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Report of the individual review of the inventory submission of the United States of America submitted in 2011*

* In the symbol for this document, 2011 refers to the year in which the inventory was submitted, and not to the year of publication.

Contents

I. Introduction and summary

A. Overview

1. This report covers the centralized review of the 2011 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 5 to 10 September 2011 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Domenico Gaudioso (Italy); energy – Mr. Ricardo Fernandez (European Union), Mr. Sergiy Skybyk (Ukraine) and Mr. Michael Strogies (Germany); industrial processes – Ms. Natalya Parasyuk (Ukraine) and Ms. Ingrid Person (Brazil); agriculture – Ms. Olga Gavrilova (Estonia) and Mr. Yuriy Pyrozhenko (Ukraine); land use, land-use change and forestry (LULUCF) – Mr. Sandro Federici (San Marino) and Ms. Marina Shvangiradze (Georgia); and waste – Ms. Tatiana Tugui (Republic of Moldova). Ms. Parasyuk and Mr. Federici were the lead reviewers. The review was coordinated by Mr. Stelios Pesmajoglou and Ms. Ruta Bubniene (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 the 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. Emission profiles and trends

3. In 2009, the main greenhouse gas (GHG) in the United States was carbon dioxide (CO_2), accounting for 83.2 per cent of total GHG emissions[1] expressed in CO_2 eq, followed by methane (CH_4) (10.3 per cent) and nitrous oxide (N_2O) (4.3 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) collectively accounted for 2.2 per cent of the overall GHG emissions in the country. The energy sector accounted for 87.0 per cent of total GHG emissions, followed by the agriculture sector (6.3 per cent), the industrial processes sector (4.3 per cent), the waste sector (2.3 per cent) and the solvent and other product use sector (0.1 per cent). Total GHG emissions amounted to 6,608,226.77 Gg CO_2 eq and increased by 7.2 per cent between 1990 and 2009. The overall trend in GHG emissions is in line with the economic growth in the United States during the years 1990 to 2007, followed by a decline in recent years, in particular between 2008 and 2009.

4. Tables 1 and 2 show GHG emissions under the Convention, by gas and by sector, respectively. In table 1, CO_2, CH_4 and N_2O emissions do not include emissions and removals from the LULUCF sector.

[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.

Table 1
Greenhouse gas emissions by gas, 1990 to 2009

	Gg CO_2 eq							
Greenhouse gas	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Change 1990–2009 (%)*
CO_2	5 091 601.76	5 414 691.17	5 966 222.25	6 104 817.98	6 110 795.73	5 911 797.22	5 496 281.94	8.0
CH_4	671 657.88	673 676.73	645 569.69	621 636.07	644 579.59	664 782.73	678 448.96	1.0
N_2O	311 515.99	337 952.47	327 745.70	313 073.27	306 826.24	299 146.04	287 351.70	–7.8
HFCs	36 924.10	62 242.64	103 195.11	120 226.91	129 523.42	129 383.12	125 676.33	240.4
PFCs	20 759.93	15 587.02	13 479.45	6 194.63	7 523.64	6 663.82	5 626.92	–72.9
SF_6	34 352.69	29 322.11	20 130.67	19 010.00	16 650.14	16 139.07	14 840.92	–56.8

Table 2
Greenhouse gas emissions by sector, 1990 to 2009

	Gg CO_2 eq							
Sector	*1990*	*1995*	*2000*	*2005*	*2007*	*2008*	*2009*	*Change 1990–2009 (%)*
Energy	5 287 795.97	5 611 390.10	6 168 025.35	6 282 795.68	6 290 737.78	6 116 599.06	5 751 105.53	8.8
Industrial processes	315 785.06	336 181.85	348 843.09	334 079.55	350 932.67	331 706.62	282 881.29	–10.4
Solvent and other product use	4 404.02	4 587.52	4 879.50	4 387.15	4 387.15	4 387.15	4 387.15	–0.4
Agriculture	383 599.09	411 533.48	410 645.26	418 782.32	425 767.85	426 256.62	419 347.29	9.3
LULUCF	–846 554.88	–795 375.72	–540 259.93	–1 027 881.75	–1 013 383.98	–1 007 251.51	–990 061.78	17.0
Waste	175 228.20	169 779.20	143 949.69	144 914.16	144 073.30	148 962.54	150 505.51	–14.1
Other	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	**5 320 257.47**	**5 738 096.42**	**6 536 082.96**	**6 157 077.11**	**6 202 514.77**	**6 020 660.47**	**5 618 164.99**	**5.6**
Total (without LULUCF)	**6 166 812.35**	**6 533 472.14**	**7 076 342.89**	**7 184 958.86**	**7 215 898.75**	**7 027 911.98**	**6 608 226.77**	**7.2**

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

II. Technical assessment of the inventory submission

A. Overview

1. Inventory submission and other sources of information

5. The 2011 inventory submission was submitted on 13 April 2011. It contains a complete set of common reporting format (CRF) tables for the period 1990–2009 and a national inventory report (NIR). The inventory submission was submitted 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).

6. Where necessary, the expert review team (ERT) also used previous years' submissions during the review. During the review, the United States provided the ERT with additional information and documents which are not part of the inventory submission but are in many cases referenced in the NIR. The full list of information and documents used during the review is provided in annex I to this report.

Completeness of inventory

7. The inventory generally covers all source and sink categories for the period 1990–2009 and is complete in terms of years and geographical coverage. A number of categories and subcategories have been reported as not estimated ("NE"), including:

(a) CO_2, CH_4 and N_2O emissions from gaseous fuel use in railways and navigation;

(b) CO_2, CH_4 and N_2O emissions from the use of biomass and other fuels in the United States territories (other (stationary fuel combustion));

(c) CO_2, CH_4 and N_2O emissions from the use of solid, gaseous, biomass and other fuels in military use (other (mobile fuel combustion));

(d) HFC-32 emissions from commercial refrigeration (CRF table 2(II).F);

(e) SF_6 emissions from miscellaneous SF_6 uses;

(f) CH_4 emissions from sludge in industrial wastewater handling and domestic and commercial wastewater handling;

(g) The net carbon stock change in living biomass and dead organic matter (DOM) in land converted to cropland and land converted to grassland;

(h) The net carbon stock change in each carbon pool in land converted to settlements and in land converted to other land.

8. The United States has provided explanations for these exclusions in the relevant sectoral chapters, in annex 5 to the NIR and in the CRF tables; the main reasons for reporting these categories as "NE" seem to be a lack of activity data (AD). The Party also notes that emissions from the categories correctly labelled as "NE" in the CRF tables are very low in comparison with the overall estimate of total GHG emissions, and that not including those categories introduces a very minor bias and does not impact the overall completeness of the inventory. The ERT takes note of the explanations provided by the Party; however, it emphasizes that omissions shall be kept at a level that does not impair the completeness of the inventory and its comparability with those of other Parties, in line with the UNFCCC reporting guidelines.

9. The ERT recommends that the United States further improve its coverage of categories in the inventory, particularly those categories for which 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 *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the *IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) provide methodologies and/or EFs, focusing resources, as appropriate, on improvements in line with the IPCC good practice guidance.

10. The United States does not report emissions from some other categories for which the IPCC does not provide default methodologies in either the Revised 1996 IPCC Guidelines or the IPCC good practice guidance; such categories include N_2O from caprolactam production, CH_4 from styrene production, CO_2 and CH_4 emissions from calcium carbide production, and CO_2 emissions from non-hazardous industrial waste incineration.

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

Overview

11. The ERT concluded that the institutional arrangements continue to perform their required functions.

Inventory planning

12. The NIR and additional information submitted by the Party during the review describe the institutional arrangements for the preparation of the inventory. The United States Environmental Protection Agency (EPA) is the lead federal government agency charged with compiling the annual GHG inventory: the Office of Atmospheric Programs (OAP) is responsible for the emission calculations provided in the inventory, as well as for the completion of the NIR and the CRF tables. The Office of Transportation and Air Quality (OTAQ) is also involved in calculating the emissions. OAP and OTAQ jointly coordinate the collection of AD and emission calculations at the individual category level, and ensure consistency and quality throughout the NIR and the CRF tables.

13. A wide range of agencies and individuals are involved in the preparation of the inventory, such as the Energy Information Administration of the Department of Energy (DOE); the Department of Agriculture (USDA); the Geological Survey (USGS); the Federal Highway Administration; the Department of Transportation; the Bureau of Transportation Statistics; the Department of Commerce; the National Agricultural Statistics Service; and the Federal Aviation Administration (FAA). Data-sharing arrangements have been made within the executive branch for additional federal government agencies to support the production of the annual GHG inventory in order to meet the United States' reporting commitments to the UNFCCC. The format of these arrangements can vary, although individual federal government agencies have their own mandate for data collection that feeds into the compilation of and calculations provided in the United States' inventory.

14. For example, DOE's Energy Information Administration (EIA) is responsible for gathering the official fuel production and consumption statistics and there is a formal memorandum of understanding on data-sharing between EIA and EPA regarding the national fuel consumption statistics used in the Party's inventory. Academic and research

centres provide AD and calculations to EPA, as well as individual companies participating in voluntary outreach efforts with EPA.

15. The United States' inventory is prepared in a decentralized manner; emission calculations for individual categories are the responsibility of individual category leads in different organizations, who also determine the most appropriate methodology, collect the best AD to use in the emission calculations, based upon their expertise in the category, and coordinate with researchers and contractors familiar with the categories.

