes made to the institutional arrangements and/or the national system since the previous annual submission and informed the ERT that additional changes are expected in the near future. The Party also explained that the frequent changes in the personnel responsible for climate change policy at the highest political level have resulted in a delay to the establishment of the national system. The ERT recommends that Slovakia provide a more detailed description of the national system, including the changes made since the last inventory submission, in its next annual submission.

2. Inventory planning

22. Inventory planning related to the choice of methods used and the data to be collected is the responsibility of the sectoral experts. The services of external experts and/or institutions have to be used when there is not sufficient expertise within SHMU. Under the current inventory system, external experts are bound by yearly contracts, which can introduce difficulties in the inventory planning process and thus does not ensure the necessary sustainability of the inventory system.

23. Every year, SHMU develops a plan for inventory preparation and management of the activities planned by it. The Slovakian Ministry of Environment ensures that adequate funds are provided. Depending on the availability of resources, SHMU decides which planned activities will be carried out and which will be deferred. This decision-making process is not sufficient to manage larger and more complex issues, such as preparation of the National Forest Inventory to enhance the inventory of

emissions/removals from the LULUCF sector. The ERT encourages Slovakia to explain the rationale for the decisions on the further development of the inventory and to improve the planning process so that long-term planning of more complex issues can be carried out under the national system in a transparent and efficient manner.

24. The continuity of the functionality of the national system is questionable, as, in some sectors, it relies on the expertise of one person. This is relevant to the LULUCF sector in particular, as reporting of this complex sector requires significant specific expertise. The ERT recommends that Slovakia strengthen human capacity to improve the robustness of the national system, especially for the LULUCF, agriculture and waste sectors.

25. The ERT also recommends that Slovakia further improve transparency and documentation of the inventory approval process that takes place before it is submitted to the secretariat.

3. Inventory preparation

Key categories

26. Slovakia has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2009 submission. The key category analysis performed by the Party and that performed by the secretariat[5] produced different results owing to the different levels of aggregation used in the key category analysis. Slovakia has included the LULUCF sector in its key category analysis, which was performed in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The ERT noted that the summary table of key categories, submitted as an annex to the NIR in Excel format, is not consistent with the key category analysis performed by the Party and reported in annex 2 to the NIR. CO_2 emissions from ammonia (NH_3) production, emissions of PFCs from aluminium production and N_2O emissions from road transportation became key categories in the 2009 submission. The ERT recommends that Slovakia improve the key category analysis and report it consistently in its next annual submission.

27. Slovakia is planning to further develop its key category analysis by using a higher level of disaggregation. The ERT encourages Slovakia to continue with this planned improvement and to prioritize its inventory improvement activities according to the results of the key category analysis.

Uncertainties

28. The ERT noted that considerable efforts have been made to estimate uncertainties using a tier 2 approach for the energy sector (except transport) and for the category solid waste disposal on land. The Party intends to apply the same approach for other sectors (the industrial processes sector by 2010 and the agriculture and LULUCF sectors after new methodologies have been applied in these sectors). The ERT also noted that only a tier 1 uncertainty analysis has been presented for total GHG emissions for 2007. The ERT further noted that many uncertainty ranges have been presented in the NIR but that their sources have not been described. The ERT encourages Slovakia to continue with the above-mentioned planned improvements and to prioritize these improvements according to the results of the uncertainty analysis. The ERT also encourages the Party to substantiate the many uncertainty ranges that are presented in the NIR by providing the sources of the background information.

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[5] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance for LULUCF. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year or period. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

Recalculations and time-series consistency

29. Recalculations have been performed and reported in accordance with the IPCC good practice guidance. The ERT noted that recalculations reported by the Party of the time-series 1990–2006 have been undertaken to take into account reallocation of emissions among several categories, improved activity data (AD) and methodological corrections and changes. The corresponding explanations for most of the recalculations have been provided in CRF table 8(b). The most notable increases in emission estimates following recalculations were: an increase in N_2O emissions from the waste sector (by 38.7 per cent) and an increase in CH_4 emissions from the energy sector (by 14.2 per cent). The effect of the recalculations (as reported in the CRF tables) was an increase in total national emissions by 0.07 per cent for 2006 and a decrease by 0.6 per cent for 1990.

30. The ERT recommends that Slovakia explain and provide a more comprehensive overview of the recalculations in chapter 10 of the NIR, following more closely the requirements of the UNFCCC reporting guidelines (in particular by including justification for recalculations, sources of information and assumptions, and description of changes in methodologies; presenting effects of recalculations on emission levels, trends and time-series consistency; and listing the recalculations carried out in response to recommendations made during the review process), in its next annual submission.

Verification and quality assurance/quality control approaches

31. Slovakia is in the process of further improving its QA/QC system, in particular the QA/QC system at SMHU. The implementation of a formal quality management system started in 2008 with the goal of obtaining by 2010 formal accreditation by the International Organization for Standardization (EN ISO 9001:2000). During the review, Slovakia presented a draft QA/QC plan indicating the time schedule, control mechanisms and responsibilities of the staff implementing the plan. Slovakia intends to implement this plan before its next annual submission.

32. Despite these efforts, some weaknesses in the Party's QA/QC system remain, such as the lack of a formal process to harmonize emissions data included in the national emission information system (NEIS) with those estimated and verified under the European Union emissions trading scheme (EU ETS), and shortcomings in ensuring the quality of the inventory for the LULUCF and agriculture sectors. The description of the QA/QC plan in the NIR is not comprehensive and the ERT recommends that it be significantly improved in order to outline the significant QA/QC activities implemented in the energy and industrial processes sectors. The ERT recommends that Slovakia verify emissions data for all sectors and/or categories, following the IPCC good practice guidance. The ERT also recommends that the Party enhance its documentation of QC for all stages of inventory preparation (within SHMU and for external institutions and/or experts) and that the Party nominate a QA/QC coordinator at SHMU for the national inventory submission.

Transparency

33. The transparency of the inventory could be improved in all sectors. The ERT strongly recommends that Slovakia provide comprehensive information on methodologies for emission estimation (including the choice of EFs and parameters) for each source and/or sink category for the entire time-series and that it include appropriate references to the data sources in its next annual submission. Slovakia is encouraged to provide relevant figures (e.g. diagrams explaining data flow or figures describing the decision-making process) to support the text in the NIR.

4. Inventory management

34. Slovakia does not yet have a centralized archiving system. Most of the background information for emission estimates for different sectors is only available from the responsible institutions and/or

experts. The Party planned to store all of the background information at one location, but frequent changes in decision makers have meant that these plans have yet to be implemented.

35. The single national entity, SHMU, archives annual submissions and input information (part of the NIR and Excel sheets) for the annual submissions provided by the external experts. During the review, the ERT was not provided with all of the requested additional archived information. The ERT recommends that the Party improve the long-term robustness of archiving and record-keeping at SHMU by archiving underlying calculation sheets as well as all references for all categories. This would allow information to be retrieved quickly upon request (e.g. during a review), the institutional memory to be safeguarded and the estimates to be reproduced if needed.

C. Follow-up to previous reviews

36. Since its previous submission, Slovakia has made improvements in the following areas: completeness of reporting, uncertainty analysis, key category analysis, applying higher-tier methods, eliminating a number of gaps by estimating emissions, e.g. CH_4 and N_2O emissions from composting of waste, further developing the QA/QC system, and providing public access to information on transactions and holdings.

37. The most relevant cross-cutting improvements recommended by the previous ERT that have yet to be implemented relate to complete reporting in CRF tables, transparency of reporting in the NIR, establishing a comprehensive QA/QC system that covers all sectors, establishing a centralized archiving system and providing estimates for all categories that are currently not estimated but for which methodologies do exist in the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance.

38. The most significant issues yet to be addressed are:

(a) Improving the transparency of EFs applied for fossil fuels in road transportation;

(b) Improving the transparency of the reporting of methodologies used in the industrial processes and agriculture sectors that differ from those included in the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance;

(c) Providing a detailed explanation of why default EFs were used instead of country-specific EFs for key categories;

(d) Enhancing completeness regarding the reporting of AD used to estimate emissions of F-gases;

(e) Providing detailed explanation for the difference in the country-specific and IPCC default EFs;

(f) Providing an explanation for estimates of emissions from DOM in forest land, cropland and grassland;

(g) Including a definition of land-use categories in the NIR;

(h) Monitoring and reporting the changes in waste composition as a result of changes in legislation;

(i) Providing a comprehensive overview of waste management and/or waste streams (e.g. a flow diagram).

D. Areas for further improvement

1. Identified by the Party

39. During the review, Slovakia informed the ERT that it is working to improve its emission estimates in the following areas:

(a) Disaggregation in the category other under manufacturing industries and construction (1.A.2.f) according to type of industrial production;

(b) Enhancement of the use of EU ETS data in the inventory, while ensuring compatibility with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance;

(c) Comparison of the parameters used in the preparation of the inventory with those provided by the International Energy Agency (IEA);

(d) Implementation of a tier 2 approach to estimate emissions from domestic aviation;

(e) Recalculation of emissions from road transportation using the COPERT IV model;

(f) Reallocation of emissions from limestone and dolomite use within the industrial processes sector;

(g) Development of a methodology to estimate CO_2 emissions using the inventory on non-methane volatile organic compounds (NMVOCs);

(h) Application of a tier 2 methodology for estimation of indirect N_2O emissions from soil;

(i) Use of an updated classification of Slovakian regions according to agro-climatic zones for estimation of direct emissions from soil;

(j) Revision of AD considered necessary for the reporting of activities under Article 3, paragraph 3, of the Kyoto Protocol;

(k) Improvement of the time-series for industrial waste disposal and incineration;

(l) Improvement of the methodology and parameters applied to estimate emissions from industrial wastewater treatment.

