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Report of the individual review of the greenhouse gas inventory of the United States of America submitted in 2008*

* In the symbol for this document, 2008 refers to the year in which the inventory was submitted, and not to the year of publication.

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I. Overview

A. Introduction

1. This report covers the in-country review of the 2008 greenhouse gas (GHG) inventory submission of the United States of America, coordinated by the UNFCCC secretariat, in accordance with decision 19/CP.8. The review took place from 8 to 13 September 2008 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Klaus Radunsky (Austria) and Mr. Marius Țăranu (Moldova); energy – Mr. Simon Eggleston (United Kingdom) and Ms. Roberta Quadrelli (International Energy Agency); industrial processes –Ms. Suvi Monni (European Community) and Mr. Menouer Boughedaoui (Algeria); agriculture –Ms. Tajda Mekinda-Majaron (Slovenia) and Mr. Sergio González (Chile); land use, land-use change and forestry (LULUCF) – Ms. Naoko Tsukada (Japan) and Mr. Walter Oyhantçabal (Uruguay); and waste – Mr. Kai Skoglund (Finland) and Mr. Oscar Paz (Bolivia). Mr. Radunsky and Mr. González were the lead reviewers. The review was coordinated by Mr. Harald Diaz-Bone (UNFCCC secretariat).

2. In accordance with the "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention" (hereinafter referred to as UNFCCC review guidelines), a draft version of this report was communicated to the Government of the United States of America, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Inventory submission and other sources of information

3. In its 2008 submission, the United States of America submitted a complete set of common reporting format (CRF) tables for the period 1990–2006 and a national inventory report (NIR). The submission date of both the CRF tables and the NIR was 10 April 2008. Where needed, the expert review team (ERT) also used previous years' submissions, additional information provided during the review and other information. The full list of materials used during the review is provided in the annex to this report.

C. Emission profiles and trends

4. In 2006, the main GHG in the United States was carbon dioxide (CO_2), accounting for 85.1 per cent of total GHG emissions[1] expressed in CO_2 equivalent (CO_2 eq), followed by methane (CH_4) (7.6 per cent) and nitrous oxide (N_2O) (5.2 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 2.1 per cent of the overall GHG emissions in the country, with HFCs contributing the most to this share, at 1.8 per cent, and PFCs and SF_6 accounting for 0.1 per cent and 0.2 per cent of the total GHG emissions, respectively. The energy sector accounted for 86.6 per cent of the country's total GHG emissions, followed by agriculture (6.5 per cent), industrial processes (4.6 per cent), waste (2.3 per cent) and solvent and other product use (0.1 per cent). Total GHG emissions in the United States amounted to 7,017,320.86 Gg CO_2 eq, reflecting an increase of 14.4 per cent between the base year and 2006.

5. Between 1990 and 2006, HFCs displayed the largest increase, rising by 237.2 per cent, followed by CO_2 emissions, which increased by 18.1 per cent. Emissions of the other gases showed a decreasing trend for this period: PFCs by 70.8 per cent, SF_6 by 47.0 per cent, CH_4 by 11.8 per cent and N_2O by 4.8 per cent. The largest increase in emissions, by 16.8 per cent, was in the energy sector, followed by industrial processes, where emissions increased by 7.0 per cent, and agriculture, with an increase of 1.5 per cent. Emissions from the waste sector decreased by 10.3 per cent between 1990 and 2006.

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

Removals in the LULUCF sector increased by 16.9 per cent. The drivers for these trends have been documented in the NIR and the ERT finds the observed trends reasonable.

6. Tables 1 and 2 show GHG emissions by gas and by sector, respectively.

D. Key categories

7. The United States has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2008 submission. The key category analysis performed by the Party and that performed by the secretariat[2] produced similar results. The categorization and aggregation levels used by the Party in its analysis differed from those used by the secretariat. This resulted in differences in the key categories identified by the Party and the secretariat, but the coverage of the key categories was the same.
The United States has included the LULUCF sector in its key category analysis, which was performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as IPCC good practice guidance for LULUCF).

8. The United States has not provided a tier 2 key category analysis, indicating that such an analysis would be incorporated into future inventory submissions when tier 2 uncertainty assessments are available for all categories. The ERT noted that, in the 2008 submission, a tier 2 approach was implemented for all categories apart from composting and parts of agricultural soil management.
The United States uses the results of the key category analysis and uncertainty assessment as drivers for planning and prioritizing improvements to the inventory. The ERT noted that the use of a tier 2 key category analysis would be a systematic way of combining these results for use in prioritizing inventory improvements. Therefore, the ERT reiterates the recommendation of the ERTs from the reviews of the 2006 and 2007 GHG inventory submissions that the United States provide a tier 2 key category analysis in its next submission.

E. Main findings

9. The inventory is generally in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC good practice guidance and the IPCC good practice guidance for LULUCF.

[2] The secretariat identified, for each Party, those source 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 Land Use, Land-Use Change and Forestry*. Key categories according to the tier 1 trend assessment were also identified for those Parties that provided a full set of CRF tables for the base year. 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.

Table 1. Greenhouse gas emissions by gas, 1990–2006

Greenhouse gas emissions	Gg CO_2 eq								Change base year–2006 (%)
	Base year	1990	1995	2000	2003	2004	2005	2006	
CO_2	5 061 388.24	5 061 388.24	5 387 109.03	5 932 184.39	5 944 390.34	6 030 655.84	6 066 452.04	5 975 096.29	18.1
CH_4	601 604.48	601 604.48	594 180.91	555 284.81	550 636.27	538 636.66	527 358.81	530 738.97	–11.8
N_2O	381 894.91	381 894.91	393 757.12	382 420.04	353 824.75	350 941.01	366 982.03	363 573.69	–4.8
HFCs	36 924.10	36 924.10	61 803.11	100 087.47	104 441.90	116 568.87	121 422.54	124 525.71	237.2
PFCs	20 759.93	20 759.93	15 595.56	13 494.46	7 088.33	6 138.74	6 209.95	6 055.50	–70.8
SF_6	32 671.03	32 671.03	27 990.45	19 148.53	18 106.92	17 969.63	18 212.61	17 330.70	–47.0

Table 2. Greenhouse gas emissions by sector, 1990–2006

Sectors	Gg CO_2 eq								Change base year–2006 (%)
	Base year	1990	1995	2000	2003	2004	2005	2006	
Energy	5 203 922.89	5 203 922.89	5 529 598.58	6 067 772.65	6 078 294.68	6 150 888.22	6 174 356.25	6 076 897.36	16.8
Industrial processes	299 860.82	299 860.82	315 660.59	326 465.56	301 211.08	315 896.17	315 548.69	320 904.12	7.0
Solvent and other product use	4 404.02	4 404.02	4 587.52	4 879.50	4 387.15	4 387.15	4 387.15	4 387.15	–0.4
Agriculture	447 499.37	447 499.37	453 819.77	447 908.00	434 289.15	432 056.83	453 599.54	454 144.99	1.5
LULUCF	–724 623.10	–724 623.10	–761 728.77	–643 614.33	–841 168.80	–856 579.93	–855 370.93	–846 793.30	16.9
Waste	179 555.58	179 555.58	176 769.72	155 593.98	160 306.48	157 682.39	158 746.36	160 987.24	–10.3
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	**5 410 619.58**	**5 410 619.58**	**5 718 707.40**	**6 359 005.36**	**6 137 319.72**	**6 204 330.84**	**6 251 267.05**	**6 170 527.56**	**14.0**
Total (without LULUCF)	**6 135 242.68**	**6 135 242.68**	**6 480 436.18**	**7 002 619.69**	**6 978 488.52**	**7 060 910.76**	**7 106 637.99**	**7 017 320.86**	**14.4**

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

10. The 2008 inventory submission shows noticeable improvement with regard to major issues that were identified in previous reviews: carbon stock changes for some parts of the forest land in Alaska have been reported for the first time; activity data (AD) and several calculation approaches have been used more consistently, particularly when a common source of data was used for more than one category (e.g. the cattle population numbers used for both enteric fermentation and manure management); the notation keys and cell comments have been used more consistently in the CRF tables for the LULUCF and waste sectors; for certain sectors (e.g. industrial processes), the order in which the categories are presented in the NIR has been made consistent with the order in the CRF tables; and three new categories have been included in the energy, LULUCF and waste sectors. Nonetheless, the ERT identified a need for the following further improvements:

(a) Further enhance consistency between the NIR and the CRF tables in accordance with 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), see paragraph 14 below;

(b) Use higher-tier methods for key categories where appropriate (e.g. for stationary combustion), as a matter of priority;

(c) Include a tier 2 key category analysis in the next inventory submission;

(d) Include descriptions of the quality assurance/quality control (QA/QC) and verification measures in the chapters on the different sectors, and follow more closely the guidance on the structure of the NIR in the UNFCCC reporting guidelines;

(e) Provide information on uncertainty estimates for AD and emission factors (EFs) separately, where applicable;

(f) Continue to improve the completeness of the inventory, in terms of the categories covered.