Inventory preparation

Key categories

16. The United States has reported key category tier 1 and tier 2 analyses, both level and trend assessment, as part of its 2011 submission. The tier 1 key category analysis performed by the Party and that performed by the secretariat[2] produced similar results. The Party has also applied a qualitative approach in determining its key categories. The United States has included the LULUCF sector in its assessment of the key categories, which was performed in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. In line with the IPCC good practice guidance, the key categories are prioritized within the inventory and efforts are made on an ongoing basis to change and/or refine the calculation methods used to estimate emissions and removals from the key categories.

Uncertainties

17. The NIR states that an IPCC tier 2 uncertainty analysis has been performed and the results of this analysis are presented both at the summary level and at the individual category level. Annex 7 to the NIR further disaggregates the underlying information in the uncertainty analysis. The ERT noted that the United States has not followed the recommendation in previous review reports regarding the addition of columns containing information on the uncertainty of emission factors (EFs) and AD to the tables in annex 7 to the NIR. However, the Party provided additional information on uncertainties in an addendum to the annex to the NIR containing relevant data on uncertainty ranges for EFs and AD. The ERT encourages the United States to explore ways of including relevant information from the addendum to the annex to the NIR for its future inventory submissions.

18. The overall level uncertainty for the inventory has not changed significantly in the last four inventory submissions: minor shifts (approximately 1–2 per cent) in uncertainty ranges are observed, which could be attributed to changes in the contributions by categories to overall GHG emission levels and to the random nature of the Monte Carlo simulation.

Recalculations and time-series consistency

19. Recalculations have been performed and reported in accordance with the IPCC good practice guidance, mostly to reflect methodological and historical data changes. The rationale for these recalculations is provided in CRF table 8(b) and in detail in chapter 10 of

[2] 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.

the NIR. The major changes, and the annual average magnitude of the impact (with respect to previous estimates for the same category), include:

(a) For the energy sector, an increase in fugitive CH_4 emissions from natural gas systems and from oil systems;

(b) For the industrial processes sector, a decrease in N_2O emissions from nitric acid production and an increase in SF_6 emissions from electrical transmission and distribution;

(c) For the agriculture sector, an increase in CH_4 emissions from manure management;

(d) For the waste sector, a decrease in CH_4 emissions from landfills.

20. The United States provided recalculated estimates (CRF table 8(a)) and explanatory information for the period 1990–2008. The effect of the recalculations (as reported in the CRF tables) was an increase in CO_2 eq emissions excluding LULUCF of 0.9 per cent for the base year and an increase of 1.49 per cent for 2008.

Verification and quality assurance/quality control approaches

21. The United States has a quality assurance/quality control (QA/QC) plan entitled "Quality Assurance/Quality Control and Uncertainty Management Plan for the United States Greenhouse Gas Inventory: Procedures Manual for QA/QC and Uncertainty Analysis", which stipulates tier 1 procedures for the entire inventory. The key attributes of this plan are summarized in section 1.6 of the NIR. Where QA/QC activities for a particular category go beyond the minimum tier 1 level, further explanation is provided within the respective category section.

22. The ERT considers that the Party's QA/QC plan, as described in the NIR, is in accordance with the IPCC good practice guidance. Both tier 1 (general) and tier 2 (category-specific) QC activities and checks are performed in line with the IPCC good practice guidance. The inventory is also subjected to QC through a public review by the United States. Information on the QC procedures performed in individual sectors is provided in the sectoral chapters of the NIR. During the review, the United States also informed the ERT that it is making efforts to standardize its documentation and archiving processes to strengthen the QA of the inventory. Given the decentralized approach to the preparation of the inventory, the ERT reiterates the recommendation in previous review reports that the United States include additional information in the general description of QA/QC activities in the NIR, including an explanation of the QA/QC procedures applied by the major data providers outside the inventory agency.

Transparency

23. In general, the NIR provides sufficient information on the methodologies and approaches used in the inventory preparation process and follows the structure outlined in the UNFCCC reporting guidelines. Detailed information on the methodologies used, the key category analysis and the uncertainty analyses is included in annexes to the NIR. However, the ERT identified areas where greater transparency is needed, for example in the energy and LULUCF sectors. Sector-specific recommendations on transparency are provided in the relevant sector chapters of this report.

24. The ERT noted that, for a number of categories for which the emission estimates are calculated in accordance with the *2006 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines), the emissions and removals are not reported in line with the UNFCCC reporting guidelines, but rather are aggregated at a higher level (e.g. for industrial energy uses, non-energy use of fuels, and

forest land). While the 2006 IPCC Guidelines represent an authoritative source of information, their use should not decrease the overall transparency of the inventory submission. To increase the transparency of the reporting and to avoid confusion, the ERT recommends that the United States enhance the reporting of the methods and EFs used in the CRF tables and in the NIR in a consistent manner and in accordance with the UNFCCC reporting guidelines.

25. The ERT noted that the NIR still contains limited information on the emissions reported under "U.S. territories", despite recommendations in previous review reports. In response to questions raised by the ERT during the review, the Party stated that it has been considering the use of resources needed to improve current data collection approaches for these territories. The ERT recommends that the United States improve the information on emissions from the "U.S. territories" in its future inventory submissions.

26. In CRF table summary 3, the United States sometimes uses notation keys (e.g. "D", "T1", "T2" or "T3") in reference to the methodological levels defined in the 2006 IPCC Guidelines, which are not always in accordance with the Revised 1996 IPCC Guidelines or the IPCC good practice guidance. To increase the transparency of reporting, the ERT recommends that the United States provide descriptions of the methods and EFs in relation to the IPCC good practice guidance and the Revised 1996 IPCC Guidelines.

Inventory management

27. The United States has a centralized archiving system, which includes the archiving of disaggregated EFs and AD, and documentation on how these factors and data have been generated and aggregated for the preparation of the inventory. The archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key categories and key category identification, and planned inventory improvements. The inventory coordinator at EPA also collects descriptive text and annexes for the categories and aggregates the emission estimates into a summary spreadsheet that links together individual category spreadsheets and contains all essential data. In addition, other data used in the executive summary, introduction, and recent trends section of the inventory report are also contained in the summary spreadsheet. All EFs at a disaggregated level, AD and documentation are retained both by inventory category leads and centrally by the inventory coordinator.

3. Follow-up to previous reviews

28. In response to previous review reports, the United States has implemented several improvements in its 2011 submission, in particular with regard to the completeness of the submission and the use of higher-tier estimation methodologies. However, other recommendations made in previous review reports have not yet been implemented, such as:

(a) The improvement of the information on the United States territories;

(b) The inclusion in the NIR of information on the QA/QC activities applied by the major data providers outside the inventory agency.

4. Areas for further improvement

Identified by the Party

29. The 2011 NIR identifies areas for improvement. In particular, it provides a list of specific areas that require further research, such as:

(a) The incorporation of excluded emission categories;

(b) The improvement of the accuracy of the EFs;

(c) The collection of detailed AD.

30. It also identifies the following areas which deserve further attention in order to improve the quality of the uncertainty estimates:

(a) The refinement of the categories and overall uncertainty estimates;

(b) The inclusion of a global warming potential uncertainty in the estimation of the overall level and trend uncertainty;

(c) The improvement of the characterization of the trend uncertainty associated with the base year inventory estimates.

Identified by the expert review team

31. During the review, the ERT identified cross-cutting issues for improvement. These are listed in paragraph 115 below.

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

B. Energy

1. Sector overview

33. The energy sector is the main sector in the GHG inventory of the United States. In 2009, emissions from the energy sector amounted to 5,751,105.53 Gg CO_2 eq, or 87.0 per cent of total GHG emissions. Since 1990, emissions in the energy sector have increased by 8.8 per cent. The key drivers for the rise in emissions are the increases in emissions from public electricity and heat production and road transportation. Within the sector, 37.8 per cent of the emissions were from energy industries, followed by 30.0 per cent from transport, 12.8 per cent from manufacturing industries and construction and 9.9 per cent from residential and commercial combustion. Fugitive emissions from oil and natural systems accounted for 5.0 per cent. Other combustion (including non-energy use) and solid fuels accounted for the remaining 3.2 per cent and 1.3 per cent, respectively.

34. The ERT considers that the 2011 inventory submission for the energy sector is not sufficiently transparent in several aspects. All non-energy use of fuels, including non-energy use in the United States territories, is reported under the energy sector (other (stationary combustion). Moreover, all subcategories under manufacturing industries and construction, petroleum refining, manufacture of solid fuels and agriculture/forestry/fisheries are grouped together under the subcategory other (manufacturing industries and construction). The ERT considers that this reporting both reduces the transparency of the inventory and undermines the comparability with other Annex I Parties. The ERT reiterates previous recommendations that the Party improve the transparency of the reporting for these categories at the most disaggregated level, in line with the UNFCCC reporting guidelines.

