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Report of the individual review of the greenhouse gas inventory of Ukraine submitted in 2006*

* In the symbol for this document, 2006 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

I. Overview

A. Introduction

1. This report covers the in-country review of the 2006 greenhouse gas (GHG) inventory submission of Ukraine, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 16 to 21 April 2007 in Kiev, Ukraine, and was conducted by the following team of nominated experts from the roster of experts: generalist – Mr. Jan Pretel (Czech Republic); energy – Ms. Erasmia Kitou (European Community); industrial processes – Mr. Hongwei Yang (China); agriculture – Ms. Batima Punsalmaa (Mongolia); land use, land-use change and forestry (LULUCF) – Mr. Mikhail Gytarsky (Russian Federation); waste – Ms. Tatiana Tugui (Moldova). Mr. Jan Pretel and Mr. Hongwei Yang were the lead reviewers. The review was coordinated by Mr. Javier Hanna (UNFCCC secretariat).

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

B. Inventory submission and other sources of information

3. In its 2006 submission, Ukraine submitted a complete set of common reporting format (CRF) tables for the years 1990–2004 and a national inventory report (NIR). Where needed the expert review team (ERT) also used submissions from previous year, additional information provided during the review and other information. The full list of materials used during the review is provided in the annex to this report.

4. After the in-country review, following the recommendations of the ERT, Ukraine submitted a complete set of revised CRF tables for the years 1990–2004.

C. Emission profiles and trends

5. In 2004, the most important GHG in Ukraine was carbon dioxide (CO_2), contributing 76.5 per cent to total[1] national GHG emissions expressed in CO_2 equivalent,[2] followed by methane (CH_4), 18.1 per cent, and nitrous oxide (N_2O), 5.4 per cent. Perfluorocarbons (PFCs) contributed 0.02 per cent of the overall GHG emissions in the country. No numerical values for hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) were reported. The energy sector accounted for 68.5 per cent of the total GHG emissions followed by the industrial processes sector, 21.8 per cent, agriculture, 7.4 per cent, waste, 2.2 per cent, and solvent and other product use, 0.1 per cent. Total GHG emissions amounted to 411,994.09 Gg CO_2 equivalent and decreased by 55.3 per cent from 1990 to 2004.

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

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

[2] In this report, the values for total and sectoral emissions for the complete time series, and in particular for the base year and for 2004, reflect the revised estimates submitted by Ukraine in the course of the review. These estimates differ from Ukraine's GHG inventory submitted in 2006.

~~Table 1.~~Table 1. Greenhouse gas emissions by gas, 1990–2004

	Gg CO_2 equivalent								Change
GHG emissions	**Base year Convention[a]**	**1990**	**1995**	**2000**	**2001**	**2002**	**2003**	**2004[a]**	**BY–2004 (%)**
CO_2 (with LULUCF)	680 470.91	680 470.91	349 753.59	256 648.60	255 398.49	262 562.37	279 533.02	282 999.52	–58.4
CO_2 (without LULUCF)	714 310.07	714 310.07	392 186.65	294 692.97	297 410.31	299 904.58	318 756.42	315 141.35	–55.9
CH_4	151 726.04	151 726.04	94 700.51	77 154.03	72 412.56	75 640.00	74 686.70	74 498.77	–50.9
N_2O	54 615.69	54 615.69	33 152.52	21 579.79	23 520.50	23 340.02	20 890.62	22,277.80	–59.2
HFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	IE,NA,NE,NO	NA
PFCs	203.23	203.23	153.45	99.74	96.59	85.02	66.49	80.44	–60.4
SF_6	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	IE,NA,NE,NO	NA

Note: LULUCF = Land use, land-use change and forestry; NA = not applicable; NE = not estimated; NO = not occurring; IE = included elsewhere.

[a] Ukraine submitted revised estimates for the complete time series in the course of the initial review on 2 June 2007. These estimates differ from Ukraine's GHG inventory submitted in 2006.

~~Table 2.~~Table 2. Greenhouse gas emissions by sector, 1990–2004

	Gg CO_2 equivalent								Change
Sectors	**Base year Convention[a]**	**1990**	**1995**	**2000**	**2001**	**2002**	**2003**	**2004[a]**	**BY–2004 (%)**
Energy	684 877.96	684 877.96	387 193.54	270 267.82	266 916.66	271 904.84	286 907.23	282 289.60	–58.8
Industrial Processes	125 798.64	125 798.64	62 077.65	81 325.30	82 232.84	83 055.80	87 982.18	89 761.97	–28.6
Solvent and Other Product Use	376.80	376.80	372.11	354.89	351.51	348.22	345.45	342.97	–9.0
Agriculture	101 355.29	101 355.29	61 976.35	32 885.96	35 130.03	34 691.34	30 100.59	30 417.33	–70.0
LULUCF	–33 821.06	–33 821.06	–42 408.07	–38 036.44	–41 991.54	–37 325.57	–39 213.87	–32 137.56	–5.0
Waste	8 428.24	8 428.24	8 548.48	8 684.65	8 788.65	8 952.78	9 055.25	9 182.22	8.9
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	887 015.9	887 015.9	477 760.1	355 482.2	351 428.1	361 627.4	375 176.8	379 856.5	–57.2
Total (without LULUCF)	920 836.9	920 836.9	520 168.1	393 518.6	393 419.7	398 953.0	414 390.7	411 994.1	–55.3

Note: LULUCF = Land use, land-use change and forestry; NA = not applicable.

[a] Ukraine submitted revised estimates for the complete time series in the course of the initial review on 2 June 2007. These estimates differ from Ukraine's GHG inventory submitted in 2006.

D. Key categories

7. Ukraine has reported a tier 1 key category analysis, both level and trend assessment, as part of its 2006 submission and has also applied a qualitative approach in determining its key categories. Ukraine included the LULUCF sector in its key category analysis. Ukraine does not report a key category analysis for 1990 and the ERT encourages Ukraine to report such an analysis in its next submission. The key category analyses performed by Ukraine and the secretariat[3] produced similar results. Ukraine identified 20 key categories in its analysis for 2004; the secretariat identified 27 key categories. The main reasons for the differences are the different levels of aggregation used for the LULUCF sector and the agricultural soils category. Ukraine used the key category analysis to prioritize the development of its inventory. During the review, Ukraine explained that the results have had an effect on inventory planning in the context of allocating resources.

E. Main findings

8. Ukraine's GHG inventory is generally accurate, as defined in 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), and is consistent with the *Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) 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). The 2006 inventory submission shows significant improvements on the major issues in all sectors, and covers all sectors and most categories. However, the NIR is neither detailed nor comprehensive enough, which results in an insufficient level of transparency. The further improvements required in the NIR relate to detailed descriptions of methodology, the identification of the emission factors (EFs) used, and the description of individual sectors (e.g. LULUCF). A data archiving system is still under development. It should be further developed in order to guarantee that all background information is archived in a single location and can be made readily available at the request of the ERT.

