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Report of the individual review of the greenhouse gas inventory of the Republic of Belarus submitted in 2005*

* In the symbol for this document, 2005 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

I. Executive summary

1. This report covers the in-country review of the 2005 greenhouse gas (GHG) inventory submission of the Republic of Belarus, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 3 to 7 October 2005 in Minsk, Belarus, and was conducted by the following team of nominated experts from the roster of experts: Generalist – Mr. Paul Filliger (Switzerland); Energy – Mr. Amit Garg (India); Industrial Processes – Ms. Irina Yesserkepova (Kazakhstan); Agriculture – Ms. Batima Punsalmaa (Mongolia); Land Use, Land-use Change and Forestry (LULUCF) – Mr. Mikhail Gytarsky (Russian Federation); Waste – Ms. Irina Yesserkepova (Kazakhstan). Mr. Amit Garg and Mr. Mikhail Gytarsky were the lead reviewers. The review was coordinated by Mr. James Grabert and Ms. Katia Simeonova (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 Belarus, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

3. In 2003, carbon dioxide (CO_2) was the most important GHG in Belarus, contributing 71.5 per cent of total[1] national GHG emissions in CO_2 equivalent, followed by methane (CH_4), 17.7 per cent, and nitrous oxide (N_2O), 10.8 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) taken together contributed almost "0" per cent of overall GHG emissions. For potential sources of HFCs, PFCs and SF_6, Belarus has only estimated consumption of HFCs. According to the national inventory report (NIR), production of halocarbons and SF_6 does not occur in the country, while HFC 134 and HFC 134a are mainly used. The shares of HFC 143a and HFC 23 are negligible (less than 0.01 per cent). All HFCs are used for household refrigerators and freezers. Data on imports/exports of halocarbons are not available.

4. The Energy sector accounted for 73.3 per cent of total national GHG emissions in 2003, followed by Agriculture (18.4 per cent), Waste (4.6 per cent), Industrial Processes (2.9 per cent) and Solvent and Other Product Use (0.1 per cent). Total GHG emissions amounted to 73,718 Gg CO_2 equivalent and had decreased by 43.8 per cent since 1990. CO_2 emissions had decreased by 48.5 per cent, CH_4 by 21.6 per cent and N_2O by 34.7 per cent over the same period. Total emissions from the Energy sector had decreased by 47.7 per cent, from Industrial Processes by 7.3 per cent, and from the Agriculture sector by 39.5 per cent. Total emissions from the Waste sector increased by 32.4 per cent and net removals from LULUCF increased by 16.2 per cent over this period. The emission trends for different gases and sectors are analysed separately in the respective sector sections of this report.

5. The expert review team (ERT) acknowledges Belarus' continuing efforts to improve its inventory submissions, and particularly the substantial progress it has made in the development of the 2005 inventory. The ERT further noted the Party's strong commitment to enhance the inventory further. In its 2005 submission, Belarus has provided a complete set of the common reporting format (CRF) tables for 1990. A revised version of the 2003 CRF tables and NIR was made available just before the review. Belarus is aware of the need for further steps to improve the inventory.

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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. Belarus has not provided the tables of the common reporting format for LULUCF as required by decision 13/CP.9 using the land use categories of the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-use Change and Forestry*. Instead it has used the common reporting format tables for Land-use Change and Forestry as contained in the common reporting format adopted by decision 18/CP.8, which are based on the categories of the Intergovernmental Panel on Climate Change *Revised 1996 Guidelines for National Greenhouse Gas Inventories*.

6. Belarus has made substantial improvements since its last submission: the NIR has been extended to include more information on the activity data (AD) and parameters used in the inventory calculations; a key category analysis and an uncertainty analysis have been performed; notation keys have been used throughout the CRF tables; and a CRF for the year 1990 has been made available. As a follow-up to previous reviews, Belarus has estimated emissions and removals of most source categories. However, the reporting in both the NIR and the CRF is not entirely consistent 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 revised UNFCCC reporting guidelines). The problems with regard to cross-cutting aspects of the inventory are the completeness of the CRF and the NIR in terms of inclusion all sources, and the transparency of the NIR where methods, AD and emission factors (EFs) are concerned. The ERT encourages Belarus to improve the transparency of the inventory by including more background information in the NIR. The ERT further recommends that in the next inventory submission the NIR should follow the revised UNFCCC reporting guidelines as outlined in decision 18/CP.8.

7. In its 2005 submission, Belarus reports on the key category analysis undertaken including the LULUCF sector. The ERT noted that the key source analysis made by Belarus differs from that performed by the UNFCCC secretariat due to the level of aggregation in the Energy sector and inclusion of the LULUCF in the estimates. The ERT encourages Belarus to revise its key category analysis in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) (chapter 7.2) 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) (chapter 5.4). The key categories should be identified first excluding and then including the LULUCF categories. The ERT recommends that the Party conduct the analyses at a more disaggregated level and by fuel types. The documentation of key categories in the NIR should be extended substantially by including more detailed information on methods used, complete time-series of AD and EFs.

8. Belarus has not yet submitted a full set of CRF tables and has not provided the LULUCF reporting as required by decision 13/CP.9. During in-country review Belarus stated that it would provide full CRFs from 1990 to the latest year and use the new LULUCF reporting tables in its 2006 submission. The ERT strongly encourages Belarus to submit the full set of CRF tables from 1990 to the latest inventory year. The ERT further encourages Belarus to use the new LULUCF reporting tables as required by decision 13/CP.9. It is recommended that Belarus report on the subcategories in Energy Industries and Manufacturing Industries and Construction that are currently missing. The ERT further recommends more detailed documentation of the recalculations performed.

9. Belarus has carried out an uncertainty analysis. Its documentation in the NIR is limited and should be extended. The ERT considers the uncertainty estimates low. Verification and quality assurance and quality control (QA/QC) procedures are not yet fully developed but they are expected to be of growing importance at the next stage, when the inventory becomes more sophisticated. During the review the ERT learned that the projects funded by the World Bank and the European Union's EuropAid Cooperation Office and Regional Action Programme 2002 (TACIS) provided additional support to improving capacity for inventory development in Belarus. The ERT noted that the institutional framework for preparation of the inventory is well developed to maintain sustainable inventory preparation and encourages Belarus to document it appropriately in its next inventory submission.

10. The following issues for improvement were identified by the ERT: the submission of CRF tables for the years currently missing; revision of the key category analysis; adherence to the revised UNFCCC reporting guidelines; the provision of estimates for missing sources referred to in paragraphs 41, 43, 53, 61 and 73 of the present report; reporting of the LULUCF tables adopted by decision 13/CP.9; documentation of recalculations; and the development of QA/QC procedures.

Table 1. Greenhouse gas emissions by gas, 1990–2003

GHG emissions	Gg CO_2 equivalent														Change 1990–2003 (%)
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	
CO_2 (with LULUCF)	82 399	75 901	67 648	59 190	50 290	41 713	40 017	37 366	40 218	31 062	28 026	30 577	35 404	35 931	–56.4
CO_2 (without LULUCF)	102 316	96 106	88 248	80 300	72 200	64 035	61 302	59 271	58 738	57 263	52 019	52 168	51 761	52 670	–48.5
CH_4	16 665	16 144	15 523	14 809	14 031	13 284	13 108	13 134	13 232	13 351	12 840	12 841	12 781	13 062	–21.6
N_2O	12 222	9 963	7 899	7 899	5 940	6 265	5 831	6 488	6 960	7 434	8 082	7 573	5 881	7 986	–34.7
HFCs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PFCs	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SF_6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total (with CO_2 from LULUCF)	**111 287**	**102 009**	**91 070**	**81 898**	**70 260**	**61 262**	**58 957**	**56 987**	**60 410**	**51 847**	**48 948**	**50 991**	**54 066**	**56 980**	–48.8
Total (without CO_2 from LULUCF)	**131 203**	**122 214**	**111 670**	**103 008**	**92 170**	**83 584**	**80 242**	**78 892**	**78 930**	**78 048**	**72 941**	**72 582**	**70 423**	**73 718**	–43.8

LULUCF = Land Use, Land-use Change and Forestry.