35. During the review, the ERT asked the United States to provide a justification for the use of the 2006 IPCC Guidelines for estimating and reporting GHG emissions from fossil fuel combustion. The Party indicated that the use of the most recently published calculation methodologies by the IPCC, as contained in the 2006 IPCC Guidelines, was fully in line with the IPCC good practice guidance on methodological choice to improve rigour and accuracy, and had been recognized by the Subsidiary Body for Scientific and Technological Advice in its conclusions at its thirtieth session. The ERT notes that the UNFCCC reporting

guidelines[3] state that all Annex I Parties shall use the Revised 1996 IPCC Guidelines and the IPCC good practice guidance to estimate and report GHG emissions and removals by sinks. During the review, the United States also noted that the UNFCCC reporting guidelines allow the use of different methods from the Revised 1996 IPCC Guidelines to produce more accurate estimates. The ERT recommends that the United States endeavour to follow the UNFCCC reporting guidelines, without compromising accuracy, in order to improve the comparability of its emission estimates with those of other Annex I Parties.

36. In terms of completeness, a number of categories in the 2011 submission are reported as "NE" due to a lack of relevant AD, such as: CO_2, N_2O and CH_4 emissions from the combustion of biomass and other fuels used in the United States territories, as well as CO_2, N_2O and CH_4 emissions from solid, gaseous, biomass and other fuels for military use. The ERT recommends that the United States obtain the necessary activity data to prepare emission estimates for the combustion of biomass and other fuels used in United States territories, focusing resources, as appropriate, on improvements in line with the IPCC good practice guidance, and report them in future inventory submissions. The ERT also recommends the Party, in future inventory submissions, to ensure that emissions from solid fuels, gaseous fuels, biomass, and other fuels used by the military are either also estimated and reported or that the appropriate notation key is used.

37. During the review, the ERT requested that the Party provide an informed estimate of the potential underestimation in total GHG emissions in 2009. The ERT also asked the Party whether the improved reporting to EPA from facilities emitting more than 25,000 t CO_2/year is expected to lead to significant recalculations in the 2012 submission due to the estimation of new categories and improvements to the categories that are currently estimated. The United States informed the ERT that the emissions from categories reported as "NE" are very low in comparison with the overall estimate of total GHG emissions and that not including those categories introduces a very minor bias which does not impact the overall completeness of the inventory. The Party also expects that any recalculations of data as a result of new data from the EPA GHG Reporting Program to be used in future inventory submissions are likely to be unnoticed in the aggregate totals. The ERT recommends that the Party estimate emissions from all categories currently reported as "NE" for which methods and/or EFs are available in the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance in its future inventory submissions, focusing resources, as appropriate, on improvements in line with the IPCC good practice guidance.

2. Reference and sectoral approaches

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

38. The ERT considers that the reference approach has not been calculated in accordance with the Revised 1996 IPCC Guidelines. For example, the notes to CRF table 1.A(b) refer to corrections made to stock changes to take into account feedstocks in industrial processes. CRF table 1.A(d) is designed to include such non-energy use corrections. Further, the apparent energy consumption (excluding non-energy use and feedstocks) in CRF table 1.A(c) is negative, and the differences in energy consumption between the reference and the sectoral approach are as high as 101 per cent. The ERT recommends that the Party estimate and report the reference approach by strictly following the Revised 1996 IPCC Guidelines.

39. The main source of AD used for the estimation of GHG emissions from energy combustion is EIA. There are a number of differences between the energy data reported by EIA to EPA and the energy data reported by EIA to the International Energy Agency (IEA).

[3] See FCCC/SBSTA/2006/9.

During the review, the ERT asked the Party to clarify whether the data reported to IEA via the Joint Energy Questionnaires were consistent with EIA's annual and/or monthly energy reviews, used in the preparation of the inventory, regarding the methods and calorific values. In addition, previous review reports have identified that the CRF totals are systematically smaller than the IEA data. During the review, the United States informed the ERT that it did not have any information on why the IEA values differ from the values supplied by EIA to IEA. The ERT notes that EIA is the main source of AD for the energy sector of the inventory, and it is also the institution responsible for submitting the energy balances to IEA. The ERT recommends that the United States investigate these differences and include relevant additional information in its future inventory submissions.

International bunker fuels

40. Based on the information provided in the NIR, aviation bunkers in the United States appear to be estimated as the residual fuel from EIA's total jet consumption and modelling results for domestic flights using the AEDT/SAGE model. In response to a question by the ERT during the review, the Party clarified that FAA is currently updating its AEDT model, which will form the basis of modelling runs to be used in future inventories. The United States explained that FAA and EPA are currently working together to ensure that the territory definitions according to the AEDT model match the definitions used in the inventory submitted to the UNFCCC.

41. In response to a question by the ERT during the review for further clarification as to whether the national total GHG emissions exclude emissions from flights between the United States and its territories, and whether one can conclude that since EIA's total jet fuel consumption includes the United States territories (emissions from the United States territories would be included under international aviation), the United States responded that flights between the United States and its territories are considered domestic flights and that it is currently verifying that modelled data from FAA reflect this correct allocation for the United States territories. The ERT recommends that the Party ensure that these emissions are allocated to civil aviation under the energy sector and increase the transparency of its reporting with regard to the allocation of emissions between the United States and its territories in its future inventory submissions.

42. Emissions from multilateral operations have been reported as "NE" in CRF table 1.C. However, emissions from international military flights have been reported under aviation bunkers together with commercial aviation. During the review, the United States informed the ERT that its Department of Defense (DOD) provides data on international aviation and maritime consumption, as described in annex 3.7 to the NIR, "Methodology for Estimating Emissions from International Bunker Fuels used by the United States Military". The Party also informed the ERT that data on fuel consumption at DOD military bases are included in EIA's statistics for the commercial and institutional sectors, and reported under commercial and institutional in the CRF tables. The ERT recommends that the Party assess whether emissions from multilateral operations can be reported separately, while respecting the United States' principles of confidentiality. If emissions cannot be reported separately, the ERT recommends that the United States improve the use of the notation keys and replace "NE" by "IE" (included elsewhere) in its future inventory submissions.

43. The United States reports that its international shipping emissions have decreased by 18 per cent since 1990. This is despite a global trend of increasing international freight transport demand and emissions. During the review, the United States informed the ERT that the decreasing trend is both a product of the uncertainty in the underlying data used in the calculations, as well as a potential outcome in ship fuelling cost-saving practices. The

ERT encourages the United States to improve the quality of its GHG estimates as well as the description of the trends regarding maritime transport in future inventory submissions.

Feedstocks and non-energy use of fuels

44. Despite recommendations from previous review reports, the United States continues to allocate emissions from non-energy use of fuels under the energy combustion sector (category other (energy) as reported in CRF table 1.A(d)). Non-energy use of fuels in the United States territories has also been reported under the subcategory other stationary combustion. This reporting is not consistent with the UNFCCC reporting guidelines and the Revised 1996 IPCC Guidelines. The ERT recommends the Party to allocate emissions from non-energy use to the industrial processes sector, as defined in the UNFCCC reporting guidelines, in its future inventory submissions. During the review, the United States expressed the view that its country-specific methodology to estimate emissions from and storage in feedstocks and non-energy use of fuels is the most accurate approach, and thus in line with the IPCC good practice guidance. The Party also stated that it will continue its efforts to improve the transparency of this approach and conduct an assessment of the data received through the EPA GHG Reporting Program to assess any improvements that could be made to this category. The ERT looks forward to this assessment and strongly recommends that the United States improve the transparency of its reporting by allocating these emissions to the correct categories in accordance with the UNFCCC reporting guidelines and the Revised 1996 IPCC Guidelines.

Country-specific issues

45. During the review, the ERT asked the United States to clarify why the emissions associated with CO_2 exported to Canada are not accounted for in the inventory if these emissions originate from a combustion activity that takes place in the United States. The Party responded that the CO_2 emissions were the result of fuel combusted in the state of North Dakota that had been captured and then transported through a pipeline to Saskatchewan in Canada. Since the CO_2 was not emitted in the United States, the energy used to produce the CO_2 was subtracted from the energy consumption statistics. Moreover, the ERT asked the United States to clarify whether the primary energy input to electricity production which is then exported to Canada (using the Eastern and Western Interconnects) and to Mexico (using the Western and the Texas Interconnect) would also be subtracted from U.S. energy consumption statistics. The United States confirmed that emissions from electricity generation facilities located in the United States are included in the United States totals for electricity generation. The ERT recommends the Party to include these explanations in its future inventory submissions to improve the understanding in the treatment of exported CO_2 and electricity to neighbouring countries.

46. The ERT also asked the United States to clarify why EIA data on non-energy fuel use and carbon contents are corrected to account for net exports, as stated in the NIR. The Party responded that EIA corrects its data on total petrochemical feedstocks entering the United States economy taking into account imports and exports of certain products that do not cover all imports and exports that are relevant to the mass balance calculated by the NEU model. The ERT recommends that the Party increase the transparency of its reporting on non-energy fuel use, whether for export or other purposes, and follow the rules regarding the allocation of emissions as described in the UNFCCC reporting guidelines and the Revised 1996 IPCC Guidelines. During the review, the Party informed the ERT that it believes its country-specific methodology to estimate emissions and storage from feedstocks and the non-energy uses of fuels is the most accurate approach, and thus in line with good practice, to assess this large and complex industry in the United States, but that it will continue its efforts to improve the transparency of its approach.