F. Cross-cutting issues

1. Completeness

11. The inventory is complete in terms of years and GHGs covered, and close to complete in terms of geographical coverage. For Hawaii, Alaska and the United States Territories (small autonomous islands in the Pacific and the Caribbean), data are not available for all categories (e.g. carbon stock changes for some parts of the forest land in Alaska have not been included) and data do not always allow for the same level of disaggregation (e.g. information on energy use) as for the rest of the country. This issue has been addressed in the NIR in a transparent manner. However, despite the recommendation of the ERT from the 2007 review for it to do so, the NIR still does not include a definition of the United States Territories that identifies all territories in an explicit manner. The ERT encourages the Party to include such a definition, explicitly identifying all territories, in its next inventory submission.

12. The United States has included three new categories in its 2008 submission: in the energy sector, CO_2 emissions from oil and natural gas – crude oil production; in the LULUCF sector, CO_2 emissions from cropland remaining cropland – urea fertilization; and in the waste sector, CH_4 and N_2O emissions from composting. These categories accounted for 0.1 per cent of the total GHG emissions in 2006. Some categories have still been reported as not estimated ("NE"); however, in the NIR, the United States has provided a comprehensive discussion of these categories and of other potential sources or sinks which are not addressed in the Revised 1996 IPCC Guidelines, and has assessed the possibility of including them in future submissions. The ERT noted that, although the completeness of the inventory in terms of

categories covered has been improved, more needs to be done. The ERT encourages the Party to continue collecting data on the excluded source categories and to consider a more streamlined approach to these categories, which will enable the Party to report on those sources and sinks which are not yet covered by the inventory within a reasonable time frame.

2. Transparency

13. The general structure of the 2008 NIR is in line with the UNFCCC reporting guidelines. The NIR and its annexes include comprehensive descriptions of the trends in GHG emissions and removals in the United States, and descriptions of the methodological choices and cross-cutting issues which are to be reported in accordance with the UNFCCC reporting guidelines. The ERT noted that sector-specific QA/QC measures have not been fully described under all sector chapters in the NIR, although this is recommended in the UNFCCC reporting guidelines. The ERT encourages the United States to include more category-specific information on the QA/QC and verification measures, broken down into specific sections, in all sector chapters of the NIR in its future submissions.

14. Total GHG emissions with and without LULUCF have been presented slightly differently in the NIR and in the CRF tables. In the NIR, non-CO_2 emissions from LULUCF have been included in the total emissions. The ERT noted that the United States has not followed the recommendation of the 2007 review to present these sums in the NIR as they are presented in the CRF tables, which would help to improve the consistency of the reporting.

15. The methodologies, models and country-specific methods used have generally been presented in the NIR in a transparent way. The ERT noted that the United States used higher-tier methods for many key categories. However, despite the recommendation from the 2007 review, higher-tier methods have still not been used for stationary combustion, which is the largest category in the inventory but has been reported at a fairly aggregated level. The ERT reiterates the recommendation from previous reviews that the United States consider applying higher-tier methods also for stationary combustion, given the significant contribution of this category to the overall emissions profile.

3. Recalculations and time-series consistency

16. The ERT noted that the Party has provided recalculations for the years 1990 to 2005 to take into account the availability of new methodologies, more accurate AD, and improved EFs and other parameters. The implementation of the new methodologies from the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines) was a driving factor for these recalculations.

17. As a result of these recalculations, the estimate of total emissions for 1990 decreased by 1.5 per cent excluding LULUCF and by 2.2 per cent with LULUCF. The emission estimate for 2005 also decreased, by 1.9 per cent excluding LULUCF and by 2.8 per cent with LULUCF. The most significant recalculations were performed for the agriculture sector, in which CH_4 emissions increased by 7.3 per cent in 1990 and by 7.9 per cent in 2005, while N_2O emissions decreased by 25.0 per cent in 1990 and by 25.5 per cent in 2005. The rationale for and impact of the recalculations have been addressed in the chapter on recalculations and improvements, as well as in the sector chapters, of the NIR. The ERT noted that, overall, the recalculations have resulted in improving the inventory.

4. Uncertainties

18. The United States has used a tier 2 method (Monte Carlo analysis) for quantitative uncertainty assessment for all but two categories, namely composting and parts of agricultural soils management. The quantitative uncertainty for the total emissions varied from –1.0 to 5.0 per cent. The smallest range of uncertainty was for CO_2 (–2.0 to 5.0 per cent), while the greatest ranges were for CH_4 (–8.0 to 19.0 per cent) and N_2O (–4.0 to 22.0 per cent). The estimated uncertainty for HFCs, PFCs and SF_6 ranged

from –1.0 to 12.0 per cent. The range of uncertainty for fossil fuel combustion (–2.0 to 5.0 per cent) had the greatest influence on the overall uncertainty of the inventory. The uncertainty of the trend in total emissions for 1990 to 2006 was estimated using a tier 2 method and ranged from 9.0 to 19.0 per cent.

19. The uncertainty analysis has been documented in an annex to the NIR and the category-specific uncertainties discussed under the sector chapters. The ERT noted that the Party has not followed the recommendation of the 2007 review to add columns containing information on AD and EF uncertainties to the tables in annex 7 to the NIR, where the uncertainty analysis is described. The ERT reiterates the recommendation of the previous review in this regard and encourages the United States to make this addition in its next submission. The United States uses the results of the uncertainty analysis to prioritize further improvements to be made to the inventory.

5. Verification and quality assurance/quality control approaches

20. The United States has a national QA/QC plan in place; this plan is contained in the document *Quality Assurance/Quality Control and Uncertainty Management Plan for the U.S. Greenhouse Gas Inventory: Procedures Manual for Quality Assurance/Quality Control and Uncertainty Analysis*, which has been referenced in the NIR. The national QA/QC plan is consistent with the IPCC good practice guidance and is being implemented in a comprehensive and commendable way. The QC procedures have been standardized through the use of specific forms. These forms are used as checklists in order to document the findings of the checks, including corrective actions which have been taken or those planned for the future. The United States also used manual and semi-automated checks in the course of compiling the inventory to ensure that data was transferred correctly from the sectoral source leads and contractors to CRF Reporter.

21. Detailed information on QA/QC and verification measures has been given in the NIR, in a category-specific manner for each sector. Tier 1 QC measures have been implemented with procedures tailored to specific categories, while tier 2 QC measures were undertaken, generally, only for key categories. However, the NIR presents only an overview of the QA/QC procedures for all categories in the industrial processes sector, and no information on QA/QC or verification has been provided for the solvent and other product use sector. The ERT encourages the United States to include more category-specific information on the QA/QC and verification measures in all sector chapters of the NIR in its next inventory submission.

