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**Report of the individual review of the inventory submission  
of the United States of America submitted in 2010\***

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\* In the symbol for this document, 2010 refers to the year in which the inventory was submitted, and not to the year of publication.

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## **I. Introduction and summary**

### **A. Overview**

1. This report covers the centralized review of the 2010 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 20 to 25 September 2010 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Ms. Katarina Mareckova (European Union) and Ms. Daniela Romano (Italy); energy – Mr. Matej Gasperic (Slovenia), Mr. Norbert Nziramasanga (Zimbabwe) and Mr. Ole-Kenneth Nielsen (Denmark); industrial processes – Ms. Ingrid Person (Brazil) and Mr. Koen Smekens (Belgium); agriculture – Mr. Etienne Mathias (France), Mr. Yuriy Pyrozhenko (Ukraine) and Mr. Amnat Chidthaisong (Thailand); land use, land-use change and forestry (LULUCF) – Ms. Dominique Blain (Canada) and Mr. Walter Oyhantçabal (Uruguay); and waste – Ms. Cherie Sweeney (New Zealand) and Mr. José Villarin (Philippines). Ms. Blain and Mr. Oyhantçabal were the lead reviewers. The review was coordinated by Mr. Vitor Gois Ferreira (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”, 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 2008, the main greenhouse gas (GHG) in the United States was carbon dioxide (CO<sub>2</sub>), accounting for 85.4 per cent of total GHG emissions<sup>1</sup> expressed in CO<sub>2</sub> eq, followed by methane (CH<sub>4</sub>) (8.0 per cent) and nitrous oxide (N<sub>2</sub>O) (4.4 per cent). Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) collectively accounted for 2.2 per cent of the overall GHG emissions in the country. The energy sector accounted for 86.6 per cent of total GHG emissions, followed by the agriculture sector (6.2 per cent), the industrial processes sector (4.8 per cent), the waste sector (2.3 per cent) and the solvent and other product use sector (0.1 per cent). Net removals from the LULUCF sector offset 13.1 per cent of the total GHG emissions. Total GHG emissions amounted to 6,924,556.11 Gg CO<sub>2</sub> eq and increased by 13.3 per cent between 1990 and 2008.

4. Tables 1 and 2 show GHG emissions under the Convention, by gas and by sector, respectively. In table 1, CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions do not include emissions and removals from the LULUCF sector.

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<sup>1</sup> In this report, the term “total GHG emissions” refers to the aggregated national GHG emissions expressed in terms of CO<sub>2</sub> eq excluding LULUCF, unless otherwise specified.

Table 1  
Greenhouse gas emissions, by gas, 1990 to 2008

Greenhouse gas	Gg CO <sub>2</sub> eq							Change 1990–2008 (%)
	1990	1995	2000	2005	2006	2007	2008	
CO <sub>2</sub>	5 092 723.05	5 419 238.73	5 968 432.97	6 099 491.66	6 008 466.85	6 110 889.37	5 912 624.62	16.1
CH <sub>4</sub>	610 201.80	608 975.30	571 675.13	543 365.77	546 655.79	549 193.72	555 698.08	–8.9
N <sub>2</sub> O	318 614.73	337 658.78	332 310.00	318 473.32	310 051.80	309 383.63	306 508.59	–3.8
HFCs	36 924.10	62 242.64	103 177.87	119 257.78	121 831.76	127 388.40	126 882.53	243.6
PFCs	20 759.93	15 587.02	13 479.45	6 194.63	6 030.44	7 479.87	6 704.52	–67.7
SF <sub>6</sub>	32 591.15	27 925.11	19 115.92	17 832.01	17 039.92	16 108.65	16 137.77	–50.5

Table 2  
Greenhouse gas emissions by sector and activity, 1990 to 2008

Sector	Gg CO <sub>2</sub> eq							Change 1990–2008 (%)
	1990	1995	2000	2005	2006	2007	2008	
Energy	5 224 073.75	5 545 751.41	6 087 492.77	6 187 894.77	6 089 077.70	6 182 926.02	5 999 047.50	14.8
Industrial processes	318 286.09	339 082.34	351 919.14	334 697.12	339 740.57	350 925.25	334 464.05	5.1
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	387 843.29	407 725.90	410 935.21	419 679.05	417 191.47	422 953.27	427 528.47	10.2
LULUCF	–894 467.37	–825 670.96	–627 959.01	–921 817.11	–909 361.02	–907 775.09	–908 148.34	1.5
Waste	177 207.63	174 480.41	152 964.71	157 957.08	159 679.67	159 251.97	159 128.96	–10.2
Other	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (with LULUCF)</b>	<b>5 217 347.41</b>	<b>5 645 956.62</b>	<b>6 380 232.32</b>	<b>6 182 798.07</b>	<b>6 100 715.54</b>	<b>6 212 668.56</b>	<b>6 016 407.77</b>	<b>15.3</b>
<b>Total (without LULUCF)</b>	<b>6 111 814.77</b>	<b>6 471 627.58</b>	<b>7 008 191.33</b>	<b>7 104 615.17</b>	<b>7 010 076.56</b>	<b>7 120 443.65</b>	<b>6 924 556.11</b>	<b>13.3</b>

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 2010 inventory was submitted on 15 April 2010; it contains a complete set of common reporting format (CRF) tables for the period 1990–2008 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) used previous years’ inventory submissions during the review.

7. 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

8. The inventory is complete in terms of years and geographical coverage, and generally covers all source and sink categories for the period 1990–2008. The ERT noted that emissions from fuel combustion in “U.S. territories” (American Samoa, Guam, Puerto Rico, United States Virgin Islands, Wake Island and other United States Pacific Islands) are reported as a subcategory under the category other (1.A.5) in the energy sector, because information on energy use for these territories is not available at the appropriate level of disaggregation. The ERT considers that this procedure is not in line with the UNFCCC reporting guidelines and the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance), and recommends that the United States provide estimates of sectoral emissions for “U.S. territories” in its future inventory submissions and that it focus the use of resources, as appropriate, to allocate activity data (AD) and emissions to the appropriate categories in accordance with the IPCC good practice guidance.

9. A number of categories and subcategories have been reported as not estimated (“NE”), including:

(a) CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from gaseous fuel use under railways and national navigation;

(b) CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from the use of biomass and other fuels in “U.S. territories” (under other (stationary fuel combustion));

(c) CO<sub>2</sub> emissions from calcium carbide production;

(d) CH<sub>4</sub> emissions from styrene production;

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

(f) CH<sub>4</sub> emissions from sludge in industrial wastewater handling and domestic and commercial wastewater handling;

(g) The net carbon stock change in and CO<sub>2</sub> emissions from mineral soils under forest land remaining forest land and for all pools under land converted to forest land;

(h) The net carbon stock change in and CO<sub>2</sub> emissions from living biomass under cropland remaining cropland and grassland remaining grassland, and living biomass and dead organic matter under land converted to cropland and land converted to grassland;

(i) The net carbon stock change in and CO<sub>2</sub> emissions from land converted to wetlands, settlements and other land;

(j) CH<sub>4</sub> and N<sub>2</sub>O emissions from biomass burning for land converted to forest land, cropland, grassland and wetlands.

10. The United States has provided explanations for these exclusions in the relevant sectoral chapters of its NIR, in annex 5 to the NIR and in the CRF tables; the main reason for reporting these categories as “NE” seems to be a lack of AD. The ERT recommends that the United States further improve the coverage of categories in its inventory, covering particularly those categories for which 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 for estimating emissions.

11. For some other categories the United States reports emissions as “NE” but provides explanations suggesting that these emissions are in fact not occurring (“NO”) or included elsewhere (“IE”). The ERT recommends that the Party revisit the use of the notation keys for these categories and provide more transparent justifications for not estimating emissions for these categories in the NIR of its future inventory submissions. These categories include:

(a) CH<sub>4</sub> emissions from enteric fermentation and manure management and N<sub>2</sub>O emissions from manure management for buffalo, camels and llamas, and mules and asses, which were reported as “NE” with the justification that there are no significant populations of these animal types in the United States;

(b) CH<sub>4</sub> and N<sub>2</sub>O emissions from biomass burning of oats, rye, dry beans and peas, which were reported as “NE” with the justification that there is no significant burning of residues from these crops;

(c) N<sub>2</sub>O emissions from nitrogen (N) fertilization of land converted to forest land, which were reported as “NE” with the justification that data on the amount of land converted to forest land are currently lacking, and, thus, emissions cannot be separated out between those from land converted to forest land and those from forest land remaining forest land.

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

Overview

12. The ERT concluded that the institutional arrangements established by the United States continue to perform their functions, which are described in the NIR in detail. The ERT noted that the institutional arrangements show a high level of decentralization, but with good coordination between the different agencies involved.

### Inventory planning

13. The NIR thoroughly describes the institutional and procedural arrangements for the preparation of the Party's inventory. The United States Environmental Protection Agency (EPA), particularly its Office of Atmospheric Programs (OAP) in the Office of Air and Radiation (OAR), prepares the "Inventory of U.S. Greenhouse Gas Emissions and Sinks", in cooperation with other United States government agencies. While the United States Department of State is the entity responsible for the official submission of the annual GHG inventory to the UNFCCC secretariat, OAP serves as the focal point for technical questions and comments on the United States' inventory.

14. OAP is responsible for the emission estimates 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 emission estimates. OAP and OTAQ jointly coordinate the collection of AD and the calculation of emission estimates at the individual category level, and ensure consistency and quality throughout the NIR and the CRF tables.

15. A wide range of agencies and individuals are involved in supplying data for, reviewing or preparing parts of the United States' inventory, including: federal and state government authorities; research and academic institutions; industry associations; and private consultants. The Energy Information Administration of the Department of Energy (DOE) provides national fuel consumption data and the Department of Defense provides military fuel consumption and bunker fuel data. Agreements to ensure that AD are provided to EPA also exist with other United States agencies, such as 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. Academic and research centres provide AD and calculations to EPA, as do individual companies participating in voluntary outreach efforts with EPA.