3. Key categories

Stationary combustion: all fuels – CO_2, N_2O and CH_4

47. The key categorization for the United States has been carried out at the aggregated level under stationary combustion for each fossil fuel separately. The ERT recommends the United States to determine its key categories at the level at which the IPCC methods are described, in line with the IPCC good practice guidance, in order to better prioritize resources for inventory improvement. The ERT also notes that the Party uses low tier methods and IPCC default EFs for the estimation of CH_4 and N_2O emissions from key categories under stationary combustion. This reduces the accuracy of CH_4 and N_2O estimates. During the review, the United States informed the ERT that it has updated its calculation approach by using a tier 2 method for estimating CH_4 and N_2O emissions from fuel combustion at electricity-generating power plants in its 2012 inventory submission. The ERT takes note of and welcomes this improvement by the United States. The ERT recommends the Party to improve the disaggregation at which key categories are both determined and their emissions reported in order to improve the comparability of the United States emission estimates with other Annex I Parties.

48. As part of the Party's planned inventory improvements, facilities emitting more than 25,000 t CO_2 eq/year from stationary combustion will have to calculate and report their GHG emissions, starting in 2010, to EPA through the GHG Reporting Program. According to the NIR, these data will be used in future inventories to improve the emission calculations through the use of higher-tier methodological data. During the review, the ERT asked the United States to confirm whether some of these improvements will be incorporated in the 2012 inventory submission. The Party responded that it had already begun an assessment of ways to improve the inventory using the data from the EPA GHG Reporting Program. The ERT looks forward to the implementation of these improvements. The ERT recommends that the United States estimate the emissions from key categories using higher-tier methods and report any data improvements from the EPA GHG Reporting Program in a transparent way in its future inventory submissions. The ERT also recommends that the Party document, in the NIR of its future inventory submissions, how it will ensure the time-series consistency of the recalculated data.

49. The descriptions in the NIR are far more transparent and complete than the information provided in the CRF tables. All subcategories under manufacturing industries and construction, petroleum refining, manufacture of solid fuels and agriculture/forestry/fisheries are reported as "IE" under the subcategory other (manufacturing industries and construction). This reduces the transparency of the reporting and the comparability of the emission estimates with the estimates of other Annex I Parties. During the review, the Party informed the ERT that it uses national-level energy consumption data from the EIA and that its statistical methods result in an aggregated data set that does not provide categorizations matching the CRF tables.

50. The ERT cannot find any objective reasons for not estimating and reporting the emissions from the subcategories mentioned in paragraph 49 above in accordance with the UNFCCC reporting guidelines and the Revised 1996 IPCC Guidelines, given the long record of reporting of detailed energy balances to the IEA by the United States. The ERT believes there should be good methodological agreement between the energy data reported in the energy balance and the activity data reported in the CRF tables, particularly for industrial branches. The ERT asked the United States to explain whether the aggregation of emissions, which is not in line with the Revised 1996 IPCC Guidelines, would be resolved in the 2012 inventory submission. The Party responded that efforts were under way to collect data for the EPA GHG Reporting Program, which will provide further information on fossil fuel combustion operations at industrial facilities. In addition, the United States

confirmed that it has already begun an assessment of ways to improve the inventory using the EPA GHG Reporting Program data. The ERT welcomes these planned improvements and strongly recommends that the Party report a full GHG inventory for all categories required in the CRF tables in accordance with the UNFCCC reporting guidelines and the Revised 1996 IPCC Guidelines. The ERT also recommends that the United States strive to improve the link between its energy balance and the activity data reported in the CRF tables, and reflect the data reported to the EPA via the GHG Reporting Program in future inventory submissions, to the extent possible.

51. The United States estimates emissions from fossil fuels on the basis of gross calorific values (GCVs). During the review, the Party informed the ERT that all EFs used in the inventory are based on GCV energy units and that any use of IPCC default EFs (which are in net calorific values (NCVs)) have been converted, using standardized conversions, in order to be consistent with the United States' energy units. However, the ERT noted that the carbon content values of the fuels in the reference approach are generally lower than the default values provided in the Revised 1996 IPCC Guidelines or by other Annex I Parties and that this difference could not be explained by the conversion of GCVs to NCVs alone. The United States informed the ERT that the derivation of country-specific carbon content values is described in annex 2.2 to its NIR, and that the carbon content of fuels described in the annex reflects the national circumstances of the United States. For non-CO_2 EFs, where the United States uses IPCC default values, the ERT finds that the EFs in annex 3 to the NIR are significantly different to those from the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. Given the importance of calorific values and EFs in determining GHG emissions, and in order to improve the transparency of the information in annexes 2 and 3 to the NIR, the ERT recommends that the United States expand the current description in the main part of the NIR ('determine the total C content of fuels consumed') to briefly describe how EFs are derived for CO_2, CH_4 and N_2O taking into account both the link between GCVs and NCVs and between country-specific and default EFs.

52. The United States performed a number of recalculations in its 2011 inventory submission. There was a major recalculation of fugitive CH_4 emissions from natural gas systems, in both absolute and relative terms. As described in the NIR, the net effect was an increase of CH_4 emissions from natural gas systems between 47 per cent and 120 per cent each year between 1990 and 2008 compared with the previous inventory submission. The recalculations were largely due to methodological changes to gas well clean-ups and the addition of gas well completions and workovers with hydraulic fracturing. The ERT commends the United States for this methodological improvement and the transparency of the description in its NIR.

4. Non-key categories

Stationary combustion – waste incineration – CO_2, N_2O and CH_4

53. The NIR states that "almost" all incineration of municipal solid waste (MSW) occurs at waste-to-energy facilities and industrial facilities where useful energy is recovered. During the review, the ERT asked the United States to clarify the method used to estimate the emissions from the remaining (smaller) part of incinerated MSW. The Party informed the ERT that there is no separate estimate of waste incineration without energy recovery due to a lack of data but that all emissions have been included under waste incinerated for energy recovery. The Party also informed the ERT that hazardous waste incineration of organic materials (assumed to be fossil-derived), where regulated waste is burned without energy recovery, and burning of fossil-derived materials for energy recovery are included within the analysis of the emissions from and storage in non-energy use of fossil fuels. The ERT recommends that the Party allocate the emissions from the

incineration of hazardous waste to the correct categories in line with the IPCC good practice guidance and the UNFCCC reporting guidelines and increase the transparency of the description of the method used to estimate emissions from all waste streams in its future inventory submissions.

Domestic navigation: liquid fuels – CO_2, N_2O and CH_4

54. Section 3.9 of the NIR on bunker fuels states that international marine bunkers comprise emissions from fuels burned by ocean-going ships of all flags engaged in international transport, including fishing. During the review, the United States clarified that combustion emissions from fishing boats are reported under the transportation sector under domestic navigation (transport) in the CRF tables. The ERT considers that these emissions are indeed included in the national totals but notes that they are not reported in line with the UNFCCC reporting guidelines. The United States does not report emissions under agriculture/forestry/fisheries and all emissions from this category are reported as "IE" under the subcategory other (manufacturing industries and construction). The ERT is of the view that it is more intuitive to report emissions from fishing boats under navigation (transport) than under other (manufacturing industries and construction) but recommends that the Party follow the allocation rules described in the Revised 1996 IPCC Guidelines and the UNFCCC reporting guidelines in future inventory submissions. The ERT also recommends that the Party ensure consistency between the information reported in the CRF tables and in the NIR.

C. Industrial processes and solvent and other product use

1. Sector overview

55. In 2009, emissions from the industrial processes sector amounted to 282,881.29 Gg CO_2 eq, or 4.3 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 4,387.15 Gg CO_2 eq, or 0.1 per cent of total GHG emissions. Since 1990, emissions have decreased by 10.4 per cent in the industrial processes sector, and decreased by 0.4 per cent in the solvent and other product use sector.

56. The key drivers for the fall in emissions in the industrial processes sector are the reductions in emissions from iron and steel production, metallurgical coke production, ammonia production and urea consumption, adipic acid production, hydrochlorofluorocarbon-22 (HCFC-22) production, aluminium production and cement production. Within the industrial processes sector, 37.1 per cent of the emissions were from refrigeration and air-conditioning equipment, followed by 14.9 per cent from iron and steel production, 10.3 per cent from cement production and 5.1 per cent from nitric acid production. SF_6 emissions from electrical equipment accounted for 4.5 per cent and other chemical products accounted for 4.2 per cent. The remaining 23.8 per cent were from a variety of miscellaneous categories.

57. The ERT noted a large decrease in sectoral emissions between 2008 and 2009: the 2009 emissions are 14.7 per cent lower than the 2008 emissions. This inter-annual variation is mainly the consequence of the decrease in emissions from metal production, chemical industry, production of halocarbons and SF_6, and mineral products. The ERT commends the United States for the information provided at each category level with regard to the significant decline in emissions due to the recent economic recession. This reduction is partially offset by an increase in emissions from the consumption of halocarbons and SF_6, specifically fire extinguishers, semiconductor manufacture and foam blowing.

58. This sector is generally complete and covers more categories than provided for by the IPCC methodologies, and in this regard the ERT commends the United States for the efforts undertaken to identify and report on additional categories and activities. The CRF

tables provide an almost complete set of emission estimates. The exclusion of N_2O emissions from caprolactam production, for example, is justified in annex 5 of the NIR although the methodology for this source of emission estimates was only introduced in the 2006 IPCC Guidelines, but some categories are still reported as "NE" such as: CO_2 emissions from graphite consumption in ferroalloys and steel production, CO_2 emissions from calcium carbide production, and ethylene production; and SF_6 emissions from miscellaneous uses.