Table 2. Greenhouse gas emissions by sector, 1990–2003

Sectors	Gg CO_2 equivalent														Change 1990–2003 (%)
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	
Energy	103 315	97 134	89 271	81 418	73 723	65 648	62 885	60 624	58 466	56 446	53 442	53 871	53 280	54 068	–47.7
Industrial Processes	2 284	2 159	2 084	1 914	1 394	1 212	1 293	1 581	1 787	1 797	1 681	1 662	1 875	2 118	–7.3
Solvent and Other Product Use	74	0	0	0	0	0	0	0	0	0	0	0	0	81	+8.3
Agriculture	22 442	19 844	17 977	16 789	14 322	14 149	13 285	13 698	13 991	14 086	14 425	13 590	13 158	13 567	–39.5
LULUCF	–19 402	–19 714	–20 126	–20 653	–21 466	–21 888	–20 838	–21 441	–22 147	–23 404	–23 556	–21 112	–15 878	–16 263	+16.2
Waste	2 574	2 587	2 577	2 430	2 289	2 140	2 332	2 526	2 729	2 923	2 956	2 980	3 092	3 409	+32.4
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

LULUCF = Land Use, Land-use Change and Forestry.

II. Overview

A. Inventory submission and other sources of information

11. Belarus submitted an NIR on 8 April 2005 and the CRF tables for the year 2003 on 23 May 2005. A revised version of the 2003 NIR and CRF was sent to the UNFCCC secretariat on 2 September 2005, and on the same date an NIR and a CRF for the year 1990 were also submitted. During the in-country review a paper copy of a further revised 2003 NIR (with corrections made in table 1.2) was provided to the ERT. The NIR and CRF versions of 2 September 2005 were the focus of the review. Where needed, the ERT also used previous years' submissions, including the CRF tables and the NIR for the year 2002.

12. During the review Belarus provided the ERT with additional information. The full list of materials used during the review is provided in the annex to this report.

B. Key categories

13. As a part of its 2005 submission, Belarus reports a tier 1 key category analysis level assessment, which is an improvement over the previous year's submission. The key category analysis performed by Belarus and the secretariat[2] produced different results due to the inclusion of LULUCF emissions in the Party's key category analysis (removals were not included). Key categories should in fact first be identified for the inventory excluding LULUCF, and as a second step, the analysis should be carried out including LULUCF to define additional key categories within the LULUCF sector (without changing the key categories derived for the other sectors). For the next inventory submission, the ERT recommends that Belarus revise its key category analysis according to the IPCC good practice guidance (chapter 7.2) and the IPCC good practice guidance for LULUCF (chapter 5.4). The ERT further recommends that the Party do the key category analyses at a more disaggregated level, distinguishing between fuel type in the Energy sector and undertaking a trend assessment in its key category analysis.

14. The key category analysis should be used as a tool to guide the choice of priorities for the future development of the inventory. All key categories should be well documented in the NIR, including detailed description of methods used, time series and EFs. The ERT encourages Belarus to include more detailed discussion of its key category analysis in its next inventory submission.

C. Cross-cutting topics

1. Completeness

15. Belarus has not yet submitted a full set of CRF tables and has not provided the LULUCF reporting as required by decision 13/CP.9. During in-country review Belarus stated that it would provide full CRFs from 1990 to the latest year and use the new LULUCF reporting tables in its 2006 submission.

16. In its CRFs for 1990 and 2003, Belarus reports on emissions and removals for all main sources. However, the notation keys "not estimated" ("NE") and "not applicable" ("NA") are used inconsistently and frequently are not appropriately documented in the NIR or the CRF. Examples are CRF tables 1.A(a)s3 and 1.A(b), 1.A(c) and 1.A(d) in the Energy sector. The ERT further noted that emissions for several significant sources (e.g. Energy Industries, Manufacturing Industries and Construction) are

[2] The secretariat identified, for each Party, those source categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance. 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 year 1990. 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.

reported in an aggregated way, that is, the notation key "included elsewhere" ("IE") is provided for their subcategories. These subcategories may be key, and detailed reporting on their emissions is therefore important. To improve the completeness of the inventory, the ERT recommends that Belarus report emission estimates at a more disaggregated level giving high priority to the base year inventory. The ERT further encourages Belarus to check for the appropriate use of the notation keys in the CRF.

2. Transparency

17. In Belarus' 2005 submission, the NIR and the CRF include information on key categories, EFs, AD and methods used. The ERT noted that the earlier 2005 submission included separate chapters on recalculations and quantitative uncertainty estimates, but the uncertainty assessment has not been provided in the latest submission. Very little information is provided on the institutional framework and QA/QC procedures. Although the NIR has been expanded compared to the earlier submission, it is not yet transparent enough. The NIR is not fully consistent with the revised UNFCCC reporting guidelines as outlined in decision 18/CP.8. The ERT recommends that Belarus restructure its NIR in accordance with the revised UNFCCC reporting guidelines and expand it to provide:

(a) Detailed descriptions of methods used for all key categories (based on the revised key category analysis);

(b) AD for all years from 1990 onwards (at least for all key categories); and

(c) Documentation of the EFs applied.

18. During the in-country visit the ERT was informed that a special manual on EFs was in preparation and should be made official by 1 November 2006. The ERT acknowledges this effort as a further improvement of the transparency of Belarus' reporting and recommends that it be included in the NIR as an annex or at least summarized and referenced.

19. Belarus stated that some data are confidential (e.g. detailed energy statistics) and did not make them available to the ERT team. The ERT encourages the Party in future submission to provide more information on how confidential data are collected and how they are included in the inventory. The ERT encourages Belarus to consider the possibility to submit this information, which will be handled in accordance with the code of practice for the treatment of confidential information contained in decision 12/CP.9.

20. Belarus has not followed to the full extent the IPCC good practice guidance, which is mandatory for Parties included in Annex I (details are indicated in the relevant sector sections of this report). The ERT recommends that Belarus follow more closely the IPCC good practice guidance and the IPCC good practice guidance for LULUCF in its next submission.

3. Recalculations and time-series consistency

21. Recalculations have not yet been made systematically as Belarus has submitted only the 1990 CRF and some aggregated trend level data in their latest CRF. In its earlier 2005 submission, Belarus provided explanations of the recalculations and listed the sources and sectors where these have been applied. The latest NIR submission does not include this information. During the review the Belarusan experts noted that they considered the latest submission a supplement to the earlier ones. However, there should be only one NIR at any point in time that is complete in all respects. The ERT recommends that Belarus ensure this. To maintain consistency between the NIR and the CRF, Belarus is encouraged to document recalculations both in the NIR and in the CRF.

4. Uncertainties

22. In the April 2005 version of the NIR a tier 1 uncertainty analysis had been performed, and the results are presented at the individual source category level. The method is used correctly. Uncertainties of EFs and AD are mainly taken from expert judgement. The documentation of the uncertainties is very limited. The ERT considers many uncertainty estimates to be low (e.g. the EF uncertainty of N_2O from agricultural soils is taken as 20 per cent, which is extremely low compared to other countries' assumptions). Belarus should be aware that uncertainty estimates are mainly used to identify sectors which are important for the overall quality of the inventory and which should be given high priority in future improvements. The ERT encourages Belarus to include more documentation of uncertainties in the NIR and to use them as a tool for setting priorities.

5. Verification and quality assurance/quality control approaches

23. The documentation on QA/QC procedures in the NIR is very limited: Belarus clarified during the in-country review that internal cross-checks (between Belarussian Research Centre "Ecology" of the Ministry of Natural Resources and Environmental Protection (hereinafter referred as the BelRC Ecology), and the Ministry of Statistics) are regularly done, but no independent peer reviews or cross-checks are currently performed. A formal QA/QC plan in accordance with the IPCC good practice guidance is not available. Belarus has prepared an improvement list under the TACIS project (referred to in paragraph 9 above), but it is not included in the NIR. The ERT encourages Belarus to develop the QA/QC procedures as planned and to document them in a formalized QA/QC plan.