22. The QA measures taken by the United States include an expert review and a public review, which are undertaken annually before the submission of the inventory to the UNFCCC secretariat. The comments received from the relevant experts from industry, government and universities, as well as details of the action taken on the basis of these comments, are documented and archived.

6. Follow-up to previous reviews

23. The United States has systematically addressed the issues raised in the previous reviews and followed their recommendations, where deemed appropriate or possible. For example, the carbon stock changes for some parts of the forest land in Alaska have been reported for the first time in the 2008 submission. Furthermore, AD and calculation approaches have been used more consistently, particularly when a common source of data was used for more than one category (e.g. the cattle population numbers used for both enteric fermentation and manure management). The notation keys and cell comments have been used more consistently in the CRF tables for the LULUCF and waste sectors. For certain sectors (e.g. industrial processes), the order in which categories are presented in the NIR has been made consistent with the order in the CRF tables, following the recommendation from the review of the 2007 inventory submission. With regard to other recommendations, such as the development of a tier 2 key category analysis, the description of sector-specific QA/QC measures under all sector chapters in the NIR, the consistent presentation of the total emissions with and without LULUCF in the NIR and the

CRF tables, or the provision of more detailed data for the CRF categories in the energy sector, implementation is still in process or under consideration.

G. Areas for further improvement

1. Identified by the Party

24. The 2008 NIR identifies several areas for improvement in the sector chapters:

(a) Incorporate some categories which are currently not estimated;

(b) Improve the accuracy of EFs;

(c) Collect more detailed AD;

(d) Include a tier 2 key category analysis in future submissions, as soon as tier 2 uncertainty estimates are available for the remaining two categories (composting and parts of agricultural soil management);

(e) Improve the quality of the uncertainty estimates by refining the estimates for the categories as well as for overall uncertainty, by including global warming potential uncertainty in the analysis and by improving the characterization of trend uncertainty associated with base year inventory estimates.

2. Identified by the ERT

25. The ERT identified the following cross-cutting issues for improvement:

(a) Enhance consistency between the NIR and the CRF tables in accordance with the UNFCCC reporting guidelines;

(b) Use higher-tier methods for key categories, where appropriate (e.g. for stationary combustion);

(c) Include a tier 2 key category analysis in the next inventory submission;

(d) Include descriptions of the QA/QC and verification measures in the sector chapters of the NIR in accordance with the guidance on the structure of the NIR in the UNFCCC reporting guidelines;

(e) Provide information on AD and EF uncertainties separately, where applicable;

(f) Develop a data collection strategy which will allow for categories which are not yet covered in the inventory to be reported in future submissions.

26. Recommended improvements relating to specific source/sink categories are presented in the relevant sector chapters of this report.

II. Energy

A. Sector overview

27. The energy sector is the main sector in the GHG inventory of the United States. In 2006, the energy sector accounted for 6,076,897.36 Gg CO_2 eq, or 86.6 per cent of total GHG emissions. Emissions from the sector increased by 16.8 per cent between 1990 and 2006. The key drivers for this rise in emissions were the energy industries and transport, for which emissions increased by 29.0 per cent and 25.9 per cent, respectively. In contrast, fugitive emissions from solid fuels (coal mining and

processing) fell by 29.1 per cent and those from oil and natural gas fell by 17.1 per cent. In 2006, 95.9 per cent of the energy sector emissions were CO_2, 3.3 per cent were CH_4 and 0.8 per cent N_2O. Within the sector, 38.8 per cent of emissions were from public electricity and heat production, followed by 26.3 per cent from road transportation, 14.3 per cent from manufacturing industries and construction, 5.4 per cent from residential and 3.5 per cent from commercial/institutional. Domestic civil aviation accounted for 2.6 per cent of emissions in this sector, while fugitive emissions from coal, oil and natural gas combined contributed 3.7 per cent.

B. Reference and sectoral approaches

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

28. CO_2 emissions from fuel combustion were calculated using the reference and sectoral approaches. For 2006, the estimates for CO_2 emissions calculated using the two approaches differ by 3.55 per cent. Explanation for the differences has been provided in the CRF tables and the NIR.

29. CRF table 1.A(b) states: "The United States Reference Approach is also provided in a separate Excel spreadsheet, which is more detailed than this table allows information to be reported." The ERT noted, however, that no such spreadsheet was included in the 2008 submission. Following a request by the ERT, the Party provided this information. The ERT encourages the Party to include this information as a regular part of its future inventory submissions.

30. The ERT noted that the United States has not closely followed the UNFCCC reporting guidelines when completing CRF table 1.A(b) on the reference approach. First, the Party has made adjustments to account for feedstock and other non-energy use of fuels, which the ERT noted should be done separately in the subsequent tables 1.A(c) or 1.A(d). Second, the data for natural gas include synthetic gas produced from coal, which the ERT noted should not be the case. The ERT requests that the Party demonstrate in its future NIRs that the deduction of the energy in the gas from the energy in coal consumption data, and the treatment of exported CO_2, is equivalent to a carbon mass balance consideration. Third, the figures for natural gas have been adjusted to include a 'balancing term' (the residuals after production, trade, storage and consumption are accounted for). The ERT noted that this is not consistent with the Revised 1996 IPCC Guidelines and the UNFCCC reporting guidelines, as the reference approach is based on production and trade alone. Finally, the ERT noted that coke has been allocated to coking coal in CRF table 1.A(b).

31. The ERT recommends that the Party follow the UNFCCC reporting guidelines more closely and complete these CRF tables as indicated, bearing in mind that they are intended as a simple check on the sectoral approach. The ERT recognizes that the Party had difficulty in allocating fuels in the tables; therefore, it encourages the Party to add additional lines to the tables to allow for the reporting of country-specific data and fuel types.

32. In addition, the ERT noted a number of issues with the data provided by the United States. There is no separation by type of coal for imports and exports and a single EF has been used, which has not been updated since 2001. Moreover, the production, import and export data only cover the 50 States of the United States and the District of Columbia, with consumption by the United States Territories added as an adjustment (see also para. 30 above and para. 38 below). The ERT recommends that the Party explore ways of collecting data which allow it to follow the Revised 1996 IPCC Guidelines more closely and to provide separate data for all coal types.

2. International bunker fuels

33. The ERT noted that the United States has reported emissions from international bunker fuel use for military services, in line with the IPCC good practice guidance.

34. The ERT also noted some considerable year-on-year changes in CO_2 emissions under international bunkers – marine, namely 1998/1999 (–19.8 per cent), 2001/2002 (–28.0 per cent), 2002/2003 (60.0 per cent) and 2003/2004 (20.8 per cent). The ERT encourages the Party to examine this issue and provide additional explanation for these significant changes in its next submission.

3. Feedstocks and non-energy use of fuels

35. The United States deducts fuels used for feedstocks in industrial processes from fuel consumption, and the resulting emissions are reported under the appropriate sector.

36. The ERT noted that the United States has reported a significant amount of emissions (130,693.11 Gg CO_2) under the category other – non-energy use of fuels (CRF category 1.A.5). This accounts for 2.2 per cent of emissions in the energy sector, or 2.1 per cent of the total GHG emissions. The ERT noted that a large proportion of these emissions might have been wrongly allocated to the energy sector. Using data from the 2008 NIR, the ERT calculated that 55.0 per cent of these emissions could be reported under energy industries (burnt for energy recovery). Emissions from hazardous waste (accounting for 1.0 per cent of the misallocated emissions) could be reported in the waste sector, and another 8.0 per cent of these misallocated emissions could be split between the industrial processes and solvent and other product use sectors. The remaining emissions reported under this category could also be reallocated. The ERT noted that, according to the Revised 1996 IPCC Guidelines, only emissions from fuels burned for their energy should be reported under fuel combustion. Reiterating a similar recommendation from the 2007 review, the ERT recommends that the Party consider reallocating the emissions currently reported under other – non-energy use of fuels, as the current practice reduces the comparability of the inventory.