F. Cross-cutting topics

1. Completeness

9. Ukraine provided inventory data for the years 1990 to 2004. Ukraine provided CRF tables for the entire time series. However, not all the CRF tables have been completed in full, the use of notation keys needs to be improved and explanations should be provided in CRF table 9. Some of the categories, particularly in the energy and industrial processes sectors, were not reported (e.g. CO_2 fugitive emissions from solid fuels, GHG emissions from solid fuel transformation, CH_4 emissions from venting, and actual emissions of HFCs, PFCs and SF_6 from the consumption of halocarbons and SF_6). Additionally, the inventory does not contain complete time-series data on the energy sector; for instance, for the years 1991–1997 activity data (AD), implied emission factors (IEFs) and emissions of liquid, solid, gaseous and other fuels from energy industries, manufacturing industries and construction, transport and other sectors are reported as not estimated ("NE"). The ERT recommends Ukraine make the necessary efforts

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

to provide data and emissions estimations for all the sectors, categories and gases that have not been estimated so far (see the sectoral sections of this report). The ERT encourages Ukraine to use the new version of the CRF reporter software (v3.1) required for inventory submissions to the secretariat for its next inventory submission.

2. Transparency

10. The NIR and the CRF tables are generally transparent. During the review, Ukraine provided additional material requested by ERT and explained in detail many of the calculations it had made. This significantly improved the understanding of the major underlying assumptions and rationales behind the choices of data and methods and of other inventory parameters. Confidentiality issues were quite limited and mainly related to some industrial processes data. The NIR and the CRF tables should be more transparent, and emission estimation methodologies and data sources should be more appropriately referenced. Methodological descriptions in the NIR should be more detailed and more consistent with the data used. The ERT recommends Ukraine to increase the NIR's transparency in its next submission.

3. Recalculations and time-series consistency

11. GHG emissions and removals for 1990–2003 were recalculated for the majority of categories in the 2006 inventory submission due to the inclusion of new sources (e.g. PFCs from aluminum production), improvements in methodologies (e.g. the use of tier 2 methodologies for some categories, such as enteric fermentation – cattle, and the implementation of the IPCC good practice guidance for LULUCF), as well as the refinement of AD and EFs, including the development of national EFs for some key categories (e.g. cement production), and the reallocation of emissions (e.g. emissions from combustion of coke in blast furnaces are now reported in the industrial processes sector and emissions from waste incineration are reported in the energy sector). In general, the recalculations were performed according to the IPCC good practice guidance and have resulted in significant improvements to the inventory. Ukraine explained the rationale and quantified the impact of the recalculations during the in-country review, but no explanations were reported in CRF table 8(b). The ERT noted that the recalculations reported by Ukraine for 1990–2003 particularly affected CO_2 and CH_4 emissions from the energy sector, CO_2 emissions from the industrial processes sector, CO_2 emissions/removals from the LULUCF sector and CH_4 emissions from the waste sector. The recalculations led to a decrease in total GHG emissions in individual years of between 6.7 and 21.1 per cent; and the 2003 recalculations led to a total decrease of 21.1 per cent in total national emissions. The ERT recommends Ukraine to report the explanatory information on the recalculations in the CRF tables in its next submission and to make the tables consistent with the information provided in the NIR.

4. Uncertainties

12. The information provided on uncertainties for each source category and for the inventory as a whole follows the requirements of the UNFCCC reporting guidelines and the IPCC good practice guidance. Uncertainty estimates have been provided using the tier 1 method. The ERT encourages Ukraine to use uncertainty analysis to prioritize its improvements to the inventory, in particular for the solvent and other product use, agriculture, LULUCF and waste sectors where the uncertainties in the estimates are very high. The information provided on uncertainties should be refined taking into account national circumstances and existing data gaps.

5. Verification and quality assurance/quality control approaches

13. Ukraine provided information on its quality assurance/quality control (QA/QC) procedures in line with the UNFCCC reporting guidelines and the IPCC good practice guidance. During the in-country review, Ukraine presented its national QA/QC plan for the 2006 inventory submission. This includes general QC procedures (tier 1) as well as some source/sink category-specific QC procedures (tier 2) for key categories. However, this plan lacks documentation on QC procedures for individual sectors as well

as clear and detailed information on implemented QA/QC activities. The ERT suggested introducing better documentation on QC procedures at all stages of inventory preparation. The ERT recommended Ukraine to clearly define and document in the QA/QC plan the relevant responsibilities of cooperating institutions and experts and their contribution to QA/QC activities. After the in-country review, Ukraine provided the ERT with the QA/QC plan approved by the Ministry of Environmental Protection of Ukraine (MEP) on 31 May 2007. This plan contains most of the elements recommended by the ERT. The ERT encourages Ukraine to implement its QA/QC plan, to extend its verification procedures to models, AD and estimates, to further develop the plan in line with the recommendations outlined above and to document all these actions in its next inventory submission.

6. Follow-up to previous reviews

14. The most important improvements made by Ukraine were the preparation and submission of a complete set of CRF tables from 1990 to 2004, including emissions reported for the LULUCF sector, using the tables required by decision 13/CP.9; and of recalculations of the entire time series from 1990 to 2003 following the recommendations of the previous review report (2005). Ukraine also improved the record keeping and archiving system, which has been developed under the responsibility of the MEP.

G. Areas for further improvement

1. Identified by the Party

15. The NIR identifies several areas for improvement. During the in-country review, Ukraine indicated that it is working to improve its estimates of limestone and dolomite use (2.A.3) as it is a key category. Furthermore, Ukraine plans to improve its inventory by developing a national methodology to estimate CH_4 emissions from enteric fermentation of cattle in the agriculture sector. Some improvements related to EFs and AD are also planned for the waste sector (solid waste disposal on land and wastewater handling).

16. For the LULUCF sector, Ukraine identifies AD collection and development of national parameters as the areas for inventory improvement. Ukraine is planning to improve statistical data and national EFs by enhancing its observations within the net of monitoring of forests, using the national forest inventory and extension of scientific investigations. Ukraine also indicated a willingness to collect AD on land categories converted to cropland, grassland, wetland and settlements using a tier 2 approach.

2. Identified by the ERT

17. The ERT identified the following cross-cutting issues for improvement. The Party should:

(a) Maintain and enhance existing inter-institutional and inter-agency cooperation and responsibilities for inventory compilation based on the current expertise of Ukrainian experts, ensuring enough capacity for timely performance of its functions;

(b) Implement and further develop the recently approved QA/QC plan, expanding its verification procedures to models, AD and estimates;

(c) Enhance and further develop the centralized archiving system;

(d) Make the necessary efforts to provide data and emissions estimations for all sectors, categories and gases that have not been estimated, in particular the missing estimates for the energy sector;

(e) Improve transparency and documentation on AD, parameters, emission estimates and trends, and reference them appropriately in the NIR;

(f) Provide more detailed and precise methodological descriptions in the NIR consistent with the AD used in the CRF tables, in particular for country-specific methods and EFs;

(g) Verify country-specific methodologies, in particular for the LULUCF sector;

(h) Report the explanatory information on recalculations in the CRF tables and make it consistent with the information provided in the NIR;

(i) Refine the uncertainty analysis taking into account national circumstances and existing data gaps and use it to prioritize inventory improvements, in particular for the solvent and other product use, agriculture, LULUCF and waste sectors;

(j) Cross-check the applicability of tier 1 methods to intensively managed Ukrainian land for estimates in the LULUCF sector.