2. Identified by the expert review team

40. The ERT identifies the following cross-cutting areas for improvement:

(a) Introduction of a more formalized, transparent and better documented process for inventory improvement;

(b) Strengthening of the national system by providing long-term employment contracts, especially in the LULUCF, agriculture and waste sectors;

(c) Use of higher-tier methods for all key categories where data are available;

(d) Improvement in completeness, consistency and quality of the NIR;

(e) Improvement in the QA/QC system;

(f) Improvement in archiving;

(g) Provision of estimates for all categories that are not currently estimated;

(h) Strengthening of the national system, in particular with respect to LULUCF;

(i) Provision of more complete CRF tables, including CRF table 7;

(j) Provision of a detailed description of the national system;

(k) Improvement in the transparency and documentation of the process of prioritizing inventory improvements;

(l) Improvement in the management of the national system to allow for planning and improvement of more complex issues;

(m) Improvement in the transparency and documentation of the process of approving the inventory submission;

(n) Further improvement in the key category analysis;

(o) Further improvement in the uncertainty analysis;

(p) Addressing of all unresolved issues from previous review reports;

(q) Exploration of the possibility of structuring the reporting, in the next annual submission, following the annotated outline of the NIR that can be found on the UNFCCC website.

41. Recommended improvements relating to specific categories are presented in the relevant sector chapters of this report.

III. Energy

A. Sector overview

42. The energy sector is the main sector in the GHG inventory of Slovakia. In 2007, emissions from the energy sector amounted to 35,531.78 Gg CO_2 eq, or 75.7 per cent of total GHG emissions. Since 1990, emissions have decreased by 40.7 per cent. The key driver for the fall in emissions is the Party's economic development, which has caused a decrease in the share of solid fuels in the total energy mix. Within the sector, 35.2 per cent of the emissions were from manufacturing industries and construction, followed by 28.9 per cent from energy industries, 18.9 per cent from transport and 10.8 per cent from other sectors. The category other under fuel combustion accounted for 3.2 per cent and fugitive emissions from oil and natural gas for 2.1 per cent. The remaining 0.8 per cent were fugitive emissions from solid fuels.

1. Completeness

43. The CRF tables include emission estimates for almost all categories, gases and fuels used in the energy sector, as recommended by the Revised 1996 IPCC Guidelines. Emissions from the energy sector have been reported for all years of the inventory time-series. Categories and gases not reported by the Party in the 2009 submission include GHG emissions from domestic navigation (reported as not occurring ("NO")).

2. Transparency

44. Country-specific methodologies applied to estimate emissions from some categories are not transparently documented. For example, the NIR does not give information on the CO_2, CH_4 and N_2O EFs used to estimate emissions from road transportation. This is particularly significant because CO_2

emissions from road transportation is a key category. The NIR does not list all emission sources included under the category other (manufacturing industries and construction); however, in response to a request made by the ERT during the review, Slovakia provided the ERT with such a list. Further, in some cases, fluctuations in the time-series of EFs are not explained in the NIR; for example, the high values of and fluctuating trends in CO_2 emissions from other fuels used in public electricity and heat production. The allocation of emissions from fuels used in industrial processes to the energy sector has not been documented in the NIR, except those emissions from iron and steel production.

3. Recalculations and time-series consistency

45. Slovakia reported recalculations for the period 1990–2006 for the following categories: natural gas consumption in the category other (manufacturing industries and construction) and in commercial/institutional was recalculated (recalculations of CO_2 and CH_4 emission estimates for this category resulted in a less than 1 per cent change during the time-series); CO_2, CH_4 and N_2O emissions from the blast furnace gas from gaseous fuels in iron and steel production were reallocated to solid fuels (which did not affect the estimate of total GHG emissions); CO_2, CH_4 and N_2O emissions from biomass under the category residential were reallocated from solid fuels; and the CO_2 EFs for energy industries and manufacturing industries and construction have been harmonized with EU ETS data for all large and medium-sized plants for the period 2005–2007 for natural gas, coal, coke and coke oven gas. The ERT encourages Slovakia to ensure the time-series consistency of the categories in which EU ETS data are used.

4. Uncertainties

46. A detailed uncertainty analysis has been carried out using a tier 2 Monte Carlo method for each of the categories reported in the energy sector. Details of the data used for this analysis were not provided in the NIR. During the review, the ERT noted that these data obtained were not used in order to prioritize improvements to the GHG inventory. The ERT recommends that Slovakia support such efforts by providing information in the NIR on the input data used in these analyses as well as explanations as to how the uncertainty analysis has been used to further improve the quality of the inventory.

5. Verification and quality assurance/quality control approaches

47. The IPCC good practice guidance requires national experts to compare national energy statistics with energy statistics provided to international organizations by the Party, in order to identify any inconsistencies that would require explanation in the NIR. The NIR does not provide information on how fuel-use data, collected through NEIS or as input to the COPERT III model for estimation of emissions from road transportation, correspond with national fuel-use statistics published by international agencies such as IEA and the Statistical Office of the European Commission (Eurostat). The ERT reiterates the recommendation made during the previous review that Slovakia provide this information in its next annual submission.

B. Reference and sectoral approaches

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

48. Emissions of CO_2 from fuel combustion were calculated using the reference approach and the sectoral approach. For 2007, there is a difference of 3.7 per cent between the CO_2 emission estimates calculated using the two approaches. Explanations are not provided in the documentation box of CRF table 1.A(c) but are provided in the NIR. Further, there are inconsistencies between the reporting of CO_2 emissions from the energy sector calculated using the sectoral approach in the NIR (table 3.19) and what is reported in CRF table 1.A(c) for 2007. Also, the difference between the reference approach and the sectoral approach has been reported differently: this is given as 3.7 per cent in the CRF tables and

3.4 per cent in the NIR. The ERT recommends that Slovakia improve consistency between the CRF tables and the NIR in its next annual submission.

2. International bunker fuels

49. The data on aviation gasoline consumption in civil aviation are based on the fuel statistics provided by the companies that sell aviation gasoline and jet kerosene to airports in Slovakia. The data from the six airports in the country include data on total numbers of landing/take-off cycles. These data are partially used as additional data for the compilation of the national GHG inventory.

50. No official statistical data that distinguish between domestic and international aviation are available in the country and there are no international sources for this information. Following expert judgement, a fuel consumption ratio of 90:10 (where 90 per cent represents jet kerosene and 10 per cent represents aviation gasoline) was used. The ERT reiterates the recommendation made during the previous review that Slovakia provide detailed reasoning to support this expert judgment in its next annual submission.

3. Feedstocks and non-energy use of fuels

51. Slovakia estimated the quantity of residual carbon from combustion stored in products (1,042.46 Gg C in 2007). This estimate is based on plant-specific information and expert judgement. The ERT recommends that the Party explain and document the reasoning behind the expert judgement in its next annual submission.

C. Key categories

1. Stationary combustion: all fuels – CO_2, CH_4 and N_2O

52. The NIR reports that CO_2 EFs obtained from EU ETS data have been used to estimate emissions from fuel combustion in energy industries and manufacturing industries and construction for 2005–2007. The ERT recommends that Slovakia document in tabular format the fuels and the period for which these EFs were applied, in order to ensure that the EFs used are in line with the IPCC good practice guidance and that the time-series is consistent. The ERT also recommends that Slovakia improve the consistency of emission estimates for energy industries and manufacturing industries and construction for the entire time-series in its next annual submission.

53. Slovakia estimates GHG emissions from stationary combustion using data collected in NEIS, in accordance with national legislation. The NIR states that the data for total fuel use in NEIS correspond with the statistics on national fuel use, but a comparison has not been included in the NIR. The ERT recommends that Slovakia include in the NIR of its next annual submission a table presenting this comparison by fuel type (solid, liquid, gaseous, biomass and other).

54. A comparison of the 2008 and 2009 inventory submissions indicates that the CO_2 implied emission factors (IEFs) for solid fuels increased by 12–50 per cent over the period 1990–2007. The CO_2 IEF reported for solid fuels in energy industries for 2007 is one of the highest of all of the reporting Parties (about 150 t/TJ), but the reasoning for the high value of this IEF is not explained in the NIR. The ERT encourages Slovakia to explain the reasoning for this high CO_2 IEF in its next annual submission.

55. The ERT noted inter-annual fluctuations in the CO_2 IEFs for stationary combustion of fuels (combustion of other fuels in public electricity and heat production) between 1990 and 2007, with values continuously declining: between 1990 and 2007, the IEFs decreased by 84.5 per cent. Explanation of this trend is not provided in the NIR. During the review, Slovakia explained that the reason for the decline was the inclusion in the annual submission of emissions from industrial waste incineration for the beginning of the time-series. Since the reallocation of incinerated fuel from the waste sector to the

energy sector, the CO_2 IEFs have decreased significantly. However, the values are still variable across the years compared with those of other reporting Parties with similar national circumstances. The ERT encourages Slovakia to further investigate the reasons for the high CO_2 IEFs for other fuels and to provide an explanation for them in its next annual submission.

56. The CO_2 EF for solid fuels combusted in the chemical industry increased by 205 per cent between 2001 and 2005 and decreased by 55 per cent between 2006 and 2007. During the review, Slovakia explained that the high EF was caused by increased consumption of natural gas in urea production. Slovakia subtracted natural gas used as feedstock from natural gas used in the chemical industry, but subtracted only a part of the CO_2 emissions from NH_3 production. This led to an inconsistent IEF across the time-series for natural gas used as energy in the chemical industry (see para. 83 below). The ERT recommends that Slovakia include all relevant CO_2 emissions and document these emission estimates in its next annual submission.

2. Road transportation: liquid fuels and biofuels – CO_2 and N_2O

57. Slovakia applies the COPERT III model to estimate GHG emissions from road transportation. The EFs are generated using this model. Since CO_2 from road transportation is a key category, the ERT recommends that Slovakia ensure that a country-specific CO_2 EF be developed and used for future inventory reporting.

58. During the review, Slovakia informed the ERT that it intends to apply the COPERT IV model to estimate emissions from road transportation. The preliminary results show that N_2O emissions estimated using the COPERT IV model are about 50 per cent lower than those estimated using the COPERT III model. Therefore, it is likely that N_2O emissions from road transportation will not become a key category.

59. In response to the request made by the ERT during the review that the Party elaborate on the country-specific EF for road transportation, Slovakia noted that the European Union (EU) member States are to harmonize the N_2O EFs for diesel oil and gasoline based on updated values from the COPERT IV model in accordance with the recommendation of working group I under the Climate Change Committee of the European Commission, and that it intends to use the updated EFs in its next annual submission. It also noted that the value for the hydrogen–carbon ratio of 1.89 used in the COPERT model for the estimates in the 2009 submission will be re-estimated in cooperation with the Slovnaft company (refinery and major fuel distributor in Slovakia), with a view to developing a country-specific value.