24. The ERT noted that the data are transferred manually to the CRF. The ERT identified several typing errors which occurred during these manual transfers of data. The ERT encourages Belarus to improve quality control, to avoid typing errors, and progressively to use electronically-based data transfer. Belarus developed an emissions database, which in 2005 was still at a testing stage. It plans to have this database operational for the 2006 submission. This may help to resolve the above problems. For its future submissions, the ERT recommends that Belarus use the CRF Reporter software, which will also reduce the potential for typing errors.

6. Institutional arrangements

25. No overview of the institutional arrangements is included in the NIR. During the in-country review Belarus explained the institutional arrangements for preparation of the inventory. The Ministry of Natural Resources and Environmental Protection has the overall responsibility for the national inventory. All data are collected and archived at BelRC Ecology. The most important data supplier is the Ministry of Statistics and Analysis, which reconciles all the data and then publishes them. Normally data are not changed once they have been published and no amendments to the data can be made without the approval of Ministry of Statistics and Analysis.

26. Belarus explained that the legal frameworks for a sustainable inventory process are being put in place. For these purposes three legal documents have been prepared:

(a) An organizational reference manual on inventory preparation;

(b) Instructions on data collection; and

(c) A draft national inventory system.

27. The ERT noted that the annual inventory preparation framework is well structured, timetables are set and the data flow is documented. The data are collected through standard forms distributed annually by official letter from the Ministry of Natural Resources and Environmental Protection to the various data suppliers. The responses, including completed data forms are then collected and archived in the BelRC

Ecology. In its comments to the draft review report, Belarus provided additional information on the national legislation being developed to establish national inventory system and to make it operational. The ERT recommends that Belarus include a brief overview of legal and institutional arrangements and data-flow structure for the national inventory system in its next inventory submission.

7. Record keeping and archiving

28. Belarus is currently building a centralized file storage system for collecting and archiving all inventory-related information at the BelRC Ecology through the EU project and intends to save all the information electronically on that storing system. It is planned to use it for the first time for the 2006 inventory submission.

8. Follow-up to previous reviews

29. In response to previous reviews, Belarus has made substantial progress since its last submission: key category and uncertainty analyses have been carried out, notation keys are used throughout the CRF tables, the NIR has been expanded, and a CRF for the year 1990 has been submitted for the first time. The ERT acknowledged this progress and noted Belarus' strong commitment to developing the inventory further.

D. Areas for further improvement

1. Identified by the Party

30. In an overview and sectoral presentations during the in-country review, Belarus identified the following planned improvements:

(a) Completion of a full national inventory system;

(b) Analysing and assessing the methods used, including uncertainties, accuracy and EFs;

(c) Review and elaboration of national EFs;

(d) Completion of the CRF for the years 1991–2000;

(e) Building up a QA/QC plan;

(f) Enhancement of consistency and transparency of the NIR and CRF.

2. Identified by the ERT

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

(a) Provide CRF tables for the period 1991–2000;

(b) Provide LULUCF CRF tables in accordance with decision 13/CP.9;

(c) Revise the key category analysis (as described in paragraphs 13 and 14);

(d) Restructure and expand the NIR (as described in paragraphs 15–20;

(e) Improve the completeness of the inventory (as described in paragraphs 23 and 24), particularly for the base year (1990);

(f) Develop an improvement plan which includes future improvement steps, defines responsibilities and sets the timetable.

32. The ERT recommends that the Party provide more thorough information on recalculations in accordance with the revised UNFCCC reporting guidelines. Improvements in particular with regard to completeness are needed, ensuring transparent explanations for all recalculations. This information should be provided in the appropriate CRF tables 8(a) and 8(b). Furthermore, more thorough and detailed descriptions should be provided in the NIR regarding related changes in methodologies, EFs AD.

33. The ERT recommends that the Party document uncertainties in line with the IPCC good practice guidance as below:

(a) Clearly characterize each parameter to which a specific uncertainty is attributed;

(b) Where expert judgement is used, establish uncertainties for specific categories:

(i) Develop a protocol for the elicitation of expert judgement (see the IPCC good practice guidance, page 6.10);

(ii) Use a template for documentation (see the IPCC good practice guidance, page 6.11);

(c) Make an effort to compare uncertainty values to those of other countries.

34. In the development of its planned QA/QC system, the ERT recommends that Belarus:

(a) Develop a formal documentation of the various QC activities undertaken (and those planned), detailing the participants and procedures. Prioritization of QC activities could as well be implemented, for example on the basis of key categories and recent changes in methodologies or data;

(b) Review and improve its record-keeping and archiving system already in place. The review highlighted that although elements were in place, a more thorough approach could be developed, in particular with regard to implementing more electronic management of information. As well, due to the range of sources and data providers, a formal documentation of the system and process would be beneficial (as part of the documentation mentioned above).

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

III. Energy

A. Sector overview

36. Belarus saw a decline in GHG emissions from the Energy sector after 1990 due to the break-up of the former Soviet Union and the subsequent reduction in almost all energy-related activities. Gross domestic product (GDP) fell sharply between 1990 and 1995 and has staged the recovery since 1995. In 2003 GDP was 10 per cent higher than in 1990, but GHG emissions were only 51.5 per cent of those in 1990. Since the Energy sector is the major contributor to these emissions, the main reasons for this strong decoupling between GDP and GHG emissions during the period 1995–2003 were analysed. Belarus explained the main reasons for this during the review – structural changes in GDP, with higher shares of less energy-intensive sectors such as services and commercial in 2003 compared with 1990; a higher penetration of energy-saving technologies in almost all sectors; fuel switching from coal to natural gas; and enhanced use of biomass in domestic and commercial households owing to government policy. The ERT recommends that Belarus provide such explanations in the NIR to allow a better understanding of the emission trends from the Energy sector over the time series.

37. In 2003, the Energy sector accounted for 73.3 per cent of total national GHG emissions. Fuel combustion contributed 69.7 per cent of total national GHG emissions and 96.7 per cent of total CO_2 emissions (excluding LULUCF). Energy industries contributed 44.8 per cent of total national GHG emissions. Over the period 1990–2003, total GHG emissions from the Energy sector decreased by 47.7 per cent. Emissions of CO_2 from the sector decreased by 49.3 per cent over the same period.

38. The fuel consumption statistical data system operates as follows: the enterprises send their reports using the state reporting forms to the Ministry of Statistics and Analysis. This Ministry is the principle depositary of such data. The State Energy Efficiency Committee of the Council of Ministers has main competencies in the area of analysis of the information on energy consumption, but it also takes its primary information from the Ministry of Statistics. The ERT recommends that Belarus maintain consistency in the use of national energy statistical data and to document the methods used, AD, EFs and estimates in the NIR and the CRF.

39. Belarus has applied a tier 1 approach for estimating for all gases for the year 2003 at a fairly highly aggregated level and here the transparency of the reporting is inadequate. For the subcategories Energy Industries and Manufacturing Industries and Construction, no refinement of emissions is reported (e.g. 1.A.1.a-c, 1.A.2.a-f). Data on feedstocks and non-energy use of fuels (CRF table 1.A(d)) have not been estimated due to lack of data (CRF table 9s1). However, during the review process the ERT was shown disaggregated data for 2004 which would be sufficient for detailed reporting. The ERT encourages Belarus to provide a more detailed inventory for the Energy sector in its next submission. This would also improve transparency across the Energy and Industrial Processes sectors, particularly for emissions from energy and non-energy use of fuels in the iron and steel industry, which is required by decisions 18/CP.8 and 13/CP.9.

1. Completeness

40. The CRF for the year 2003 includes estimates of all gases and most sources from the sector, as recommended by the Revised 1996 IPCC Guidelines. Emissions of CO_2 under the reference approach and N_2O from Other Transportation were not reported, CH_4 emissions from fugitive emissions from solid fuels were reported as not occurring ("NO"), and N_2O emissions from fugitive emissions of oil and natural gas – flaring and emissions from multilateral operations were reported as "NE". During the in-country review Belarus clarified that where the relevant information is available it would be provided in the next year's submission.