4. Country-specific issues

37. The energy data for the United States were obtained from the Energy Information Administration (EIA) of the United States Department of Energy directly. Most of the information was taken from published reports, although some data were drawn from unpublished energy studies. Therefore, in order to meet the UNFCCC reporting requirements for combustion emissions from all United States territories, the estimates for fuel consumption differ from the published EIA estimates. The ERT also noted that some double counting could have occurred, as the coal used to produce synthetic gas and the gas itself are both included in the final energy consumption. The United States adjusted the energy data to account for these factors.

38. The United States Environmental Protection Agency (EPA) also adjusted the data for fuels used for transport on the basis of a separate bottom-up analysis of the fuels consumed for transportation, which is based on Federal Highway Administration data on vehicle miles travelled. Fuel consumption is considered accurate at the national level; so, as using the studies mentioned in paragraph 37 above results in a higher use of fuel for transport, fuel consumption in the residential, commercial and industrial sectors was adjusted downwards to compensate.

39. In order to ensure and demonstrate that such adjustments do not reduce the transparency of the inventory or increase its uncertainty, the ERT recommends that the United States present fuel data in the NIR as it is received from the EIA. The United States should also include data on each adjustment that has been made, so that the NIR provides transparent information on the size and effect of such adjustments, which are an important part of the inventory compilation process.

C. Key categories

1. Fuel combustion: all fuels – CO_2, CH_4 and N_2O[3]

40. Emissions from fuel use were calculated on the basis of fuel consumption data, as discussed in paragraph 38 above, and estimates of the carbon content of the fuels. The ERT noted that, while the United States had a complex process of changing the estimated carbon content of the coal year by year on the basis of the origin and type of the coal, this process was based on data from 6,588 coal samples collected by the United States Geological Survey between 1973 and 1989. The ERT questions whether this data is sufficiently up to date, as these values do change over time. The ERT notes that, according to the previous review report, the Party has indicated its intention to explore the possibility of implementing a standardized system for updating the CO_2 EFs on a rotational basis, whereby individual, discrete fuel types can be analysed on a continuous multi-year basis. The ERT recommends that the United States act on this intention and also to explore the possibility of improving the estimates for the carbon content of fuels by making more use of existing contacts with data suppliers and also by obtaining additional data from other relevant entities, such as gas companies, fuel associations and refineries.

41. According to the 2008 NIR, the United States assumes (in the absence of measured data) that 100 per cent of the carbon in fossil fuels is oxidized to CO_2 "based on guidance in IPCC (2006)". The 2006 IPCC Guidelines state that: "For some solid fuels this fraction [of unoxidized carbon] will not necessarily be negligible, and higher-tier methods can be applied. Where this is known to be the case, it is good practice to use country-specific data based on measurements or other well-documented data" (Vol. 2, page 2.14). Therefore, while this assumption is probably correct in general, the Party is encouraged to consider if it is true in all cases.

42. As the data from the EIA have a coarse sectoral resolution, AD, and therefore emissions, have been reported under manufacturing industries and construction – other (other non-specified) for the following subcategories: iron and steel; non-ferrous metals; chemicals; pulp, paper and print; and food processing, beverages and tobacco. AD for the petroleum refining and manufacture of solid fuels and other energy industries subcategories have been reported under the category energy industries – other (other non-specified). The ERT notes that such reporting prevents the use of a tier 2 approach for some key categories, as required by the IPCC good practice guidance. Applying a tier 2 approach would entail a further breakdown of fuel consumption so that more specific CO_2 EFs (and more appropriate CH_4 and N_2O factors) could be used and more detailed reporting could be carried out. The ERT encourages the United States to collect sufficient data to enable higher-tier estimates to be made for the key categories as soon as possible.

43. The ERT noted that the stationary combustion reported under non-energy use of fuels might have been wrongly allocated to that sector and recommends that these emissions be reallocated to the correct sectors (see paras. 30 and 31 above).

2. Road transportation: liquid fuels – CO_2, CH_4 and N_2O[4]

44. Estimates for CO_2 emissions were based on aggregated fuel consumption data and country-specific EFs. For the estimation of CH_4 and N_2O emissions, fuel consumption was further broken down according to vehicle types (including control technologies), using information on vehicle miles travelled and the age structure of the vehicle fleet. The CH_4 and N_2O EFs are country-specific.

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[3] It should be noted that not all emissions related to all fuels and gases under this category are key categories, particularly CH_4 and N_2O emissions. However, since the calculation procedure for stationary combustion is discussed as a whole, individual categories are not separated here.

[4] See footnote 3 above.

3. Domestic navigation: liquid fuels – CO_2, CH_4 and N_2O[5]

45. Fuel consumption for navigation shows large inter-annual changes: 1991/1992 (18.4 per cent), 1994/1995 (21.4 per cent), 1996/1997 (–34.3 per cent), 1997/1998 (–22.2 per cent), 1999/2000 (127.8 per cent), 2000/2001 (–29.0 per cent), 2001/2002 (41.4 per cent), 2002/2003 (–49.8 per cent) and 2003/2004 (25.8 per cent). Having noted that this fuel consumption is what is left after international marine bunkers have been subtracted from total fuel sales to shipping, the ERT also noted that this might be one factor contributing to the large inter-annual changes. The ERT welcomes plans by the United States to develop an alternative approach that will be a better reflection of the data on marine fuel bunkers. The ERT recommends that the Party review the total fuel sales to shipping, reconsider the estimation of emissions from international marine bunkers and make revisions to this information for the 1990–2006 time series accordingly. In addition, the ERT recommends that the Party clearly explain significant variations in the time series.

4. Fugitive emissions: CO_2 and CH_4

46. The estimates of fugitive emissions were calculated using a detailed approach which is based on the plants and equipment used in the United States. Estimates from abandoned coal mines were included. The ERT acknowledges the high level of detail included in the estimates of fugitive emissions from coal mining, natural gas and petroleum systems.

D. Non-key categories

Fugitive emissions: oil and natural gas – CO_2

47. In its 2008 NIR, the United States has provided information on accounting for the capture, transport, injection and storage of CO_2 (hereinafter referred to as CCS). The CCS activities considered by the Party relate to natural and industrial sources of CO_2 and the use of CO_2 for enhanced oil recovery. The United States also exports some CO_2 to Canada for a CCS project and is working with Canada to ensure that this CO_2 stream is accurately accounted for. The ERT welcomes this effort.

III. Industrial processes and solvent and other product use

A. Sector overview

48. In 2006, the industrial processes sector accounted for 320,904.12 Gg CO_2 eq, or 4.6 per cent of total GHG emissions, and the solvent and other product use sector accounted for 4,387.15 Gg CO_2 eq, or 0.1 per cent of total GHG emissions. Emissions from the industrial processes sector increased by 7.0 per cent between 1990 and 2006 and, for the solvent and other product use sector, emissions decreased by 0.4 per cent over the same period. The emissions from cement production and the use of substitutes for ozone-depleting substances were the key drivers for the rise in emissions from industrial processes.

49. Within the industrial processes and solvent and other product use sectors, 39.5 per cent of the GHG emissions were from the consumption of halocarbons and SF_6, followed by 22.9 per cent from mineral products, 19.0 per cent from metal production and 13.0 per cent from the chemical industry. Production of halocarbons and SF_6 accounted for 4.3 per cent of sectoral GHG emissions and solvent and other product use for 1.3 per cent.

50. The following categories have been reported as "NE": ammonia production – CH_4 and N_2O; ethylene – CO_2; styrene – CH_4; silicon carbide consumption – CH_4; calcium carbide – CO_2 and CH_4; other production – CO_2; production of halocarbons and SF_6 – PFCs and SF_6; and solvent and other product use – CO_2. The ERT encourages the United States to estimate emissions for these categories.

[5] See footnote 3 above.