60. Biofuel blending in gasoline and diesel oil has been required by law in Slovakia since 2006. In accordance with the law, up to 2009, 2 per cent of biofuel had to be blended into the fuel used and, from 2010, 5.75 per cent will have to be blended. In response to the request made by the ERT during the review, Slovakia noted that the actual biofuel content of the fuels is documented in the annual reports required under Article 4, paragraph 1, of the EU directive on the promotion of the use of biofuels or other renewable fuels for transport (directive 2003/30/EC). The actual values achieved in Slovakia were in 2007 2.59 per cent and in 2008 2.65 per cent of biofuel in relation to the energy content of the total quantity of petrol and diesel fuel. The ERT recommends that Slovakia document the regular monitoring of the actual biofuel content of gasoline and diesel oil used in road transportation. This would clarify the amount of CO_2 emissions that could be excluded from the inventory each year and would ensure that emissions from road transportation are not underestimated.

61. The level of achievement of the reference value in 2007 reflects the introduction of the mandatory placing of biofuels on the domestic market, in accordance with the EU directive relating to the quality of petrol and diesel fuels (directive 98/70/EC), as amended by EU directive 2003/17/EC.

D. Non-key categories

1. Road transportation: liquid fuels and biomass – CH_4

62. The CH_4 IEF decreased by 13.5 per cent between 1990 and 2007. During the review, Slovakia indicated that this was the result of changes in driving patterns and renewal of the vehicle fleet. The ERT reiterates the recommendation made during the previous review that Slovakia include this explanation and an improved description of the application of the COPERT III model in its next annual submission.

2. Domestic navigation: liquid fuels – CO_2, CH_4 and N_2O

63. Slovakia has reported domestic navigation as "NO". During the review, the ERT learned that domestic navigation takes place on the Danube River. Slovakia identified the estimation of emissions from domestic navigation as an area for further improvement and it notified the ERT that it intends to make efforts to collect the relevant data. The ERT recommends that Slovakia carry out its intention to report on domestic navigation and consequently improve the completeness of reporting in its next annual submission.

3. Venting and flaring: gas – N_2O

64. The N_2O emissions from and the N_2O IEF for oil and gas flaring are reported as "NE". The Party indicated that these N_2O emissions are below the measurable range. During the review, in response to the request made by the ERT, Slovakia provided estimates of N_2O emissions from venting and flaring from natural gas production and processing and from oil production (ranging from 0.02 t N_2O in 1990 to 0.006 t N_2O in 2007) for the entire time-series 1990–2007. The ERT recommends that Slovakia improve the completeness of reporting by including these emissions in its next annual submission.

E. Areas for further improvement

1. Identified by the Party

65. The Party identified the following planned improvements:

(a) The revision of its CH_4 and N_2O EFs on the basis of the EU ETS data;

(b) The comparison of the country-specific net calorific values (NCVs) used to date with the NCVs published by Eurostat;

(c) The reallocation of sources of emissions from manufacturing industries and construction (which currently covers all industrial sources not included under other categories) according to AD from NEIS and allocation of sources in EU ETS;

(d) The use of a tier 2 methodology to estimate emissions from civil aviation, estimating the amount of fuel sold and the number of flights (domestic and international) in cooperation with the Ministry of Transport and Bratislava airport;

(e) In the transport sector, improvements include:

(i) The classification of buses according to EURO emission standards for the period 1990–2006;

(ii) The estimation of an updated CH_4 EF for compressed natural gas to ensure time-series consistency after recalculations;

(iii) The application of the COPERT IV model by including fuel consumption data on heavy-duty vehicles and buses;

(f) The verification of fuel consumption data by the international carriers in order to document emissions from domestic aviation;

(g) The collection of information on emissions from pleasure boats on several lakes and small rivers.

2. Identified by the expert review team

66. The ERT identified the following improvements:

(a) Including in the NIR a category-by-category description of AD by source, methodology and EFs used, along with a brief description of background information and references, improvements made since the previous year's submission and the improvements planned for the next year's submission;

(b) Checking the time-series consistency of AD and EFs reported in the CRF tables and checking the consistency of reporting in the NIR and the CRF tables;

(c) Comparing the CO_2 EFs generated for different fuels for the period 2005–2007 with those generated from NEIS for the same period and ensuring that the most accurate EFs are applied across the time-series for all categories under energy industries and manufacturing industries and construction;

(d) Making efforts to develop country-specific EFs that include the typical fuel characteristics and the driving cycles of various types of vehicle, bearing in mind that CO_2 emissions from road transportation is a key category;

(e) Making efforts to regularly monitor and check the biofuel mix of fuel used in road transportation;

(f) Estimating GHG emissions from domestic aviation and domestic navigation, and N_2O emissions from the venting and flaring of natural gas.

IV. Industrial processes and solvent and other product use

A. Sector overview

67. In 2007, emissions from the industrial processes sector amounted 5,825.32 Gg CO_2 eq, or 12.4 per cent of total GHG emissions; emissions from the solvent and other product use sector amounted to 79.95 Gg CO_2 eq, or 0.2 per cent of total GHG emissions. In 2007, within the industrial processes sector, 53.0 per cent of emissions were from mineral products, followed by 29.9 per cent from the chemical industry, 12.9 per cent from metal production and 4.2 per cent from consumption of halocarbons and SF_6. CO_2 accounted for 70.2 per cent of sectoral emissions, N_2O accounted for 25.3 per cent and HFCs accounted for 3.8 per cent.

68. Between 1990 and 2007, emissions from the industrial processes sector increased by 564.05 Gg, or 10.7 per cent, and emissions from the solvent and other product use sector increased by 63.09 Gg, or 368.9 per cent, resulting in a total increase of 626.95 Gg, or 11.9 per cent, for both sectors. The key reasons for the rise in emissions in the industrial processes sector are the increases in N_2O emissions from nitric acid production, in emissions of HFCs from refrigeration and air-conditioning equipment, and

in CO_2 emissions from mineral products. The increase was partially offset by reductions in emissions of PFCs from aluminium production and in CO_2 emissions from magnesite production.

69. Between 2006 and 2007, total GHG emissions from both sectors decreased by 119.59 Gg, or 2.0 per cent. The reduction was mainly caused by a decrease in N_2O emissions from nitric acid production and a decrease in CO_2 emissions from magnesite and steel production. This decrease in emissions was partially offset by an increase in CO_2 emissions from cement and lime production, and in emissions of HFCs from refrigeration and air-conditioning equipment.

1. Completeness

70. The CRF tables include estimates of GHG emissions from almost all categories in the industrial processes and solvent and other product use sectors, as recommended by the Revised 1996 IPCC Guidelines. Slovakia reports on both actual and potential emissions of HFCs, PFCs and SF_6. Emissions reported as "NE" in the 2009 submission include: CO_2 emissions from paint application, CO_2 emissions from degreasing and dry cleaning, CO_2 emissions from chemical products, manufacturing and processing, and N_2O emissions from degreasing and dry cleaning in the solvent and other product use sector. Keeping in mind that there is no estimation methodology provided in the Revised 1996 IPCC Guidelines, the ERT noted that the Party has used the notation key "NE" to report CO_2 and N_2O emissions for these categories in the solvent and other product use sector.

71. The ERT noted that Slovakia did not report CO_2 emissions from the use of acetylene, as part of CO_2 emissions from carbide production. The ERT recommends that Slovakia estimate and include these emissions for the entire time-series in its next inventory submission. CO_2 emissions from carbide production should include emissions from the production as well as those related to the use of carbide (in acetylene production).

72. The ERT also noted that Slovakia has reported NMVOC emissions from asphalt roofing in the category other non-specified under chemical industry as not applicable ("NA"), although specific AD and EFs have been given in the NIR. The notation key for included elsewhere ("IE") should have been used instead. The rationale provided by the Party for not estimating these NMVOC emissions was their inconsistency with the corresponding emissions reported under the EU ETS. The Party may wish to develop a procedure for checking the consistency of the data used for reporting under the EU ETS and under the Convention, and should report on NMVOC emissions in this category in its next annual submission.

2. Transparency

73. The description of methods and EFs in the NIR is not sufficiently comprehensive or detailed to enable the ERT to assess fully the underlying assumptions and rationale for choices of data, methods and other parameters. During the review, the Party provided additional explanations, which addressed most of the concerns of the ERT. The ERT recommends that Slovakia improve the description of the methodologies used and of the use of background information, and that the Party include references to sources and background information used in the NIR in its next inventory submission.

3. Recalculations and time-series consistency

74. The ERT noted that no recalculations were reported by Slovakia for emissions from the industrial processes and solvent and other product use sectors. The Party allocated CO_2 emissions from carbon-containing materials used in some categories in the industrial processes sector, in particular for iron and steel and ferroalloy metal production, to the energy sector rather than to the industrial processes sector in order to ensure time-series consistency. Although this does not affect the overall estimate of emissions, it results in some categories becoming non-key categories in the industrial processes sector,

for which the emissions could be estimated using a lower-tier methodology, according to the UNFCCC reporting guidelines.

75. Slovakia explained that detailed information on AD and assumptions used, required by the UNFCCC reporting guidelines, is not available for the years prior to 1997 or to 2000 depending on the category. The ERT recommends that the Party disaggregate emission estimates and report emissions in the industrial processes sector using the available data and recommended methodology. The ERT also recommends that the Party revise its estimates of emissions from the industrial processes sector for the earlier years, applying trend extrapolation and the historic AD that are available in order to ensure time-series consistency.

4. Uncertainties

76. Slovakia used a tier 1 uncertainty analysis for the main GHG emission sources for each category in the industrial processes sector. The Party has not yet developed a tier 2 Monte Carlo method for these categories. During the in-country review, Slovakia announced its intention to develop this method for its next inventory submission. For the solvent and other product use sector, only a default uncertainty analysis has been carried out, but the results of this analysis are not contained in the NIR. The ERT encourages the Party to develop and report in more detail on the uncertainty analysis its next annual inventory submission.

5. Verification and quality assurance/quality control approaches

77. The NIR does not fully reflect the QA/QC procedures which the Party applies for its emissions data and AD in the industrial processes sector. As explained by the Party during the review, the use of NEIS involves a high level of monitoring, reporting and verification, and QA/QC. For NMVOC emissions and GHG emissions from the consumption of HFCs, PFCs and SF_6, the Party has developed its own methodology with the necessary QA/QC procedures, as required by the EU directive on the limitation of emissions of volatile organic compounds (directive 1999/13/EC) and national regulations on F-gases.