59. The ERT noted some inconsistency in the use of notation keys for some categories, such as CO_2 emissions from ethylene, which were reported as "NE", although emissions from this activity were accounted for under non-energy use of fossil fuels in the energy sector (page 4-26 of the NIR). The ERT considers that the correct notation key should be "IE", although this procedure is not in accordance with the IPCC good practice guidance. In addition, CO_2 emissions from food and drink production are included under the subcategory other (chemical industry)", as stated in the NIR (page 4-32) "…producing CO_2 from naturally occurring CO_2 reservoirs for use in both EOR and in other commercial applications (e.g. chemical manufacturing, food production)". The ERT reiterates the recommendation from the previous review report that the United States revise the use of notation keys in its future inventory submissions.

60. The Party reported on the progress made with regard to the implementation of the EPA GHG Reporting Program; in 2010 the industrial plants started the collection of data, which will help to improve the accuracy of the estimates of emissions from categories in the industrial processes sector. The ERT welcomes this improvement and again encourages the Party to pursue its efforts even if these new mandatory reporting rules are not yet reflected in the 2011 submission.

2. Key categories

Cement production – CO_2

61. Estimates from this category were based on IPCC tier 2 default values for the cement kiln dust (CKD) correction factor and clinker EF, although a higher-tier method is expected to be used for the estimation of emissions from this key category in its future inventory submissions due to the EPA's GHG Reporting Program, which will provide plant-specific data, thereby increasing the accuracy not only of this category but also of the entire sector.

62. The ERT encourages the Party to include an explanation of the magnesium oxide (MgO) content in cement in the sectoral emissions chapter of its future inventory submissions, as discussed with the Party during the review. As MgO may also arise from a non-carbonate source and because the MgO content in Portland cement is kept deliberately low, the true MgO emissions from carbonate are likely to be very small. Given the fact that the assumption of a 100 per cent carbonate source for the CaO already leads to an overestimation of emissions (there is likely to be at least some contribution of CaO from non-carbonate sources) and the fact that some of the MgO is also likely to be from a non-carbonate source, a correction for MgO is not required for a tier 2 calculation.

63. As cement production is a key category, the ERT reiterates the recommendation from the previous review report that the United States use a higher-tier method to estimate emissions from cement production and also develop country-specific values for the clinker and CKD EFs, focusing resources as appropriate on improvements in line with the IPCC good practice guidance.

Ammonia production – CO_2

64. During the review, the United States provided additional explanations on the use of country-specific EFs for the estimation of emissions from ammonia production. The ERT encourages the Party to incorporate this information in the next version of its NIR in order to improve the description of its methodological approach. The ERT noted that not allocating all emissions from ammonia production under the industrial processes sector is not in accordance with the Revised 1996 IPCC Guidelines (page 2.16). The ERT recommends that the Party report emissions in line with the Revised 1996 IPCC Guidelines in its future inventory submissions. Also, the ERT noted that the Party has not included in the NIR a CO_2 balance including the amounts of carbon temporarily stored, as previously recommended by the ERT. In addition, the ERT encourages the United States to assess the EF data for the period 1990–2000 from plant-specific information to be gathered through the EPA GHG Reporting Program and to recalculate the CO_2 emissions from ammonia production for the whole time series. The ERT welcomes both the planned efforts to identify consistent data sources for urea consumption and its related emissions reporting, and the exhaustive discussion regarding the EF on page A-359 to the NIR, which increases the transparency of reporting on the category.

Nitric acid production – N_2O

65. N_2O emissions from this category were estimated using an IPCC tier 2 method, which involves multiplying the nitric acid production by the weighted average EF calculated from the default values contained in the 2006 IPCC Guidelines in relation to the type of plant technologies used in the country. The ERT commends the Party for having applied a weighted average EF, which increases the accuracy of the inventory, and for the clear explanation in the NIR. The ERT expects the Party to use a higher-tier method to estimate emissions from nitric acid production in its future inventory submissions due to the availability of data from the EPA GHG Reporting Program.

Adipic acid production – N_2O

66. The United States use both tier 2 and tier 3 methods from the 2006 IPCC Guidelines to estimate N_2O emissions from adipic acid production. The NIR text is transparent regarding the application of a tier 3 method for some of the plants, as well as the description of the abatement technologies used by these plants, which have led to a reduction in emissions due to the emission control systems in place. For the remaining plants, tier 2 default EF values were used, which were discounted (using a default value from the 2006 IPCC Guidelines as the correcting factor) to take into account the impact of emission control technologies. The ERT welcomes the efforts of the Party to provide estimates based on the continuous emission monitoring control systems used by the plants that are able to provide such plant-specific data.

Iron and steel production – CO_2 and CH_4

67. The ERT noted that the United States has not differentiated the technology types used in coking plants (recovery and non-recovery of by-products) for the estimation of CH_4 emissions. This could lead to an overestimation of CH_4 emissions because the IPCC literature, which refers to the Best Available Techniques Reference (BREF) document 2001, does not cite the different types of coke oven technology. The ERT encourages the Party to undertake efforts to gather data regarding the national production of coke oven plants that comes from non-recovery by-product technology, in order to increase the accuracy of the CH_4 emission estimates from this category.

68. The ERT noted that table 4-50 of the NIR makes no reference to basic oxygen furnace (BOF) gas collection and further use in steel mills or as a fuel gas in a stationary

combustion category due to its high carbon monoxide (CO) content. Considering the potential use of BOF gas as a fuel gas in different activities in steel mills or its sale to a third party, the ERT encourages the Party to undertake research to check whether the iron and steel industry collects and uses BOF gas as a fuel source in its own activities or if some BOF gas is exported as fuel gas.

69. The ERT noted that in the carbon balance for the CO_2 emission estimates for coke plants in the 2011 submission, the Party has not accounted for natural gas as a carbonaceous material due to a lack of data from coke plants, which represent 20 per cent of total national coke production (according to the information provided during the review (taken from an EPA paper from 2000)). The ERT welcomes the suggested estimation method for CO_2 emissions discussed with the Party during the review. The suggested approach should lead to the estimation of more accurate emissions from coke plants. The ERT recommends that the Party include the explanation of this method, provided to the ERT during the review, in its future inventory submissions, as these emissions should be recalculated. However, the Party should ensure that these emissions are not double counted in the energy sector.

70. The ERT encourages the Party to include a detailed carbon balance in the iron and steel section of the industrial processes chapter in its future inventory submissions in order to improve the transparency of the inventory.

Production of HCFC-22 – HFC-23

71. The methodology applied to estimate HFC-23 emissions from HCFC-22 production uses plant-specific data from 2006 to 2008. For 2009, no data were available at the time of the preparation of the inventory and Monte Carlo simulation errors from 2006 were applied to the estimates. The ERT recommends that the Party recalculate these emissions for its future inventory submissions using AD from the EPA GHG Reporting Program.

72. The significant decline in emissions from production of HCFC-22 and the inter-annual variation during the period 2008–2009 were described in the NIR. The 27 per cent decrease in HCFC-22 production and 46 per cent fall in HFC-23 emissions were due to the recovery and destruction technologies implemented by the industry and to the expectations of an HCFC-22 phase-out by 2020 under the United States Clean Air Act as a non-feedstock use, which has been a major driver for the reduction in production levels.

Ozone-depleting substance substitutes – HFCs and PFCs

73. Emissions from refrigeration and air-conditioning equipment accounted for 37.1 per cent of total sectoral emissions. The end-use sectors that contributed the most towards emissions of HFCs and PFCs as ozone-depleting substance (ODS) substitutes include refrigeration and air-conditioning equipment (104.9 Tg CO_2 eq, or approximately 87 per cent), aerosols and foams. Within the refrigeration and air conditioning end-use sector, motor vehicle air conditioning was the highest emitting end-use, followed by refrigerated retail food and transport. The estimation method used in the 2011 submission was the Vintaging model of ODS-containing equipment and products. It was used to estimate the actual – versus potential – emissions of various ODS substitutes, including HFCs and PFCs. This model is explained in detail in annex 3.8 to the NIR.

74. The ERT welcomes the detailed description of the data-gathering process and the Vintaging model application as well as the discussion on the uncertainty analysis in the NIR and its annexes.

3. Non-key categories

Lime production – CO_2

75. CO_2 emissions from lime production were estimated using an IPCC tier 2 method and default values for the CaO or CaO + MgO content and for the lime kiln dust (LKD) correction factor. The EFs for both types of lime were calculated as the product of a constant reflecting the mass of CO_2 released per unit of lime and the average calcium plus magnesium oxide (CaO + MgO) content in lime. The ERT encourages the Party to use a higher-tier method for the estimation of emissions from lime production in its future inventory submissions as a result of the availability of data from the EPA GHG Reporting Program.

76. Considering the information in the NIR regarding the Party's plans to improve the lime and LKD EFs and the explanations provided by the Party during the review, the ERT commends the United States for making efforts to increase the accuracy and transparency of the inventory in its future inventory submissions and recommends that the Party include an explanation regarding the CaO and MgO content in lime in the chapter on lime production, as it relates to the LKD EF.

Limestone and dolomite use – CO_2

77. Emissions of CO_2 from limestone and dolomite use were estimated using an IPCC tier 2 method, which requires the quantity of limestone or dolomite consumed and the average carbon content, based on stoichiometry. The NIR provides an explanation in the chapter on the iron and steel category clarifying that the flux consumption in iron and steel industry was deducted from this category and incorrectly allocated (the Revised 1996 IPCC Guidelines request that all limestone and dolomite use be included in this category) under iron and steel production. The Party has provided an explanation for the different sources of information on limestone and dolomite consumption in iron and steel production, including data from the American Iron and Steel Institute and USGS. The ERT recommends that the Party include this emission category in its future inventory submissions, consistent with data collected through the EPA GHG Reporting Program.