51. With regard to the industrial processes sector, the 2008 inventory is generally transparent. The category-specific chapters for time-series consistency and QA/QC have not been included in the NIR, although this is required in accordance with the UNFCCC reporting guidelines. The reporting of QA/QC is especially important in the case of estimates based on industry reports. Most of the QA/QC information requested by the ERT in the previous review has not been included in the 2008 NIR. The ERT recommends that the United States include a description of QA/QC in its next submission.

B. Key categories

1. Cement production – CO_2

52. The Party has estimated the emissions from cement production based on clinker consumption, thereby using a tier 2 method which is in accordance with the IPCC good practice guidance. The parameters used to calculate EFs (calcium oxide content of clinker and cement kiln dust factor) are IPCC defaults. The ERT encourages the United States to explore the possibility of developing country-specific EFs, for example by conducting a specific study with the goal of developing such EFs. The AD were based on data from the chapter on cement in the United States Geological Survey (USGS) *Minerals Yearbook* and on personal communication. The ERT recommends that the United States be more specific about how and why the data from the USGS was modified on the basis of a personal communication.

2. Ammonia production – CO_2

53. The EFs were based on the use of natural gas and petroleum coke as feedstock. The data for ammonia production is from Cofeyville Resources and the Census Bureau of the United States Department of Commerce.

54. The trend in implied emission factors (IEFs) for this category fluctuates and shows some large inter-annual variations, which is due to the fact that the United States has reported emissions from both ammonia manufacture and urea consumption in this category, and the estimated emissions from ammonia production have been adjusted on the basis of urea consumption. In the 2007 review, the ERT encouraged the United States to explore ways of reporting emissions from ammonia production in accordance with the Revised 1996 IPCC Guidelines and the UNFCCC reporting guidelines. The ERT acknowledges that emissions were recalculated to allocate emissions from urea consumed as fertilizer to the LULUCF sector, which resulted in a decrease in the IEF. The emissions from urea consumption include both domestic production and imports (minus exports) of urea.

55. The ERT appreciates the approach used by the United States to include emissions from imported urea, which improves the completeness of the inventory. However, the description in the NIR of how urea consumption was estimated in sectors other than LULUCF is unclear (87.0 per cent of urea use is estimated to occur in the LULUCF sector). The ERT recommends that the United States explore ways of estimating emissions on the basis of domestic production, imports, exports and use of urea in the LULUCF sector. The ERT welcomes the effort made by the United States to increase the transparency and comparability of its inventory by reporting separately the emissions from ammonia production, from consumption of domestically produced urea and from consumption of imported urea.

3. Adipic acid production – N_2O

56. There are four plants in the United States which produce adipic acid. Two of these plants monitored emissions continuously for the period 1990–2002 and the data collected was used to estimate emissions. Since 2002, emissions have been estimated by applying the national rates for production growth to the data on emissions from previous years. The emissions from the two other plants were estimated on the basis of an EF, N_2O destruction factor and abatement system utility factor. The AD were obtained from the American Chemistry Council. The data were allocated to different plants on the basis of their nameplate capacity, in the case of plants that did not measure their emissions directly.

The reference regarding the technologies and control measures is from 1999. The ERT encourages the United States to discuss in its next NIR whether changes have been made to the production and control measures. The ERT also recommends that the United States explain why emission estimates are no longer available from the two plants that used to measure emissions, and whether they are expected to be available in the future.

4. Iron and steel – CO_2

57. The calculation of emissions for this category was based on the carbon content of coking coal and coke, carbon stored in the end and intermediate products, and the amount of carbon in anodes. The AD were from the EIA and the American Iron and Steel Institute. Additional data for the calculation were obtained from various other sources. The emissions were recalculated in the 2008 submission, as a result of a revised estimate of the carbon content of crude steel. The ERT welcomes the Party's intention to provide, in its future inventory submissions, emission estimates for this category based on the methodologies provided in the 2006 IPCC Guidelines in order to improve transparency and align its methods with those of the other reporting Parties.

5. Production of hydrochlorofluorocarbon-22 – HFCs

58. There are five hydrochlorofluorocarbon (HCFC)-22 plants currently operating in the United States, all of which measure the HFC-23 emissions continuously. In 1990, there were three more HCFC-22 production plants, the last of which was closed in 1993. The emissions from these plants were estimated based on a tier 1 method and were then recalculated applying an updated EF. In addition, the emissions from plants that had carried out continuous monitoring were recalculated. The differences resulting from these recalculations were largest in 1995, when the HFC-23 estimate increased by 22 per cent. The ERT recommends that the United States clarify why the emission estimates that are based on continuous monitoring have been recalculated and to report QA/QC processes which were carried out in relation to the recalculated data.

6. Substitutes for ozone-depleting substances – HFCs and PFCs

59. The emissions from substitutes for ozone-depleting substances were calculated applying a detailed bottom-up Vintaging Model described in an annex to the 2008 NIR. The previous review in 2007 recommended that the United States include additional information on the Vintaging Model in order to improve transparency, but the requested information has not been included. The ERT encourages the United States to include more information in its next submission, especially with regard to leak rates and emissions from the manufacture and service of these substitutes. Since the previous submission in 2007, emissions have been recalculated and shown to have decreased by about 15.0 per cent. The ERT recommends the United States to provide further information on the reasons for this recalculation, as well as on the verification and QA/QC processes that were carried out after the emissions were recalculated.

7. Electrical equipment – SF_6

60. The emissions for this category were estimated using two different methods for the periods 1990–1998 and 1999–2006. For the first period, emissions were estimated on the basis of a global study on SF_6 sales. The emissions were estimated to follow the global trajectory. The ERT recommends that the United States explore ways in which to estimate the emissions following the Revised 1996 IPCC Guidelines, or to provide an explanation for using this global study as a basis for the estimates. For the 1999–2006 period, emissions were estimated on the basis of reports from utility companies which were participating in the SF_6 Emission Reduction Partnership of the EPA and, in the case of non-reporting companies, emissions were estimated on the basis of information on transmission miles and emissions provided by the reporting companies. The method used by the reporting companies is not transparently documented; therefore, it is not clear which tier the method corresponds to or whether emissions from the

retirement of equipment have been included. The ERT welcomes the intention of the United States to increase transparency by describing the method used by the utility companies in its next NIR.

C. Non-key categories

1. Limestone and dolomite use – CO_2

61. The emissions were estimated by multiplying the amount of limestone and dolomite used by the average carbon content of these materials. The amount of lime used for the desulphurization of flue gas decreased by 31.0 per cent, from 6,785 kt in 2005 to 4,683 kt in 2006; however, the use of solid fuels in the energy sector decreased by just 1.3 per cent. The ERT recommends that the United States explain this discrepancy in its next inventory submission.

2. Nitric acid production – N_2O

62. Emissions were estimated using the IPCC EFs separately for plants with and without non-selective catalyst reduction systems. Data on the shares of production carried out using the two technologies is based on a study from 1993. The ERT recommends that the United States clarify whether this information is still valid, and also clarify whether the proportion of plants with each technology is equal to their share of production.

3. Ferroalloys production – CO_2

63. The United States has reported emissions from two types of ferrosilicon, silicon metal and miscellaneous alloys. Emissions from the production of ferrochromium and ferromanganese were reported as not included, owing to the small number of manufacturers of these metals. The ERT recommends that the United States include these emissions in its national inventory for the sake of completeness.