78. The Party compares verified emission estimates from EU ETS with emissions calculated using a bottom-up approach in NEIS. According to a report prepared by the Institute for Applied Ecology,[6] of all the EU member States Slovakia has one of the lowest levels of difference between the data obtained from EU ETS and those obtained from NEIS. The ERT recommends that Slovakia improve its reporting of the QA/QC procedures applied and of the use of information from EU ETS in its next inventory submission. In addition, the ERT advises the Party to include time-series consistency checks for AD and EFs as part of its QA/QC plan.

B. Key categories

1. Cement production – CO_2

79. In the CRF tables, Slovakia reports CO_2 emissions from cement production in accordance with the IPCC good practice guidance. However, the NIR does not report the time-series of underlying data as requested by the previous ERT. During the review, the Party provided these data for the entire time-series. The ERT recommends that Slovakia include this information in its next annual inventory submission. The Party is invited to explain in more detail in the NIR of its next inventory submission the observed increase in the EFs, which Slovakia explained during the review to be caused by the different composition of clinker and cement.

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[6] Institute for Applied Ecology. 2009. Use of data from EU ETS for the purposes of the preparation of national greenhouse gas inventories by EU Member States during the period 2005–2007.

2. Lime production – CO_2

80. The NIR contains improved explanation of the methodology used to estimate CO_2 emissions from lime production, as requested by the previous ERT. The present ERT noted that Slovakia converted dolomitic lime into calcium lime to estimate CO_2 emissions, in order to maintain time-series consistency, which is not good practice. The ERT recommends that the Party report emissions from dolomitic lime as well as from calcium lime and that it further improve the reporting of the methodology used.

3. Limestone and dolomite use – CO_2

81. Slovakia included an improved explanation of the methodology used to estimate CO_2 emissions from limestone and dolomite use in the NIR, as recommended by the previous ERT. In addition, the Party mentions "other carbonates" in the NIR without further explanation. During the review, Slovakia provided the time-series of background data, which allowed the ERT to conduct an assessment of the emission trend. The Party also mentioned the methodology used to convert these other carbonates into limestone equivalents; however, sufficient detail on resultant emissions and the methodology used was not provided. The present ERT reiterates the recommendation made by the previous ERT that the Party improve the reporting of the methodology used. The ERT recommends that Slovakia include the time-series of background data and that it explain the emission trend in the NIR of its next annual inventory submission.

4. Ammonia production – CO_2

82. Slovakia uses a country-specific methodology that is not in line with the IPCC good practice guidance to estimate CO_2 emissions from NH_3 production. Emissions of CO_2 for urea production were subtracted from the total CO_2 emissions from NH_3 production and allocated to the grassland category under the LULUCF sector.

83. Following the Revised 1996 IPCC Guidelines, Slovakia subtracted natural gas used as feedstock from natural gas used in the chemical industry within the energy sector, but subtracted only a part of the CO_2 emissions from NH_3 production. This led to an inconsistent IEF across the time-series for natural gas used as energy in the chemical industry within the energy sector. During the review, the Party reported on additional natural gas used for urea production, which was not included in the reporting and which partly caused the observed inconsistency in the EF trend in the energy sector. In addition, Slovakia informed the ERT that the data on natural gas consumption for NH_3 and urea production would be reported separately in the next annual submission. The ERT recommends that Slovakia follow the IPCC good practice guidance and the Revised 1996 IPCC Guidelines to estimate emissions from NH_3 production. The ERT also recommends that the Party report on all CO_2 emissions in this category, including those from additional natural gas consumed for CO_2 production for urea production in the category other under chemical industry.

5. Nitric acid production – N_2O

84. Slovakia follows a tier 2 methodology using verified plant-specific EFs for two out of the three nitric acid production plants in the country from 2005 onwards and a default EF for the remaining plant to estimate N_2O emissions from nitric acid production. For the period 1990–2004, the Party applied IPCC default EFs for all production plants. These EFs are lower than those verified EFs measured at two production plants. An expert explained, during the review, that in a few years it will become mandatory for all plants to provide measured and verified EFs. In response to the question raised by the ERT during the review, Slovakia noted that the N_2O emissions from a medium-pressure plant would be recalculated in the next annual submission and that the EF would be based on the EF from the other medium-pressure plant and on preliminary measurements taken at the former plant. The ERT reiterates the recommendation made during the previous review that the Party further analyse the impact of using such

a country-specific EF on time-series consistency. The Party is also invited to include a reference to the verification reports used for the plant-specific EFs applied.

6. Iron and steel production – CO_2

85. By reporting only CO_2 emissions from steel made from pig iron in this category and by allocating the remaining CO_2 (and all other) emissions of this category to the category iron and steel in the energy sector, Slovakia is not following the provisions of the IPCC good practice guidance. Slovakia explained that historic data for the years prior to 1997 do not allow for a clear distinction to be made between the use of carbon-containing materials for combustion and carbon-containing materials for production processes; therefore, the Party concluded that most emissions could be reported under the energy sector. Since detailed annual data are available for the years from 1997 onwards, the ERT recommends that Slovakia report CO_2 (and other) emissions under the relevant subcategories in the industrial processes sector, following a tier 2 or higher methodology. The ERT suggests that the Party revise the allocation of emissions for the time-series using available historic AD and a trend analysis of the period 1997–2007.

7. Consumption of halocarbons and SF_6 – HFCs

86. In its NIR and during the review, Slovakia identified that some, presumably low, emissions of HFCs occur in some subcategories in this category, although they were not included in the emissions reported in the CRF tables. The ERT recommends that Slovakia estimate these emissions and include them in its next inventory submission. The present ERT reiterates the recommendation made by the previous ERT that the Party provide detailed data on the consumption of halocarbons in the sectoral background tables (CRF table 2(II).F) for all subcategories and gases. In response to the request made by the ERT during the review, Slovakia noted that the data on consumption of HFCs and PFCs would be available once the new online database of importers and users of F-gases has been set up.

C. Non-key categories

1. Limestone and dolomite use – CO_2

87. Slovakia has included CO_2 emissions from carbonates used in glass production under limestone and dolomite use. However, no information about emissions from soda ash use is reported in the NIR. The ERT recommends that Slovakia provide more information on the materials used in limestone and dolomite use in its next annual submission.

2. Magnesite production – CO_2

88. Emissions of CO_2 from magnesite production decreased over the latest years of the time-series and this trend is not explained in the NIR. During the review, Slovakia explained that the decrease was caused by a drop in economic activity and that this decrease in emissions is expected to continue. The Party is encouraged to report this information in its next annual inventory submission.

3. Calcium carbide production – CO_2

89. Slovakia does not report separately on CO_2 emissions from calcium carbide production, but instead includes the CO_2 emissions from limestone use in that category and includes CO_2 emissions from the graphite used under the energy sector. CO_2 emissions from the use of acetylene are not included in the inventory; therefore, the ERT recommends that Slovakia include them in its next inventory submission. As a result of the allocation of CO_2 emissions from calcium carbide production to other categories and the omission of CO_2 emissions from the use of acetylene, this category has become a non-key category. In response to a request made by the ERT during the review, Slovakia provided data on the use of the non-exported carbide and on estimates of CO_2 emissions from carbide production for the entire time-series, and noted that consumption of limestone has still been reported under limestone

consumption. The ERT recommends that Slovakia estimate and report all CO_2 emissions from this category and that it assess whether it should become a key category in its next inventory submission.

4. Ferroalloys production – CO_2

90. Slovakia has included all CO_2 emissions from this category under the category iron and steel in the energy sector. As there is a high activity level in the ferroalloys production industry in Slovakia, this category could have been a key category, but the ERT was unable to assess this possibility. The ERT recommends that the Party report CO_2 emissions from ferroalloys production in the industrial processes sector using the appropriate tier methodology according to the results of the key category assessment.

5. Food production – CO_2

91. The ERT noted an inconsistency between the NIR and the CRF tables in the reporting of CO_2 emissions from food production: these emissions have been reported as "NE" in the NIR, but "NO" in the CRF tables. The Party is recommended to improve the accuracy of its reporting and be consistent in its next inventory submission.

6. Solvents – CO_2 and N_2O

92. Slovakia has not estimated CO_2 emissions from paint application, CO_2 emissions from degreasing and dry cleaning, CO_2 emissions from chemical products, manufacturing and processing, and N_2O emissions from degreasing and dry cleaning. The lack of a country-specific methodology was given as justification for not providing these emission estimates. In response to a request made by the ERT during the review, Slovakia provided estimates of CO_2 emissions from solvent and other product use for the entire time-series 1990–2007, basing the estimates on the NMVOC emissions and assuming that NMVOC emissions contain 60 per cent carbon. Slovakia noted that only direct N_2O emissions from other (use of N_2O in industrial, medical and other applications) occur in the country. The ERT encourages Slovakia to report these emissions in its next inventory submission. The ERT also encourages Slovakia to continue its efforts to develop and implement a country-specific methodology as mentioned in the NIR and to report on progress made in its next inventory submission.

D. Areas for further improvement

1. Identified by the Party

93. Slovakia identified the following areas for improvement in the 2009 submission: the application of a higher-tier uncertainty analysis for emissions from industrial processes; the completion of sectoral background tables for consumption of halocarbons and SF_6; and the development of a country-specific emission estimation methodology for CO_2 and N_2O emissions in the solvent and other product use sector.

2. Identified by the expert review team

94. The present ERT reiterates the recommendation made during the previous review that Slovakia provide more complete, consistent and transparent reporting of methodologies, AD and EFs and that the Party justify the reallocation of emissions to other categories and sectors.

V. Agriculture

A. Sector overview

95. In 2007, emissions from the agriculture sector amounted to 3,244.56 Gg CO_2 eq, or 6.9 per cent of total GHG emissions. Since 1990, emissions have decreased by 53.9 per cent. The key driver for the fall in emissions is the reduction in livestock numbers and a decrease in the consumption of mineral

fertilizers by two thirds. Within the sector, 53.9 per cent of the emissions were from agricultural soils, followed by 29.2 per cent from enteric fermentation and 16.9 per cent from manure management.

1. Completeness

96. The CRF tables include emission estimates for all categories and gases in the agriculture sector, as recommended by the Revised 1996 IPCC Guidelines. Emissions from the agriculture sector have been reported for all years of the inventory time-series and are complete in terms of geographical coverage. Slovakia explained that field burning of agricultural residues is prohibited by law in the country and, hence, was reported as "NO" in the CRF tables.