Calcium carbide production – CO_2

78. CO_2 emissions from calcium carbide production were not estimated in the 2011 submission due to a lack of suitable data. Although this leads to an underestimation of emissions, this problem could be solved in the future when the EPA GHG Reporting Program starts to provide data, which will improve the completeness of the inventory. The CH_4 EF should have been reported using the notation key "NA" (not applicable) and its related emissions as "NE" with a comment explaining the difficulties in obtaining AD. The ERT recommends that the Party include this emission category in its future inventory submissions.

D. Agriculture

1. Sector overview

79. In 2009, emissions from the agriculture sector amounted to 419,347.29 Gg CO_2 eq, or 6.3 per cent of total GHG emissions. Since 1990, emissions have increased by 9.3 per cent. The key drivers for the rise in emissions is the general trend in dairy cattle and swine manure management towards a shift to large agricultural enterprises that utilize liquid storage systems. Within the sector, 48.8 per cent of the emissions were from agricultural soils, followed by 33.3 per cent from enteric fermentation, 16.1 per cent from

manure management and 1.7 per cent from rice cultivation. The remaining 0.1 per cent were from field burning of agricultural residues.

80. The United States' inventory for the agriculture sector is complete, as emissions for all years, categories and gases for the total national territory have been estimated.

81. The NIR is mostly transparent regarding the description of AD, methodologies, assumptions and EFs used to estimate emissions from all categories. However, the Party has not provided an explanation of the trends and inter-annual variability of the implied emission factors (IEFs). Therefore, the ERT encourages the United States to include, in its future inventory submissions, more detailed information regarding any changes in agricultural practices that influence the dynamics of animal productivity indices, the manure allocation per animal waste management system and, as a consequence, the IEFs.

82. The ERT noted that the results of the sector-specific QA/QC procedures have not been presented in a transparent manner in the NIR in line with the IPCC good practice guidance. In particular, if a tier 2 method or country-specific methodology is used to calculate emissions, the inventory agency should cross-check the country-specific parameters (i.e. the gross energy intake, the methane conversion rate, the volatile solids (VS) and nitrogen (N) excretion rates, the methane-producing capacity, the methane correction factor (MCF)) and the EFs against the IPCC defaults. Significant differences between country-specific parameters and IPCC default parameters should be explained and documented in the NIR. The ERT encourages the Party to include the results of the above-mentioned tier 2 QC procedures in its future NIRs. The ERT further recommends that the United States conduct a peer review of the cattle enteric fermentation model (CEFM), which employs an IPCC tier 2 approach in combination with an enhanced population characterization, by independent agricultural experts from academic institutions and undertake an analysis of data consistency between the agriculture and LULUCF sectors.

83. The Party has applied tier 2 and tier 3 methods to calculate GHG emissions from all major categories across the sector. The United States uses very accurate data on the cattle population that are based on the cattle transition matrix in the CEFM. The model uses USDA population estimates and weight data from 1 January to simulate the population of cattle from birth to slaughter and results in an estimate of the number of animals in a particular cattle group, while taking into account the monthly rate of weight gain, the average weight of the animals, and the death and calving rates. Agricultural soils are the biggest source of N_2O emissions and the United States uses the process-based model DAYCENT[4] in combination with a tier 1 approach from the 2006 IPCC Guidelines (for minor subcategories) for this category. The DAYCENT model was developed specifically for the conditions in the United States and represents the interaction of N inputs and the environmental conditions at specific locations (i.e. weather patterns and soil characteristics). The ERT acknowledges and encourages the efforts made by the Party to improve the accuracy of the calculations.

84. As data from the USDA 2007 Census of Agriculture are already available, the ERT recommends that the Party improve the accuracy of the emission estimates by incorporating these data into the county-level population estimates used for the agricultural soils category and the estimates of the MCF and use them to update the waste management system distributions for swine and dairy cattle in its future inventory submissions.

[4] Parton WJ, MD Hartman, DS Ojima and DS Schimel. 1998. DAYCENT: Its Land Surface Submodel: Description and Testing. *Global and Planetary Change*. 19: pp.35–48. Del Grosso SJ, WJ Parton, AR Mosier, MD Hartman, J Brenner, DS Ojima and DS Schimel. 2001. Simulated Interaction of Carbon Dynamics and Nitrogen Trace Gas Fluxes Using the DAYCENT Model. *In*: M Schaffer, L Ma and S Hansen (eds.). *Modeling Carbon and Nitrogen Dynamics for Soil Management*. Boca Raton, Florida: CRC Press. pp.303–332.

85. The United States applied a tier 2 approach (the Monte Carlo stochastic simulation technique) to estimate the uncertainties in the sector. The ERT found that the recalculations of emissions have not been followed by a corresponding revision of the uncertainty estimates. During the review, the Party explained that the actual inventory uncertainty may be slightly different from the current estimates. Nevertheless, the ERT considers that inconsistent estimates of emissions and uncertainties are not in line with the IPCC good practice guidance and recommends that the Party harmonize the uncertainty analysis with the updated results of emission calculations in its future inventory submissions.

86. The main reason for the recalculations performed by the Party in the 2011 submission was due to the use of more accurate data on the average weight and lactation rates of dairy cows, the animal population and the VS and N excretion values for a number of livestock subcategories as a result of the updated data from the USDA Census of Agriculture and the *Agricultural Waste Management Field Handbook*. The recalculations resulted in an increase in estimated CH_4 emissions by 1.8 per cent and a decrease in N_2O emissions by 2.0 per cent for 2008. In total, the recalculations led to a decrease in estimated emissions for 2008 by 0.3 per cent, from 427,528.47 Gg CO_2 eq to 426,256.62 Gg CO_2 eq. The ERT commends the Party for these improvements. To improve transparency, the ERT recommends that the Party include, in its future NIRs, tables with recalculated values for each category as well as an explanation of the impact of the recalculations on the sectoral and national total GHG emissions.

2. Key categories

Manure management – CH_4

87. The AD and methodology used to account for the reductions in CH_4 emissions due to the capture and destruction of biogas at facilities using anaerobic digesters are not transparently described in the NIR. During the review, the United States provided the ERT with a report entitled "Methodology for Improving Methane Emissions Estimates and Emission Reductions from Anaerobic Digestion System for the 1990–2007 Greenhouse Gas Inventory for Manure Management". Based on the analysis contained in the report, the ERT concluded that the proposed methodology is accurate and appears to be relevant for the national conditions. The ERT recommends the Party to include descriptive information from this report in future inventory submissions.

88. The temperature data used to estimate the MCFs were not updated for the current inventory. The ERT recommends that the Party obtain the necessary temperature values and revise the MCF values accordingly in its future NIRs and in the CRF tables.

3. Non-key categories

Manure management – N_2O

89. In the 2011 submission, the Party revised the N excretion (Nex) rates for livestock categories (except cattle) based on recently published data from the USDA 2008 *Agricultural Waste Management Field Handbook*. The ERT notes that the proposed Nex values, particularly for swine, are still very low, and using the methodology from the 2006 IPCC Guidelines would lead to a substantial increase (by 40–60 per cent) in the Nex values for most animal categories. The ERT encourages the United States to conduct a QC cross-check analysis of national Nex values with the IPCC default values and explain any significant differences.

Field burning of agricultural residues – CH_4 and N_2O

90. As stated in CRF table 4.F, the Party did not estimate GHG emissions from field burning of potatoes or other tubers and root residues and, consequently, the notation key "NE" was used. During the review, the ERT requested that the Party provide a justification for the non-occurrence of potato burning and clarify the common practice for potatoes and other tubers, and root residue usage. The Party stated that a recent review of crop residue burning practices in the United States using remote sensing (McCarty, 2009)[5] identified the crops whose residues are most frequently burned in the United States, and this list does not include potatoes or other root crops. The most frequently burned crops are now all accounted for in the NIR, except for Kentucky bluegrass, which is excluded due to a lack of data on the crop residue characteristics.

91. The USDA Natural Resources Conservation Service indicates that potatoes are typically grown on highly erodible soils, and that retaining maximum crop residues on the soil surface helps prevent erosion. Therefore, many potato farmers are moving towards a reduced tillage, such as a chisel-plant residue management system, which leaves most residues in place (Bailey, 1994).[6] Otherwise, residues tend to be ploughed into the soil. The ERT recommends that the United States include this explanatory information in its future inventory submissions and make efforts to collect AD for Kentucky bluegrass.

E. Land use, land-use change and forestry

1. Sector overview

92. In 2009, net removals from the LULUCF sector amounted to 990,061.78 Gg CO_2 eq. Since 1990, net removals have increased by 17.0 per cent. The key drivers for the rise in removals are the increases in removals from forest land remaining forest land, and from trees in settlements. Within the sector, removals of 794,316.9 Gg were from forest land, followed by 94,431.8 Gg from trees in settlements, 66,882.9 Gg from other (carbon stock changes in solid waste disposal and harvested wood products) and 31,913.7 Gg from grassland soils. Cropland soils accounted for removals of 3,611.1 Gg and peatlands accounted for emissions of 1,094.5 Gg. The removals from the sector offset 15 per cent of total emissions in 2009.