IV. Agriculture

A. Sector overview

64. In 2006, the agriculture sector accounted for 454,145.0 Gg CO_2 eq, or 6.5 per cent of total GHG emissions. Although emissions from the sector increased by 1.5 per cent from 1990 to 2006, the general trend is fluctuating and does not provide evidence of a consistent change over time. Sectoral uncertainty analyses were performed mainly using the IPCC tier 2 estimation methodology (the Monte Carlo Stochastic Simulation Technique), excluding that fraction of N_2O emissions from agricultural soils due to non-major crops and a small component of the grasslands (federal grasslands) where a tier 1 approach was used both for the estimates and the uncertainty analyses. IPCC tier 1 and tier 2 QA/QC procedures were implemented consistent with the Party's QA/QC plan for the livestock categories; whereas, for agricultural soils, estimates were compared with field data and, for the other categories, a category-specific QA/QC plan was produced. Recalculations of the estimates from the previous submission in 2007 resulted in an overall decrease in estimated emissions for the agriculture sector by 15.4 per cent for 2005, which can be broken down to an increase in CH_4 emissions by 7.9 per cent and a decrease in N_2O emissions by 25.5 per cent. The reasons for these respective increases and decreases are well documented in the NIR.

65. CH_4 accounted for 38.4 per cent and N_2O for 61.6 per cent of sectoral emissions. Although the overall trend indicates no consistent change in the magnitude of the sectoral emissions over time, such an assertion is not valid for the individual gases, which show opposing trends: while CH_4 emissions exhibit a light increasing trend, N_2O emissions are decreasing within an oscillating trend. The key driver for the increase in CH_4 emissions from agriculture was a 33.8 per cent increase in CH_4 emissions from manure management from 1990 to 2006; no key driver for the apparent decrease in N_2O emissions has been identified. Agricultural soils was the most important category in 2006, accounting for 58.3 per cent of the

sectoral emissions, followed by enteric fermentation (27.8 per cent), manure management (12.3 per cent), rice cultivation (1.3 per cent) and crop residues from field burning (0.3 per cent). The inventory of the United States is complete for the agriculture sector, as emissions for all the categories covering the whole national territory are reported. At sub-category level, emissions from some very minor animal populations (buffaloes, mules and asses, camels and llamas) have been reported as "NE".

66. In previous reviews, some questions on institutional arrangements and cross-cutting issues at the sectoral level had been raised by the ERT. Although the United States answered these questions, it has not then included this important information in the 2008 NIR, as it was recommended to do. The ERT encourages the United States to improve transparency with regard to these issues by including, in its next submission, the information which it provided during previous inventory reviews.

B. Key categories

1. Enteric fermentation – CH_4

67. CH_4 emissions from enteric fermentation were estimated applying a tier 3 method for cattle (Cattle Enteric Fermentation Model, developed by the EPA) and a tier 1 method for the other species of animal, applying the 2006 IPCC default values. This methodological approach is in line with the IPCC good practice guidance.

68. AD for some animal species (cattle, horses, swine, sheep and goats) differed from the values derived from the database of the Food and Agriculture Organization of the United Nations, by a maximum of 12.0 per cent for goats and by a minimum of less than 1.0 per cent for sheep. The ERT encourages the United States to find the origin of these discrepancies and welcomes the continuing effort of the Party to improve its approach to estimating population data where possible.

2. Agricultural soils – N_2O

69. Direct and indirect emissions of N_2O from agricultural soils were estimated using a combination of tier 3 (DAYCENT ecosystem model) and tier 1 methodological approaches, which is in line with the IPCC good practice guidance. AD were taken from official statistics agencies. Defaults from the 2006 IPCC Guidelines were applied at the tier 1 level.

70. During previous reviews, the United States had been recommended to improve the transparency of its NIR by including the information which it had provided to the ERTs during their reviews for clarification purposes. This has been done to some extent. The ERT encourages the United States to proceed in this way and to include, in its NIR, information on the structure of the model applied for its estimations and its outputs.

71. Nitrogen (N) input from manure applied to the soil is approximately 60.0 per cent higher than in the previous submission in 2007 and no transparent explanation for this has been included in the 2008 NIR. During the review, the United States explained to the ERT that this increase was due to changes in the IPCC Guidelines (from 1996 to 2006) and some additional internal changes in the subcategory. The ERT recommends that the United States include this explanation in the NIR of its next submission.

72. Emissions from the cultivation of histosols were constant for the period 1993–2006, but the area of cultivation increased and, consequently, the IEF decreased from 9.4 to 8.9 kg N_2O-N/ha between 1993 and 2006. During the review, the United States explained that the area and EF for the cultivation of histosols were in fact constant; therefore, there appears to be a problem with how the area data was transferred to the CRF tables. The United States will correct this problem and investigate how the CRF tables are generated by CRF Reporter in the future.

V. Land use, land-use change and forestry

A. Sector overview

73. In 2006, according to the 2008 NIR, the LULUCF sector represented a net sink of 883,7 Tg CO_2 eq, offsetting 14.8 per cent of the total CO_2 emissions in the United States. The ERT notices that a different figure (–846,793.30 Gg) has been reported in the CRF tables (see Summary 2), which represents 4.2 per cent less net removals than were reported in the NIR. From 1990 to 2006, net removals of CO_2 increased by 19.9 per cent. During the review, the United States explained that the CRF tables included only sequestration and that gross emissions from LULUCF were included elsewhere in the CRF structure. The ERT recommends that the United States report the emissions and removals of the LULUCF sector in its next submission as specified in the UNFCCC reporting guidelines.

74. Within the LULUCF sector, 72.5 per cent of the GHG removals were from forest land, followed by harvested wood products and yard trimmings (13.77 per cent), settlements (10.90 per cent), cropland (2.79 per cent) and grassland (0.01 per cent).

75. The category which shows the greatest increase in removals is cropland, for which removals grew by 196.4 per cent between 1990 and 2006. Removals by settlements also show very dynamic behaviour, increasing by 57.4 per cent during this period. Forest land, which is by far the greatest sink in relative terms, also shows a dynamic increase in removals of 29.8 per cent. Wetland and other lands were reported as "NE" for CO_2 emissions.

76. All the CH_4 emissions accounted for in the LULUCF sector came from forest land, as the other categories were reported as "NE". In the case of N_2O, only two categories were estimated, namely forest land and settlements, which accounted for 65.9 per cent and 34.1 per cent of emissions, respectively. Emissions of N_2O from forest land have grown by 460.2 per cent since 1990.

77. The 2008 NIR is very well structured and ordered and, in spite of how large it is, every section clearly identifies the relevant issues, providing information on methodologies and tiers used, uncertainties, QA/QC, recalculations and both implemented and planned improvements. Most AD and EFs are provided and have been derived from national studies, and many sources of data are well documented. In cases where AD were not available, this is explicitly mentioned.

78. The United States has reported forest data for the conterminous United States only. The ERT noted that forest area in important parts of the United States territory, in particular for parts of Alaska, has not been included in the inventory. The United States recognizes this issue and is planning to improve it by utilizing a tier 3 approach on area data in the future. Reiterating the recommendation from previous review reports, the ERT recommends that the Party report its forest data for the complete territory of the United States in its next submission.

79. The United States has reported emissions from carbon stock changes for forest land remaining forest land, cropland remaining cropland, land converted to cropland, grassland remaining grassland, land converted to grassland, settlements remaining settlements and harvested wood products. Emissions from carbon stock changes for land converted to forest land, wetlands, land converted to settlements, and other land have been reported as "NE".

80. Owing to the fact that no system is in place to detect land use and track land-use changes, as required by section 2.1 of the IPCC good practice guidance for LULUCF, the ERT noted that the 2008 inventory is generally lacking in terms of completeness and transparency. As previous reviews have already reported, the Party has: (a) not been able to report data for any kind of land use or land-use change in accordance with section 2.1 of the IPCC good practice guidance for LULUCF; and (b) not reconstructed a complete and consistent time series for relevant land uses and land-use changes. The ERT recommends that the United States put its plan into practice as soon as possible to combine data

sources (the Natural Resources Inventory, Forest Inventory and Analysis and National Land Cover Dataset), in order to be able to detect any land use or land-use change at the national level. The ERT takes note of the improvement made to the inventory, compared with previous submissions, by the adoption of a ranking of priorities to assign different lands to one of the six land-use categories and welcomes the information received from the United States during the review stating that the 2009 submission will address the issues mentioned above.