97. Emissions from histosols are reported as "NO" because cultivation on this soil type is prohibited for reasons of landscape protection. However, the ERT noted that an area of histosols measuring 4,893 ha is reported in the NIR. In response to the request made by the ERT during the review, Slovakia noted its intention to revise the area of histosols according to the detailed land-use matrix and to include the revised emission estimates in its next annual submission. The ERT recommends that Slovakia improve its documentation of the occurrence and use of histosols in the country in its next inventory submission.

2. Transparency

98. The ERT noted a number of inconsistencies in the data presented in the NIR. Also, there are inconsistencies between data in the NIR and data in the CRF tables, for example: different values for total N_2O emissions from the agriculture sector are mentioned in section 6 of the NIR (67 per cent and 49 per cent of sectoral emissions); both of these values are inconsistent with the value that may be estimated using data from the CRF tables (53.8 per cent); and different values for CH_4 emissions from enteric fermentation in 2007 have been provided (45.07 Gg in the CRF tables and 44.26 Gg in the NIR). All values for CH_4 emissions from enteric fermentation for the different livestock categories in 2007 provided in figure 6.3 of the NIR are inconsistent with the estimated values from the CRF tables. The ERT recommends that Slovakia remove repetition, errors and inconsistencies in order to increase the transparency and accuracy of reporting.

99. As noted by the previous ERT, Slovakia does not estimate some parameters, such as typical animal mass, daily excretion of volatile solids, and allocation of percentages according to climate and stable type for dairy and non-dairy cattle, that are required for applying tier 2 methodologies. The ERT recommends that Slovakia report these parameters in the CRF tables of the next inventory submission, despite the fact that they do not affect the emission estimates.

3. Recalculations and time-series consistency

100. No recalculations have been reported in the CRF tables, although the NIR states that recalculations were carried out for the years 2004–2006 for CH_4 emissions from the enteric fermentation of sheep. The NIR explains that the rationale for these recalculations is the upgrade from a tier 1 to a tier 2 methodology. The ERT recommends that Slovakia increase the transparency and accuracy of reporting recalculations in its next inventory submission.

4. Uncertainties

101. The NIR reports that uncertainties are defined by emission coefficients. For direct soil N_2O emissions, the uncertainty of calculated values may be in the range of 20–200 per cent; for N_2O emissions from animal waste management systems (AWMS), may be in the range of 25–150 per cent; for indirect N_2O emissions from NH_3 volatilization, may be in the range of 20–200 per cent; and for indirect N_2O emissions from leaching, may be in the range of 10–500 per cent. The ERT encourages the Party to

reduce the uncertainties of the data used for the estimation of emissions in its next inventory submission, as far as is practical.

5. Verification and quality assurance/quality control approaches

102. The ERT noted that there is not a sufficient description of the QA/QC procedures in the agriculture sector in the NIR and recommends that Slovakia ensure that an adequate system for the verification of AD and background information, and QA/QC be implemented.

B. Key categories

1. Enteric fermentation – CH_4

103. The ERT noted the improvement in the quality of the inventory thanks to Slovakia's moving from a tier 1 to a higher-tier method for estimating CH_4 emissions from livestock other than dairy and non-dairy cattle.

104. The NIR states that CH_4 emissions from the enteric fermentation of sheep were calculated using a tier 2 method. The average values of gross energy intake and CH_4 conservation rates for three subcategories of sheep are reported in the CRF tables as "NE". The ERT recommends that the Party report the values consistently in the NIR and the CRF tables in its next annual inventory submission.

105. A tier 2 methodology is used for non-dairy cattle but not all details of the estimates are described in the NIR and some are inconsistent with the data in the CRF tables. The present ERT reiterates the recommendation made by the previous ERT that Slovakia improve the documentation of the model used to estimate CH_4 emissions from non-dairy cattle in the NIR of its next annual inventory submission.

2. Manure management – N_2O

106. Total nitrogen excretion (N_{ex}) estimated based on data obtained from AWMS is inconsistent with N_{ex} estimated based on animals groups within CRF table 4.B(b). For example, N_{ex} from AWMS for swine is higher than N_{ex} from the swine animal group by 205,510 kg/year. The ERT recommends that Slovakia improve QA/QC and the accuracy of the reporting of N_2O emissions from manure management in its next annual inventory submission.

3. Direct soil emissions – N_2O

107. Slovakia reported a decrease in the consumption of synthetic fertilizers from 171.4 Gg in 1990 to 80.1 Gg in 2007, but did not provide an explanation for this decrease. Two methods (method A and method B) were used for the estimation of emissions, but a detailed description of the methodologies and their application for certain animal categories is lacking in the NIR. The ERT noted the inconsistency between the methods mentioned in the NIR and the methods mentioned in the CRF tables, and recommends that the Party improve transparency in its next annual inventory submission. The ERT also noted the intention of Slovakia to conduct direct measurements of N_2O emissions from soils and the Party's intention to report these data in its next annual inventory submission. The ERT commends Slovakia for this intention and encourages the Party to carry it out.

108. As identified by the previous ERT, the methodology used for estimating emissions from nitrogen (N)-fixing crops is based on country-specific information and differs from the methodology contained in the IPCC good practice guidance. When estimating the N_2O emissions, Slovakia included the N-fixing process and the N turnover of crop residues from N-fixing plants. The N-fixation rate was estimated at 26 kg N/ha, and the remaining amount of N/ha reported under N-fixing is the nutrition potential in crop residuals in kg N/ha. The ERT noted that the quantified amount of N in N-fixing crops reported in the 2009 submission is within the range defined by the IPCC good practice guidance, and recommends that

Slovakia improve its description of the methodology applied and the assumptions made, in the NIR of its next inventory submission.

C. Areas for further improvement

1. Identified by the Party

109. The ERT commends Slovakia's plans for improvements, including the revision of estimates of direct soil emissions of N_2O and N_2O emissions from manure management. During the review, Slovakia stated that it intends to implement the following improvements: update the share of AWMS using the information collected by regional statistical agencies; improve reporting of the parameters in CRF table 4.B(b); recalculate direct N_2O emissions from soils according to the new research knowledge on the classification of the country according to agricultural and climatic conditions (the preliminary results from the denitrification decomposition model are already available); and carry out direct measurements of N_2O emissions from soils in order to adjust the model applied by the Slovak University of Agriculture in Nitra.

2. Identified by the expert review team

110. The ERT noted a number of inconsistencies within the NIR and between the NIR and the CRF tables and recommends that Slovakia improve QA/QC procedures in the agriculture sector for its next annual inventory submission.

VI. Land use, land-use change and forestry

A. Sector overview

111. In 2007, the LULUCF sector accounted for net removals of 3,196.44 Gg CO_2 eq. Since 1990, net removals from the sector have increased by 33.8 per cent. The rise in removals is attributable to the carbon stock change in living biomass under forest land remaining forest land, which has increased by 56.4 per cent since 1990 and contributed 85.1 per cent of the net removals from the LULUCF sector in 2007.

112. Slovakia categorizes its national land area into the following four land-use categories: forest land, cropland, grassland and other land. The first three land-use categories are the main land-use categories in Slovakia and cover about 90 per cent of the national territory. The rest of the land includes settlements and wetlands, which are reported as other land. Land-use definitions are not described in the NIR, but they were provided during the review. The ERT recommends that Slovakia distinguish wetlands and settlements from the category other land, and that it include a land-use definition and information on the similarities between national land-use definitions and land-use categories described in the IPCC good practice guidance for LULUCF, in its next annual submission. The ERT noted that a land-use matrix containing the four land-use categories is provided in the NIR for the first time. The ERT welcomes this effort made by Slovakia.

113. The ERT noted that there is a small area of organic soil in Slovakia which is reported under both forest land and cropland in the CRF tables. During the review, the Party explained that this area falls under the area of national parks and thus is not cultivated. The ERT encourages the Party to include the area of organic soil under the correct land-use category and to provide information in the NIR on which land-use category includes this area of organic soil, in its next inventory submission.

114. During the review, Slovakia explained its plan for reporting activities under Article 3, paragraph 3, of the Kyoto Protocol and the progress made so far. The ERT noted that all necessary requirements relating to activities under Article 3, paragraph 3, are taken into account in this ongoing

work; however, some methodological issues that should have been resolved remain (e.g. separation of carbon stock changes in living biomass – see para. 115 below). The ERT recommends that Slovakia continue its efforts to collect data and continue reporting these activities.

115. Slovakia does not report separately carbon stock changes in living biomass as a result of either deforestation (i.e. conversion from forest land to other land uses) or afforestation and/or reforestation (i.e. conversion from other land uses to forest land). During the review, the Party explained that the development of a methodology to separate these carbon stock changes is in progress. The ERT encourages Slovakia to continue with this effort.

1. Completeness

116. The CRF tables include estimates of emissions and removals for most categories and gases in the LULUCF sector, as recommended by the IPCC good practice guidance for LULUCF. Categories and gases not estimated by the Party in this annual submission include: DOM and soil organic matter (SOM) in mineral soils and organic soils in forest land remaining forest land; all carbon stocks in cropland remaining cropland and land converted to cropland; living biomass, DOM and SOM in mineral soils and organic soils in grassland remaining grassland; living biomass and SOM in mineral soils and organic soils in land converted to grassland; living biomass in land converted to other land (except for forest land converted to other land, which is reported as "IE"); N_2O emissions from N fertilization of forest land and other land; non-CO_2 emissions from drainage of mineral soils in forest land; N_2O emissions from disturbance associated with land-use conversion to cropland; and CO_2 emissions from lime application to grassland. Emissions and removals from the LULUCF sector have been reported for all years of the inventory time-series, and are complete in terms of geographical coverage. The ERT encourages the Party to improve the completeness of its reporting by providing estimates and relevant information for categories currently reported as "NE".

2. Transparency

117. The ERT noted that the description of the LULUCF sector in the NIR has improved since the previous submission and it welcomes the efforts made by Slovakia to achieve this. However, there is still a lack of information, including information on the reasons for using the notation key "NO", on underlying assumptions and on the rationale for choices of data. The ERT encourages Slovakia to include this information in the NIR of its next annual submission.