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

II. Energy

A. Sector overview

19. Energy-related emissions from Ukraine have declined by 58.8 per cent since 1990. Nonetheless, in 2004 Ukraine's total GHG emissions from the energy sector constituted 68.5 per cent of total national GHG emissions. Most of the energy-related GHG emissions are due to the energy industries, which constitute 35.6 per cent of the sectoral emissions, while manufacturing industries contribute 16.7 per cent, other sectors 15.3 per cent, and transport 13.3 per cent. Ukraine is a major producer of bituminous coal, but imports most of the crude oil and natural gas that it consumes. Fugitive emissions from fossil fuels contribute about 18.6 per cent of the total energy-related GHG emissions, while 10.4 per cent is due to solid fuels and 8.3 per cent is due to oil and natural gas.

20. Ukraine provided all the CRF tables. Ukraine additionally provided a table in the NIR detailing the missing source categories and the reasons behind these omissions. The NIR fails to provide a more detailed discussion of the completeness of the fuel combustion and fugitive emissions categories. Previous review stages identified some gaps in tables 1A(b) and 1A(c). The ERT recommends Ukraine to provide a more detailed discussion of the completeness of its estimates of fuel combustion and fugitive emissions.

21. The period 1991–1997 lacks complete data on fuel consumption by categories because of changes that occurred in the Ukrainian statistical system. For instance, for this period AD, IEFs and emissions of liquid, solid, gaseous and other fuels from energy industries, manufacturing industries and construction, transport and other sectors are reported as not estimated ("NE"). The ERT encourages Ukraine to use splicing and the techniques recommended in the IPCC good practice guidance to make the time series consistent. The ERT also strongly recommends that as a next step Ukraine disaggregate the data available for 1991–1997 using existing statistical or other AD sources (e.g. information on the vehicle fleet that allows it to obtain road transportation emission estimates for 1991–1997, or industry data such as fuel use). During the in-country review, Ukraine informed the ERT that for its 2008 submission it expects to have an energy balance available for the entire time series. The ERT also recommends that Ukraine provide more information regarding its particular circumstances in its next NIR.

22. The ERT welcomes the efforts made by Ukraine to provide additional methodological information and background in the NIR and recommends that Ukraine provide a detailed overview of the assumptions made and the underlying EFs and AD used. The ERT believes that transparency in the NIR

could be further improved if Ukraine were able to provide some additional information on the steps followed to ensure time-series consistency as well as explanations of the trends observed.

23. The NIR reports a limited discussion on the statistical forms used as the basis for the compilation of the inventory and on how the data in these forms was handled to complete the CRF tables. As these statistical forms constitute one of the main sources of AD, the ERT recommends Ukraine to include a more detailed description of this in its next NIR.

24. Ukraine has provided no specific discussion of its QA/QC and verification procedures for the energy sector in the NIR. The ERT was pleased to see during the in-country review of this sector that the results of a number of specific QA/QC and verification procedures conducted by Ukraine were readily available. However, these are not documented in the relevant energy part of the NIR. When reviewing the NIR and the CRF tables, editorial mistakes and incorrect or out-of-date values were identified, which could have been avoided by a better application of the QA/QC procedures (e.g. certain incorrect values are reported in the tables in annex 4 of the NIR). The ERT also recommends the application of further QA/QC checks related to time-series consistency and the correctness of the information presented in the CRF tables, and that Ukraine clearly document all the QA/QC and verification procedures performed in its next NIR.

25. Ukraine verifies its estimated CO_2 emissions using the sectoral approach by comparing them with its reference approach estimates. The ERT considers that further QA/QC checks are required to ensure that the data presented in the reference approach, taken from national statistics, are accurate.

26. Ukraine has provided estimates of the uncertainties associated with the energy sector following the IPCC good practice guidance. However, these uncertainty values seem to be underestimated because they do not take into account the lack of data under certain source categories, such as, for example, oil and natural gas. The ERT recommends that Ukraine revise its uncertainty estimates to reflect data availability for its next submission.

B. Reference and sectoral approaches

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

27. Ukraine provided estimates for the reference approach for the years 1990 and 1998–2004. The NIR also provides a discussion of the comparison between the reference and the sectoral approaches. During the in-country review, the ERT also noted that the differences between the two approaches on energy consumption were calculated incorrectly as the apparent energy consumption used for the reference approach included non-energy use and feedstocks consumption data (for 2004 the difference is 11.0 per cent for the CO_2 emission estimates and 40.5 per cent from fuel consumption). Ukraine corrected these estimates during the in-country review.

28. The differences that remain between the reference and the sectoral approaches when the above is taken in consideration, for example, for 2004, could not be explained during the review and might be due to mistakes in the underlying statistical forms. The ERT recommends Ukraine to complete the time-series of estimations using the reference approach for its next submission and to investigate further the differences reported and reduce the gap between these two approaches, particularly in fuel consumption. The ERT also recommends that in the future Ukraine perform additional QA/QC checks to ensure that such mistakes are avoided and that the information contained in the statistical forms is properly scrutinized before it is used for any calculations.

29. The data reported in the CRF tables are in certain cases significantly different from those reported to the IEA. This is the case, for example, for jet kerosene consumption in aviation. The ERT recommends that Ukraine further research and identify the potential sources of these discrepancies,

identify potential additional sources of information and review its calculations as necessary in its next submission.

2. International bunker fuels

30. Ukraine assumed in its calculations that all jet kerosene consumption is related to domestic aviation. Neither AD nor emissions were reported for international aviation emissions. The ERT recommended that Ukraine collect information on the number of domestic flights to enable an estimation of jet kerosene consumption for domestic aviation, and to subtract this amount from total jet kerosene consumption to obtain the international share of such consumption; or conversely to first collect information on the number of international flights and estimate jet kerosene consumption for international aviation and then estimate the domestic share of jet kerosene consumption.

31. After the in-country review, Ukraine informed the ERT that it had determined the share of domestic versus international aviation fuel consumption by using an average of the share used by other countries with similar conditions (Poland, Belarus, Bulgaria and the Czech Republic) based on the AERO2K and SAGE models as well as information from document FCCC/SBSTA/2005/Misc.4.[4] The share of international jet fuel consumption was set at 94 per cent of the total consumption in 1990 and was applied for the entire time series. Ukraine revised the CO_2, CH_4 and N_2O emission estimates for the entire time series.

32. The ERT agrees with the approach taken by Ukraine, as it believes it is a conservative estimate for 1990, but it is possible that it overestimates 2004 emissions. The ERT recommends that Ukraine further investigate this issue and encourages the use of the methods recommended by the IPCC good practice guidance for its future submissions, to ensure that emissions from international aviation are systematically neither overestimated nor underestimated for the entire time series. The ERT encourages Ukraine to establish further contacts with the national aviation authorities and also to contact EUROCONTROL[5] or other international organizations in order to obtain relevant statistics.

33. The ERT welcomes Ukraine's efforts to estimate for the first time emissions from international navigation bunkers. Ukraine explains in its NIR that an indirect methodology based on total fuel consumption by water transport (statistical reporting form 4-MTP) and turnover of goods by sea transport during coastwise trade and foreign navigation was used. The ERT recommends that Ukraine make efforts to confirm these estimates through collection of actual AD and revise them if necessary in its next submission.