81. For 2006, the United States has not separated land-use changes (land converted to) from permanent land uses (land remaining). Making this separation would greatly improve the inventory, owing to the implications for the level and dynamic of carbon stocks. The ERT noted some issues related to the completeness of the 2008 submission. First, in relation to the N fertilization of forest land and other, and for forest land remaining forest land, non-CO_2 emissions from the drainage of soils and wetlands for all land-use categories (forest land and wetlands) have not been estimated. Second, CO_2 emissions from liming have all been reported under cropland because the Party was not able to separate lime applications by land-use category. Non-CO_2 emissions from biomass burning of forest land remaining forest land have been reported, while the CO_2 emissions from this category have been reported as included elsewhere. Emissions from biomass burning for all other land-use categories have been reported as "NE".

82. The ERT recommends that the United States further disaggregate these data in its future submissions or provide an explanation of the specific difficulties it faces in disaggregating data, as recommended in the IPCC good practice guidance for LULUCF.

B. Key categories

1. Forest land remaining forest land – CO_2 and CH_4

83. The time series of net carbon stock changes in forest soils shows high inter-annual variability. The variations were especially significant between 1997 and 1998 (116.0 per cent) and between 1998 and 1999 (822.0 per cent). The United States explained that, over the 1990–2003 time period, there was a decrease in the total forest area of the forest types with high soil carbon density as compared with those with lower soil carbon density. Since it is impossible to provide, within the inventory submission, detailed tables showing these changes, the United States proposed that data from the United States Forest Service could be reviewed in more detail during its next in-country review. The United States indicated in the NIR that, as more information becomes available about historical land use, the ongoing effects of changes in land use and forest management will be better accounted for in its estimates of soil carbon.

84. The ERT noted that the IEF for carbon stock change in living biomass increased by 36.0 per cent between 1990 and 2006. In response to a question raised by the ERT, the Party explained that, because the AD for the living biomass calculations is based on periodic data collected in different years in different states, inter-annual variations are dependent upon which states updated their data in a particular year and, therefore, it is likely that inter-annual variations identified as outliers correspond to the years in which the data for larger states were updated. The ERT has some difficulty accepting this explanation. The IEFs included in CRF table 5.A are representative of the Party's whole territory and updating some individual states should not have a dramatic effect on the general IEF. Since the Party has not identified a definite reason for it, the ERT encourages the Party to re-examine the issue of high inter-annual variability for its next submission.

85. The ERT noted that there is also high inter-annual variability in the IEFs of dead organic matter. The Party gave the same explanation as for living biomass. The ERT reiterates the recommendation expressed in paragraph 84 above.

2. Cropland remaining cropland – CO_2

86. Carbon stock changes in living biomass and dead organic matter have been reported as "NE". Although carbon stock changes in living biomass for cropland remaining cropland are likely to be minor compared with those for forest lands, the ERT recommends that the Party make its planned improvement to provide, in its future submissions, more transparent and complete documentation in the NIR and CRF tables, in particular regarding the estimation of carbon stock changes for agroforestry and woody crops.

87. In CRF table 5(IV), the wrong values for lime AD seem to have been reported for both limestone and dolomite. The CRF values are 1,000 times less than the values reported in the NIR (tables 7–13). In response to questions from the ERT, the United States noted this error and replied that it would be corrected in the 2009 inventory submission.

88. The IEF of carbon stock change for mineral soil was constant at –0.338 Mg C/ha between 1990 and 1994, then it increased by 54.7 per cent to –0.154 in 1994 and remained at this value up to 2006. The ERT considers that, for the sake of transparency, further information should have been provided in the 2008 NIR on the use of methods and tier 3 models (e.g. CENTURY). However, the United States does plan to make improvements by reporting data on an annual basis and by recalculating the time series. In response to a question raised by the ERT, the Party announced that future inventories should have separate rates of carbon stock change for each year instead of for time blocks, so as to better reflect annual changes in soil carbon stocks.

89. In the case of organic soils, the IEF of carbon stock change was reported as constant at –9.429 Mg C/ha between 1990 and 1992, then it increased by 9.1 per cent to –10.286 Mg C/ha in 1993 and 1994, increased again by 133.3 per cent to –24.0 Mg C/ha in 1995 and then remained constant up to 2006. The ERT encourages the Party to use new data for carbon stock changes in organic soils to improve the accuracy of the time series.

3. Settlements remaining settlements – CO_2

90. Urban trees represent a significant proportion of the total tree canopy cover in the United States (3.0 per cent) and the related net annual increase in living biomass pool reported remained constant for the whole period 1990–2006. The observed increase in removals by urban trees is the result of an important increase in the area of these trees. Considering that the growth rate is the first derivative of a sigmoidal function, the ERT noted that the assumption of a linear constant change may not be conservative. In practice, mature trees should be discounted from the calculation process. Accordingly, the net change of carbon stock in living biomass reported for urban trees should reflect the dynamic resulting from AD and changes in carbon stock (the rate of change is a function of the age and of the management, such as pruning and thinning). Although the Party provided documentation on methodologies and information on sources of AD and growth rates, the importance of this pool, and the high uncertainties reported, justify making additional efforts to provide a more accurate and transparent estimation of the net removals. The ERT noted that many Parties do not report this pool and that, in comparison with other Parties that do report it, the IEF of carbon stock change in urban trees is extremely high in the United States.

91. The AD show that the area of settlement was increasing constantly over the reporting period (1990–2006), but the ERT notes that land converted to settlements has been reported as "NE". The ERT encourages the Party to report changes of land use as appropriate. The United States stated that it hopes to improve the set of data on urban trees in order to derive a trend for carbon sequestration from 1990 to the present. The Party will also address the "steady state" problem identified by the ERT.

4. Other – CO_2

92. The Party reported CO_2 removals by harvested wood products under the category other (5.G), because there is no detailed methodology for reporting on harvested wood products in landfills in the IPCC good practice guidance on LULUCF or in the 2006 IPCC Guidelines, and the uncertainty of the estimates for removals by harvested wood products is high. In response to a recommendation by the ERT in the previous review in 2007, the Party now reports harvested wood products in use and in landfills separately. Nevertheless, the problem of reporting harvested wood products under forest land remaining forest land in the NIR still remains. In addition, the data on half-lives for different harvested wood products in landfills are not substantiated. The ERT recommends that the Party further improve the transparency and accuracy of the estimates in this category and welcomes the stated intention of the United States to include in its next NIR some additional information on half-lives as well as reference to recent literature.

93. In accordance with the recommendation of the ERTs in previous review reports, yard trimmings and food scraps are now reported under the category other (5.G), rather than under settlements as before. In spite of that, the ERT recommends that the Party make an effort to continue to improve the transparency and accuracy of the estimates in this category.

C. Non-key categories

1. Biomass burning – CO_2

94. Emissions from biomass burning for all land-use categories other than forest land were not estimated. The ERT encourages the Party to estimate emissions for the categories currently not estimated for the sake of completeness.

2. Wetlands

95. The emissions and removals from wetlands were not estimated, owing to lack of data. Although the estimation of emissions from wetlands is optional, the ERT encourages the Party to provide this information in future submissions and welcomes information received from the Party during the review that the United States will include emissions from peatlands in its next inventory submission.

VI. Waste

A. Sector overview

96. In 2006, the waste sector accounted for 160,987 Gg CO_2 eq, or 2.3 per cent of total GHG emissions. Within the sector, solid waste disposal on land accounted for 78.1 per cent of emissions, wastewater handling for 19.9 per cent and composting for 2.1 per cent. The ERT noted that, despite increases in the population and in waste generation between 1990 and 2006, sectoral emissions decreased by 10.3 per cent over the same period. A decrease in the CH_4 emissions from solid waste disposal on land, by 16.0 per cent over this period, was the main contributor to this decrease in the total emissions from the waste sector. The downward trend in overall emissions was also the result of increases in the amount of landfill gas collected and combusted, which more than offset the additional CH_4 generated as a result of the increase in the amount of municipal solid waste landfilled. CH_4 emissions from unmanaged waste disposal sites (6.A.2) have been reported as "NE". The ERT recommends that the Party change this notation key to not occurring ("NO"), since all waste disposal sites in the United States are managed.