16. The United States' inventory is prepared in a decentralized manner. EPA is the inventory coordinator, responsible for compiling all emission estimates and ensuring consistency and quality throughout the NIR and the CRF tables. Calculating emission estimates for individual categories is the responsibility of individual category leads, who also determine the most appropriate methodology and collect the best AD to use for the calculation of emission estimates, on the basis of their category-specific expertise, and coordinate with researchers and contractors familiar with the categories. A multistage process for collecting information from the individual category leads and for producing the inventory is undertaken annually to compile all the information and data.

### Inventory preparation

#### *Key categories*

17. The United States reported a key category tier 1 and tier 2 analysis, both level and trend assessment, as part of its 2010 inventory submission. A qualitative assessment was also conducted to include any key categories that were not identified by either quantitative method; as a result, international bunker fuels was identified as an additional key category, and the NIR presents clear explanations for this selection. The key category analysis

performed by the United States and that performed by the secretariat<sup>2</sup> produced similar results.

18. The United States included the LULUCF sector in its key category analysis, which was performed in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The ERT recommends that the United States report how it uses the key category analysis for the prioritization of the development and improvement of its inventory, in its future inventory submissions.

#### *Uncertainties*

19. The overall uncertainty estimate for the United States' GHG emission inventory was developed by applying the tier 2 Monte Carlo method. The ERT noted that the United States did not follow the recommendation made in the previous review report<sup>3</sup> that it add columns containing information on the uncertainty of emission factors (EFs) and AD to the tables in annex 7 to the NIR, but it also noted that an addendum with extensive information was provided during the review in response to questions raised by the ERT, which provides most of the necessary information. The ERT encourages the United States to explore ways of including relevant information from the addendum in the NIR for its future inventory submissions.

20. The overall uncertainty was estimated to be in the range of -1 to +6 per cent for total GHG emissions excluding LULUCF and -2 to +7 per cent for total GHG emissions including LULUCF. The uncertainty of the trend was estimated at 8-18 per cent for total GHG emissions excluding LULUCF and 7-22 per cent for net GHG emissions including LULUCF. These ranges are similar to the uncertainty estimates reported in the Party's 2009 inventory submission.

21. According to the NIR, the uncertainty analysis is used within the framework of the institutional arrangements for the identification of future improvements and revisions to the inventory preparation process. In section 7 of the NIR, the Party has identified opportunities for changes to data measurement, data collection and calculation methodologies for each category, and the ERT commends the Party for having done so.

#### *Recalculations and time-series consistency*

22. Recalculations have been performed and reported in accordance with the IPCC good practice guidance, which were undertaken mostly to reflect improvements in AD and/or methods. The rationale for these recalculations is provided in CRF table 8(b) and in detail in chapter 10 of the NIR. The recalculations resulted in an increase in estimated total GHG emissions excluding LULUCF of 0.45 per cent for 1990 and 0.19 per cent for 2007, a decrease in estimated total GHG emissions including LULUCF of 0.76 per cent for 1990 and an increase of 2.06 per cent in the latter emissions for 2007. The recalculations led to a slight decrease in the emission trend: while in the Party's previous inventory submission total GHG emissions in the period 1990-2006 were reported to have increased by 16.8 per cent, in the 2010 inventory submission the increase for the same period is reported as 14.6 per cent.

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<sup>2</sup> 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.

<sup>3</sup> FCCC/ARR/2009/USA, paragraph 17.



23. The major changes in the emission estimates for 1990 and 2007 as a result of the recalculations were observed in the LULUCF sector, where N<sub>2</sub>O emissions increased by 141.0 and 275.8 per cent for 1990 and 2007, respectively; CH<sub>4</sub> emissions decreased by 30.8 and 31.0 per cent for 1990 and 2007, respectively; and CO<sub>2</sub> net removals increased by 8.2 per cent for 1990 and decreased by 10.2 per cent for 2007.

#### *Verification and quality assurance/quality control approaches*

24. The NIR states that the quality assurance/quality control (QA/QC) activities performed in relation to the inventory are undertaken within the framework of the United States QA/QC plan, entitled “Quality Assurance/Quality Control and Uncertainty Management Plan for the U.S. Greenhouse Gas Inventory: Procedures Manual for QA/QC and Uncertainty Analysis”.

25. 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 an expert review process and through a broad review by the United States public. Information on the QC procedures performed in individual sectors is provided in the sectoral chapters of the NIR. 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.

#### *Transparency*

26. In general, the NIR provides sufficient information on the methodologies and approaches used in the inventory preparation process and it follows the structure outlined in the UNFCCC reporting guidelines. The United States included detailed information on the methodologies used, the key category analysis and the uncertainty analysis in annexes to the NIR. The ERT welcomes the fact that the United States followed the recommendation made in the previous review report by including individual sections on uncertainty and time-series consistency in each sectoral/category chapter in the NIR. However, the ERT identified areas where greater transparency is needed, for example in the reporting on the energy and LULUCF sectors (see paras. 39 and 83 below). Sector-specific recommendations on transparency are provided in the relevant sector chapters of this report.

27. The ERT noted that the NIR contains limited information on emissions reported under “U.S. territories”. In response to questions raised by the ERT during the review, the Party provided additional information on calculations and emissions for these territories. The ERT recommends that the United States improve the information on “U.S. territories” in its future inventory submissions.

28. In CRF summary table 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 for National Greenhouse Gas Inventories* (hereinafter referred to as the 2006 IPCC Guidelines), which do not always match the Revised 1996 IPCC Guidelines or the IPCC good practice guidance that are referred to in the UNFCCC reporting guidelines (e.g. in CRF summary table 3, the United States explains that tier 2 and tier 3 methods were used to estimate SF<sub>6</sub> emissions from the consumption of halocarbons and SF<sub>6</sub>, and that the “D” method was used to estimate CH<sub>4</sub> emissions from rice cultivation; whereas, in both cases, the NIR indicates that the method contained in the 2006 IPCC Guidelines was used). 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.

29. Annex 6 to the NIR presents additional information on emission trends based on the global warming potential provided in the IPCC Third and Fourth Assessment Reports.

Inventory management

30. The NIR reports that the United States has a centralized archiving system at EPA, covering both electronic and paper documents. Electronic copies of the summary spreadsheets for each year's inventory submission, which contain all the estimates of emissions and removals, are kept on a central server at EPA under the jurisdiction of the inventory coordinator.

31. The NIR further reports that the inventory coordinator at EPA also collects descriptive text and annexes for the categories, and aggregates 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 gathered in the summary spreadsheet. All EFs at a disaggregated level, AD and documentation are retained both by the inventory category leads and centrally by the inventory coordinator. The NIR also reports that the archived information also includes internal documentation on QA/QC procedures, external and internal reviews, and documentation on annual key category analyses and planned inventory improvements.

**3. Follow-up to previous reviews**

32. The ERT noted that several recommendations made in previous review reports have not yet been fully implemented, including:

- (a) The use of higher-tier estimation methods for key categories, where appropriate;
- (b) The development of a data collection strategy which will allow for categories which are not yet covered in the inventory to be reported in future inventory submissions;
- (c) The separate provision of information on AD and EF uncertainties in the overview tables in the NIR (see para. 19 above);
- (d) The inclusion of the analysis of time-series consistency in the category-specific sections of the NIR.

**4. Areas for further improvement**

Identified by the Party

33. The 2010 NIR provides detailed and comprehensive information on areas for improvement for almost all reported categories. However, it is not clear from the information provided when the Party is planning to implement the improvements. The ERT therefore encourages the Party to report on the time schedule for the implementation of the inventory improvements in its future inventory submissions.

34. The improvements identified by the Party relate to either AD, EFs or the use of higher-tier methods, and include:

- (a) The improvement of the quality of the data for "U.S. territories", in particular fuel combustion data to estimate emissions from stationary combustion;
- (b) The updating or improvement of EFs for some categories, such as: the improvement of CH<sub>4</sub> and N<sub>2</sub>O EFs for diesel vehicles, motorcycles and biodiesel vehicles; the development of new EFs for off-road machinery and vehicles; the improvement of EFs for fugitive emissions; the improvement of CH<sub>4</sub> and N<sub>2</sub>O EFs for stationary combustion;

and the development of EFs for clinker production and for the consideration of the cement kiln dust (CKD) factor;

- (c) The revision of the AD used in estimating fugitive emissions from oil;
- (d) The evaluation of the feasibility of estimating N<sub>2</sub>O and CH<sub>4</sub> emissions from aviation from landing and take-off data instead of from total fuel consumption;
- (e) The development of improved estimates of emissions from the consumption of residual and distillate fuel in domestic waterborne navigation;
- (f) The inclusion in the inventory of estimates for categories reported as “NE”, such as for some land-use activities that are missing, some industrial processes and some mobile sources;
- (g) The improvement of the characterization of the flows of fossil carbon in non-energy use of fuels (particularly in organic chemical wastewater, plasticizers, adhesives, films, paints and coatings, and in the treatment of fuel additives and backflows);
- (h) The improvement of the completeness of the emission estimates for lime production and limestone and dolomite use by ameliorating the collection of AD and carrying out further research on methods;
- (i) The improvement of the emission estimates for ammonia production and consumption of urea, including the update of EFs to include both fuel and feedstock CO<sub>2</sub> emissions, and the consideration of the effect of carbon dioxide capture and storage;
- (j) The allocation of emission estimates for the production of metallurgical coke to the energy sector, as well as the identification of the amount of carbonaceous material, other than coking coal, consumed at commercial coke plants;
- (k) The improvement of the AD for several categories under the industrial processes sector (e.g. ferroalloys production, aluminium production, and production and consumption of fluorinated gases), including the use of direct measurement data from facilities (e.g. for adipic acid production);
- (l) The maintenance of research and the regular updating of the model used to estimate cattle diet characterization, feedlot placement data and rates of weight gain and calving, among other necessary data inputs, the improvement of the Cattle Enteric Fermentation Model (CEFM) and the consideration of options for creating region-specific EFs for rice cultivation;
- (m) The incorporation of area data by land-use category for major portions of Alaska and all the “U.S. territories” as a key major improvement for the LULUCF sector, and the undertaking of planning to acquire state-level area data on fertilizer use on south-eastern pine plantations and north-western Douglas fir forests to estimate soil N<sub>2</sub>O emissions at the regional level;
- (n) The improvement of the estimates of the amount of waste deposited in municipal solid waste (MSW) landfills, the identification of additional landfills equipped with flares and the improvement of the emission estimates of CH<sub>4</sub> and N<sub>2</sub>O from composting.