3. Verification and quality assurance/quality control approaches

118. There are inconsistencies between the NIR and the CRF tables and there has been little improvement since the previous submission. The ERT strongly recommends that Slovakia improve QA/QC procedures in the LULUCF sector to ensure consistent reporting of estimation methods and to avoid any mistakes in reporting.

119. The national system to identify areas of afforestation, reforestation and deforestation is under development and it is likely that these categories will be reported in the next submission. The ERT noted that the national inventory of land data is the main data source to identify land areas and land-use changes. During the review, the Party explained that these data are based on the legal status of land and that they differ slightly from actual land use.

120. In response to the request made by the ERT during the review, Slovakia noted that information on soil carbon in forest soils is based on two basic soil surveys: forest monitoring within the European forest monitoring system and the National Forest Inventory. Supplementary information on carbon content and the carbon pool in forest soils comes from other research plots. Slovakia also noted its intention to improve its methodology for separating emissions from forest land converted to grassland

and forest land remaining forest land, and from forest land converted to other land and forest land remaining forest land, in its next annual submission.

121. The ERT encourages the Party to verify the data on land use and land-use change using several data sources, such as the national inventory of land data, the National Forest Inventory and other land data, such as satellite images. This could be done using the guidance provided in chapter 5 of the IPCC good practice guidance for LULUCF, in order to improve the quality of land use and land-use change data for inventory preparation, including reporting of activities under Article 3, paragraph 3, of the Kyoto Protocol.

B. Key categories

1. Forest land remaining forest land – CO_2

122. Slovakia calculated carbon stock changes in living biomass using a tier 2 method in line with the IPCC good practice guidance for LULUCF. Most of the important parameters are country specific and are derived from national forest statistics and the National Forest Inventory. Fluctuations in net removals in this category are influenced by harvesting and disturbances as well as significant changes in gross removals from 1999 to 2001. Background information on harvesting and disturbances was provided by the Party during the review, but the reason for the variability in gross removals remains unclear. The ERT recommends that Slovakia explain the fluctuations in the estimates and that it provide sufficient information on this issue in its next inventory submission.

123. Carbon stock changes in DOM are reported as "NE"; however, a summary table of data on trends in carbon stock in DOM in forest land exists in the Green Report.[7] Carbon stock changes in soil organic carbon are reported as "NE", as the carbon content of forest soil remains stable according to national data. The ERT recommends that Slovakia include carbon stock changes in DOM, and that it use the correct notation key of "NA" for the carbon content of forest soil, in its next annual inventory submission.

2. Land converted to forest land – CO_2

124. According to the NIR, the Party calculates carbon stock changes in soil organic carbon using country-specific data derived from the national soil inventory. However, the values reported in the CRF tables are inconsistent with the description in the NIR. Only carbon stock changes in DOM from 2004 to 2007 are reported, while the rest of the pools and years are reported as "NE" in the CRF tables. The ERT recommends that Slovakia correct this inconsistency and report carbon stock changes in DOM for the entire time-series in its next annual inventory submission.

3. Cropland remaining cropland – CO_2

125. According to the NIR, the Party does not calculate any carbon stock changes in cropland remaining cropland. However, carbon stock changes in DOM are estimated and reported in the CRF tables for the years 1990–2003. The ERT recommends that Slovakia correct this inconsistency and report carbon stock changes in DOM for the entire time-series in its next annual inventory submission.

126. Slovakia explained that the economic transition in the country has influenced the trends in agriculture. The ERT noted that this change may also have influenced carbon stocks in cropland if agricultural land management has changed. The ERT also noted that Slovakia has a soil inventory for agricultural land, but that this information is not reflected in the estimation of carbon stock changes in

[7] Ministry of Agriculture of Slovak Republic. 2008. Report of the status of forestry in the Slovak Republic. Green report.

cropland remaining cropland. The ERT encourages Slovakia to research the carbon stock changes in all carbon pools under cropland remaining cropland and to report on these in future inventory submissions.

4. Grassland remaining grassland – CO_2

127. According to the NIR, the Party does not calculate any carbon stock changes in grassland remaining grassland. However, carbon stock changes in DOM are estimated and reported in the CRF tables for the years 1990–2003, except for 1993. The ERT recommends that Slovakia correct this inconsistency and report carbon stock changes in DOM for the entire time-series in its next annual inventory submission.

128. As the economic transition in Slovakia may have also influenced carbon stocks in grassland, the ERT encourages Slovakia to research carbon stock changes in carbon pools under the category grassland remaining grassland and to report on them in future inventory submissions.

5. Land converted to grassland – CO_2

129. According to the NIR, the Party calculates carbon stock changes in soil organic carbon using country-specific data derived from the national soil inventory. However, the values reported in the CRF tables are inconsistent with the description in the NIR. The ERT recommends that Slovakia correct this inconsistency in its next annual inventory submission.

130. The ERT noted that the values of average carbon stocks in grassland are lower than those in forest land for all soil types. An explanation is not provided for this in the NIR. The ERT recommends that Slovakia provide sufficient information on soil carbon, including a summary of the soil carbon inventory and the soil monitoring system, an explanation of the national circumstances of Slovakia and information on how the average carbon stocks are derived from the national soil inventory, in its next annual inventory submission.

C. Non-key categories

1. Land converted to cropland – CO_2

131. Only carbon stock change in DOM in 2004 is estimated under the category other land converted to cropland. During the review, the Party explained that no land areas have been converted to cropland in Slovakia. Land conversion to cropland is not indicated in the land-use matrix or in the NIR. The ERT recommends that Slovakia correct this inconsistency in its next annual submission.

2. Emissions from agricultural lime application – CO_2

132. The trend in CO_2 emissions from agricultural lime application fluctuates from 1999 to 2000 and from 2006 to 2007, which reflects the changes in the amount of limestone and dolomite applied to cropland, but no explanation for this trend has been provided in the NIR. During the review, in response to the request made by the ERT, Slovakia noted that further research into this issue is needed. The ERT recommends that Slovakia check the consistency of the time-series and that it provide information on the source of data on lime application in its next annual submission.

D. Areas for further improvement

1. Identified by the Party

133. The Party states in the NIR that several improvements are planned in the LULUCF sector, using data obtained from the 2015 National Forest Inventory.

2. Identified by the expert review team

134. Taking into account the information provided by the Party during the review, the ERT noted that some non-CO_2 emissions which are reported as "NE" might not occur in Slovakia. The ERT recommends that Slovakia clarify whether or not these emissions actually occur in the country and report accordingly in its next annual inventory submission.

VII. Waste

A. Sector overview

135. In 2007, the waste sector accounted for 2,269.07 Gg CO_2 eq, or 4.8 per cent of total GHG emissions. Emissions from the sector increased by 114.5 per cent between the base year and 2007. Within the sector, 79.4 per cent of the emissions were from solid waste disposal on land, including industrial solid waste (ISW), followed by 19.4 per cent from wastewater handling and 0.6 per cent from waste incineration without energy recovery. Slovakia has reported CH_4 and N_2O emissions from composting; however, emissions from the composting of ISW in the period 1990–2001 have been reported as "NE" owing to the very high level of uncertainty of the AD available.

136. The significant 114.5 per cent increase in emissions between the base year and 2007 is explained by the non-inclusion of emissions from the ISW disposal sites for the base year. However, the growth in emissions in the latest years is largely attributed to the CH_4 correction factor increasing from 0.6 to 1.0 during the period 1990–2007. This reflects the transition from the use of predominantly unmanaged landfills in the period 1960–1990, uncategorized solid waste streams in the period 1991–2000 and managed disposal sites in the period 2000–2007. The results of the application of the first order decay (FOD) model show that contributions of emissions from the unmanaged landfill sites and uncategorized waste in the period 1960–1990 were very low in 1990 compared with those from the managed sites that have been predicted for the period 2000–2007.

137. The ERT noted that the recording and reporting of waste amounts, and activities by waste generators and operators of the waste management facilities, are mandated by various decrees or regulations under the Waste Act.[8] The provisions follow those included in the EU landfill directive[9] in order to promote recovery, recycling and reuse for the effective separation of biodegradable fractions from waste streams through economic incentives. The regulations under the Waste Act oblige the inspection, collection, verification and validation, and publication of waste data by the relevant institutions.

138. The Statistical Office of the Slovak Republic archives and publishes AD on municipal solid waste (MSW) and ISW as well as on wastewater handling; the Waste Management Centre of the Slovak Environmental Agency compiles data on ISW; and the Slovak Environmental Agency validates reporting on ISW. The ERT noted that rationalization of the various data sources can effectively improve quality of reporting and reduce uncertainty of waste AD. The ERT recommends that Slovakia report sources of AD and provide diagrams of waste flows in its next annual inventory submission. The ERT encourages Slovakia to incorporate the sectoral QA/QC of the various institutions involved in data collection into the QA/QC procedures that are being formalized by SHMU across the GHG inventory.

139. Slovakia provided adequate information on the methods, EFs and emission trends. It has improved reporting and transparency in the waste sector since its 2008 inventory submission. The ERT

[8] Zákon č. 223/2001 Z. z. o odpadoch and zákon č. 409/2006 Z. z. – úplné znenie zákona o (b).odpadoch Vyhláška MŽP SR č. 283/2001 Z. z. o vykonaní niektorých ustanovení zákona o (c) odpadoch; Vyhláška MŽP SR č. 284/2001 Z. z., ktorou sa ustanovuje Katalóg odpadov. (In Slovak language).

[9] EU directive on the landfill of waste (directive 99/31/EC).

observed that Slovakia could further improve the transparency of the NIR by providing an explanation for and background documentation on inter-annual variations in emission trends and by describing the influence on emissions of drivers such as legislation, economic activities, waste management practices and historical factors.

140. Slovakia reported the recalculation of CH_4 emissions from MSW and ISW disposal on land and wastewater handling in its 2009 submission, following changes in AD, methodological choices and the classification of waste, as well as the introduction of CH_4 capture and flaring systems for emission reduction at two private-sector landfill sites. As a result of these changes, sectoral emission estimates in the 2009 submission increased by 5.7 per cent compared with those in the 2008 submission. This resulted in an increase of 0.30 per cent in the estimate of total emissions.

141. The ERT appreciates the improvements mentioned in paragraphs 139 and 140 above and 145 below, and noted that Slovakia provided adequate information on all of the changes made in the NIR in response to recommendations made during previous reviews.