41. The energy balances reported in the NIR and the CRF contain few discrepancies. For example, 2003 coke consumption in table 1.2 of the NIR (2,393 TJ) differs from the value shown in the work sheets on which the CRF tables are based (2,099 TJ). The work sheets were provided to the ERT during the review. There is also a considerable number of typing errors in table 1.2 which were clarified during the review. There were as well some mismatches detected in the NIR tables and text. For example, based on the percentage description in paragraph 5, page 9, of the NIR, household stove oil consumption in 2003 was about 783 TJ, whereas the consumption shown in table 1.2 is 3,334 TJ. Sample checks applied on the CRF, the worksheets and the background data provided to the ERT during the review indicated a perfect match, which is encouraging. The ERT recommends that Belarus check the consistency of its reporting in the NIR and the CRF.

42. Belarus has provided information on methodologies and EFs used in CRF table Summary 3. However, there are some inconsistencies between the NIR and the CRF. For example, CRF table Summary 3 indicates that IPCC default EFs and methodology were used for estimating fugitive emissions from solid fuels for all gases. However, in CRF table 1.B.1 and in the NIR these emissions are reported as "NO". It was clarified during the review that fugitive CH_4 emissions from peat mining do occur in Belarus, but they have not been estimated. The ERT recommends that Belarus estimate these emissions, if possible, or report them as "NE".

2. Transparency

43. The NIR does not provide sufficient information on the methodologies, AD and EFs applied in estimating emissions from the Energy sector. There is a lack of information on the allocation of AD between the Energy and Industrial Processes sectors (e.g. use of coke) and on the allocation of waste incineration data between the Energy and Waste sectors. During the review, Belarus provided plausible explanations for many apparent inconsistencies noticed in the NIR. The ERT recommends that Belarus provide more detailed documentation of the inventory for the Energy sector in the next submission.

3. Recalculations and time-series consistency

44. There are high inter-annual variations in the estimates of CO_2 emissions for Manufacturing Industries and Construction during the period 2000–2002, for Transport during the period 1999–2002, and for Other during 1990–1991 and 1999–2002. The fuel combustion estimates of CH_4 emissions are very high in 1999; and figures for N_2O emissions fall abnormally between 1999 and 2000. The NIR does not provide explanations for these variations. In response to the draft review report, the Party explained that emission trends are so far assessed through interpolation. Only when all the years are covered in the inventory next year, will there be a basis to discuss changes, and therefore the time series. The ERT encourages Belarus to explain these variations in the next inventory submission.

4. Uncertainties

45. The uncertainties of AD and EFs have been determined primarily through expert appraisal and are estimated to be 2–7 per cent for the Energy sector. CRF table 7 indicates a medium level of uncertainty in fuel combustion-related emissions and a low level in oil- and gas-related fugitive CH_4 emissions. However, no detailed quantitative uncertainty analysis is provided.

46. It was explained during the review that Belarus uses primary surveys to collect energy balance information. The IPCC good practice guidance stipulates uncertainties in AD from such well-developed statistical systems of up to 5 per cent. The uncertainty from domestic use of biomass could be as high as 10–30 per cent. However, since Belarus has used IPCC default EFs for most of the inventory estimates, the ERT recommends that the related uncertainty in EFs should be taken from the IPCC good practice guidance. For example, the IPCC good practice guidance indicates uncertainties of EFs as high as 50–150 per cent for CH_4 for stationary and $\pm$40 per cent for mobile combustion. For N_2O EFs it is an order of magnitude for stationary and $\pm$50 per cent for mobile combustion. The sum of squares method is normally used to estimate the combined uncertainty from AD and EFs, and therefore combined uncertainty cannot be lower than the uncertainly of either of the two. The ERT recommends that Belarus undertake the uncertainty analysis in line with the IPCC good practice guidance and report on it in its next inventory submission.

5. Verification and quality assurance/quality control approaches

47. The NIR does not provide information on QA/QC for the Energy sector. However, during the review Belarus described a sophisticated bottom–up system in place for AD collection which would make it possible to calculate estimates using the higher tiers of the IPCC good practice guidance. The ERT encourages Belarus to maintain this system and use it for higher-tier estimates based on key category analysis as per the IPCC good practice guidance.

48. The ERT noted that Belarus has good QA/QC procedures in place for AD collection for the Energy sector. However, the procedures for utilizing the raw data for the GHG inventory are not well established and are not documented in the NIR. The ERT recommends that Belarus establish and verify its QA/QC procedures for inventory preparation and document them in its future submissions.

B. Reference and sectoral approaches

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

49. CO_2 emissions using the reference approach have not been estimated and comparison of the reference approach with the sectoral approach and international statistics was therefore not possible. Belarus indicated that reference approach estimates would be provided in its next submission.

2. International bunker fuels

50. Belarus reports emissions from marine bunkers and domestic navigation in the CRF for 2003. These are due to river-based navigation to the Black and Baltic seas. However, no background information on the methodologies used for splitting the AD between domestic and international marine bunker fuels is provided in the CRF or the NIR. The ERT encourages Belarus to provide background data on bunker fuels in its next submission.

51. For aviation bunkers, no information is provided on how the international and domestic aviation was separated in the reporting in the NIR and CRF, making a potential for overestimation of emissions from this category source. Although no aviation kerosene consumption is reported for international bunkers, it is reported for domestic aviation. During the review, the ERT was shown very detailed annual data for all flights in Belarus. This included information such as landing and take-off by aircraft type, and total fuel consumption including consumption for domestic aviation. It indicates that Belarus is in a position to report aviation emissions at a higher-tier level. To improve transparency and accuracy of the reporting, the ERT encourages Belarus to provide background data for aviation bunkers in its next NIR and, if possible, to make efforts to report aviation emissions at a higher-tier level.

3. Feedstocks and non-energy use of fuels

52. Data on feedstocks and non-energy use of fuels are reported as "NE" in CRF table 1.A(d). The ERT encourages Belarus to report this information in the CRF and supporting background data in the NIR.

C. Key categories

1. Stationary combustion: gas, liquid, solid- CO_2

53. For Energy Industries, AD and emissions are reported as ("IE") for the source categories Public Electricity and Heat Production, Petroleum Refining, and Manufacture of Solid Fuels and Other Energy Industries. They are reported as aggregated emissions under Energy Industries. Belarus indicated that the Ministry of Statistics and Analysis collects enterprise-level AD for all fuels annually. The data forms were also shown to the ERT. The ERT encourages Belarus to use these high-quality data for sectoral disaggregation in its next submission.

54. AD and emissions are reported as "IE" for the subcategories of Manufacturing Industries and Construction category. Belarus indicated that the Ministry of Statistics and Analysis collects enterprise-level AD for all fuels annually. The data forms were also shown to the ERT. AD for various source subcategories were also shown for the year 2004. The ERT encourages Belarus to use these data for sectoral disaggregation in its next submission. During the review, Belarus indicated that it would aim to provide the necessary details in its next submission.

2. Road transportation: diesel and gasoline – CO_2

55. There are major inter-annual variations in the estimates of CO_2 emissions for Road Transportation during the period 1999–2002. Transport sector emissions fell drastically from 1990 to 2001, and started to increase again during 2001–2003. During the review, Belarus explained that the

main reasons for this drastic decline were a reduction in the daily number of regular bus trips on many routes, a reduction of over 70 per cent in the size of the fleet of heavy-duty goods transport vehicles, and energy efficiency improvements. Furthermore, it was explained that, although the number of private cars went up by 80 per cent over the period 1990–2003, their actual use has not increased proportionately. This is due to many socio-economic reasons and the considerable share of old vehicles in the national stock of private cars. To improve the transparency of its reporting, the ERT recommends that Belarus explain the time-series and emission trends for the Transport sector in the NIR.