Identified by the expert review team

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

- (a) The improvement of the completeness of the inventory, particularly by the Party focusing its efforts on those categories for which methodologies for estimating emissions are available (see paras. 9 and 10 above);

- (b) The use of higher-tier methods to estimate emissions for key categories, in particular for the energy sector;
- (c) The reporting of emissions from the energy sector at a more disaggregated level (see para. 39 below);
- (d) The improvement of the transparency of the emission estimates for the “U.S. territories”;
- (e) The improvement of the reporting of trends and inter-annual variations, in particular for the industrial processes, agriculture and LULUCF sectors.

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

## **B. Energy**

### **1. Sector overview**

37. The energy sector is the main sector in the GHG inventory of the United States. In 2008, emissions from the energy sector amounted to 5,999,047.50 CO<sub>2</sub> eq, or 86.6 per cent of total GHG emissions. Since 1990, emissions have increased by 14.8 per cent. The key drivers for the rise in emissions are the increases in fuel consumption in energy industries and transport, from which emissions increased by 29.9 per cent and 20.4 per cent, respectively. Within the sector, 39.8 per cent of the emissions were from energy industries, followed by 29.8 per cent from transport, 13.8 per cent from manufacturing industries and construction and 9.5 per cent from other sectors. Emissions from the category other accounted for 3.3 per cent, fugitive emissions from oil and natural gas accounted for 2.6 per cent and the remaining 1.1 per cent were from the category fugitive emissions from solid fuels.

38. Emissions from combustion of biomass and other fuels used in the “U.S. territories” (reported under other (stationary)) and emissions from solid, gaseous, biomass and other fuels for military use (reported under other (mobile)) have been reported as “NE”, since data are not currently available to the inventory team. The ERT noted that during the previous review<sup>4</sup> the United States indicated that data for the United States territories do exist at DOE, but that these data were not provided to the inventory preparation team for the purpose of the GHG inventory. During the current review, the United States clarified that only data on biomass and other fuels for the United States territories are not available, and that once they are available they will be used to prepare emission estimates. The ERT recommends that the United States make efforts to obtain the data and prepare the respective estimates. The ERT also recommends that the United States undertake work to conclude whether solid, gaseous, biomass or other fuels are used for military purposes, and that it report estimates for these fuel categories or appropriate notation keys, such as “NO” or “IE”, in its future inventory submissions.

39. The United States has generally reported emissions from fuel combustion at a highly aggregated level. In particular, emissions from petroleum refining, manufacture of solid fuels and other energy industries, all categories under manufacturing industries and construction, and emissions from agriculture/forestry/fisheries are reported as “IE”. Emission estimates for all these categories are aggregated and reported under the category other (manufacturing industries and construction). This issue has been raised in previous review reports, and the ERT considers that this reporting procedure significantly reduces the transparency of the inventory, makes in-depth analysis difficult and impairs

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<sup>4</sup> FCCC/ARR/2009/USA, paragraph 30.

comparability with other reporting Parties. The ERT strongly recommends that the Party improve the transparency of the reporting for these categories at the most disaggregated level, in line with the UNFCCC reporting guidelines. In addition, the ERT noted that the explanations for the use of the notation key “IE” provided in the CRF tables are not correct for all categories (e.g. the explanatory note for the use of “IE” for emissions from agriculture/forestry/fisheries is “Fuel consumed in and emissions from petroleum refining and manufacture of solid fuels and other energy industries are included under other manufacturing industries and construction (1.A.2.f)”). The ERT also recommends that the Party check and verify the corresponding explanatory notes in the CRF tables.

40. In response to a question raised by the ERT during the review, the United States explained that, in the follow-up of new legislative requirements (the Mandatory Greenhouse Gas Reporting Rule), data for large plants will be available, and that these data could potentially form the basis of a more disaggregated inventory and could also allow the use of higher-tier estimation methods. These data could be available in reference to 2010 for the 2012 inventory submission. The ERT welcomes the intention of the United States to use the new data to improve the inventory and recommends that the Party, in its future inventory submissions, include information on the progress of this improvement and describe in detail the expected outcome of implementing the use of new data.

## 2. Reference and sectoral approaches

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

41. The United States reported estimates of CO<sub>2</sub> emissions from fuel combustion in 2008 calculated using both the reference and the sectoral approaches. The estimate of total CO<sub>2</sub> emissions calculated using the reference approach is 1.4 per cent higher than the estimate calculated using the sectoral approach.

42. The ERT found that the information on energy consumption is not consistent between the NIR and the CRF tables: according to the NIR (annex 4) the difference in the calculated energy consumption between both approaches is -1.5 per cent, which is not the same as the value reported in CRF table 1.A(c) (-101.55 per cent). During the review week, the United States explained that the comparison between the calculated values for energy consumption was reported incorrectly in CRF table 1.A(c), owing to errors in calculating the apparent energy consumption excluding non-energy use of fuels, and that this will be revised in its 2011 inventory submission. The ERT recommends that the United States ensure that the data on energy consumption are correctly reported and consistent between the NIR and the CRF tables in its future inventory submissions.

43. The United States also informed the ERT that it would include additional necessary fuel categories to allow for improved consistency between the reference approach and the statistical data in the United States. The ERT welcomes this planned improvement and recommends that the United States report these fuel categories in its future inventory submissions.

44. As also indicated in the previous review report, the ERT noted that, in the documentation box of CRF table 1.A(b), it is stated that the reference approach has also been reported on a separate Excel spreadsheet containing more detailed information. This information is included in annex 4 to the NIR for 2008. During the review, the United States provided information for all years of the time series, which allowed a better understanding of the differences between the sectoral and the reference approaches. The ERT recommends that the United States update the text in the documentation box of the CRF table and add a direct reference to annex 4 to the NIR in its future inventory submissions.

45. The total apparent consumption of energy reported in the inventory for 2008 is 3 per cent lower than that reported by the International Energy Agency (IEA) for the same year, owing to discrepancies in the data on solid fuel production and liquid fuel stock changes. The Party informed the ERT during the review that the consumptions of liquid and solid fuels reported in the inventory are from the annual energy review and annual coal report of the DOE Energy Information Administration, and that they are the most appropriate AD for the energy sector of the United States' inventory. However, the United States could not clarify why the IEA values differ from the values used in the emission inventory, and the ERT encourages the United States to investigate the reasons for that difference.

#### *International bunker fuels*

46. The ERT noted considerable inter-annual changes in the estimates of CO<sub>2</sub> emissions from marine bunkers, most noticeably for the periods 1998–1999 (19.9 per cent decrease) and 2003–2004 (21.0 per cent increase). This issue was also identified in the previous review report.<sup>5</sup> Although the ERT recognizes that very high fluctuations in emissions from marine bunkers are common for most reporting Parties, it encourages the United States to improve the estimates for marine bunkers, in particular the consistency of the time series, and to include information in the NIR explaining the fluctuations in the time series.

47. During the review, discrepancies between the data provided in CRF tables 1.C and 1.A(b) for jet kerosene (international aviation) and for gas/diesel oil and residual fuel oil (international marine bunkers) were identified by the ERT. This issue was also identified in the previous review report.<sup>6</sup> The United States informed the ERT that it would work to correct these inconsistencies. The ERT reiterates the recommendation that the United States provide consistent estimates for these fuels in its future inventory submissions.

#### *Feedstocks and non-energy use of fuels*

48. As in previous reviews, the ERT noted that the United States reported a significant amount of CO<sub>2</sub> emissions (127,038.23 Gg CO<sub>2</sub> for 2008) under the subcategory stationary (other) as non-energy use. This accounts for 2.1 per cent of the energy sector's total emissions or 1.8 per cent of the Party's total GHG emissions in 2008. In addition, estimated CO<sub>2</sub> emissions from the use of liquid fuels in "U.S. territories" include non-energy use of fuels (also reported under stationary (other)). In the review report of the Party's 2008 inventory submission,<sup>7</sup> the ERT estimated that around 55.0 per cent of the emissions for this category in 2006 could be reported under energy industries (fuel combusted for energy recovery). Further, emissions from hazardous waste could be reported under the waste sector (around 1.0 per cent of the emissions) and other parts of the emissions for this category (around 8.0 per cent) could be allocated to the industrial processes and solvent and other product use sectors. The ERT reiterates that, according to the Revised 1996 IPCC Guidelines, only emissions from fuels combusted for the use of their energy should be reported under fuel combustion. The ERT also reiterates the recommendation of previous ERTs, contained in particular in the review reports of the Party's 2007, 2008 and 2009 inventory submissions, that the United States reallocate, in its next inventory submission, the relevant emissions currently reported under the subcategories of the category other (non-energy use of fuels and part of the fuel use in "U.S. territories"), as the Party's current practice reduces the transparency and comparability of the inventory and is not in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. Responding to the ERT at the end of the review week, the United States stated that it believes that its country-specific methodology to estimate emissions from and storage in feedstocks and

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<sup>5</sup> FCCC/ARR/2009/USA, paragraph 35.