97. The United States has reported estimates for all gases in the sector. The background data tables in the CRF have been updated since previous submissions and this has made the subsequent recalculations more transparent. Emissions from waste incineration have been reported under the energy sector. In terms of completeness, the ERT encourages the United States to include emission estimates for CH_4 from waste incineration in future submissions.

98. Some recalculations have been performed for this sector, resulting in an estimate for emissions in 1990 which is 6.6 per cent lower, and an estimate for emissions in 2005 which is 4.0 per cent lower, than the estimates provided in the 2007 submission. For solid waste disposal on land, this difference can be attributed mostly to the improved estimates of the amount of waste landfilled and the updated recovery estimates. Emissions associated with wastewater handling have also been recalculated to take into account changes in AD, measurements and methodology. Estimates of emissions from composting have been included in the inventory for the first time, using the tier 1 method in accordance with the IPCC 2006 Guidelines.

99. In general, the waste sector includes QA/QC analyses and detailed information on uncertainties. AD, EFs and the methods used are documented in the NIR in a transparent manner.

B. Key categories

1. Solid waste disposal on land – CH_4

100. The United States has used an advanced tier 2 model for its emission estimates and provided both uncertainty analyses and QA/QC procedures for these emission estimates. In 2006, CH_4 emissions from solid waste disposal on land accounted for 1.8 per cent of total emissions. The United States improved the analysis in this sector by revising the AD for waste amount and recovery values. The 2006 IPCC Guidelines for the estimation of CH_4 emissions from solid waste disposal sites have been applied.

101. The ERT noted that the United States has improved its definition of the historically landfilled waste amounts. However, the degradable organic carbon (DOC) value remained constant. This constant DOC value may not reflect the changing composition of waste in the United States owing to increased recycling and composting of degradable fractions. The ERT recommends that the Party investigate the sensitivity of the first order decay method to changing DOC.

102. The amount of waste disposed to landfills decreased between 1990 and 1996 (reaching its lowest value in 1996, at 187,369 Gg), and then increased from 1996 (to reach its highest value in 2006, at 306,582 Gg). Meanwhile, the waste generation rate per capita (kg/person/day) increased between 1990 and 2000, and decreased thereafter. The reasons for these fluctuations have not been transparently documented in the 2008 NIR. During the review, the United States explained that the amount of waste disposed for 2005 and 2006 was calculated using population data for each year and the waste disposal rate for 2004. The ERT noted that, in the CRF tables, the United States reported different values for the rate of waste generation for 2004, 2005 and 2006. The ERT encourages the United States to further investigate this issue and to provide some information in its next NIR to explain the fluctuations in the rate of waste generation.

2. Waste incineration – CO_2

103. The United States has not provided any information on the method used for estimating emissions for this category, either in the CRF tables or in the NIR. In the NIR of the 2007 submission, the United States indicated that 50.0 per cent of hazardous wastes were combusted with energy recovery and that a proportion was also incinerated solely for waste management purposes without energy recovery. In the 2008 submission, the United States did not include any information on waste incineration without energy recovery. The ERT recommends that a short summary on waste incineration be included in the NIR under the waste sector to indicate the rationale for the allocation, thereby improving the transparency and consistency of the reporting.

C. Non-key categories

Wastewater handling – CH_4 and N_2O

104. In the United States, four industrial activities were identified as likely to produce significant CH_4 emissions from wastewater handling: pulp and paper manufacturing; meat and poultry processing; processing of vegetables, fruits and juices; and starch-based ethanol production. The IPCC good practice guidance also provides EFs for other industrial activities. Therefore, the ERT recommends that the United States investigate the possibility of including additional industrial activities in its emission estimates. During the review, the United States announced plans to include additional industries, such as plastics and resins, in future inventory submissions.

105. The 2008 NIR states that emissions from anaerobic digesters at domestic and commercial wastewater treatment plants were combusted in flares or energy devices, but the notation keys "NA" and "NE" have been used in the CRF tables.

106. N_2O emissions from human sewage were estimated using the 2006 IPCC Guidelines. The IPCC methodology uses annual, per capita protein consumption (kg protein/person/year). Average protein intake fluctuated over the 1990–2006 period. During the review, the United States explained that the reduction in protein intake was related to the reduction in the gross domestic product (GDP) of the United States and also likely to be related to the decrease in the popularity of high protein diets after 2002. However, the ERT noted that the GDP in the United States increased during the 2002–2006 period. The ERT recommends that the Party make a more in-depth study into the effect of protein intake on N_2O emissions from human sewage.

VII. Conclusions and recommendations

107. The ERT concludes that the 2008 inventory submission of the United States is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The 2008 inventory shows noticeable improvement with regard to major issues identified in previous reviews, for example several calculation approaches have been used more consistently, particularly when a common source of data was used for more than one category, and three new categories have been included in the energy, LULUCF and waste sectors. The inventory is complete in terms of years and GHGs covered, and close to complete in terms of geographical coverage. The ERT noted that, although the completeness of the inventory in terms of categories covered has been improved, more needs to be done.

108. The methodologies, models and country-specific methods used are presented, generally, in a transparent way. The national QA/QC plan is consistent with the IPCC good practice guidance and is being implemented in a comprehensive and commendable way. The United States has systematically addressed issues raised in previous reviews and followed recommendations, where deemed appropriate or possible. The ERT noted that the United States has used higher-tier methods for many key categories. However, despite the recommendation from the previous review in 2007, stationary combustion, which is the largest category in the inventory, has still been reported at a fairly aggregated level.

109. The key recommendations are that the United States of America:

(a) Enhance consistency between the NIR and the CRF tables in accordance with the UNFCCC reporting guidelines;

(b) Use higher-tier methods for key categories, where appropriate (e.g. for stationary combustion);

(c) Include a tier 2 key category analysis in the inventory submission;

(d) Include descriptions of the QA/QC and verification measures in the sector chapters of the NIR in accordance with the guidance on the structure of the NIR in the UNFCCC reporting guidelines;

(e) Provide information on AD and EF uncertainties separately, where applicable, and add columns with information on AD and EF uncertainties to the tables in annex 7 to the NIR;

(f) Develop a strategy for data collection which will allow for categories which are not yet covered in the inventory to be reported in future submissions;

(g) Provide separate data for all coal types and complete data covering the full territory of the United States;

(h) Present fuel data in the NIR as it is received from the EIA, as well as data on each adjustment so that the NIR provides transparent information on the size and effect of these adjustments, which are an important part of the inventory compilation process;

(i) Reconsider its approach to reporting energy data to assess whether it can be simplified and whether complete, constant and accurate data on fuel use can be collected.

Annex

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. *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>.

Status report for the United States of America 2008. Available at <http://unfccc.int/resource/docs/2008/asr/usa.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2008. Available at <http://unfccc.int/resource/webdocs/sai/2008.pdf>.

FCCC/ARR/2007/USA. Report of the individual review of the greenhouse gas inventory of the United States of America submitted in 2007. Available at <http://unfccc.int/resource/docs/2008/arr/usa.pdf>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Leif Hockstad (US Environmental Protection Agency), including additional material on the methodology and assumptions used. The following documents were also provided by the Party:

Quality Assurance/Quality Control and Uncertainty Management Plan for the U.S. Greenhouse Gas Inventory: Procedures Manual for Quality Assurance/Quality Control and Uncertainty Analysis.

United States Geological Survey (USGS) *Minerals Yearbook.*

The Natural Resources Inventory, Forest Inventory and Analysis and National Land Cover Dataset.

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