56. With regard to CO_2 emissions from use of diesel, Belarus indicated in response to the previous (2004) review that the EF was erroneously based on national gross calorific values (GCVs). The ERT noted that the implied EF has been changed from 73.33 t/TJ in 2002 to 73.08 t/TJ in 2003. However, the NIR does not provide any information on the reasons for changes, and it does not appear that the change came from switching from the GCV to net calorific values (NCVs). The ERT encourages Belarus to document the changes in EF in its next submission.

3. Venting and flaring of natural gas – CO_2, CH_4 and N_2O

57. CO_2 and N_2O emissions are reported as not estimated, while CH_4 emissions are indicated as "IE". Activity data on natural gas flaring and venting are reported as "IE" without specifying where. The ERT recommends that Belarus provide information on the amounts vented and flared since they have implications for the estimates of CO_2 and CH_4 emissions.

D. Non-key categories

1. Road Transportation (liquid and gas) – CH_4 and N_2O

58. CH_4 emissions from road transportation decreased by 60 per cent and N_2O emissions decreased by 57.6 per cent over the period 1990–2003. Over the same period, diesel and gasoline consumption also decreased by 60 per cent, and natural gas consumption decreased by 72.6 per cent, as shown in the CRF. The NIR does not provide any information on level of fuel consumption by the vehicle fleet. As indicated earlier, fleet composition and use underwent considerable changes during the period 1990–2003, and since CH_4 and N_2O emissions are technology-specific, reductions in emissions would not move directly in proportion to reductions in fuel consumption for these gases. The ERT was provided with detailed data sheets for fleet-specific data collected nationally on an annual basis. In response to the draft review report, the Party explained that these data should be supported by comprehensive statistical data on fuel consumption by automobile transport, which at present is difficult to provide. The ERT encourages Belarus to aspire for higher-tier estimation of road transport emissions in its future submissions.

59. The N_2O implied emission factor (IEF) for gasoline is 0.6 kg/TJ, that for diesel 0.59 kg/TJ, and that for gas 0.1 kg/TJ. These are consistent with the IPCC default EFs for a tier 1 approach. However, since Belarus has detailed data based on vehicle technology type, as shown during the review process, the ERT encourages Belarus to apply a higher-tier method for these estimates if this is a key category based on the revised key category analysis. For higher tiers, the EFs for certain fleet categories are an order of magnitude higher.

2. Railways (solid fuels) – CH_4 and N_2O

60. Belarus has reported these emissions as "0". However, AD are reported. The ERT recommends that Belarus estimate these emissions or to use the correct notation key.

3. Navigation (all fuels) – CH_4 and N_2O

61. Belarus has indicated these emissions as "IE", but has not provided details in the NIR or the CRF as to where they are reported. It was clarified during the review that these emissions were added directly to the

sectoral total (1.A.3 Transport) without being reflected in the total for the subsector (1.A.3.d Navigation). This is not consistent with the Revised 1996 IPCC Guidelines. The ERT recommends that Belarus report these emissions under 1.A.3.a Aviation and then in the total for the category.

4. Other Transportation (gas) – CH_4 and N_2O

62. The NIR does not explain the main sources in this category. During the review Belarus indicated that the main source is energy combusted during pipeline transport. Belarus indicates these emissions as "NA", but does report CO_2 emissions from the same source. Therefore the notation key used for CH_4 and N_2O emissions should be "NE". The ERT encourages Belarus to estimate these emissions, however small they are.

5. Civil Aviation: liquid – CO_2, CH_4 and N_2O

63. Belarus has indicated in response to the previous year's review that the CO_2 EFs for jet kerosene and aviation fuel are based on GCVs. These EFs show minor changes between the 2004 and 2005 submissions. However, the NIR does not report any changes in national GCVs. The ERT recommends that Belarus clarify the reasons for the changes in the EFs in its next NIR.

64. Belarus indicates CH_4 and N_2O emissions as "IE", but does not report in the NIR or the CRF where they have been included. It was clarified during the review that they were added directly to the sectoral total (Transport) without being reflected in the total for Civil Aviation. This is inconsistent with the IPCC good practice guidance. The ERT recommends that Belarus report these emissions under Civil Aviation and then under the total for the category.

6. Other: gas, liquid, solid, other, biomass – CO_2

65. Between 2001 and 2002, CO_2 emissions decreased by 55.9 per cent. The ERT encourages Belarus to verify the AD and EFs used to estimate emissions from this category. The ERT further encourages Belarus to document fuel consumption under this item in the NIR.

E. Areas for further improvement

1. Identified by the Party

66. Belarus has not provided any areas for improvement in the Energy sector in the NIR. However, during the review process, Belarus indicated a need to develop a reference approach, analyse applied AD and EFs, improve AD collection and develop national EFs. The ERT encourages Belarus to use the revised key category analysis to focus on the EFs that require national assessment.

67. During the review Belarus also identified a need to analyse and complete previous years' inventories and CRF tables for the years they have not yet completed, 1991–2000. The ERT appreciates this since this would also improve time-series consistency. The ERT encourages Belarus to report and record these in its next NIR.

2. Identified by the ERT

68. The ERT recommends that Belarus maintain consistency in the use of national energy statistical data and conduct consistency checks between the AD, the work sheets, the CRF tables and the NIR in order to avoid input mistakes.

69. The ERT recommends transparent and detailed documentation of methods, AD, EFs and estimates in the NIR and the CRF.

70. To ensure greater transparency, the ERT recommends that Belarus describe clearly in the NIR:

(a) Explanations of recalculations performed;

(b) Allocation of emissions across the energy, industrial processes and waste categories;

(c) Differences between the subsector allocations of the GHG inventory and national energy balance;

(d) Fuel consumption balance in road transport; and

(e) Explanation of flows of carbon within iron and steel production.

IV. Industrial Processes and Solvent and Other Product Use

A. Sector overview

71. In 2003 the contribution of the Industrial Processes sector to total national GHG emissions had increased from 1.7 per cent in 1990 to 2.9 per cent. In 2003, Industrial Processes and Solvent and Other Product Use accounted for 3 per cent of the total CO_2 equivalent emissions of Belarus (without LULUCF). Emissions from industrial processes decreased by 7.8 per cent between 1990 and 2003. CO_2 had the largest share in total emissions from the sector, accounting for almost 81.5 per cent of sectoral emissions, due to cement production, which is the only key category in the sector. The contributions of N_2O, CH_4 and HFC emissions were 16.5 per cent, 1.7 per cent and less than 0.02 per cent, respectively. N_2O emissions were generated mainly from nitric acid production.

1. Completeness

72. The CRF includes estimates of most gases and sources of emissions from the sector, as recommended by the Revised 1996 IPCC Guidelines; however, some are reported as "IE", "NE" or "NO", and in particular the ERT noted that emissions from limestone and dolomite and soda ash use, asphalt roofing, consumption of SF_6 and potential emissions of HFCs were not provided. In response to the draft review report, the Party explained that only minor emissions of HFC-134 occur in Belarus. There is an ongoing research on SF_6 emissions. Due to insignificant input to the overall emission profile, the emissions of these gases were not estimated.

2. Transparency

73. The information provided is not fully detailed and transparent neither in the NIR nor in the CRF because of unclear descriptions of methodologies used, although EFs are presented in the NIR for all sources estimated in the inventory, making it possible to replicate the emission estimations. For some cases the EF is provided in the latest submission in the CRF only, but not included in the NIR (e.g. the EF for CO_2 emissions for Iron and Steel Production). For Ammonia Production it is not clear whether the volume of natural gas used for non-energy purposes is subtracted in the Energy sector in order to avoid double counting. The ERT encourages Belarus to document this in its next inventory submission.