<sup>6</sup> FCCC/ARR/2009/USA, paragraph 34.

<sup>7</sup> FCCC/ARR/2008/USA, paragraph 36.

non-energy use of fuels is the most accurate approach, and thus in line with the IPCC good practice guidance, to assessing this large and complex industry in the country, although it will continue its efforts to improve the transparency of this approach. The ERT commends the efforts planned by the Party and recommends that the Party report on the results of such efforts in the NIR, when appropriate.

### 3. Key categories

#### Stationary combustion: solid, liquid and other fuels – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

49. In the previous review report it was identified that CH<sub>4</sub> emissions from MSW incineration were incorrectly reported as not applicable (“NA”) in the CRF tables, and that the notation key “NE” should have been used instead.<sup>8</sup> In the 2010 inventory submission, the United States has provided emission estimates of CH<sub>4</sub> from MSW incineration (0.01 Gg CH<sub>4</sub>). In addition, it was noted in the previous review report that there was a discrepancy between the information in the NIR and in the CRF tables concerning where the emissions from the incineration of MSW were allocated: while CRF table 1.A(a) informed that emissions from MSW were reported under other fuel use in the category public electricity and heat production, the NIR informed that these emissions were reported under the category other (1.A.5). In the 2010 inventory submission, the Party reports in a consistent manner that emissions from MSW were reported under other fuel use in the category public electricity and heat production. The ERT commends the United States for these improvements.

50. Emissions from solid fuels under stationary combustion are calculated on the basis of data on fuel consumption and estimates of the country-specific carbon content of the fuels. However, as also noted in the previous review report,<sup>9</sup> the ERT noted that data on the carbon content of coal may not be sufficiently up to date for the most recent years: the United States has a complex process of changing the estimated carbon content of coal annually on the basis of the origin and type of the coal, which are based mostly on data from 6,588 coal samples collected by USGS between 1973 and 1989; for the 2010 inventory submission the United States has included 504 new coal samples from the Pennsylvania State University database, but these also mostly predate 1990. Responding to the ERT at the end of the review week, the United States stated that it has assumed that these samples remain relevant to the coal produced and consumed in the United States over the 1990–2008 period. The ERT recommends that the Party make every effort to update the carbon content of coal using more recent data and use it to prepare the emission estimates for its future inventory submissions.

51. The United States has revised the CO<sub>2</sub> EF time series for a number of liquid fuels. During the review, the Party explained to the ERT that the update of EFs used densities and carbon shares from the products covered by the EPA Mandatory Greenhouse Gas Reporting Rule. The new fuel properties were collected from data sources that are based on samples collected over differing time frames. In particular, and as an example, the ERT noted the decrease in the EF for residual oil (no. 6 residual fuel), for which the CO<sub>2</sub> EF has decreased from 21.49 Tg/QBTU (1990) to 20.48 Tg/QBTU (2008). The United States informed the ERT that the decrease can be explained by the adoption of a density and a carbon share for the whole time series from the latest edition of *Perry's Chemical Engineers' Handbook* (eighth edition).<sup>10</sup> The previous (seventh) edition was published in 1997. This would indicate a change in these parameters over time, since the methodology for estimating densities and carbon shares has not changed significantly. The ERT recommends that the

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<sup>8</sup> FCCC/ARR/2009/USA, paragraph 40.

<sup>9</sup> FCCC/ARR/2009/USA, paragraph 38.

<sup>10</sup> Green W and Perry RH. 2008. *Perry's Chemical Engineers' Handbook*. Eighth edition. McGraw-Hill.

United States investigate whether it is appropriate to use the most recent values for the entire time series for all fuels.

52. The United States has reported CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from MSW incineration under the category public electricity and heat production. Significant recalculations reported in the Party's 2010 inventory submission were due to the change of the data source from EPA to BioCycle.<sup>11</sup> From the explanations provided by the United States during the review, the ERT is of the view that the use of data from BioCycle has improved the quality of the estimates, but it noted that the BioCycle report clearly states that emissions from industrial waste incineration are not included in the estimates. In addition, these data do not include emissions from clinical waste incineration. Further, CO<sub>2</sub> emissions from hazardous waste incineration are included by the Party under non-energy use of fuels (under the subcategory stationary (other)). The NIR clarifies that half of the hazardous waste is combusted with energy recovery, while the other half is not. Responding to the ERT at the end of the review week, the United States stated that it believes 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, to assessing this large and complex industry in the United States, although it will continue its efforts to improve the transparency of this approach. The ERT believes that this reporting approach is not in line with the IPCC good practice guidance and the UNFCCC reporting guidelines. The ERT recommends that the United States estimate and report all emissions from the incineration of industrial and clinical waste and 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.

Road transportation: liquid fuels – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

53. The United States added an extra subcategory under road transportation entitled "alternative fuelled vehicles" (under other fuels). The NIR states that this category comprises a number of different liquid fuels. The ERT noted that fuel consumption and CO<sub>2</sub> emissions for this extra subcategory are reported as "IE", whereas figures are reported for CH<sub>4</sub> and N<sub>2</sub>O emissions. The United States informed the ERT during the review that this can be explained by the fact that CO<sub>2</sub> emissions are estimated on the basis of fuel consumption, whereas N<sub>2</sub>O and CH<sub>4</sub> emissions are estimated on the basis of vehicle miles travelled and allocated to vehicle types. The ERT is of the view that transparent explanations are provided in the NIR, but that transparency and comparability in the CRF tables could be enhanced. Therefore, the ERT encourages the United States to add individual liquid fuel categories in the CRF tables as necessary, and to report CO<sub>2</sub> emissions together with N<sub>2</sub>O and CH<sub>4</sub> emissions and fuel consumption for each liquid fuel type in a consistent manner for the "alternative fuelled vehicles" subcategory.

Navigation: liquid fuels – CO<sub>2</sub>

54. The ERT noted several inconsistencies between the CRF tables and the NIR for this category. During the review, the ERT identified that consumption of gasoline in navigation and the associated emissions are reported in the CRF tables as "IE" and that they are reported under the fuel category gas/diesel oil. The ERT noted that the consumption of and emissions from gasoline are reported in the NIR. When comparing the information provided in the NIR with that provided in the CRF tables, the ERT noted a discrepancy in the reported total fuel consumption of gasoline and gas/diesel oil: according to the NIR it amounts to 219.6 TBTU (189.3 TBTU gasoline and 30.3 TBTU gas/diesel oil), which is equivalent to 231,690 TJ; whereas in the CRF tables a total amount of 162,075.61 TJ is reported. The ERT also noted that the CO<sub>2</sub> implied emission factor (IEF) for the reported mix of gasoline and gas/diesel oil (67.04 kg/TJ) is low when compared with the IEF

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<sup>11</sup> BioCycle is America's foremost magazine on composting and organics recycling.



reported for the use of the same fuels in road transportation: 67.62 kg/TJ for gasoline and 70.10 kg/TJ for diesel. The ERT recommends that the United States report separately the consumptions of gasoline and gas/diesel oil and the associated emissions. The ERT also recommends that the Party investigate whether the information provided in the CRF tables on fuel consumption, EFs and CO<sub>2</sub> emissions is correct.

#### Oil and natural gas – CH<sub>4</sub>

55. In the previous review report,<sup>12</sup> significant inter-annual changes in the estimates of CH<sub>4</sub> emissions from production/processing were identified, and the ERT recommended that the United States include in the NIR explanations for the inter-annual changes. In the 2010 inventory submission, the Party has indeed provided detailed information on these changes (in annex 3.4 to the NIR), and the ERT commends the United States for this improvement in transparency.

56. The ERT considers that the estimates of fugitive emissions from oil and gas are very detailed and that the methodology is generally well described in the NIR. However, the ERT noted that the CRF tables contain a significant proportion of AD and emissions reported as “IE” with the explanation “included in the sector” (e.g. AD for and CH<sub>4</sub> emissions from exploration of oil; AD for and emissions from other leakage of natural gas; emissions from venting and flaring for oil and gas; and emissions from other non-specified). During the review, the United States indicated that the explanations provided in the CRF tables could be improved. The ERT recommends that the Party implement these improvements in its future inventory submissions. Responding to the ERT at the end of the review week, the United States informed the ERT that future reporting at facility level could provide information that would enable splitting the emissions from venting and flaring. The ERT acknowledges the difficulties in separating these emissions and appreciates the continued work by the United States to improve its reporting. Therefore, the ERT recommends that the United States continue to explore the possibilities for a more disaggregated reporting of fugitive emissions from oil and natural gas.

#### **4. Non-key categories**

##### Other transportation: gaseous fuels – CH<sub>4</sub> and N<sub>2</sub>O

57. As already noted in the previous review report,<sup>13</sup> emissions of CH<sub>4</sub> and N<sub>2</sub>O from the use of gaseous fuels under the category other transportation, which refer to pipeline emissions, are reported as “NE”. The ERT reiterates the recommendation that the United States, for its future inventory submissions, estimate all emissions for this category.

### **C. Industrial processes and solvent and other product use**

#### **1. Sector overview**

58. In 2008, emissions from the industrial processes sector amounted to 334,464.05 Gg CO<sub>2</sub> eq, or 4.8 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 4,387.15 Gg CO<sub>2</sub> eq, or 0.1 per cent of total GHG emissions. Since 1990, emissions have increased by 5.1 per cent in the industrial processes sector and decreased by 0.4 per cent in the solvent and other product use sector. The key driver for the rise in emissions from the industrial processes sector is the increase in the consumption of halocarbons and SF<sub>6</sub>. Within the industrial processes sector, 39.3 per cent of the emissions were from the consumption of halocarbons and SF<sub>6</sub>, followed by 24.3 per

<sup>12</sup> FCCC/ARR/2009/USA, paragraph 42.