93. The United States has reported, in NIR table 7-5, a time series (1990, 2000 and 2005–2009) for AD, which covers 80 per cent of the national territory, of land use and land-use change categories consistent with the IPCC tier 3 approach for land representation. However, the time-series data reported in the CRF tables do not correspond to that provided in the NIR. For example, for the year 2009, the forest land area reported in NIR table 7-5 is 274,462 kha, while in the CRF tables it is 279,939 kha; for cropland, the figures are 163,137 kha and 176,349 kha, respectively; for grassland, 258,350 kha versus 182,761 kha; for wetlands, 26,412 kha versus no reporting in the CRF tables; for settlements, 49,212 kha versus 12,486 kha (this includes trees in settlements only); and for other land, 14,272 kha versus no reporting in the CRF tables. Furthermore, the total area reported in the CRF tables changes annually; for example, it is 644,381 kha in 1990 and 651,536 kha in 2009. The Party noted that although table 7-5 contains the total area of the country, excluding Alaska, in the CRF tables only areas for which emissions and removals have been

[5] McCarty JL. 2009. Seasonal and Interannual Variability of Emissions from Crop Residue Burning in the Contiguous United States. Dissertation. University of Maryland, College Park.

[6] Bailey FG. 1994. Technical Notes: Using Chisel-Plant Residue Management Systems to Improve Potato Quality and Protect the Environment. USDA Natural Resources Conservation Service, Boise, Idaho. Available at <ftp://ftp-fc.sc.egov.usda.gov/ID/technical/technotes/agronomy/agronomy_tn30.pdf>.

estimated are reported to ensure comparability of IEFs. The ERT recommends that the Party provide a complete, consistent and accurate time series of annual land use and land-use change matrices that cover the whole national territory, including Alaska, and all land use and land-use categories and subcategories and that it ensure that the data reported in the NIR and in the CRF tables are fully consistent. The ERT further recommends the Party to report as a subdivision of categories and subcategories the area for which emissions and removals have not been estimated so that the total national area is reported throughout the time series while ensuring comparability of IEFs.

94. The ERT also noted that, since the level of aggregation of forest land is not consistent with the IPCC good practice guidance for LULUCF and with the 2006 IPCC Guidelines, comparability with other reporting Parties is challenging. The ERT also noted an inconsistent use of notation keys for the data and emission estimates related to land converted to forest land in several cases: for example, the notation keys "NA" or "NE" have been used instead of "IE", since the emissions and removals from land converted to forest land have been reported together with the emissions and removals from forest land remaining forest land. Also, the ERT noted that land conversion subcategories have been reported as totals while individual land conversions (e.g. from forest land to cropland and from grassland to cropland) are reported as "IE". This lack of transparency is particularly important in the case of the conversion of land to settlements, which is the fastest-growing land-use category. The ERT recommends that the Party continue to make efforts to obtain the missing data, revise the use of the notation keys and report emissions and removals from land-use change subcategories separately by subcategory, in order to increase the transparency of its reporting.

95. The Party did not estimate losses of living biomass and DOM carbon stocks due to deforestation. The ERT recommends that the Party provide estimates of the living biomass DOM carbon stock changes for each conversion subcategory from forest land to any other land use.

96. The ERT notes that the Party when applying the stock difference method to calculate carbon stock changes in different pools, does not always ensure that stocks, at two points in time, are calculated on the same area (i.e. for any pool of any category, the area used to calculate the stock at time 1 can be different from that used to calculate the stock at time 2). For instance, in the NIR, p. A-258, it is reported that:

> "C stocks are estimated based on data from each inventory, at the level of permanent inventory plots. C per hectare (for a sample location) is multiplied by the total number of hectares that the plot represents, and then totals are summed for an area of interest, such as the state of Maine. Net annual C stock changes are calculated by taking the difference between the inventories and dividing by the number of years between the inventories for a selected state or sub-state area."

This is not consistent with the IPCC good practice guidance for LULUCF (e.g. equation 3.2.14 that applies the stock difference method to mineral soils) or the 2006 IPCC Guidelines (e.g. equation 2.5). It also results in the accounting of emissions and removals that never occur in reality since the accounted fluxes are simply the result of the transfer of carbon stocks from one category to another; therefore, the applied method provides biased GHG estimates. The ERT recommends that, when the Party applies the stock difference method, it calculates the carbon stock values at two consecutive points in time in the same area. The ERT also recommends that the Party revise its estimates of carbon stock changes and associated emissions and removals and report the recalculated estimates in its future inventory submissions.

97. The United States cover a large territory and, consequently, the reported GHG fluxes are the result of differing environmental conditions, management practices, land-use

dynamics and disturbance regimes. The ERT recommends that the Party, in order to ensure the transparency of the inventory, report disaggregated estimates at a level that clearly identifies the impact of those factors and provide, in the NIR, a short analysis qualifying, and possibly quantifying, the impact of the different factors on the levels, trends and inter-annual variations of the reported carbon stock changes.

2. Key categories

Forest land remaining forest land – CO_2

98. The United States has developed a country-specific tier 3 approach, according to which estimates of carbon stock changes are derived from successive forest inventory measurements available at the state level from different data sources. The ERT noted that documentation on the collection and processing of forest inventory data is widely available, but there are some situations where transparency could be improved, for example by adding a diagram (similar to the one provided to the ERT during the review), which clearly explains which measurement data are selected for each annual estimate of stocks and stock changes. The ERT also noted that, because of the impossibility of ensuring synchrony among states' inventories and the moving window average approach applied in the continuous inventory system, the reported inter-annual changes may not represent the actual trends in annual stock changes in real time, while the signals of sudden change may not be registered in the estimates at the proper point in time. The ERT encourages the Party to explore methods to annually forecast, on the basis of new measured data, stock changes for areas not measured and to revise, each year, the forecasted values on the basis of new measured data, with the aim of reflecting, as far as possible, the real inter-annual variability in the carbon stocks dynamic.

Cropland remaining cropland – CO_2

99. The Party has applied a model-based tier 3 approach to estimate the soil carbon stock changes in cropland remaining cropland together with tier 2 methods for some cultivation systems and soils for which the model has not been validated. Due to the lack of AD from 2003 onwards, the trend in CO_2 net removals is quite flat and the detected variability should be determined by changes in area and climatic variability. The time series shows that, in spite of the impact of disturbances, such as wind erosion, and the oxidation of organic matter due to the influence of agricultural practices on mineral and organic soils, the category acts as a sink throughout the time series. The reported sink is decreasing, 20.5 per cent, from 1990 to 2009 although the area subject to conservation tillage and the conservation reserve programme increased, from 1990 to 2008, by 56.6 per cent and 8.1 per cent, respectively; furthermore, the total area reported under cropland remaining cropland decreased by 3.4 per cent. The ERT encourages the Party to report on carbon losses from disturbances, such as soil erosion, which are not currently calculated by the model.

Other (LULUCF) – CO_2

100. Under this category, the United States has included net removals of CO_2 that are stored in wood products that are both harvested in the United States and are either still in use or buried in landfills. Because the estimates include all wood products originating from the United States regardless of their final geographical location, a key assumption is that products exported to other countries have the same half-lives as products in use, the same percentage of discarded products going to solid waste disposal sites and the same decay rates in disposal sites as they would in the United States. The ERT recommends that the Party report as a separate subdivision the stock changes associated with exported harvested wood products, in order to increase the transparency of its reporting.

F. Waste

1. Sector overview

101. In 2009, emissions from the waste sector amounted to 150,505.51 Gg CO_2 eq, or 2.3 per cent of total GHG emissions. Since 1990, emissions have decreased by 14.1 per cent. The key driver for the fall in emissions is the increase in the amount of landfill gas collected and combusted, which has more than offset the additional CH_4 emissions resulting from the increase in the amount of municipal solid waste disposed in landfills. Within the sector, 78.0 per cent of the emissions were from solid waste disposal on land, followed by 19.6 per cent from wastewater handling. The remaining 2.4 per cent were from waste composting reported under the category other (waste).

102. The ERT commends the Party for continuously reviewing the estimates contained in previous inventory submissions, by extending the number of sources covered under the different categories. However, the ERT notes that information on AD is based on relatively old literature and may not be representative of the most recent trends. The ERT, therefore, recommends that the Party undertake literature reviews to determine whether there are more recent and reliable estimates of the amount of the different types of waste disposed of according to the different modalities.

2. Key categories

Solid waste disposal on land – CH_4

103. The ERT noted that, despite the recommendations in previous review reports, waste generation and disposal data are based on extrapolations for the years 2007, 2008 and 2009. In particular, the waste generation rate has been kept almost constant throughout the time series (1990–2009), despite likely changes in individual consumption and waste generation patterns. During the review, the United States informed the ERT that the waste generation data are based on BioCycle[7] *State of Garbage* data, which are used for the years 1989 to 2009 (with some extrapolation between reporting years for odd years after 2000). In general, the per capita generation rate increased almost every year in the time series until 2004. During this same period, however, waste recycling has increased, so that the quantity of waste landfilled per capita has been fairly constant (ranging from 1.9 to 2.8 kg/cap/day). The ERT noted that the most recent BioCycle data (published in 2010) are for the year 2008 and thus may not reflect the full effects of the financial crisis.