3. Recalculations and time-series consistency

74. Recalculations for cement and glass production have been carried out and are provided in CRF table 8 for 2003 and 1990 in response to recommendations from the centralized review of the previous (2004) submission. A default correction factor for cement kiln dust (1.02) has been applied and the EF for the decomposition of alkaline carbonates added to glass-making sand has been changed. As a result of recalculations in 2003 and in the base year, the estimates of emissions from industrial processes have increased. CO_2 emissions from steel production in electric arc furnaces have also been added, but no information on these recalculations is included in CRF table 8. The recalculations have improved the completeness and time-series consistency of the inventory. Additionally to the NIR, Belarus has reported

changes in actual emissions of HFCs separately, but no explanatory information is provided. The ERT encourages Belarus to report all changes in emission estimates and recalculations in CRF table 8 followed by appropriate explanations both in the CRF tables and in the NIR.

4. Uncertainties

75. The uncertainty of emission estimates in Industrial Processes is defined by expert judgement for AD. They are reasonable and in line with the IPCC good practice guidance for EFs for the methodology.

5. Verification and quality assurance/quality control approaches

76. There are several possibilities of double counting or omissions of CO_2 emissions in industrial processes which are important to take into account. For example, CO_2 emissions from iron and steel production, where coke (or coal) and limestone are used as reductants are considered to be industrial and should be reported under subcategories Iron and Steel Production and Limestone and Dolomite Use. Another possibility of double counting occurs with ammonia production, where part of the natural gas is used as feedstock and should be subtracted from the Energy sector. Belarus should state in the NIR that this part of natural gas has been taken into account in the energy balance and there is no double counting. The ERT encourages Belarus to check whether there is any double counting and whether there are any emissions missing from the inventory. The ERT also recommends that Belarus include this check in the QA/QC plan.

B. Key categories

Cement production – CO_2

77. Cement production is assessed as a key category according to level assessment by the UNFCCC secretariat. Belarus in its key category analysis identifies Mineral Products as a key category, including both Cement Production and Lime Production. Nevertheless CO_2 emissions have the largest share of emissions from cement production in total emissions from industrial processes – 66.9 per cent in 2003, an increase from 53.3 per cent in 1990. The time series of CO_2 emissions is not provided for the whole period and could only be assessed together with CO_2 emissions from mineral products. The methodology used to calculate emissions from cement production is the IPCC default method and is in line with Revised 1996 IPCC Guidelines. Belarus has used an EF based on clinker production. The EF used in the calculations is correct (the default value is 0.5061 t CO_2/ t of clinker), but it is reported in the NIR as 0.5701. The NIR does not include detailed descriptions of the methodology used, and evidently the information on the lime (CaO) fraction in clinker has not been used in the calculations. The ERT recommends Belarus perform the key category analyses at a more disaggregated level, distinguishing between emissions from cement and lime production separately. The ERT further recommends that Belarus document the methods and parameters used for inventory calculations in its future inventory submissions.

78. In response to previous review recommendations, Belarus has provided separate AD for clinker production. However, the emissions reported in CRF tables 2(I) and 2(I).A-G are different (they are 1,135.80 and 1,158.52, respectively). The ERT encourages Belarus to provide corrected figures in the CRF tables.

C. Non-key categories

Consumption of halocarbons and SF_6 – HFCs and SF_6

79. Belarus reports only actual emissions of HFCs from refrigeration and air conditioning (2.F.1). The ERT recommends that Belarus estimate potential emissions from this source using information on the export and import of halocarbons. Belarus is encouraged to estimate possible emissions of SF_6 which could be defined on the basis of information on the use of electrical equipment (switchgears).

D. Areas for further improvement

1. Identified by the Party

80. Belarus identified the need to improve its emissions estimation and to apply a higher-tier methodology by using a number of items of data concerning: fraction of CaO in clinker and lime; the quantity of lime used for glass production; consumption of the reducing agent in iron production; amount of road paving; exports and imports of HFCs; and exports and imports of equipment containing fluorinated gases (F-gases).

2. Identified by the ERT

81. The ERT recommended the review and consideration of possible sources of emissions that are not estimated in the inventory. In particular, the ERT noted with concern that the emissions from ash use and SF_6 leakages from electrical equipment were reported as "NO", limestone and dolomite use were reported as "IE", N_2O emissions from caprolactam manufacture were reported as "NA", and that there was no reporting of potential emissions from consumption of HFCs.

82. In the interests of better reporting, Belarus is recommended to use the documentation boxes for explanatory information in the CRF, to provide detailed descriptions of methodology used, especially where double counting is possible (Iron and Steel Production, Ammonia Production) and to report CO_2 emissions from Limestone and Dolomite Use separately.

V. Agriculture

A. Sector overview

83. In 2003, the Agriculture sector accounted for 8.7 per cent of total national emissions (excluding LULUCF). CH_4 emissions accounted for 49 per cent (305.2 Gg) of the total CH_4 emissions of Belarus. The sector was also the largest source of N_2O, contributing 90.2 per cent (23.1 Gg CO_2 equivalent) of total N_2O emissions. Overall sectoral CO_2 equivalent emissions decreased by 39.5 per cent between 1990 and 2003. This decrease is due to a sharp drop in animal populations, which is attributed to changes in the political and economic situation in Belarus. Emissions have been estimated for the years 1990, 1995 and 1999–2003, but only reported at the level of trend data (CRF table 10) for 1995, 1999–2002.

1. Completeness

84. The CRF includes estimates of emissions in the categories Enteric Fermentation, Manure Management, Field Burning of Agricultural Residues and Agricultural Soil, all of which are key categories except Field Burning of Agricultural Residues. Emissions of carbon monoxide (CO) and nitrogen oxides (NO_x) are also reported for the Agriculture sector as recommended by the Revised 1996 IPCC Guidelines. CH_4 emissions from rice cultivation, and CH_4 and N_2O emissions from burning of savannas are reported as "NO".

85. The information contained in the CRF tables submitted is generally complete, but not adequately documented in the NIR. The ERT encourages Belarus to improve the transparency of its reporting in the NIR.

2. Transparency

86. The NIR does not include information related to sources of AD and country-specific methods, and detailed references are not provided. Belarus has estimated emissions for 1990, 1995 and 1999–2003. The emissions for the years 1991–1994 and 1996–1998 were calculated by interpolation, but this is not documented in the NIR. Only trend level data (CRF table 10) are reported for the years 1991–2002. To

improve the transparency and consistency of the inventory, the ERT encourages Belarus to include AD, detailed references and clearer documentation of the inventory estimates in its next submission.

3. Recalculations and time-series consistency

87. The IPCC default EF for direct N_2O emissions from histosols has been updated from 5 kg N_2O-N/ha to 8 kg N_2O-N/ha for temperate climate (table 4.17, page 4.60 of the IPCC good practice guidance) in the September 2005 submission, in response to comments from previous 2005 review stages, and recalculations have been performed for the years 1990, 1995 and 1999–2003. The country experts explained during the visit that Belarus belongs to a cool climate region, and thus had originally used the EF 5 kg N_2O-N/ha, and noted that the default EFs they use for other categories are for a cool climate. The ERT recognized this, and encouraged Belarus to use the EFs that are consistent with their climate condition and to ensure that they use the same climate category for all source categories of emissions.

4. Uncertainties

88. The documentation of the uncertainties in the NIR is very limited. Uncertainties of EFs and AD are mainly based on expert judgement, and the EF uncertainties for N_2O from agricultural soils and CH_4 from enteric fermentation are estimated as 20 per cent. The ERT noted that even though 20 per cent is higher than the uncertainties for other source categories, it is still low compared to other Parties' assumptions for N_2O emissions from agricultural soils. For the sake of transparency, the ERT encourages Belarus to provide detailed documentation of the uncertainties in its next inventory submission.

5. Verification and quality assurance/quality control approaches

89. QA/QC has not been performed. The ERT encourages Belarus to establish QA/QC procedures in accordance with the IPCC good practice guidance.

B. Key categories

1. Enteric fermentation – CH_4

90. The national inventory of Belarus for 2003 has been prepared in accordance with the Revised 1996 IPCC Guidelines. A tier 1 approach has been implemented and IPCC default values have been used. CH_4 emissions from enteric fermentation decreased by 42.6 per cent between 1990 and 2003.