3. Feedstocks and non-energy use of fuels

34. The ERT welcomes the improvements made by Ukraine in reporting emissions from feedstocks and non-energy use of fuels and recognizes that comments from the previous review regarding the allocation of these emissions were taken into consideration. Ukraine clarified in the NIR which emissions are related to non-energy use of fuels and are now reported under the industrial processes sector. Ukraine is encouraged to increase the transparency of reporting of these emissions by providing information in the NIR on the methodologies, AD and EFs used, as currently this information is not reported.

C. Key categories

1. Stationary combustion: solid, liquid and gaseous fuels – CO_2

35. Ukraine has applied default IPCC EFs to estimate its CO_2 emissions from stationary combustion, with the exception of the country-specific CO_2 EF for coal. For the years 1998–2004, statistical

[4] <http://unfccc.int/resource/docs/2005/sbsta/eng/misc04.pdf>
[5] <http://www.eurocontrol.int/statfor>

reporting forms were used as the source of data for fuel use. As this is a key category for all fuels, the ERT recommends that Ukraine intensify its efforts to obtain and use country-specific carbon contents for all fuels used in the country for its next submission.

36. For the years 1991–1997 AD, IEFs and emissions of liquid, solid, gaseous and other fuels for energy industries, manufacturing industries and construction as well as other sectors are reported as not estimated ("NE"). The ERT recommends that Ukraine make the necessary efforts to disaggregate the overall emissions for stationary combustion based on AD collected from existing statistical sources or other AD sources as mentioned above for its next inventory submission. Ukraine plans in the future to obtain and use national CO_2 EFs for natural gas and fuel oil combustion.

2. Road transportation: liquid and gaseous fuels – CO_2

37. In the period 1990–2004, CO_2 emissions from road transportation have decreased by 55.3 per cent. The trend of CO_2 emissions fluctuates (inter-annual change for 1999–2000 is –9.7 per cent, for 2000–2001 is 9.8 per cent and for 2001–2002 is 11.8 per cent). Ukraine explained that this difference is due to the changes in the source of statistical data because different agencies were responsible for their compilation. Ukraine made efforts to map the various categories between these two sources of information and to ensure that they were comparable. Economic instability could be the reason for some of the differences observed in the most recent years. Ukraine is recommended to use economic data and trends to compare with those data and trends observed for CO_2 emissions.

38. The CO_2 IEF for gasoline in 1990 is 68.66 t/TJ and the CO_2 IEFs reported for 1998–2004 have a constant value of 68.61 t/TJ. Ukraine indicated that the reason for this difference in the IEFs is that some technical jet kerosene emissions were aggregated along with the gasoline ones. Ukraine is recommended to include this information separately under other liquid fuels in order to ensure correct allocation and transparency in the calculations.

39. Ukraine is planning to use higher tier methods for emission estimations in the category road transportation, based on information about the stock of cars, distances travelled and specific fuel consumption. Development of national CO_2 EFs for gasoline and diesel oil combustion is also planned .

3. Coal mining and handling – CH_4

40. Ukraine uses a mix of tier 3 and tier 2 methods to estimate emissions from this category. The ERT welcomes the efforts of Ukraine to use a country-specific methodology to estimate emissions from coal mining based on research in Ukrainian mines (measurement of emissions through venting systems). The results of this research were used to estimate CH_4 emissions in 1990–2000 and the resulting weighted average of CH_4 EFs and coal production volumes from statistical reporting forms were used to estimate emissions in 2001–2004. The ERT encourages Ukraine to make consistent use of tier 3 methods for the entire time series. The ERT recommends Ukraine to investigate and include emissions from closed mines in its next submission.

41. Volumes of recovered CH_4 in 1990–2000 were also obtained from the same research carried out in Ukrainian mines. The amount of recovered CH_4 in 2001 was taken from an official research report and this has been extrapolated to 2002–2004 with an annual growth rate of 10 per cent. The ERT considers that the recovery rates for CH_4 for the years 2001–2004 appear to be high relative to those used in most other years between 1990 and 2000. Additionally, the extrapolation curve does not appear to match the overall trend for the time series. The ERT recommended Ukraine to document and revise if necessary the assumptions made for the estimation of CH_4 recovery for the years 2001–2004.

42. After the in-country review, Ukraine informed the ERT that according to expert opinion CH_4 utilization volumes increased in 2002–2004 compared to 2001. However, due to a lack of supporting information Ukraine revised its assumptions and used the same CH_4 utilization volume as in 2001. The

ERT recommends that Ukraine further explore this issue and provide further clarification in its next inventory submission. The ERT also recommends that Ukraine carefully examine the CH_4 production and utilization trends and ensure consistency throughout the entire time series.

43. Ukraine plans to undertake research on CH_4 emissions from closed mines and to define more exactly the volumes of recovered CH_4.

4. Oil and natural gas – CH_4

44. AD and emissions of CH_4 for oil – exploration, oil – distribution of oil products, oil – other, natural gas – exploration, and venting and flaring – combined are reported as "NE" for the entire time series. The ERT recommended Ukraine to gather further AD from industry and provide estimates for the abovementioned categories in its next inventory submission.

45. After the in-country review, Ukraine informed the ERT that for the 2008 inventory submission an attempt will be made to collect all the necessary data from the oil and gas production companies in order to provide the missing estimates. It noted, however, that the Revised 1996 IPCC Guidelines and the IPCC good practice guidance do not make recommendations on how to estimate GHG emissions from oil – distribution of oil products (1.B.2.a.v). The ERT encourages Ukraine to continue its efforts to collect information and provide estimates for this category in its next inventory submission and to explore the methods used by other Parties or included in the international literature in order to calculate emissions from 1.B.2.a.v if possible. Ukraine plans to undertake research on emission sources and national fugitive CH_4 EFs for end-use consumers.

D. Non-key categories

1. Stationary combustion: solid, liquid and gaseous fuels – CH_4

46. This category was identified as a key category by trend in the secretariat's key category analysis for 2004 but is not reported as such by Ukraine in the NIR. The ERT recommends that Ukraine check its key category analysis to ensure that this category was not omitted by mistake.

2. Road transportation: liquid fuels – N_2O

47. The IEFs for N_2O emissions from gasoline (0.60 kg/TJ) reported by Ukraine for the complete time series were among the lowest of reporting Parties (0.60–15 kg/TJ in 1990) and lower than the IPCC default range (1–20 kg/TJ). As Ukraine is expected to have renewed its fleet with vehicles equipped with catalytic converters, the ERT recommended that Ukraine collect the relevant AD required to enable use of a higher tier method as specified in the IPCC good practice guidance, and revise its estimates for N_2O emissions for the entire time series accordingly (including gasoline and diesel oil and other fuels). After the in-country review, Ukraine informed the ERT that there is a study under way that should provide updated information and that the MEP included the provision of estimates for this category using the higher tier method in its work plan for inventory improvements to its 2008 inventory submission. The ERT welcomes this effort and encourages Ukraine to ensure that the planned improvements are implemented in its next submission.

3. Civil aviation: liquid fuels – CO_2

48. Ukraine assumed in its calculations that all jet kerosene consumption is related to domestic aviation for the entire time series. Neither AD nor emissions were reported for international aviation emissions. The ERT recommended Ukraine to collect information on the number of domestic flights to enable the estimation of jet kerosene consumption for domestic aviation, and to subtract this amount from the total consumption to obtain the international share of jet kerosene consumption; or conversely to first collect information on the number of international flights and estimate jet kerosene consumption for international aviation and then estimate the domestic share of jet kerosene consumption.