<sup>13</sup> FCCC/ARR/2009/USA, paragraph 43.

cent from metal production, 19.8 per cent from mineral products and 12.6 per cent from chemical industry. The remaining 4.1 per cent were from the production of halocarbons and SF<sub>6</sub>.

59. The ERT noted a large decrease in the sectoral emissions between 2007 and 2008: the estimate of emissions for 2008 was 4.7 per cent lower than the estimate for 2007. This inter-annual variation is mainly the consequence of the decrease in emissions from chemical industry, mineral products, metal production and production of halocarbons and SF<sub>6</sub>, but no explanations are provided in the NIR. This emission reduction is partially offset by an increase in emissions from the consumption of halocarbons and SF<sub>6</sub>. The ERT recommends that the United States analyse and explain the time-series trends and inter-annual variations in the sectoral emissions in its future inventory submissions.

60. The United States' inventory for this sector is generally complete, including estimates for several categories for which there are no estimation methodologies available in the Revised 1996 IPCC Guidelines or in the IPCC good practice guidance. The CRF tables provide an almost complete set of emission estimates, but some categories are still reported as "NE", such as: N<sub>2</sub>O and CH<sub>4</sub> emissions from ammonia production; CO<sub>2</sub> emissions from ethylene; CH<sub>4</sub> emissions from styrene production; CO<sub>2</sub> and CH<sub>4</sub> emissions from calcium carbide production; CH<sub>4</sub> emissions from silicon carbide consumption; CO<sub>2</sub> emissions from food and drink; PFCs and SF<sub>6</sub> emissions from by-product emissions and from fugitive emissions during the production of halocarbons and SF<sub>6</sub>; and HFC-32 emissions from commercial refrigeration (CRF table 2(II).F). Responding to the ERT at the end of the review week, the Party informed the ERT that CO<sub>2</sub> emissions from food and drink should be reported as "IE" and that HFC-32 emissions from commercial refrigeration will be reported as "NO" in its future inventory submissions. The ERT recommends that the United States estimate emissions for these identified categories, in particular for those for which estimation methodologies are available in the Revised 1996 IPCC Guidelines and/or in the IPCC good practice guidance (e.g. CO<sub>2</sub> emissions from calcium carbide production and CH<sub>4</sub> emissions from styrene production), for future inventory submissions.

61. The ERT noted some inconsistency in the use of the notation keys for some categories. For example, CO<sub>2</sub> emissions from ethylene were reported as "NE", although emissions from this activity were accounted for under non-energy use of fossil fuels in the energy sector (NIR, pages 4–25). The ERT considers the correct notation key to be "IE", though this procedure is not in accordance with the IPCC good practice guidance. The ERT recommends that the United States revise its use of the notation keys for its future inventory submissions, in the follow-up of the recommendations made in the previous review report, and make every effort to separate the part of the emissions not resulting from non-energy use of fuels in ethylene production and report these under the appropriate category under other chemical industry.

62. Recalculations were undertaken for: CO<sub>2</sub> emissions from limestone and dolomite use, from other chemical industry, from iron and steel production and from zinc production (under the category other (metal production)); N<sub>2</sub>O emissions from nitric acid production; SF<sub>6</sub> used in magnesium foundries; and HFCs and SF<sub>6</sub> from the consumption of halocarbons and SF<sub>6</sub>. Explanations for the recalculations are included in both the NIR and the CRF tables. The recalculations resulted in decreases of 0.8 per cent for 2007 and of 2.1 per cent for 1990 in emissions from the industrial processes sector.

63. The ERT encourages the United States to provide, in the NIR of future inventory submissions, more detailed information on and analysis of trends in AD and emissions for each category. The ERT noted significant inter-annual fluctuations in the estimates of emissions for some categories, including soda ash use, silicon carbide and urea consumption, and lead and zinc production, for which no explanations were provided in the NIR. The ERT noted improvements regarding the inclusion in the NIR of discussions on

time-series consistency for the majority of the categories, as recommended in the previous review report,<sup>14</sup> but the ERT considers that the Party may further improve the descriptions in the NIR. Therefore, the ERT encourages the United States to provide, in the NIR of future inventory submissions, more detailed information on and analysis of trends in AD and emissions for each category under the industrial processes sector.

64. The United States informed the ERT that it expects that data from large industrial facilities will be used for its future inventory submissions, in order to improve the accuracy of the inventory. The ERT encourages the Party to pursue its efforts to collect data directly from industrial plants. In particular, the ERT welcomes the effort of EPA in the rule-making and implementation of the Mandatory Greenhouse Gas Reporting Rule, which will greatly help the Party in this endeavour (see para. 40 above). The ERT recommends that the United States report on the progress made in this regard in its future inventory submissions.

## 2. Key categories

### Cement production – CO<sub>2</sub>

65. Estimates of CO<sub>2</sub> from cement production are calculated using the tier 2 methodology, using IPCC default values for the CKD correction factor and the EF. Since cement production is a key category, the ERT reiterates the recommendation made in the previous review report<sup>15</sup> that the United States use a higher-tier method to estimate emissions from cement production and that it develop country-specific values for the EF and the CKD correction factor. The ERT also recommends that the Party improve the transparency of its reporting of emissions from magnesium oxide in cement clinker production in its future inventory submissions.

### Iron and steel production – CO<sub>2</sub>

66. For its 2010 inventory submission, the United States recalculated the emission estimates for this category, in order to correct the double counting that was affecting the estimates of emissions from basic oxygen furnaces. Explanations for this are provided in the NIR. The recalculations of the estimates of CO<sub>2</sub> emissions from iron and steel production resulted in a 6.6 per cent decrease in the estimate of CO<sub>2</sub> emissions for 1990 and a 5.9 per cent decrease in the estimate of CO<sub>2</sub> emissions for 2007. During the review, the United States informed the ERT that emissions from direct reduced iron (DRI) were calculated separately using a tier 1 approach, and the ERT encourages the United States to recalculate its DRI emissions, applying a higher-tier methodology.

67. During the review, the United States provided additional information on the carbon balance for iron and steel production, which, in the opinion of the ERT, improves the transparency of the reporting. The ERT recommends that the Party update the carbon balance annually and report it in the NIR.

### Ammonia production – CO<sub>2</sub>

68. The ERT noted that the United States subtracts CO<sub>2</sub> emissions from ammonia production and allocates them to other categories: according to the NIR, not all of the CO<sub>2</sub> produced in the production of ammonia is accounted for under this category, since the carbon used in urea production is subtracted and assumed to be released into the environment as CO<sub>2</sub> during use. The majority of the CO<sub>2</sub> emissions associated with urea consumption are those that result from its use as a fertilizer, and these emissions are accounted for under cropland remaining cropland (CRF table 5(IV)). The ERT noted that

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<sup>14</sup> FCCC/ARR/2009/USA, paragraph 46.

<sup>15</sup> FCCC/ARR/2009/USA, paragraph 48.

this reporting approach is not in accordance with the Revised 1996 IPCC Guidelines and the UNFCCC reporting guidelines, although the overall balance of CO<sub>2</sub> emissions does not appear to have been either overestimated or underestimated. In order to assess the completeness of the allocation rules used, the ERT recommends that the United States allocate all emissions from ammonia production to the industrial processes sector, in accordance with the Revised 1996 IPCC Guidelines (page 2.16), and encourages the Party to include, in its future inventory submissions, a CO<sub>2</sub> balance table for this category, including the amounts of carbon temporarily stored, in addition to the AD table which is already provided in the NIR.

### 3. Non-key categories

#### Nitric acid production – N<sub>2</sub>O

69. N<sub>2</sub>O emissions are estimated using the IPCC default EFs corresponding to the two types of nitrous oxide abatement technologies used in the country: selective catalytic reduction and non-selective catalytic reduction. The ERT encourages the United States to use plant-specific data based on the actual monitoring of N<sub>2</sub>O emissions and destruction. The ERT also encourages the Party to provide historical data on the type of technology used to produce nitric acid, in its future inventory submissions, in order to facilitate the assessment of the time-series consistency of the IEF.

## D. Agriculture

### 1. Sector overview

70. In 2008, emissions from the agriculture sector amounted to 427,528.47 Gg CO<sub>2</sub> eq, or 6.2 per cent of total GHG emissions. Since 1990, emissions have increased by 10.2 per cent. The increase in GHG emissions resulted from the increase in CH<sub>4</sub> emissions from enteric fermentation and manure management. The key drivers for the rise in emissions between 1990 and 2008 are: a substantial increase in the numbers of swine (by 13.37 million heads or 24.8 per cent) and poultry (by 638.05 million heads or 41.5 per cent); an increase in productivity rates (mature weights, weight gains and milk yields); a decrease in feed digestibility in recent years (from 2004 to 2007); and the increasing use of liquid systems for managing manure, following a shift towards larger dairy and swine agricultural enterprises. Within the sector, 50.5 per cent of the emissions were from agricultural soils, followed by 32.9 per cent from enteric fermentation, 14.5 per cent from manure management and 1.7 per cent from rice cultivation. The remaining 0.3 per cent were from field burning of agricultural residues. Prescribed burning of savannas is reported as “NA”.

71. The inventory includes estimates of all gases and all major categories of emissions from the agriculture sector, in accordance with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. Emissions have been reported for all years of the inventory time series and cover the entire national territory. The ERT noted that the population size of and emissions from buffalo, camels and llamas, as well as mules and asses are reported as “NE”, and the Party states in the CRF tables that there are no significant populations of these animals in the country. However, the ERT considers that it is likely that livestock numbers for these animal categories managed in the country are known and could be used to complete the inventory. The ERT noted, for example, that data<sup>16</sup> from the Food and Agriculture Organization of the United Nations (FAO) show that in 2008 there were 52,000 asses and 28,000 mules in the United States. During the review, the United States expressed its intention to conduct analyses of these livestock populations and to determine whether it

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<sup>16</sup> FAOSTAT database of FAO, available at <<http://faostat.fao.org/site/573/default.aspx>>.

is justified to include these species in its future inventories. The ERT commends these plans and encourages the Party to use the results of these analyses to solve this issue for its future inventory submissions, focusing resources as appropriate in line with the IPCC good practice guidance. The ERT also commends the Party's intention to include estimates of emissions from managed populations of American bison in its future inventory submissions.