104. Although the waste generation rates may have decreased during this period, recycling markets were also severely impacted and thus more waste may have been landfilled, thus negating (or partially negating) the generation effect. As new information is made available, the United States has stated that it will review and update the inventory as necessary. For the 1990–2009 inventory years, the waste generation data for 2007–2009 were updated using the 2010 BioCycle *State of Garbage* report. The ERT took note of the information provided during the review and recommended that the Party report, in future inventory submissions, on any updates to the waste generation and disposal data.

105. As already noted in previous review reports, the United States uses a constant degradable organic carbon (DOC) value (0.203) over the entire time series. In response to a question by the ERT during the review concerning the use of data from the EPA GHG Reporting Program to verify and potentially revise this value (as well as other parameters), the Party stated that it has already begun an assessment of ways to improve the inventory using the above-mentioned data, and will continue to examine the data from the GHG Reporting Program with the data needs of the inventory during the current compilation

[7] BioCycle is the United States' foremost magazine on composting and organics recycling.

process. These data will not be available in time for the compilation of the 2012 inventory submission.

106. However, according to the United States, the data collected from the GHG Reporting Program may be used in future inventories to revise the parameters used in the CH_4 generation calculations, including the DOC value, the flare correction factor, the MCF, the fraction of DOC dissimilated, the destruction efficiency of flares, the oxidation factor, and the rate constant (k). The use of these higher-tier data will improve the accuracy of the emission calculations and provide a more accurate representation of GHG emissions from MSW landfills. The ERT took note of the information provided by the Party during the review and recommends that the United States include, in future inventory submissions, information on actions taken to improve the inventory using data from the new GHG reporting rule.

107. Concerns were also raised by the ERT during the review, in line with previous review reports, about the use by the Party of relatively old AD for the amount of industrial waste disposed in landfills. According to the response provided by the United States during the review, estimates of industrial landfill emissions are based on the food processing (meat, vegetables and fruit) and pulp and paper industries, as this waste makes up 99 per cent of organic industrial waste. The industrial waste AD are compiled from published sources that are updated annually (e.g. the *Lockwood-Post Directory of Pulp & Paper Mills*[8] and the USDA Quick Stats for food processing[9]). The inventory applies landfill factors to the annual amount of pulp and paper and food processed, as described in Weitz and Bahner (2006)[10].

108. For the food processing industry, the amount of food waste landfilled each year from 1940 to 2008 is the ratio of the food produced in the year in question to the food produced in 1985, times the waste landfilled in 1985, which was 3,260 Gg (3.26 Mt). The data on food waste landfilled in 1985 are taken from a 1993 EPA report. For the pulp and paper industry, it is assumed that 5 per cent of all pulp and paper processed is landfilled, based on industry data (specifically, International Paper and Weyerhauser company data) and expert judgement. The Party stated that, for the current inventory year, a literature review will be carried out to determine whether there are more recent and reliable estimates of the amount of industrial waste landfilled. The ERT took note of the information provided by the Party during the review and recommends that the United States include, in future inventory submissions, information on the outcomes of this literature review.

109. Given that the majority of changes in CH_4 emissions from landfills over the time series resulted from improvements made to the flare database, the ERT asked the Party whether specific QA/QC checks were applied to the estimates of landfill gas recovered which were provided by vendors of flaring equipment and project databases, in order to verify that the information represents actual recovered quantities, rather than recovery potentials. During the review, the United States responded that the data from vendors of flaring equipment are only used when a flare cannot be matched to a landfill in either the EPA Landfill Methane Outreach Program (LMOP) database or the EIA 1605b database. When a flare in the flare database cannot be matched to either the LMOP or the EIA database, the Party uses the midpoint of the vendor-provided flare capacity in the flare database to estimate the landfill gas recovered. According to the Party, it is not possible (due to time and budget constraints) to conduct any QA/QC checks on the actual estimates of landfill gas recovered by these landfills. The ERT took note of the information provided

[8] Lockwood-Post (2002) Lockwood-Post's Directory of Pulp, Paper and Allied Trades, Miller-Freeman Publications. San Francisco, CA.

[9] See <http://www.nass.usda.gov/Data_and_Statistics/Quick_Stats/index.asp>.

[10] Weitz and Bahner (2006), Methane Emissions Estimates for Industrial Landfills, RTI memorandum, September 5, 2006.

by the Party during the review and recommends that the United States increase the use of measured data and information from the EIA and LMOP databases, in order to minimize the use of information from the vendors, and report on the relevant action taken in its future inventory submissions.

3. Non-key categories

Waste incineration – CO_2 and CH_4

110. The NIR states that emissions from waste incineration are reported in two sections of the energy chapter of the inventory: in the section on CO_2 emissions from waste incineration and in the calculation of emissions from and storage in non-energy use of fossil fuels. The former section addresses fossil-derived materials (such as plastics) that are discarded as part of the municipal waste stream and combusted (generally for energy recovery). The latter section addresses two types of combustion: hazardous waste incineration of organic materials (assumed to be fossil-derived), in which regulated waste is burned without energy recovery; and burning of fossil-derived materials for energy recovery. Emissions from industrial non-hazardous waste burned for disposal (rather than energy recovery) are not estimated. The NIR states that data are not readily available for this category, and further research is needed to estimate the magnitude of CO_2 emissions.

111. Further, although section 3.6 of annex 3 to the NIR (page A-173) reports that "Estimates of CH_4 emissions from the incineration of waste in the United States are based on the methodology outlined in IPCC's 2006 Guidelines for National Greenhouse Gas Inventories (IPCC 2006)", these emissions are reported in the CRF tables as "NE", under category 6.C, rather than as "IE". In response to a question by the ERT during the review, the United States confirmed that the estimates of CH_4 emissions from the incineration of waste are provided under the energy sector, consistent with the reporting on energy recovery, and informed the ERT that the CRF tables will be updated so that the correct notation key ("IE") is used in its future inventory submissions. The ERT recommends that the Party continue its efforts to make available information on the quantities of industrial non-hazardous waste burned for disposal, and report this information in its future inventory submissions. The ERT also recommends that the United States increase the transparency of its reporting by revising the notation key used for CH_4 emissions from the incineration of waste from "NE" to "IE".

III. Conclusions and recommendations

112. The United States made its inventory submission on 13 April 2011. The inventory submission contains the GHG inventory (comprising a complete set of CRF tables and an NIR). This is in line with the UNFCCC reporting guidelines.

113. The ERT concludes that the inventory submission of the United States has been prepared and reported in accordance with the UNFCCC reporting guidelines. The inventory submission is complete and the Party has submitted a complete set of CRF tables for the years 1990–2009 and an NIR; these are complete in terms of geographical coverage, years and sectors, as well as generally complete in terms of categories and gases.

114. The Party's inventory is generally in line with the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. With regard to methodological choices, the NIR emphasizes that emissions from an increasing number of categories are being estimated on the basis of the methods provided in the 2006 IPCC Guidelines. While the 2006 IPCC Guidelines represent an authoritative source of

information, their use should not decrease the overall transparency of the inventory submission.

115. The ERT identifies the following cross-cutting issues for improvement:

(a) Improving the coverage of categories in the inventory, particularly those categories for which methodologies and/or EFs are provided by the IPCC, focusing resources as appropriate on improvements in line with the IPCC good practice guidance;

(b) Increasing current efforts to update AD, in particular through the use of information provided by the EPA GHG Reporting Program;

(c) Improving the quality of AD for the United States territories;

(d) Improving the transparency of the inventory, for example in the energy and LULUCF sectors, as recommend in the specific sections of this report;

(e) Ensuring that information is reported at the aggregation level as provided by the UNFCCC reporting guidelines and by relevant COP decisions.

116. During the course of the review, the ERT also formulated a number of recommendations relating to the completeness of the inventory submission. Specific recommendations are included in the sectoral chapters of this report.

Annex I

Documents and information used during the review

A. Reference documents

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. *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 2011. Available at <http://unfccc.int/resource/docs/2011/asr/usa.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2011. Available at <http://unfccc.int/resource/webdocs/sai/2011.pdf>.

FCCC/ARR/2010/USA. Report of the individual review of the greenhouse gas inventory of the United States of America submitted in 2010. Available at <http://unfccc.int/resource/docs/2011/arr/usa.pdf>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Brian Cook and Mr. Leif Hockstad (US Environment Protection Agency), including additional material on the methodologies and assumptions used. The following document[1] was also provided by the United States:

EPA. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2009: Addendum to Annex 7: Uncertainty. EPA/OAR/OAP, 2011.

[1] Reproduced as received from the Party.

Annex II

Acronyms and abbreviations

AD	activity data
BOFg	basic oxygen furnace gas
CH_4	methane
CKD	cement kiln dust
CO_2	carbon dioxide
CO_2 eq	carbon dioxide equivalent
CRF	common reporting format
DOC	degrabable organic carbon
DOM	dead organic matter
EF	emission factor
ERT	expert review team
FAA	Federal Aviation Administration
GCV	gross calorific value
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
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram (1 kg = 1,000 grams)
LKD	lime kiln dust
LULUCF	land use, land-use change and forestry
MCF	methane correction factor
MgO	magnesium oxide
Mt	million tonnes
MSW	municipal solid waste
N	nitrogen
NA	not applicable
N_2O	nitrous oxide
NCV	net calorific value
NE	not estimated
NIR	national inventory report
ODS	ozone-depleting substance
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
SF_6	sulphur hexafluoride
Tg	teragram (1 Tg = 1 million tonnes)
UNFCCC	United Nations Framework Convention on Climate Change
VS	volatile solids