49. After the in-country review, Ukraine informed the ERT that it had determined the share of domestic versus international aviation fuel consumption by using an average of the share used by other countries with similar conditions (Poland, Belarus, Bulgaria, and the Czech Republic) based on the AERO2K and SAGE models as well as information from document FCCC/SBSTA/2005/Misc.4.[6] The share of international fuel consumption was set at 94 per cent of the total jet fuel consumption in 1990 and was applied for the entire time series. Ukraine revised its CO_2, CH_4 and N_2O emission estimates for the entire time series. This revision led to a reduction in estimated GHG emissions in the civil aviation category by 76.8 per cent in 2004 (from 278.78 Gg CO_2 equivalent as reported originally to 64.60 Gg CO_2 equivalent). Aviation gasoline consumption is accounted for under domestic aviation since this fuel type is mostly used by small aircraft that do not leave the territory of Ukraine.

50. The ERT agrees with the approach taken by Ukraine as it believes it to be a conservative one for the base year, but it is possible that it overestimates 2004 emissions. The ERT recommends that Ukraine further investigate this issue and encourages the use of the methods recommended by the IPCC good practice guidance for its future submissions in order to ensure that emissions from international aviation are systematically neither overestimated nor underestimated for the entire time series. The ERT encourages Ukraine to establish further contacts with the national aviation authorities and also to contact EUROCONTROL[7] or other international organizations in order to obtain relevant statistics.

III. Industrial processes and solvent and other product use

A. Sector overview

51. In 2004, emissions from the industrial processes sector accounted for 21.8 per cent of total national GHG emissions. CO_2 represented 96.6 per cent of emissions from the sector (mostly from iron and steel production). CH_4, N_2O and PFCs emissions accounted for 0.9, 2.4 and 0.1 per cent of sectoral emissions, respectively. In this sector, CH_4 emissions mainly come from iron and steel production (95.8 per cent), N_2O emissions mainly come from adipic acid production (71.9 per cent) and PFC emissions (CF_4 and C_2F_6) are a by-product of aluminium and ferroalloy production, which is the only category in which they are reported. For the entire time series, neither actual nor potential emissions from production and consumption of halocarbons and SF_6 are reported because no reliable data are available. The ERT recommends that Ukraine consider investigating and reporting emissions from all stages of the use of ozone depleting substance (ODS) substitutes in its next submission, especially HFCs emissions from refrigeration and air conditioning equipment. N_2O emissions from the use of N_2O for anaesthesia (3.D.1) are reported, but their share in total national emissions is negligible.

52. Total GHG emissions from industrial processes decreased by 28.6 per cent between 1990 and 2004, mainly because of the general decrease in industrial production activities. Sectoral total emissions show a decreasing trend from 1990 to 1996 (emissions in 1996 are 51.1 per cent lower than the 1990 level) and an increasing trend from 1996 to 2004 (emissions in 2004 are 45.8 per cent higher than the 1996 level).

53. Indirect GHG emissions are reported for the sector, including non-methane volatile organic compounds (NMVOCs) emissions from solvent and other product use.

54. The ERT recommends that transparency in the NIR be improved by including more complete descriptions of how the AD and EFs are determined and documenting existing source-specific QA/QC procedures.

[6] <http://unfccc.int/resource/docs/2005/sbsta/eng/misc04.pdf>
[7] <http://www.eurocontrol.int/statfor>

B. Key categories

1. Cement production – CO_2

55. Ukraine uses plant-specific data for emissions estimates in this category, in accordance with the IPCC good practice guidance. However, the EFs declined by 1.3 per cent between 1990 and 2004 and no explanation is provided in the NIR. During the in-country review, it was found that the EFs are a result of the weighted average of 12 plants in the country. Two plants with relatively high content of magnesium oxide (MgO) in clinker (and hence higher EFs) were closed in 2001. The ERT encourages Ukraine to include this explanation in the NIR in order to improve transparency in its next submission.

2. Ammonia production – CO_2

56. Ukraine assumes that 99 per cent of the non-energy consumption of natural gas by the chemical and petrochemical industries was used in ammonia production. There is no statistical data on natural gas consumption for ammonia production in Ukraine but total non-energy consumption of natural gas by the chemical and petrochemical industries is available. The ERT detected a mistake in Ukraine's calculation of the shares of the non-energy consumption of natural gas in chemical and petrochemical products which resulted in an overestimation of CO_2 emissions for the complete time series. The ERT recommended that Ukraine use 82.5 per cent as a correct share of natural gas in ammonia production and revise the CO_2 emission estimates. After the in-country review, Ukraine revised the emission estimates for ammonia production in line with the ERT's recommendations, and submitted revised estimates for the period 1990–2004. This revision led to a reduction in estimated CO_2 emissions in the ammonia production category by 13.8 per cent in 2004 (from 11,541.19 Gg as reported originally to 9,952.98 Gg). The ERT also noted that ammonia production volumes were overestimated by a factor of 3 and recommends Ukraine to correct this mistake in its next inventory submission.

3. Iron and steel production – CO_2

57. Ukraine reports all CO_2 emissions from coke use in iron and steel production under the industrial processes sector rather than under the energy sector, which was the case in the previous submission, and has reported its recalculations accordingly. However, it is not clear how emissions from other coke production, use of coke oven gas and furnace gas are accounted for. During the in-country review, following the ERT's recommendation, Ukraine conducted a carbon balance check for 1990, which was important to make certain that the potential for double counting had been avoided. Considering the importance and complexity of emissions from this category, the ERT recommends Ukraine to apply the carbon balance check approach to the entire time series in order to avoid the potential for double counting between the energy sector and the industrial processes sector in its next submission.

C. Non-key categories

1. Nitric acid production – N_2O

58. Non-concentrated nitric acid production is used as AD in the CRF tables for the entire time series, which results in the lowest IEF (0.00132 t/t) of all reporting Parties (0.002–0.014 t/t in 2004). The ERT recommends Ukraine to convert data from non-concentrated nitric acid to concentrated nitric acid. The ERT encourages Ukraine to use concentrated nitric acid production in the CRF tables for its next submission in order to improve comparability.

2. Adipic acid production –N_2O

59. There are two adipic acid plants in Ukraine. Ukraine uses the assumptions about the N_2O destruction factor and the abatement system utilization factor provided in the IPCC good practice guidance for the entire time series because no plant-specific data are available. The ERT encourages

Ukraine to investigate relevant information from existing plants and to include and use this information in its next submission.

3. Production and consumption of halocarbons and SF_6 – HFCs, PFCs and SF_6

60. In the CRF tables, notation keys were used inappropriately for the production of halocarbons and SF_6 category. During the in-country review, it was clarified that there is no HCFC-22 production plant in Ukraine, and hence "NO" should be used rather than "NE" for HFC-23 emissions from the production of HCFC—22; while for the category refrigeration and air conditioning equipment (2.F.1), the notation key "NE" should be used rather than "NO" because refrigerators are widely used in Ukraine and imported cars are equipped with air conditioning. Furthermore, there is a plant in the country that uses HFC-134a to manufacture refrigerators for export. The ERT recommends Ukraine to use notation keys appropriately in its next submission and strongly recommends it to investigate and report on emissions from all stages of the use of ODS substitutes in its next submission.