72. Justifications for relevant inter-annual variability in the IEFs for cattle and swine for enteric fermentation and manure management are not transparently reported in the NIR. To improve transparency, the ERT encourages the United States to include in its future inventory submissions more detailed information regarding trends and inter-annual changes in agricultural practices, animal productivity, manure allocation per animal waste management system (AWMS) and the consequences of these changes for the IEF values, with supporting tables or charts (e.g. results of correlation analysis) where necessary.

73. The United States uses a tier 2 methodology to estimate CH<sub>4</sub> emissions from enteric fermentation and manure management. Emissions are estimated using CEFM, which includes an enhanced characterization of populations and estimates of energy intake and methane conversion rates from the 2006 IPCC Guidelines. However, the ERT noted that the Party does not present information on some country-specific EFs and parameters (e.g. volatile solid (VS) excretion, N excretion rates for animals other than cattle, and CH<sub>4</sub> EFs for manure management), nor a comparison of the values used by the United States with the IPCC default values (contained in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance). This is particularly important because some of the country-specific values used depart significantly from the values used by other reporting Parties. For example, the CH<sub>4</sub> IEF for manure management in 2008 for dairy cattle (67.75 kg/head/year) is the highest among the reporting Parties (ranging from 3.20 to 67.75 kg/head/year), while that for non-dairy cattle (1.35 kg/head/year) is among the lowest (ranging from 0.04 to 21.03 kg/head/year). During the review, the United States provided the ERT with information explaining that the differences in the IEFs are the result of country-specific data on AWMS: in the United States, very large dairy farms typically use anaerobic lagoons or liquid/slurry systems, which have higher methane conversion factors. The ERT recommends that the Party include the above-mentioned explanatory information and data in its future inventory submissions.

74. The NIR mentions (pages A-205 and A-206) that the shares of AWMS for dairy cattle and swine were established using data from the Census of Agriculture, the EPA Office of Water, USDA and expert sources. However, the ERT noted that the latest year for which such data are provided is 2002, and that for 2003 to 2008 the same distribution of AWMS is assumed. At the same time, the ERT noted that the NIR mentions (pages 6 and 7) that the practice of manure removal and storage is not the same from year to year, and that new regulations limiting the application of manure and its nutrients have changed the manure management practices at small dairy farms, shifting from daily spread to manure managed and stored on site. In response to a question raised by the ERT, the Party clarified that more recent data on AWMS are very limited, but that nevertheless the inventory team plans to update the AWMS time series using data from the 2007 Census of Agriculture. The ERT encourages the Party to continue its efforts to improve the time series of manure allocation data per AWMS in its future inventory submissions.

## 2. Key categories

### Enteric fermentation – CH<sub>4</sub>

75. The United States uses a tier 2 approach and EFs and parameters that are country-specific or calculated using the methodologies contained in the 2006 IPCC Guidelines to

estimate emissions from enteric fermentation for cattle. Emissions from all other livestock classes are estimated using the tier 1 approach and IPCC default values. The methodologies used to calculate CH<sub>4</sub> emissions from enteric fermentation for livestock are generally in line with the IPCC good practice guidance. However, the ERT noted that the EF for bulls is the default EF contained in the 2006 IPCC Guidelines for other cattle in North America (53 kg/head/year). This EF is lower than the country-specific EF for other subclasses of cattle (94 kg/head/year for cows, 60 kg/head/year for replacements 7–11 months, 69 kg/head/year for replacements 12–23 months, 57 kg/head/year for steer stockers and 59 kg/head/year for heifer stockers<sup>17</sup>) and is not consistent with the larger weight of breeding bulls (750–800 kg), even taking into account additional energy requirements for growth in younger animals. Such inconsistency is explained by the fact that the default EF from the 2006 IPCC Guidelines (table 10.11) is an average value including young animals and even calves. During the review, the United States informed the ERT that, given the relatively small national population of adult bulls, the use of this lower than appropriate EF has no significant effect on the overall accuracy of the emission estimates for cattle. Nevertheless, the ERT considers that the United States could improve the accuracy of its emission estimates and encourages the Party to make efforts to shift to a tier 2 methodology to estimate emissions for the category bulls or to revise the country-specific EFs that it is currently using for this animal type.

#### Manure management – CH<sub>4</sub>

76. The methodology used to calculate CH<sub>4</sub> emissions from livestock manure management is based on the methodology contained in the 2006 IPCC Guidelines and is consistent with the IPCC good practice guidance. Following recommendations made in the previous review report, the United States implemented some improvements to the emission estimates, such as using cattle diet characteristics and population data from CEFM. Overall, these changes resulted in changes in the estimates of VS and CH<sub>4</sub> emissions from manure management. The ERT commends the Party for such improvements, which resulted in a decrease in the estimate of emissions for 1990 by 3.6 per cent and an increase in the estimate of emissions for 2007 by 4.3 per cent.

77. According to the data in CRF table 4.B(a), warm climate in the United States is reported as “NO”. However, the ERT noted that southern states (e.g. Hawaii and Florida) may have a tropical climate (i.e. annual temperatures higher than 25 °C) and that this could have led to an underestimation of GHG emissions. During the review week, the Party clarified that climate data from the National Oceanic and Atmospheric Administration are collected at the county level but then aggregated to the state level for the calculations. While some counties may have average annual temperatures above 25 °C, when aggregated to the state level all average temperatures correspond to a cool or temperate climate. The ERT recommends that the Party include this explanation and information on annual average temperatures per state for the reported year in the NIR of its future inventory submissions.

#### Direct soil emissions – N<sub>2</sub>O

78. The ERT noted that the NIR does not describe in a transparent manner all the methodological assumptions used to calculate the amount of N in non-major crop residues applied to soils. In particular, it is not clear from the NIR whether the Party has used the 2006 IPCC Guidelines (equation 11.6) to determine the following parameters: Frac<sub>RENEW</sub> (the fraction of total area under crop that is renewed annually); and Frac<sub>REMOVE</sub> (the fraction of above-ground residues of crop removed annually for purposes such as feed, bedding and construction). Responding to the ERT after the review week, the United States clarified that Frac<sub>RENEW</sub> is assumed to be 1.00, since non-major crops are annual crops, and Frac<sub>REMOVE</sub> is

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<sup>17</sup> All values for 2008.

assumed to be zero. The ERT recommends that the United States improve the transparency of the reporting of these assumptions in the NIR, and investigate the appropriateness of the assumed value of  $\text{Frac}_{\text{RENEW}}$  for pastures, as well as the availability of data on residues removed for the purposes of bedding, construction or feed, for non-major crops.

79. The amount of synthetic fertilizer applied as reported in CRF table 4.D differs from FAO statistical data by 1.6–3.9 per cent for the period 1990–2008. The Party provided information to the ERT clarifying how the time series of the amount of synthetic fertilizer applied was estimated. The total amount of fertilizer used at farms was estimated by USGS for the period 1990–2001 on a county-level basis and from fertilizer sales data (Ruddy et al., 2006). For the subsequent period (2002–2008), the fertilizer used at farms, also available at county level, was adjusted to take into account annual fluctuations in total fertilizer sales (data from the Association of American Plant Food Control Officials or the period 1995–2008). In addition, fertilizer application data were available for major crops and grassland, estimated using the synthetic N fertilization rates defined by the USDA Cropping Practices Survey relative to 1995. Finally, the amount of N applied to non-major crops was assumed to be the remainder of the fertilizer used at farms after subtracting the amount applied to major crops and grassland. The ERT encourages the Party to include explanatory information about the differences between the data reported in the CRF tables and the FAO data under QA/QC activities in the NIR of its future inventory submissions.

80. The United States reported all fractions listed in CRF table 4.D as “NA”. During the review, the Party explained that emissions from the majority of the N sources within the direct soil  $\text{N}_2\text{O}$  emissions category (synthetic fertilizers, animal manure, crop residues and organic soils) are calculated using the DAYCENT model (tier 3) and that the fractions listed in CRF table 4.D are not used in the calculations. Only emissions from a minority of the N sources are calculated using a tier 1 approach using these fractions, but since the fractions are not used for all or even the majority of the N sources, they were reported as “NA”. The ERT understands the explanations of the Party but noted that this procedure impairs comparability with other reporting Parties. The ERT encourages the United States to report the fractions it uses in the emission calculations or make efforts to calculate implied fractions derived from AD for its future inventory submissions.

#### Manure management – $\text{N}_2\text{O}$

81. N excretion values reported for 2008 in CRF table 4.B(b) for all animal categories (except horses) are much lower than the corresponding default values contained in the Revised 1996 IPCC Guidelines (table 4-20): for dairy cattle the value in the CRF table (83.16 kg N/head/year) is 16.8 per cent lower than the IPCC default value (100 kg N/head/year); for non-dairy cattle the value in the CRF table (44.78 kg N/head/year) is 36.0 per cent lower than the IPCC default value (70 kg N/head/year); for sheep the value in the CRF table (10.52 kg N/head/year) is 34.2 per cent lower than the IPCC default value (16 kg N/head/year); and for swine the value in the CRF table (8.39 kg N/head/year) is 58.1 per cent lower than the IPCC default value (20 kg N/head/year). In response to a question raised by the ERT during the review, the Party informed the ERT that for cattle it uses region-specific (county) data on diets and animal characteristics, in combination with the energy balance equations to estimate N excretion rates from the 2006 IPCC Guidelines (equation 10.32). On the other hand, for other livestock the United States stated that it intends to use, for its next inventory submission, N excretion rates in accordance with the revised values provided in the USDA 2008 *Animal Waste Management Field Handbook* (the previous version was from 1996). The ERT recommends that the United States perform, as a QC measure, a cross-check of national N excretion estimates with the corresponding default values from the Revised 1996 IPCC Guidelines and other recognized international scientific literature, and that the Party include explanatory information about any substantial discrepancies in its future inventory submissions.