91. In response to the previous (2004) review, Belarus has corrected most of the gaps identified, and appropriate notation keys are used. However, the population data reported in the CRF are still not consistent with the information reported to the Food and Agriculture Organization of the United Nations (FAO). In its response to comments from the ERT during the review, Belarus stated that it uses statistics on cattle population on an annual basis. This could lead to larger inter-annual variations and is not consistent with the IPCC good practice guidance, which recommends the use of three-year averages to smooth out the trend. The ERT encourages Belarus to provide more explanation in its next submission on the AD and the parameters used for the inventory calculations.

2. Direct emissions from agricultural soils – N_2O

92. The estimates have been prepared in accordance with the Revised 1996 IPCC Guidelines. A tier 1 approach has been applied and IPCC default values have been used. Annual statistics have been used for estimating the years 1990, 1995 and 1999–2003, although emissions for 1995 and 1999–2002 were only reported at the trend level (CRF table 10). In 2003, emissions of N_2O from agricultural soils had decreased by 36.8 per cent since 1990.

93. There are large fluctuations in the trend for N_2O emissions from agricultural soils. As Belarus explained, fertilizer application to soils varies a great deal depending on economic activity in cropland. However, large fluctuations are noted in 1991–1994, for which the estimates were calculated by interpolation: a decrease by 19 per cent between 1990 and 1991, and by 26.5 per cent between 1993 and 1994. The ERT encourages Belarus to use three-year average data since annual data vary greatly, and to provide supporting AD in the NIR. The ERT further encourages Belarus to use tier 2 methodologies in accordance with the IPCC good practice guidance, if data are available, since N_2O emissions from Agricultural Soils is a key category, and to provide an explanation for the inter-annual variations in the emissions trend for the period 1991–1994. The ERT noted large differences in the AD on the use of nitrogen (N) fertilizer (kg N/yr) and dry production of pulses and soybeans and other crops (kg dry biomass/yr) between 2002 and 2003. Belarus explained that there was a mistake in the 2002 estimates, and this will be corrected in the next submission.

3. Indirect emissions from nitrogen used in agriculture – N_2O

94. Belarus does not provide much information with regard to indirect emissions in the NIR. According to the information provided in the CRFs, indirect N_2O emissions from N used in agriculture decreased by 45.4 per cent from 1990 to 2003.

95. The ERT noted large differences in volatized N (ammonia (NH_3) and NO_X) from fertilizers and animal waste (kg N/yr) between 2002 and 2003. Belarus explained that there was a mistake in the 2002 estimates, and this will be corrected in the next submission.

4. Manure management – CH_4

96. The estimates have been prepared in accordance with the Revised 1996 IPCC Guidelines. A tier 1 approach has been implemented and IPCC default values are used. In 2003, emissions of CH_4 from manure management had decreased by 40.7 per cent compared to 1990.

C. Non-key categories

1. Manure management – N_2O

97. Emissions of N_2O from manure management had not changed and amount to 0.01 Gg for the period 1990–2003, except for 1991. Inconsistencies in the IPCC defaults identified during the previous review have been corrected in the 2003 estimates.

2. Field burning of agricultural residues – CH_4, N_2O, NO_X

98. CH_4 and N_2O emissions have been estimated for wheat, barley, oats, rye, peas, kidney beans and potatoes. Emissions from fodder and sugar beet residues have not been estimated because residues of these crops are not burnt in Belarus. The total percentage of burnt crop residues is very low: 1 per cent of cereal crops and legumes, and 5 per cent of potato plant residue. Belarus explained that burning of crop residues occurs only in the private sector and that the total cropland area of the private sector is very small compared to the state cropland area.

D. Areas for further improvement

1. Identified by the Party

99. Belarus plans to use enhanced livestock characterization and apply more detailed AD collection for the estimation of emissions from enteric fermentation and manure management. It also plans to develop country-specific EFs for the estimation of direct N_2O emissions from agricultural soils.

2. Identified by the ERT

100. In addition to the issues identified by Belarus, the ERT encourages Belarus to use the IPCC good practice guidance to improve its emissions estimates, since four categories of the Agriculture sector are key categories. For purposes of transparency, the ERT would welcome:

(a) Further details (preferably formulae) on the methods used;

(b) Clear explanations of emission trends, inter-annual fluctuations;

(c) The documentation of the EFs and AD (preferably time series of AD) and the provision references in the NIR;

(d) The introduction of QA/QC procedures, as required by the IPCC good practice guidance;

(e) Details of the Party's further improvement plan, if any; and

(f) More thorough filling in of the documentation boxes in the CRF.

VI. Land Use, Land-use Change and Forestry

A. Sector overview

101. Belarus has not provided the CRF tables for LULUCF as required by decision 13/CP.9, using the land use categories of the IPCC good practice guidance for LULUCF. Instead it has used the CRF tables for Land-use Change and Forestry (LUCF) as contained in the CRF adopted by decision 18/CP.8, which are based on the categories of the Revised 1996 IPCC Guidelines. The ERT strongly encourages Belarus to report the LULUCF sector using the revised CRF tables. Belarus informed the ERT that the new CRF and the Revised 1996 IPCC Guidelines would be adhered to in the 2006 submission.

102. The remainder of this section is based on the reporting of the LUCF sector as contained in decision 3/CP.5.

103. In 2003, the LUCF sector was a net sink of 16,262.95 Gg CO_2 equivalent and accounted for 22.2 per cent of net GHG emissions. Between 1990 and 2003, the removals decreased by 16.2 per cent. In the CRF, Belarus reports removals from Changes in Forest and Other Woody Biomass Stocks and CO_2 and non-CO_2 emissions from Forest and Grassland Conversion, Abandonment of Managed Lands, CO_2 Emissions and Removals from Soil and Other.

104. The GHG inventory in the LUCF sector is prepared by BelRC Ecology. The AD come from the Ministry of Forestry, the Ministry of Statistics, the Ministry of Natural Resources, the Land Resource, Geodesy and Cartography Committee, the Institute of Forestry and the Institute of Experimental Botany under the National Academy of Sciences, and from forestry reference manuals and scientific publications. The ERT noted that the data on areas of forest and volume of growing stock come from continuous forest inventory and model estimations, which is generally consistent with the IPCC good practice guidance for LULUCF.

105. The elements of the national system for the LUCF sector include periodic data collection through official requests, regular inventory calculation, and non-systematic archiving and storage of AD and inventory results. The ERT noted the efforts Belarus has made to establish regular inventory preparation through the development of legal frameworks and encourages Belarus to enhance the development of a sustainable system for AD collection, inventory preparation and documentation in the LUCF sector.

106. According to the NIR and CRF table Summary 3, Belarus has used a combination of default and country-specific growth and expansion rates and a tier 1 method from the Revised 1996 IPCC Guidelines

to estimate emissions and removals in the LUCF sector. The IPCC good practice guidance for LULUCF has not been applied. During the in-country visit, the ERT was informed that Belarus has a plan to implement the IPCC good practice guidance for LULUCF in its next inventory submission. The key category analysis performed by Belarus identified two key categories in the LUCF sector.

1. Completeness

107. The CRF includes estimates of most gases and sources and sinks from the LUCF sector, as recommended by the Revised 1996 IPCC Guidelines. Information on land classification is not provided in the NIR. The ERT encourages Belarus to include the information on land classification in its next inventory submission.

2. Transparency

108. In response to the previous (2004) review, Belarus has provided tables 5.A, 5.B, 5.C and 5.D in the CRF and relevant estimates in NIR. However, the estimates in the NIR are not consistent with the calculations in the CRF. The ERT further noted a similar inconsistency between the CO_2 emission values in CRF Summary table 2 and table 10. To improve the transparency of the reporting, the ERT encourages Belarus to cross-check the estimates in the NIR and the CRF in order to avoid omissions and misprints and allow for replication of the sectoral inventory.

3. Recalculations and time-series consistency

109. The latest NIR does not include information on recalculations. During the in-country visit, the ERT was informed about recalculations undertaken for the Forest and Grassland Conversion and Abandonment of Managed Lands to avoid the double counting error identified during the previous (2004) review.