IV. Agriculture

A. Sector overview

61. In 2004, the agriculture sector accounted for 7.4 per cent of total national GHG emissions, or 30,417.33 Gg CO_2 equivalent. Over the period 1990–2004, emissions from the sector decreased by 70.0 per cent. Agricultural soils and enteric fermentation were the major agricultural categories, contributing 49.6 and 38.1 per cent, respectively, to total sectoral emissions in 2004. Recommendations from the previous review report (2005) have been taken into account and recalculations performed for the entire time series and all categories using corrected AD, and country-specific EFs and methodologies. Appropriate efforts such as using international data to fill data gaps as well as methods of interpolation and others have been made to ensure time-series consistency if the same data sources are not available for the entire time series. Tier 1 QA/QC procedures have been performed for emissions estimates, EFs and AD. Quantitative estimates of uncertainty were provided for the sector.

B. Key categories

1. Enteric fermentation CH_4

62. Ukraine used a tier 2 method for cattle with enhanced characterization and country-specific EFs to estimate CH_4 emissions from enteric fermentation. For mature dairy and mature non-dairy cattle the EFs were 94.90 kg CH_4/year and 46.15 kg CH_4/year, respectively, in 2004. These values are within the range of EFs used by other reporting Parties. The methodology used is in line with the IPCC good practice guidance. For all years, data are supplied by the State Committee on Statistics. These data were crosschecked with United Nations Food and Agriculture Organization (FAO) data. The ERT was informed that Ukraine plans to use a higher tier method to estimate CH_4 emissions from enteric fermentation of cattle. The ERT encourages Ukraine to check the consistency of the new methodology with the IPCC good practice guidance.

2. Agricultural soils (direct soil emissions and indirect emissions) – N_2O

63. Ukraine used country-specific methodology to estimate emissions from animal manure applied to soils, crop residue, atmospheric deposition and nitrogen leaching and run-off. The methodologies are in accordance with the IPCC good practice guidance. Ukraine used country-specific data for nitrogen fractions in crop residues (stubbles and roots), dry matter fractions in residues and residue/crop ratios for N-fixing crops. The majority of the data for synthetic fertilizer use are supplied by the State Committee on Statistics and, where necessary, data gaps were filled using FAO data (1992, 1994, and 1995) and interpolation when required. Ukraine provided recalculations for the entire time series in its original

2006 submission. Due to these recalculations total N_2O emissions from this category increased by 8.0 per cent in 2003 compared to the previous submission.

64. The ERT recommends Ukraine to make the necessary efforts to collect data from national sources for the subcategories that currently are using international data in order to ensure time-series consistency, and, since this is a key category, to apply higher tier methods for all the subcategories included in agricultural soils.

C. Non-key categories

1. Manure management – CH_4

65. Ukraine identified the types of animal waste management systems (AWMS) that are used in the country and developed country-specific data on allocation of manure to different types of AWMS for cattle, swine and poultry; as well as country-specific volatile solid excretion rates and EFs in accordance with the recommendations of the previous (2005) review report. Ukraine provided recalculations for the entire time series in its original 2006 submission, which resulted in a decrease of 63.8 per cent in 2003 compared to the previous submission. CH_4 emissions from this category decreased by 96.9 per cent in the 1990–2004 period. The ERT welcomes the efforts made by Ukraine to implement the recommendations of the previous (2005) review report.

2. Rice cultivation – CH_4

66. Taking into account the comments of the previous (2005) review report, Ukraine for the first time used AD on organic fertilizer application in calculations for the years 1991–1992 and 1994–1995. These data were obtained using the interpolation method. As well as compared with the previous submission, the values for organic fertilizer applied to rice were corrected in consistency with fermented fertilizers. This led to a recalculation of CH_4 emissions for the entire time series. The ERT welcomes the efforts made by Ukraine to implement the recommendations of the previous review report.

3. Field burning of agricultural residues – CH_4 and N_2O

67. In its 2006 submission, Ukraine did not provide estimations of GHG emissions from field burning of agricultural residues and used notation key "NO" in CRF table 4.F. During the in-country review, Ukraine provided the ERT with the State Law (Code on Administration Crime, Article 77–1) that prohibits the field burning of agricultural residues in Ukraine.

V. Land use, land-use change and forestry

A. Sector overview

68. In 2004, the LULUCF sector was a net sink of 32,137.6 Gg CO_2 equivalent, offsetting 7.8 per cent of total GHG emissions. This net sink has decreased by 5.0 per cent since 1990. The ERT noted significant variability in the trend, which decreased by 8.6 per cent from 1990 to 1993, increased by 69.8 per cent from 1993 to 1998 and the again decreased by 38.8 per cent from 1998 to 2004. Ukraine explained the observed fluctuations as due to inter-annual changes in land conversion. The ERT further noted that the NIR lacks documentation on AD and the parameters used, which makes it difficult to follow the calculations. Ukraine informed the ERT about its intention to improve AD collection and to enhance its development of national parameters for its inventory. In order to improve the transparency of the reporting, the ERT recommends Ukraine to improve documentation of the areas of land, methods and parameters used for emission estimates in its next submission and to properly explain emission trends and their inter-annual variability.

69. Ukraine reports on CO_2 removals for forest land (5.A), grassland (5.C) and settlements (5.E) and on CO_2 and non-CO_2 emissions from forest land (5.A), cropland (5.B) and wetlands (5.D) in the NIR and

the CRF tables. The areas of land categories were estimated with the use of a specially developed Land-Use Conversion Matrix (LUCM), which corresponds to approach 2 of the IPCC good practice guidance for LULUCF. The 20-year transition period for land-use conversion is consistently maintained. The analysis performed by Ukraine identified the categories 5.A, 5.B, 5.C and 5.E as key categories. To estimate emissions and removals from key categories, Ukraine used a combination of tier 1 and tier 2 methods as outlined in the IPCC good practice guidance for LULUCF. However, during the in-country review, the ERT noted that the tier 1 methods in the IPCC good practice guidance for LULUCF may not be fully applicable for categories 5.B, 5.C, 5.D and 5.E because of the intensive management of these land categories. To improve the completeness of the reporting, the ERT encourages Ukraine to describe verification activities for the country-specific methods (i.e. LUCM for consistent land representation) in its next inventory submission. The ERT further encourages Ukraine to reflect and apply cross-checks on the applicability of the tier 1 method for the abovementioned categories and to change its estimation method, if appropriate.

70. The reported recalculations of emissions and removals within the sector were mainly due to the introduction of the IPCC good practice guidance for LULUCF and country-specific parameters. The ERT noted that Ukraine undertook QA/QC and verification procedures for AD and parameters and appropriately documented them in the NIR. The ERT also noted that Ukraine implemented a tier 1 uncertainty assessment for the LULUCF sector and documented it in the NIR.

B. Key categories

1. Forest land – CO_2

71. In 2004, net CO_2 removals from forest land increased by 0.4 per cent above the 1990 level, offsetting 13.5 per cent of total national emissions. Ukraine used a tier 2 method and country-specific data for areas of land and parameters to estimate CO_2 removals in biomass and litter for forest land remaining forest land and land categories converted to forest land. The calculations of carbon stocks in soils were performed using a tier 1 method, country-specific AD and default parameters. The ERT noted that the weighted averages of annual growth rates used by Ukraine for estimation of forest biomass may underestimate CO_2 removals. The ERT encourages Ukraine to develop and use annual growth rates disaggregated by age to calculate removals in forest biomass in its future inventory submissions.