## **E. Land use, land-use change and forestry**

### **1. Sector overview**

82. In 2008, net removals from the LULUCF sector amounted to 908,148.34 Gg CO<sub>2</sub> eq, offsetting 13.1 per cent of total national emissions. Since 1990, net removals have increased by 1.5 per cent. Within the sector, the ongoing rise in removals from forest land remaining forest land and settlements (urban trees) is offset by declining rates of carbon sequestration in harvested wood products (reported under the category other) and carbon stock change in soils, both under grassland and cropland. In 2008, forest land (703,924.96 Gg CO<sub>2</sub> eq), settlements/urban trees (93,902.61 Gg CO<sub>2</sub> eq) and harvested wood products (87,975.23 Gg CO<sub>2</sub> eq) were the major categories responsible for removals in the sector. Other categories resulting in net CO<sub>2</sub> removals were grassland (32,913.37 Gg CO<sub>2</sub> eq), cropland remaining cropland (10,413.92 Gg CO<sub>2</sub> eq) and landfilled yard trimmings and food scraps (reported under the category other) (9,528.40 Gg CO<sub>2</sub> eq). Categories reported as having net CO<sub>2</sub> emissions were land converted to cropland (5,947.33 Gg CO<sub>2</sub> eq) and wetlands remaining wetlands (941.10 Gg CO<sub>2</sub> eq).

83. The United States has reported a complete land-use change matrix for selected years in the time series (1990, 1995, 2000 and 2005–2008) using approach 1 from the IPCC good practice guidance for LULUCF for the consistent representation of land areas (table 7-5 of the NIR). However, the ERT found some reporting gaps and an inconsistent use of the notation keys: the Party has reported net removals/emissions from land converted to forest land as “NE”, but explains that these emissions/removals cannot be distinguished from those from forest land remaining forest land; and emissions/removals for the category land converted to other land are reported only as totals, while emissions/removals from individual 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 land converted to settlements, which is the fastest-growing land-use category. Responding to the ERT after the review week, the Party informed the ERT that it has difficulties reporting carbon stock changes by land-use change category, since the Forest Inventory and Analysis (FIA) National Program is the primary source of data for reporting forest carbon stock changes and it is not possible to disaggregate the FIA data into forest land remaining forest land and land converted to forest land. However, the Party also informed the ERT that it will examine its use of the notation keys for its next inventory submission, in order to enhance consistency. The ERT encourages the Party in its efforts to improve the reporting on this sector.

84. The ERT noted that tier 3 estimation approaches have been developed and implemented for several important categories (forest land, cropland remaining cropland, grassland remaining grassland, harvested wood products and urban trees (settlements remaining settlements)) and that those methods are, in general, adequately described in the NIR. The single most important exception is the estimation of changes in organic soil carbon stocks in forest land remaining forest land, which account for 20.7 per cent of the total net annual carbon stock changes (CRF table 5.A): little information is provided on how the annual carbon stock changes are estimated. The ERT recommends that the Party include additional explanations thereon in its future inventory submissions.

85. The ERT noted that the NIR generally fails to identify and explain trends and their drivers. This applies in particular to the categories forest land, grassland and settlements, as well as to harvested wood products. For example, the NIR (pages 7–13) states that management activities and the ongoing impact of previous land-use changes are the primary drivers of large carbon stock changes in forest land, but the relative contribution of the increase in forest land area remains unclear. The ERT strongly encourages the United



States to include descriptions of the relative contributions of changes in forest area and age-class distribution in its future inventory submissions.

86. As noted in previous review reports, some inconsistencies between the values reported in the NIR and in the CRF tables continue to impair transparency; for example, estimates of net emissions from wetlands remaining wetlands are provided in the NIR and in CRF table 5, but no values are provided in CRF table 5.D. Further, the NIR states that total net CO<sub>2</sub> removals from the sector in 2008 amounted to 940.3 Tg CO<sub>2</sub> eq, while CRF table 10 reports net CO<sub>2</sub> removals of 908,148.37 Gg CO<sub>2</sub> eq. The ERT reiterates the recommendation of previous ERTs that the Party improve the quality and consistency of the information in the CRF tables with the information in the NIR.

87. Recalculations for the LULUCF sector were made for the forest land and settlements categories and resulted in a significant increase in the estimate of net removals for 1990 (by 8.1 per cent) and decrease in the estimate of net removals for 2007 (by 11.0 per cent). The reasons for the recalculations are explained in the NIR and include the revision of the time series for forest land with a new release of FIA data, the inclusion of areas previously unaccounted for (areas of forest land in western Texas were included for the first time) and the revision of areas (revised data were available for Chicago's urban forest).

88. The ERT could not find sufficient explanations in the NIR of the factors considered in the uncertainty analysis for forest land. During the review, the ERT learned that the largest sources of uncertainty in the forest land estimates are relating old and recent forest inventory data and the derivation of carbon stock changes from successive forest data. The ERT recommends that the Party provide a synoptic description of all the uncertainty sources included in the forest land uncertainty analysis, as well as a summary of their respective contribution to overall uncertainty.

## 2. Key categories

### Forest land – CO<sub>2</sub>

89. The United States has developed a country-specific tier 3 approach in which estimates of carbon stock changes are derived from successive forest inventory measurements available at the state level. The main data source is the USDA FIA Program Database. The ERT noted that documentation on the collection and processing of forest inventory data is widely available, but that there are some areas where transparency could be improved. For example, the United States indicated that inter-annual variability in carbon stock changes is driven by the incorporation of forest inventory updates; however, the ERT considers that the implications of including forest inventory data not previously included, such as the addition of 19.5 million ha forest land in western Texas, for inter-annual variability and for the trend, as well as the method used to perform the recalculations, are not transparently explained in the NIR. The ERT reiterates the recommendation made in the previous review report<sup>18</sup> that the Party provide a more in-depth assessment of the causes and drivers of trends and inter-annual variations in its future inventory submissions.

### Settlements – CO<sub>2</sub>

90. Settlements is the fastest-growing land-use category in terms of both area and net CO<sub>2</sub> removals (showing a 64.4 per cent increase from 1990 to 2008). The Party confirmed during the review that approximately 92 per cent of its settlements are deemed urban land with a 27 per cent tree cover ("urban trees"). The ERT noted that increases in the land area of settlements automatically result in an increase in fast-growing urban trees, but it also

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<sup>18</sup> FCCC/ARR/2009/USA, paragraph 68.

noted that it is unclear from the Party's NIR whether new urban tree cover represents only newly planted trees or also includes remnants of pre-conversion vegetation. The ERT recommends that the United States prioritize the collection of appropriate data to estimate rates of forest land conversion to settlements, specifying the origin of new urban tree cover, for its future inventory submissions.

#### Grassland remaining grassland – CO<sub>2</sub>

91. A model-based tier 3 approach was applied to estimate soil carbon stock changes for this category. The ERT noticed that the time series of net CO<sub>2</sub> emissions/removals shows some apparent inconsistencies: the high inter-annual variability in the period 1990–2002 is followed by a nearly flat trend after 2003. Responding to the ERT after the review week, the Party explained that this results from the fact that no new AD were available to estimate carbon stock changes after 2003. The ERT recommends that the United States revise the time series so that it is consistent, in accordance with the IPCC good practice guidance.

#### Forest land remaining forest land – CH<sub>4</sub> and N<sub>2</sub>O

92. Non-CO<sub>2</sub> emissions from forest fires on forest land are identified as key categories by virtue of their trend. Irrespective of the high inter-annual variability, which is expected for such phenomena, the AD (area burned annually) display a distinct increasing trend: the total area burned increased between 1990 (487,804.75 ha) and 2008 (1,664,588.78 ha) by 241.2 per cent. The ERT could not ascertain during the review whether this was a methodological artefact or an actual trend, and recommends that the United States clarify this matter in its future inventory submissions.

### **3. Non-key categories**

#### Other – CO<sub>2</sub>

93. Under this category the United States has included<sup>19</sup> net removals of CO<sub>2</sub> that are stored in wood products that are both harvested in the United States and are either still in use or buried in landfills. In order to estimate removals from products and emissions from the decay of products disposed of in landfills over previous decades, the United States applied a country-specific method that requires a century of production data. 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 encourages the Party to analyse the sensitivity of the estimates used to determine this assumption, and to document the reasons for the declining carbon stocks (–62.3 per cent since 1990) in harvested wood products in use.

## **F. Waste**

### **1. Sector overview**

94. In 2008, emissions from the waste sector amounted to 159,128.96 Gg CO<sub>2</sub> eq, or 2.3 per cent of total GHG emissions. Since 1990, emissions have decreased by 10.2 per cent. The key driver for the fall in emissions is the increasing rate of CH<sub>4</sub> recovery from landfills (from 10.9 per cent in 1990 to 51.7 per cent in 2008), which offsets the rise in CH<sub>4</sub> generation from MSW in disposal sites (an increase of 56.2 per cent from 1990 (7,982.26 Gg CH<sub>4</sub>) to 2008 (12,467.72 Gg CH<sub>4</sub>)). Within the sector, 79.4 per cent of the emissions in

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<sup>19</sup> Other emissions included under other are emissions from yard trimmings and food scraps.

2008 were from solid waste disposal on land, followed by 18.4 per cent from wastewater handling. The remaining 2.2 per cent were CH<sub>4</sub> and N<sub>2</sub>O emissions from waste composting, reported under the category other.