B. Key categories

1. Solid waste disposal on land – CH_4

142. In 2009, the total CH_4 emissions from MSW and ISW disposed of on land accounted for 4.8 per cent of the total national emissions. The emissions from this category increased from 469.77 Gg CH_4 in the base year to 1,802.43 Gg CH_4 in 2007, representing about a three-fold increase since the base year. This is due to the fact that emissions from ISW were not estimated for the base year. Slovakia explained that these emissions were not estimated because of the very high level of uncertainty in the extrapolation of the data on ISW before 1991 when the first legislation on landfill management was adopted. Thereafter, AD for ISW were first published in 1997. The ERT noted that the absolute levels of total emissions from MSW disposal sites (2.1 per cent) and ISW disposal sites (1.8 per cent) are high, and, when disaggregated, each subcategory becomes a key category. The ERT recommends that Slovakia disaggregate these two subcategories in its key category analysis and, if appropriate, prioritize the ISW category as a key category in its improvement plan.

143. Slovakia estimates CH_4 emissions from MSW disposal sites using a tier 2 FOD model, country-specific methane generation constant (k) and degradable organic carbon values, as well as default parameters that reflect the significant changes in waste management practices over the years. The methodology which examines the impact of k values, the biodegradability of waste streams and the solid waste disposal operations has been published. Slovakia applied tier 2 methodologies to estimate the overall uncertainty of CH_4 emissions from MSW disposal on land based on the FOD model. The methodological choices, selection of country-specific parameters, and extrapolation and interpolation of the historical AD are well explained in the publications referenced in the NIR. However, the estimated uncertainty is higher (+/–70 per cent) than the IPCC default value (+/–50 per cent), owing principally to the uncertainty of the input variables and sensitivity of the selected active period of solid waste disposal on site. The ERT encourages Slovakia to implement the improvement programme to validate the FOD model, adapted according to the national circumstances.

144. Emissions of CH_4 from ISW are estimated using an IPCC tier 1 method owing to a lack of AD for the period 1960–1990 and the country-specific parameters required for the application of the FOD model. ISW is classified as a subcategory because unmanaged disposal of MSW and ISW on land is prohibited under the regulation of the Ministry of Environment of Slovakia.[10] The ISW subcategory is currently not identified as a key category because it is aggregated with MSW. It is a potential key category using level assessment if it is disaggregated from MSW in the key category analysis. The ERT

[10] Vyhláška MŽP SR č. 284/2001 Z. z., ktorou sa ustanovuje Katalóg odpadov. (In Slovak language).

therefore reiterates the recommendation made during the previous review that the Party collect facility-specific AD from major ISW landfill operators. The ERT encourages Slovakia to include this action in its inventory improvement plan for the years 2009–2010 and to estimate emissions from ISW disposal sites using a higher-tier methodology for the entire time-series in the next inventory submission.

2. Wastewater handling – CH_4

145. The ERT noted that, following the recommendations made during previous reviews, the completeness and reporting of wastewater handling has improved significantly as a result of the application of methodologies described in the IPCC good practice guidance. The ERT commends Slovakia for the comprehensive framework developed for all of the data flows within the category, as recommended by the IPCC good practice guidance. The ERT recommends that Slovakia integrate the AD for the disaggregation of the respective wastewater handling systems and practices into the data sets used by SHMU and that it continually update those data sets so as to ensure consistent improvement in the quality of the AD used for the inventory of emissions from wastewater handling. Slovakia is encouraged to provide in its next inventory submission a summary diagram of the data flows that were explained to the ERT during the review in order to further improve the transparency of the methodological choices.

146. Slovakia indicated in the NIR and the CRF tables that CH_4 emissions from sludge from industrial wastewater handling and sludge from domestic and commercial wastewater handling are reported as "IE" under the category solid waste disposal on land. However, the CO_2 emissions from sludge handling are reported in the NIR and the CRF tables only under incineration of non-biogenic MSW and ISW. The ERT noted that the NIR states that sludge separation does occur and that the appropriate statistics are available in Slovakia.

147. The ERT encourages Slovakia to check the consistency of data on sludge across the relevant sectors and categories and to ensure that the amount disposed of at solid waste disposal sites and incinerated or used elsewhere is equivalent to the sludge removed from the wastewater treatment plants. The ERT also encourages Slovakia to investigate the disposal of aerobically stabilized sludge, because sludge disposal in landfills can be carried out after incineration. In such cases, the sludge will not be degradable and consequently will not contribute to CH_4 emissions in this category. Therefore, CH_4 emissions under the categories sludge from industrial wastewater handling and sludge from domestic and commercial wastewater handling should be reported as "NO" (N_2O emissions from these categories should be reported as "IE" and included under waste incineration with or without energy recovery). The ERT recommends that Slovakia describe the outcome of such an analysis in its next annual inventory submission.

148. In response to the request made by the ERT during the review, Slovakia noted that emissions from sludge would be included in its next annual submission. It explained that the treatment of wastewater in Slovakia includes, as a rule, wastewater sludge stabilization (aerobic or anaerobic). Thus, sludge leaving wastewater treatment plants is mineralized, with a significantly decreased amount of organic carbon. The data on wastewater sludge have been collected centrally only since 1998 and are included under the statistical data on waste. As a result, the wastewater sludge is reported not separately, but under industrial waste. Following a comparison of the total amount of disposed biodegradable industrial waste (586 Gg in 2007 and 659 Gg in 2006) with the total amount of disposed stabilized sewage sludge (3.5 Gg in 2007 and 9.2 Gg in 2006), it is assumed that the disposal of stabilized sewage sludge will not influence the balance of the estimated emissions. The ERT recommends that Slovakia report the emissions from wastewater sludge in its next annual submission.

C. Non-key categories

1. Waste incineration – CO_2

149. Slovakia reports CO_2 emissions from incineration of biogenic waste fractions of MSW, ISW and sludge generated from wastewater handling facilities as "NO" and CO_2 emissions from municipal waste burning as "IE". The ERT noted that CO_2 emissions from waste incineration of biogenic waste can be estimated from the detailed AD available, which includes the fractions of biodegradable organic streams. The ERT recommends that the AD for all of the biogenic sources incinerated with and without energy recovery (namely MSW, ISW and sludge) be disaggregated and reported under waste incineration in order to facilitate the referencing of emissions accounted for under the energy sector in accordance with the IPCC good practice guidance. In accordance with the UNFCCC reporting guidelines, CO_2 emissions should be estimated and reported as "IE" in memo items (biomass combustion) in the CRF tables. The documentation boxes of the CRF tables should be used to provide the estimates of CO_2 emissions reported under the energy sector and memo items in order to improve transparency and comparability of the inventories. In response to the request made by the ERT during the review, Slovakia noted that emissions from the biogenic fraction incinerated with and without energy recovery would be reported accordingly in the next annual submission.

2. Other – biological treatment of solid waste: composting – CH_4 and N_2O

150. Slovakia continued reporting CH_4 and N_2O emissions from composting in the CRF tables in its 2009 submission. In the NIR, Slovakia has indicated the occurrence of CH_4 and N_2O emissions from composting of MSW and ISW; however, table 8.6 of the NIR reports AD on and emissions from MSW only. The ERT recommends that Slovakia summarize and present the detailed information provided during the review on the methodological choices and the sources of AD for composting of ISW in the NIR of its next inventory submission.

151. Slovakia reported emissions from the composting of ISW in the period 1990–2001 as "NE" and explained that the very high level of uncertainty of the AD makes it difficult to extrapolate the data for the period 1990–2001. Additional information provided during the review on the composting of ISW and MWS showed an increasing trend in emissions, most likely driven by the tax incentive for source separation of waste streams and the recycling of biodegradable waste for composting. The ERT recommends that Slovakia, as part of its inventory improvement plan, collect AD from landfill operators and waste collection operators in order to improve the quality of AD and reduce uncertainty. The ERT encourages Slovakia to estimate CH_4 and N_2O emissions from the biological treatment of solid waste and composting for the period 1990–2001 in order to address this inconsistency in the time-series. In response to the request made by the ERT during the review, Slovakia noted its intention to monitor these emissions and report them in its next annual submission.

VIII. Supplementary information required under Article 7, paragraph 1, of the Kyoto Protocol

A. Information on Kyoto Protocol units

1. Standard electronic format and reports from the national registry

152. Slovakia has reported information on its accounting of Kyoto Protocol units in the required SEF tables, as required by decisions 15/CMP.1 and 14/CMP.1. The ERT took note of the findings and recommendations included in the SIAR on the SEF tables and their comparison report.[11] The SIAR was

[11] The SEF tables comparison report is prepared by the ITL administrator and provides information on the outcome of the comparison of data contained in the Party's SEF tables with corresponding records contained in the ITL.

forwarded to the ERT prior to the review, pursuant to decision 16/CP.10. The ERT reiterated the main findings of the previous ERT and the findings and recommendations contained in the SIAR, and had a constructive discussion with the Party on the information to be provided to the public pursuant to paragraph 47 of the annex to 13/CMP.1.

153. Information on the accounting of Kyoto Protocol units has been prepared and reported in accordance with section I.E of the annex to decision 15/CMP.1, and is accurate. Information has been reported in accordance with decision 14/CMP.1 using the SEF tables. This information is consistent with that contained in the national registry and the records of the international transaction log (ITL) and the clean development mechanism registry, and meets the requirements set out in paragraph 88 (a)–(j) of the annex to decision 22/CMP.1.

154. The transactions of Kyoto Protocol units initiated by the national registry are in accordance with the requirements contained in the annex to decision 5/CMP.1 and the annex to decision 13/CMP.1. No cases of non-replacement have been reported. The national registry has adequate procedures in place to minimize discrepancies.

2. National registry

155. The ERT took note of the SIAR and its finding that the national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions. The national registry has adequate security, data safeguard and disaster recovery measures in place and its operational performance is adequate.

156. However, the SIAR identified the following issues: a lack of detail on information that is publicly available, including a lack of transparency on the status of joint implementation projects in the country and a lack of transparency regarding what information on holdings and transactions is confidential. In response to questions raised by the ERT during the review, Slovakia revised the information that is publicly available under its national registry, and provided access to the annual summary of the quantity of units made in the national registry according to the type of operation. The Party explained that it intends to improve the registry website by providing more information on the status of information related to activities under Article 6 of the Kyoto Protocol. The ERT recommends that Slovakia further enhance access to this information and report thereon in its next annual submission.