2. Cropland – CO_2

72. Cropland is the major source of CO_2 emissions in the LULUCF sector, contributing an equivalent of 9.3 per cent to total national emissions in 2004. From 1990 to 2004, these CO_2 emissions increased by 32.9 per cent. For this category, Ukraine included emissions and removals in the biomass of fruit gardens and changes in soil carbon stocks related to land conversion. The estimates were performed using tier 1, country-specific data and default parameters. The ERT recommends Ukraine to check and report in its next inventory submission on the appropriateness of the use of the tier 1 method for calculating emissions from this category, because this method might not be fully applicable where intensive management of croplands occurs.

3. Grassland – CO_2

73. In 2004, the net CO_2 removals in grassland were the second biggest sink in the LULUCF sector, offsetting 3.3 percent of total national emissions, and had increased by 52.5 per cent since 1990. Under this category, Ukraine estimated changes in soil carbon stocks using the default method, country-specific data and default parameters. The ERT noted that calculations were performed for 80 per cent of the area and that the default assumption was used that the remaining 20 per cent may be covered by woody vegetation. However, no data on woody vegetation were available during the calculations, and this remaining area was not taken into account. The ERT encourages Ukraine to perform calculations for the entire area of grassland in its next submission, unless other data become available.

4. Settlements – CO_2

74. In 2004, settlements constituted a net CO_2 sink, which was 678.0 per cent lower than it was in 1990. The ERT noted significant inter-annual fluctuations in the removals trend. During the in-country review, Ukraine explained that the fluctuations were due to a mistake in land allocation during the calculations. The ERT recommends Ukraine to correct the estimates for this category in its next submission.

C. Non-key categories

1. Wetlands – CO_2

75. In 2004, wetlands constituted a net source of CO_2 emissions equivalent to 0.1 per cent of national totals, which is 69.0 per cent lower than in 1990. The ERT noted significant variability in the emission trend, which may be associated with the inappropriate use of tier 1 methodology for this category. The ERT recommends Ukraine to check and report in its next inventory submission on the appropriateness of the tier 1 method and to revise its calculations, if necessary.

2. Forest land and wetlands – CH_4, N_2O

76. In 2004, forest land and wetlands constituted a source of 4.26 Gg of CO_2 equivalent. Taken together, CH_4 and N_2O emissions are equivalent to 0.001 per cent of total national emissions. These emissions decreased by 76.5 per cent between 1990 and 2004. The sources of these emissions were biomass burning and drainage of organic soils. The estimates were performed using the tier 1 method. The ERT noted that drainage of organic soils was inappropriately documented in the NIR and encourages Ukraine to document calculations from this category correctly in its next inventory submission.

VI. Waste

A. Sector overview

77. Emissions from the waste sector contributed 2.2 per cent to total national emissions in 2004. These emissions have increased by 8.9 per cent since 1990. CH_4 emissions from solid waste disposal on land contributed 1.6 per cent to the total national emissions in 2004. Taken together, CH_4 and N_2O emissions from wastewater handling contributed 0.6 per cent. Emissions from waste incineration are reported in the energy sector due to the energy recovery in this activity. In 2004, the key category analyses made by Ukraine and the secretariat identified CH_4 emissions from solid waste disposal on land as a key category in both the level and trend assessments.

78. The information provided in the NIR covers emissions from all categories. The assumptions used, background data and studies used for estimating emissions are described in the NIR and some AD and EFs are reported in the additional information boxes of the CRF tables. Additionally, some improvements in estimating emissions from the waste sector are summarized and described in the NIR. As the NIR does not contain descriptions of the methodologies used in the calculations, the ERT recommends Ukraine to include this information, as well as more detailed references for the AD used, in its next NIR. The CRF tables include estimates for most gases and sources of emissions from the waste sector.

79. In its original 2006 submission Ukraine provided completely recalculated GHG emission estimates for all the categories in the waste sector. For the year 2003, the recalculations resulted in a decrease in CH_4 emissions of 63.9 per cent and a decrease in N_2O emissions of 1.9 per cent compared to the 2005 submission. This change is mainly due to the revision of data on landfilled waste. The data for

the 1948–2004 period were recalculated based on the average daily rate of waste generation per person, using national sources.[8]

80. Quantitative estimates of uncertainty are provided in the NIR for the waste sector (214.2 per cent in 2004). The general QA/QC plan has been used for the estimations in the waste sector. The ERT welcomes these efforts and encourages Ukraine to continue to improve the estimates for the waste sector in its next inventory submission.

B. Key categories

1. Solid waste disposal on land – CH_4

81. The IPCC tier 2 first order decay (FOD) method was used to estimate CH_4 emissions from this category. EFs for estimating CH_4 were also taken from the IPCC good practice guidance and were consistently applied over the entire time series (DOC_F=0.55, OX=0 for all solid waste disposal sites (SWDS), and MCF=0.4 and 0.8 for unmanaged shallow and unmanaged deep sites, respectively). Ukraine has informed the ERT that it plans to determine national factors for DOC_F, MCF and k, improving national data on DOC and OX by testing some SWDS. The information contained in CRF table 6.A is complete in terms of the additional information. Also in its 2006 submission Ukraine provides information about CH_4 recovery from landfills, which is excluded from the totals. Nevertheless, the ERT recommends Ukraine to provide more information on waste management practices in its next NIR. The ERT noted that the composition of landfilled waste is presented in the NIR without additional explanation and it recommends Ukraine to include explanations of the composition of landfilled waste and the trend for degradable waste in order to improve the transparency of the CH_4 emissions estimate in its next NIR.

82. In the 2005 submission, Ukraine considered 56.1 per cent of landfill sites to be unmanaged and 43.9 per cent landfill sites to be managed . In the 2006 submission Ukraine revised its breakdown of landfill into unmanaged shallow (10.3 per cent) and unmanaged deep (80.7 per cent), thereby implementing the recommendations of the previous (2005) review report. Ukraine used this assumption for the entire time series. During the in-country review, the ERT confirmed that Ukraine had at least one CH_4 landfill recovery facility, which means that some requirements for managed landfills are met. This led the ERT to conclude that the assumption that all landfills are unmanaged may be not appropriate for the entire times series and that some landfills are managed, particularly in the most recent years reported. The ERT recommended that Ukraine conduct further studies in order to revise its allocation between managed and unmanaged landfills. Based on the new allocation between managed and unmanaged landfills a methane correction factor (MCF) should be established and applied to the emission estimates in future submissions.

83. After the in-country review, and following the recommendations of the ERT, Ukraine revised CH_4 emissions from municipal solid waste disposal sites for the 1990–2004 period taking into account the results of an Expert Conclusion that was made additionally on the precise allocation of SWDS on managed, unmanaged deep and unmanaged shallow disposal sites, as well as the value of the country-specific MCF. The allocation used by Ukraine in 1990 is: managed – 0 per cent; unmanaged deep – 67.4 per cent; and unmanaged shallow – 32.6 per cent. For 2004 the allocation is: managed – 25.7 per cent; unmanaged deep – 42.5 per cent; and unmanaged shallow – 31.8 per cent. The ERT agreed with these assumptions and considers the subsequent revision of the estimates to be appropriate.