95. Recalculations were undertaken by the United States for its 2010 inventory submission, but references and explanations for these recalculations were not included in the waste chapter of the NIR and only limited information is available in CRF table 8(b). CH<sub>4</sub> emissions from solid waste disposal were recalculated on the basis of updated data; CH<sub>4</sub> emissions from wastewater handling were recalculated owing to the re-estimation of total organic product; and N<sub>2</sub>O emissions from wastewater handling were re-estimated on the basis of updated data on population and per capita protein consumption. The impact of these recalculations was an increase in the estimate of CH<sub>4</sub> emissions of 0.07 per cent for 1990 and a decrease of 4.0 per cent in the estimate for 2007, and a minimal increase in the estimate of N<sub>2</sub>O emissions for 2007 (0.03 per cent). The ERT recommends that the Party improve the transparency of the justification for the recalculations in its future inventory submissions.

## 2. Key categories

### Solid waste disposal on land – CH<sub>4</sub>

96. Concerns about a relatively constant per capita waste generation rate over the entire time series were raised in the previous review report.<sup>20</sup> In response to a question raised by the present ERT during the review, the Party stated that it is using waste disposal rates rather than waste generation rates, and that these disposal rates are based on the 2008 BioCycle *State of Garbage* report that represents waste disposal data for 2006.

97. The ERT noted that the United States used a constant degradable organic carbon (DOC) value (0.203) over the entire time series. In response to a question raised by the ERT during the review, the United States stated that changes to DOC values in the inventory would be made, as appropriate, after data have been received from the GHG Reporting Program in March 2011 and evaluated. Responding to the ERT after the review week, the United States informed the ERT that the DOC value is based on country-specific data. The ERT encourages the Party in its efforts to improve this parameter.

98. The CH<sub>4</sub> emission estimates were recalculated on the basis of updated data on the recovery of landfill gas, which is reported in CRF table 6.A.C. However, section 8.1 of the NIR, concerning recalculations, does not include any information on revised values of recovered landfill gas. The ERT recommends that the United States improve the transparency of the reporting of justifications for recalculations in the waste chapter of the NIR in its future inventory submissions.

## 3. Non-key categories

### Wastewater handling – CH<sub>4</sub> and N<sub>2</sub>O

99. The ERT commends the United States for continually improving its estimates of emissions from wastewater handling. In response to a question raised by the ERT during the review on the progress made by the Party in including emissions from organic chemical industries (another industry referred to in the NIR under planned improvements) in the emission estimates, the Party informed the ERT that, on the basis of data for 1987, emissions from this source are small and that this category is not likely to be a significant source of CH<sub>4</sub> emissions. The ERT therefore recommends that the United States use this

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<sup>20</sup> FCCC/ARR/2009/USA, paragraph 76.

reassessment to update its estimate of emissions and that it report transparently on this issue in the NIR of its future inventory submissions.

100. During the review, the ERT noted an apparent inconsistency in the reporting of CH<sub>4</sub> emissions from sludge in domestic and commercial wastewater: while emissions are reported as “NE”, an estimate of CH<sub>4</sub> recovery (788.27 Gg CH<sub>4</sub>) is provided. On the other hand, the United States reports the recovery of CH<sub>4</sub> from sludge treatment of domestic and commercial wastewater as “NE”, while the NIR (pages 7 and 8) informs that CH<sub>4</sub> emissions from the treatment of sludge in domestic wastewater were estimated. Responding to the ERT during the review, the United States clarified that it calculated CH<sub>4</sub> emissions from wastewater treatment but not their recovery, while it calculated CH<sub>4</sub> emissions and recovery from sludge treatment, but that the CRF tables do not correctly reflect the results of the calculations, owing to problems with links between the worksheets and the CRF Reporter. The Party stated that it will replace the current reporting in its next inventory submission with estimates that are already available. The ERT recommends that the Party do so in its next inventory submission.

#### Waste incineration – CH<sub>4</sub> and N<sub>2</sub>O

101. As noted in the previous review report,<sup>21</sup> emissions from waste incineration are reported under the energy sector; however, the ERT noted that CH<sub>4</sub> emissions from waste incineration have been reported as “NE” and not as “IE” as the other gases have been reported. The ERT recommends that the United States increase the transparency of its reporting by revising the notation key to “IE”, since these emissions have been accounted for under the energy sector and discussed in annex 3.6 to the NIR

### **III. Conclusions and recommendations**

102. The United States made its inventory submission on 15 April 2010. The inventory submission contains the GHG inventory, comprising a complete set of CRF tables for the years 1990–2008 and an NIR. The ERT concludes that the inventory submission of the United States has been prepared and the information therein generally reported in accordance with the UNFCCC reporting guidelines. However, the ERT noted that total emissions from fuel combustion in “U.S. territories” are reported under the category other (energy (1.A.5)) and are not allocated to the corresponding categories in accordance with the UNFCCC reporting guidelines. The ERT also found that the Party did not include sufficiently transparent information on the data and methodologies used for the estimation of emissions for the “U.S. territories” in the NIR.

103. The inventory is complete in terms of years and geographical coverage, and generally covers all source and sink categories for the period 1990–2008. However, some categories were reported as “NE” (see para. 9 above for a complete list). The Party has provided explanations for some of the exclusions in the NIR; the main reason for reporting certain categories as “NE” seems to be a lack of AD.

104. The Party’s inventory is generally in line with the UNFCCC reporting guidelines, the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. However, the ERT noted that tier 1 methods have been applied for some key categories, particularly in the energy sector. The ERT also noted that the United States is broadly using the 2006 IPCC Guidelines for all sectors. In particular, the ERT noted that the Party refers to the definition of methodological tiers provided in the 2006 IPCC Guidelines when providing information on methodologies and EFs in CRF table

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<sup>21</sup> FCCC/ARR/2009/USA, paragraph 72.

summary 3, which sometimes differ from the definitions contained in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance.

105. The institutional arrangements implemented by the United States for the preparation of the inventory continue to perform their required functions. The United States' inventory is prepared in a decentralized manner: OAP in OAR of EPA is responsible for the preparation of the annual GHG inventory, in collaboration with a wide range of government agencies and academic and research centres, as well as individual companies participating in voluntary outreach efforts with EPA. The United States has a QA/QC plan in place, which is in accordance with the IPCC good practice guidance, including both tier 1 and tier 2 checks.

106. In the course of the review, the ERT formulated a number of recommendations relating to the completeness of the Party's inventory submission and the transparency of the information presented therein. The key recommendations are that the United States:

- (a) Improve the completeness of the inventory, particularly by focusing its efforts on those categories for which the Revised 1996 IPCC Guidelines and/or the IPCC good practice guidance and the IPCC good practice guidance for LULUCF provide estimation methodologies (see paras. 9 and 10 above);
- (b) Use higher-tier methods to estimate emissions for key categories, in particular in the energy sector;
- (c) Report emissions from the energy sector at a more disaggregated level;
- (d) Improve the transparency of the emission estimates for the "U.S. territories";
- (e) Improve the reporting of trends and inter-annual variations, in particular for the industrial processes, agriculture and LULUCF sectors.

## 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/gpplulucf/gpplulucf.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 2010. Available at

<<http://unfccc.int/resource/docs/2010/asr/usa.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2010.

Available at <<http://unfccc.int/resource/webdocs/sai/2010.pdf>>.

FCCC/ARR/2009/USA. Report of the individual review of the greenhouse gas inventory of the United States of America submitted in 2009. Available at

<<http://unfccc.int/resource/docs/2010/arr/usa.pdf>>.

#### B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Leif Hockstad (United States Environmental Protection Agency), including additional material on the methodologies and assumptions used. The following documents<sup>1</sup> were also provided by the Party:

Novak, D. J. & Crane, D. E. 2001. Carbon Storage and Sequestration by Urban Trees in the USA. *Environmental Pollution* 116 (2002) 381–389. Elsevier. Available at

<[www.elsevier.com/locate/envpol](http://www.elsevier.com/locate/envpol)>.

EPA. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990–2008: Addendum to Annex 7: Uncertainty. EPA/OAR/OAP, 2010.

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<sup>1</sup> Reproduced as received from the Party.

## Annex II

### Acronyms and abbreviations

AD	activity data
AWMS	animal waste management system
CEFM	Cattle Enteric Fermentation Model
CH <sub>4</sub>	methane
CKD	cement kiln dust
CO <sub>2</sub>	carbon dioxide
CO <sub>2</sub> eq	carbon dioxide equivalent
CRF	common reporting format
DOC	degradable organic carbon
DRI	direct reduced iron
EF	emission factor
ERT	expert review team
FAO	Food and Agriculture Organization of the United Nations
GHG	greenhouse gas; unless indicated otherwise, GHG emissions are the sum of CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O, HFCs, PFCs and SF <sub>6</sub> without GHG emissions and removals from LULUCF
HFCs	hydrofluorocarbons
IE	included elsewhere
IEF	implied emission factor
IPCC	Intergovernmental Panel on Climate Change
kg	kilogram (1 kg = 1,000 grams)
LULUCF	land use, land-use change and forestry
MSW	municipal solid waste
N	nitrogen
NA	not applicable
NE	not estimated
N <sub>2</sub> O	nitrous oxide
NIR	national inventory report
NO	not occurring
PFCs	perfluorocarbons
QA/QC	quality assurance/quality control
QBTU	Quadrillion British Thermal Unit, or 10 <sup>15</sup> BTU
SF <sub>6</sub>	sulphur hexafluoride
TBTU	Tera British Thermal Unit
Tg	teragram (1 Tg = 1 million tonnes)
TJ	terajoule (1 TJ = 10 <sup>12</sup> joule)
UNFCCC	United Nations Framework Convention on Climate Change
VS	volatile solids