3. Calculation of the commitment period reserve

157. Slovakia has reported its commitment period reserve in the 2009 annual submission. Based on the national emissions in the most recently reviewed inventory (46,950.67 Gg CO_2 eq), the Party calculates its commitment period reserve to be 234,753,343 t CO_2 eq. The ERT agrees with this figure.

B. Changes to the national system

158. Slovakia reported, in the NIR of its 2009 submission, on some changes in its national system since the previous annual submission; for example, the structural changes that took place at SHMU after 1 January 2008, the establishment of a coordination body for the High-Level Committee on Climate Energy Package in June 2008 and changes in the Ministry of Environment on 1 October 2008.

159. During the in-country review, in a presentation given by the Party, the following changes to the national system were identified:

(a) Establishing a new coordination body for the High-Level Committee on Climate Energy Package;

(b) Creating two new positions in the department of emissions at SHMU with a focus on emissions from transport and LULUCF;

(c) Changing the institutional arrangements for inventory preparation for the transport sector (marking the beginning of cooperation with the Transport Research Centre in Brno);

(d) Beginning cooperation with the National Forest Centre in Zvolen for preparation of the inventory for LULUCF activities under Article 3, paragraph 3, of the Kyoto Protocol;

(e) Designating the responsibility for preparation of emission projections to SHMU;

(f) Starting cross-ministerial cooperation within the framework of the expert group under the High-Level Committee on Climate Energy Package;

(g) Preparing a quality management system in the single national entity, with a view to fully implementing a QA/QC plan.

160. The ERT welcomes the strengthening of the national system and concluded that, taking into account the reported changes in the national system, Slovakia's national system continues to be in accordance with the requirements of national systems set out in decision 19/CMP.1. The ERT recommends that the Party, in its next annual submission, report any change(s) in its national system in accordance with section I.F of the annex to decision 15/CMP.1 and provide a detailed description of the national system, including how the various bodies and contributors carry out their functions during the annual reporting cycle and how the process is coordinated and managed by SHMU, the High-Level Committee on Climate Energy Package and the expert group under this Committee.

C. Changes to the national registry

161. In its 2009 annual submission, Slovakia reported changes in its national registry since the previous annual submission, including the update of the national registry software. The national registry is connected to the ITL and has been operational since 29 September 2008. The ERT concluded that the national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 5/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions.

IX. Conclusions and recommendations

162. Slovakia made its annual submission on 14 April 2009 and resubmitted the NIR on 27 May 2009. The Party indicated that the 2009 annual submission is a voluntary submission under the Kyoto Protocol. The annual submission contains the GHG inventory (CRF tables and NIR) and supplementary information under Article 7, paragraph 1, of the Kyoto Protocol submitted in part, on a voluntary basis (information on Kyoto Protocol units, and changes to the national system and the national registry). This is in line with decision 15/CMP.1.

163. Slovakia has provided inventory data for the years 1990–2007 and included a complete set of CRF tables, with the exception of CRF table 7. Notation keys are used throughout the tables. The NIR includes information on key categories, methods, data sources and uncertainty estimates, and provides a short description of the QA/QC and verification procedures used in the preparation of the GHG inventory.

164. The ERT concludes that the inventory submission of Slovakia has been prepared and reported mostly in accordance with the UNFCCC reporting guidelines. The annual submission is complete in terms of geographical coverage, years and sectors, as well as mostly complete in terms of categories and

gases. Some of the categories, particularly in the energy, industrial processes, solvent and other product use and LULUCF sectors, were reported as "NE".

165. The submission on a voluntary basis of information required under Article 7, paragraph 1, of the Kyoto Protocol has been prepared and reported in accordance with decision 15/CMP.1. Slovakia did not report on a voluntary basis information on activities under Article 3, paragraphs 3, 4 and 14, of the Kyoto Protocol.

166. Slovakia has reported information on its accounting of Kyoto Protocol units in accordance with section I.E of the annex to decision 15/CMP.1, and used the SEF tables as required by decision 14/CMP.1.

167. The Party's inventory is generally in line with the UNFCCC reporting guidelines, the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. Some gaps in the inventory reporting were identified by the ERT, especially in the LULUCF sector. The ERT welcomes the shift to higher-tier methods for some key categories and encourages Slovakia to use higher-tier methods for all key categories in order to increase conformity with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance, the IPCC good practice guidance for LULUCF and the UNFCCC reporting guidelines.

168. The national system continues to perform its required functions as set out in the annex to decision 19/CMP.1. The ERT welcomes the ongoing efforts made by Slovakia to further improve the national system and strongly recommends that Slovakia follow the recommendations made by the ERT regarding the enhancement of its national system.

169. The national registry continues to perform the functions set out in the annex to decision 13/CMP.1 and the annex to decision 15/CMP.1, and continues to adhere to the technical standards for data exchange between registry systems in accordance with relevant CMP decisions. However, the ERT noted from the SIAR that Slovakia's annual submission lacks detail on the information that is publicly available, and reiterated the recommendation made in the SIAR that Slovakia enhance access to this information and report thereon in its next annual submission.

170. In the course of the review, the ERT formulated a number of recommendations[12] relating to the completeness and transparency of Slovakia's information presented in its annual submission. The key recommendations are that Slovakia:

(a) Provide improved information on its QA/QC activities;

(b) Enhance the completeness and consistency of the NIR;

(c) Strengthen the national system, in particular to ensure accurate reporting of activities under Article 3, paragraph 3, of the Kyoto Protocol and to enhance completeness of reporting in the LULUCF sector;

(d) Establish a central archive for the documentation relating to the inventory;

(e) Ensure the inclusion, in its next annual submission, of emissions for categories currently reported as "NE" for which methods for estimating emissions are available in the Revised 1996 IPCC Guidelines and/or in the IPCC good practice guidance, and if emissions for any category cannot be estimated, the Party is to provide sufficient explanation for this in its NIR.

[12] For a complete list of recommendations, the relevant sections of this report should be consulted.

X. Questions of implementation

171. No questions of implementation were identified by the ERT during the review.

Annex I

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

Intergovernmental Panel on Climate Change. 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Available at <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.html>.

Intergovernmental Panel on Climate Change. Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

Intergovernmental Panel on Climate Change. Good Practice Guidance for Land Use, Land-Use Change and Forestry. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". FCCC/SBSTA/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

"Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention". FCCC/CP/2002/8. Available at <http://unfccc.int/resource/docs/cop8/08.pdf>.

"Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol". Decision 19/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14>.

"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol". Decision 15/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>.

"Guidelines for review under Article 8 of the Kyoto Protocol". Decision 22/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>.

Status report for Slovakia 2009. Available at <http://unfccc.int/resource/docs/2008/asr/svk.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2009. Available at <http://unfccc.int/resource/webdocs/sai/2009.pdf>.

FCCC/ARR/2008/SVK. Report of the individual review of the greenhouse gas inventories of Slovakia submitted in 2007 and 2008. Available at <http://unfccc.int/resource/docs/2009/arr/svk.pdf>.

UNFCCC. *Standard Independent Assessment Report*, Parts I and II. Unpublished document.

B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Janka Szemesova (Slovak Hydrometeorological Institute), including additional material on the methodology and assumptions used. The following documents were also provided by Slovakia:

Integrated Skills Ltd. 2006. *Methane emissions from solid waste disposal sites in 2005. Final Report*. Bratislava.

Integrated Skills Ltd. 2007. *GHG Emissions from Waste Sector in 2006. Solid Waste Disposal Sites (4A), Waste Incineration (4C), Biological Treatment (4B). Final Draft Report*. Bratislava.

Integrated Skills Ltd. 2008. *GHG Emissions from Waste Sector in 2007*. Bratislava.

Ministry of Agriculture of Slovak Republic. 2007. *Report of the status of forestry in the Slovak Republic. Green report*.

Ministry of Agriculture of Slovak Republic. 2008. *Report of the status of forestry in the Slovak Republic. Green report*.

Ministerstvo Životného prostredia Slovenskej Republiky. 2007. *Národný inventarizačný systém Slovenskej republiky pre sledovanie emisií skleníkových plynov a ich záchytov podľa článku 5, odsek 1 Kjótskeho protokolu (National Inventory System of the Slovak Republic for monitoring GHG emissions and sinks according to Article 5, paragraph 1, of the Kyoto Protocol)*. Bratislava.

National Registry of Slovakia. 2009. *Annual summary of quantity of units per type of operation made in the national registry in 2008*. Available at <https://CO_2.dexia.sk/Edition.aspx?menu=yes>.

Statisticky urad Slovenskej republiky. Odpady v Slovenskej republike. 2007. *Statistics of Slovak Republic. Waste in Slovak Republic*.

Šiška B and Špánik Fr. 2008. Agroclimatic regionalization of Slovak territory in conditions of changing climate. *Meteorologický časopis*. 11: pp.63–66.

Szemesova J and Gera M. 2007. Uncertainty Analysis for Estimation of Landfill methane emissions. *Geophysics and Geodesy*. 37(3).

Annex II

Acronyms and abbreviations

AD	activity data
AWMS	animal waste management systems
CH_4	methane
CMP	Conference of the Parties serving as the meeting of the Parties to the Kyoto Protocol
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
COPERT	Computer Program to calculate Emissions from Road Transport
CRF	common reporting format
DOM	dead organic matter
EF	emission factor
ERT	expert review team
EU	European Union
EU ETS	European Union emissions trading scheme
F-gas	fluorinated gas
FOD	first order decay
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO_2, CH_4, N_2O, HFCs, PFCs and SF_6, without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IE	included elsewhere
IEA	International Energy Agency
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
ISW	industrial solid waste
ITL	international transaction log
kg	kilogram (1 kg = 1 thousand grams)
LULUCF	land use, land-use change and forestry
MSW	municipal solid waste
N	nitrogen
NA	not applicable
N_2O	nitrous oxide
NCV	net calorific value
NE	not estimated
N_{ex}	nitrogen excretion
NH_3	ammonia
NIR	national inventory report
NMVOC	non-methane volatile organic compound
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SEF	standard electronic format
SF_6	sulphur hexafluoride
SIAR	Standard Independent Assessment Report
SOM	soil organic matter
TJ	terajoule (1 TJ = 1012 joule)
UNFCCC	United Nations Framework Convention on Climate Change

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