84. In its 2006 submission Ukraine used the coefficient of waste density equal to 250 kg/m^3 to transform the volume of waste into mass units. In the opinion of the ERT this value appears low. Special attention should be given to the waste amount estimated in the most recent years (2000–2004) because the reference used for waste density is outdated (1966) and does not necessarily reflect the

[8] Guleaev et al (1966), Alexandrovskaia (1977) and Mirniy et al (1985, 1990).

current situation. In large cities, municipal solid waste (MSW) is collected using modern trucks with high compacting levels. Therefore, the ERT considers that the waste density should be higher (450–650 kg/m^3) and that CH_4 emissions from SWDS may be underestimated for the entire time series, which could lead to a potential problem in the future. The ERT recommended that Ukraine revise the waste density coefficient for the entire time series and provide updated estimates. After the in-country review, and in response of the ERT's comments, Ukraine confirmed that density of waste in containers was 0.25 t/m^3 calculated as an average for the different categories of household waste, in accordance with the results of research by the Ukrainian Research Institute on Progressive Technologies in Public Facilities (UKRNII Progress). The ERT encourages Ukraine to further clarify this issue and if possible to use weighted quantities of disposed MSW in order to avoid underestimation of CH_4 emissions in the future; and to report on this issue in its next submission.

85. During the in-country review, the ERT noted that, as is reported in statistical year books, some industrial waste is disposed of at the SWDS together with the MSW. However, the estimated CH_4 emissions from the SWDS do not cover emissions from industrial waste disposed. The ERT recommended Ukraine to explore the possibility of including CH_4 emissions from industrial waste disposal. After the in-country review, and following the recommendations of the ERT, Ukraine revised its estimates for this category and included a new source of CH_4 emissions – industrial waste. Data from the State Committee on Statistics on waste from agriculture and the food industry disposed in SWDS from 1994 onwards were used in the calculations. Extrapolation was used to estimate data for the period 1948–1994. The ERT considers this revision of the estimates to be appropriate and encourages Ukraine to provide all the parameters and background information used for these estimates in the NIR of its next submission. The revisions mentioned above (paragraphs 83 and 85) led to an increase in estimated CH_4 emissions from the solid waste disposal on land category of 5.3 per cent in 2004 (from 297.91 Gg as reported originally to 313.72 Gg).

C. Non-key categories

1. Wastewater handling – CH_4 and N_2O

86. Taken together, CH_4 and N_2O emissions from wastewater handling constituted 0.6 per cent of total national emissions in 2004. Emissions from wastewater handling in 2004 had decreased by 17.8 per cent since 1990, mainly due to a reduction of wastewater streams. Country-specific EFs and the tier 2 method were used to estimate emissions. Emissions of CH_4 from sludge were estimated for the first time and Ukraine excluded CH_4 recovery from the total emissions, following the ERT recommendation from the previous (2005) in-country review. The ERT notes the effort that has been made by Ukraine to obtain AD and country-specific EFs and commends it.

87. N_2O emissions from human sewage have been estimated based on population statistics. Because the population decreased by 9 per cent between 1990 and 2004 and protein consumption decreased from 105.3 g/per/day in 1990 to 79.7 g/per/day in 2004, N_2O emissions have decreased by 31.1 per cent during this period.

2. Waste incineration – CO_2 and N_2O

88. In the previous (2005) submission Ukraine reported CO_2 and N_2O emissions from waste incineration under the waste sector, as it was stated that waste is incinerated without energy recovery. In its 2006 submission, Ukraine used improved AD and reported CO_2, CH_4 and N_2O emissions from this category under the energy sector. Background information that confirms that waste is incinerated with heat recovery was provided during the in-country review. The notation key "IE" is used correctly in the CRF tables. The ERT reminds Ukraine that CH_4 and N_2O emissions from biogenic waste should be included in the total emissions from waste incineration under the energy sector.

89. The NIR contains a detailed description of the data used for estimating emissions from incineration of MSW, based on the IPCC default methodology. The trend in CO_2 emissions from waste incineration for 1990–2004 is relatively constant, but there are some fluctuations due to the closure in 1998 and 2001 of two of the four incineration plants that operated in 1990. Ukraine used AD provided directly by the two operating plants and assumptions based on the installed capacity of the closed plants. The ERT recommends Ukraine to report the total AD of the waste incinerated (under the energy sector).

VII. Conclusions and recommendations

90. Ukraine has provided its GHG inventory data for the years 1990 to 2004, including a full set of the CRF tables required with data on all relevant gases and categories and an NIR. Ukraine's GHG inventory is in general accurate, as defined in the UNFCCC reporting guidelines, and is consistent with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. During the in-country review, the ERT identified a few categories where the methods or EFs used were not fully in accordance with the IPCC good practice guidance. The ERT recommended Ukraine to revise its estimates for these categories. After the in-country review, Ukraine provided revised estimates and additional information for these categories for the entire time series in accordance with the recommendations of the ERT and in line with the IPCC good practice guidance.

91. The ERT identifies the following recommendations[9] relating to Ukraine's institutional arrangements and GHG inventory. Ukraine should:

a) Maintain and enhance existing inter-institutional and inter-agency cooperation and the responsibilities for inventory compilation based on the current expertise of Ukrainian experts, ensuring enough capacity for timely performance of the functions;

b) Implement and further develop the recently approved QA/QC plan, expanding its verification procedures to models, AD and estimates, as well as QA/QC checks for all key categories;

c) Enhance and further develop the centralized archiving system;

d) Make the necessary efforts to provide data and emissions estimations for all sectors, categories and gases that have not been estimated, in particular the missing estimates for the energy sector and emissions from all stages of the use of ODS substitutes;

e) Improve transparency in the NIR and the CRF tables by providing more detailed and precise methodological descriptions and documentation on AD, parameters, emission estimates and trends, and reference them appropriately in the NIR;

f) Regularly check the consistency of the information in the NIR against the data reported in the CRF tables, in particular for AD, country-specific methods and EFs;

g) Verify country-specific methodologies, in particular for the LULUCF sector;

h) Consider carefully any implications for the consistency of the time series when introducing further improvements to the inventory related to the use of higher tier methods;

i) Report the explanatory information on recalculations in the CRF tables and make it consistent with the information provided in the NIR;

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

j) Refine the uncertainty analysis taking into account national circumstances and existing data gaps and use it to prioritise inventory improvements, in particular for the solvent and other product use, agriculture, LULUCF and waste sectors;

k) Cross check the applicability of tier 1 methods to intensively managed Ukrainian land for its estimates in the LULUCF sector.

Annex

Documents and information used during the review

A. Reference documents

IPCC. Good practice guidance and uncertainty management in national greenhouse gas inventories, 2000. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

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B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Georgiy Panchenko (Ukrainian Research Hydrometeorological Institute), Mr. Oleksiy Khabatyuk and Ms. Oksana Butrim (Agency for Rational Energy Use and Ecology), Ms. Marina Beresnitska and Mr. Yuriy Pyrozhenko (Climate Change's Centre), Mr. Igor Buksha and Mr. Volodymyr Pasternak (Ukrainian Research Institute of

Forestry and Forest Melioration) and Ms. Nataliya Stranadko (Ministry of Environmental Protection of Ukraine) including additional material on the methodology and assumptions used.

Cross-cutting topics

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