4. Uncertainties

110. According to the NIR, a level 1 uncertainty analysis has been made. The ERT noted that the estimated uncertainties for the LUCF subcategories were low (<5 per cent). No description of the uncertainty analysis has been provided. The ERT encourages Belarus to describe the uncertainty analysis in its next inventory submission.

5. Verification and quality assurance/quality control approaches

111. The NIR does not include information on the verification and QA/QC activities applied. During the visit, the ERT was informed that Belarus has a plan to apply these procedures for its next inventory submission.

B. Sink and source categories

1. Changes in Forest and Other Woody Biomass Stocks – CO_2

112. In the year 2003, this category represented a net sink of 45.0 per cent of the total GHG emissions of Belarus. According to CRF table 10, the removals, being relatively stable until 1995, increased by 8.8 per cent by 2000 and then dropped by 6.0 per cent below the 1990 level in 2003. The changes observed have not been documented either in the NIR or in the CRF. In its next inventory submission, the ERT encourages Belarus to document the reasons for the changes in the removals trend.

113. In response to the previous (2004) review, the NIR of the latest inventory submission includes numeric values of the growth rates, harvest data and expansion factors used in the calculations. However, these parameters, and the methods and assumptions used to derive them, are not sufficiently explained

and documented in the NIR. The ERT encourages Belarus to review growth rates and expansion factors and document them appropriately in its next inventory submission.

2. Forest and Grassland Conversion – CO_2, CH_4, N_2O

114. According to the key category analysis undertaken by Belarus, Forest and Grassland Conversion is a key category, contributing 6 per cent of cumulative inventory total. In 2003, the CO_2 equivalent emissions from this source were 7.3 per cent of total national emissions. Since 1990, CO_2 emissions have increased by 19.2 per cent, while emissions of CH_4 and N_2O have decreased by 20.0 and 25.0 per cent, respectively. The reasons for changes in the trends and actual estimates are not documented. The ERT encourages Belarus to enhance the documentation of the estimates and trends of CO_2, CH_4 and N_2O in its next NIR.

3. Abandonment of Managed Lands – CO_2

115. In 2003, removals for this source category were 3.3 per cent of total national GHG emissions, being 35.7 per cent higher than in the base year. The ERT noted that the documentation in the NIR and the CRF of growth rates for forests less than 20 year old and for 20–100 years old was inappropriate. The ERT encourages Belarus to review the growth rates and document the growth rates appropriately in its next inventory submission.

4. Emissions and removals from soils – CO_2

116. In 2003, emissions from this source accounted for 2.4 per cent of total national GHG emissions, being 28.9 per cent lower than in the base year. During the visit, the ERT learned that under this source category Belarus reports emissions and removals from forest and agricultural lands and meadows (grasslands). However, tier 1 of the Revised 1996 IPCC Guidelines provides the method for reporting emissions and removals from cultivated agricultural lands. The ERT recommends that Belarus use the IPCC good practice guidance for LULUCF for this source category and document the choice of method and parameters in its next inventory submission.

5. Other – CO_2, CH_4

117. Under this source category, Belarus reports CO_2 removals and CH_4 emissions from natural peat bogs, and CO_2 emissions from peat drainage. In the key category analysis undertaken by Belarus, this is a key category, accounting for 14 per cent of the national total. Since 1990, CO_2 emissions in this source category have increased by 15.8 per cent, while emissions of CH_4 have decreased by 2.5 per cent. The ERT noted that the method applied by Belarus to report emissions from peat drainage is consistent with the IPCC good practice guidance for LULUCF and addresses the reporting requirements of decision 13/CP.9.

118. The ERT noted that, according to the Revised 1996 IPCC Guidelines and the revised UNFCCC reporting guidelines, only human-induced emissions and removals should be included in national GHG inventories. The ERT further noted that N_2O emissions from drainage of soils have not been reported. The ERT recommends that Belarus exclude emissions of CH_4 and CO_2 removals by natural (undisturbed) peat bogs from the national inventory estimates. Although reporting N_2O emissions from drainage is not mandatory, the ERT encourages Belarus to report this source category if resources are available.

C. Areas for further improvement

1. Identified by the Party

119. During the visit the ERT was informed that improvements planned by Belarus for the LULUCF sector include the application of the IPCC good practice guidance for LULUCF, the enhancement of AD and parameters, and improvement of the consistency of data and parameters for different subcategories.

2. Identified by the ERT

120. The improvements of the LULUCF sector inventory recommended by the ERT include:

(a) The use of the new UNFCCC reporting framework as required by decision 13/CP.9;

(b) The inclusion in the NIR of documentation on the parameters and methods used;

(c) The exclusion of natural emissions from peat bogs from national greenhouse gas inventory reporting;

(d) More detailed documentation of the method applied for reporting of CO_2 emissions from peat drainage; and

(e) The application of cross-checks on the consistency of both calculations and the inventory data.

VII. Waste

A. Sector overview

121. Emissions in the Waste sector include CH_4 emissions from solid waste disposal on land and N_2O emissions from human sewage. The other sources of the sector are not estimated or do not occur in Belarus. The share of CH_4 emissions from solid waste disposal on land in total national GHG emissions increased from 1.8 to 4.3 per cent between 1990 and 2003. The overall emissions of the sector increased by 35 per cent in 2003 compared to 1990. In 2003, CH_4 emissions contributed 93 per cent of total CO_2 equivalent emissions for the sector. The remaining 7 per cent was accounted for by N_2O emissions from human sewage. In 2003, overall emissions from the sector had increased by 32 per cent compared with 1990.

122. The ERT further recommends that Belarus cross-check the data and parameter inputs in the NIR and the CRF, and improve its calculations of CH_4 from solid waste disposal on land by applying the first-order decay (FOD) model and national historical data in its next inventory submission, if the required data are available.

1. Completeness

123. The CRF includes estimates of most gases and sources of emissions from the Waste sector, as recommended by the Revised 1996 IPCC Guidelines. Reported as "NO" are CH_4 emissions from industrial, domestic and commercial waste-water handling and emissions from waste incineration. During the review, Belarus explained that all waste waters are treated aerobically and therefore CH_4 emissions are not generated. Moreover, there is no waste incineration in Belarus. However, neither the NIR nor the CRF explains this clearly. However, the ERT noted that Belarus had made some changes to waste estimates from its first submission, addressing some of the lack of clarity in use of notation keys and existence of emission sources. The ERT recommends that Belarus include more information on waste management practices in the NIR and use the documentation boxes in the CRF for detailed explanations.

2. Transparency

124. The information presented in the CRF is not sufficiently detailed and transparent because some CRF tables are not appropriately filled in. Some data contain input errors (AD, degradable organic carbon (DOC) fraction, CH_4 oxidation fraction, CH_4 fraction in landfill gas), and notation keys are not used correctly. However, the result of the calculation is correct. The ERT recommends that Belarus fill in CRF tables 6 and 6.A, C correctly and include a description of the methodology used in the NIR.

3. Uncertainties

125. In Belarus' 2005 submission the uncertainty for CH_4 emissions is reported as ±12 per cent, although it is about ±15 per cent in countries with high-quality data on CH_4 generation per tonne of waste, like the Netherlands. In countries with poor-quality data on CH_4 generation in waste the uncertainty can be up to ±50 per cent. For Belarus, therefore, the uncertainty should be higher than the ±12 per cent reported. The ERT encourages Belarus to provide a stronger basis for its uncertainty estimation if possible.

4. Verification and quality assurance/quality control approaches

126. No QA/QC plan or verification procedures are reported. The ERT encourages Belarus to apply more thorough control of the information reported, including AD units and EF values for the Waste sector in the CRF, and to undertake preliminary checks of the results to the extent possible.

B. Key categories

Solid waste disposal – CH_4

127. Belarus reports that the methodology used is IPCC tier 1. However, there is some departure from this methodology because the waste disposed on municipal sites includes both municipal and industrial waste (although the part of industrial waste does not seem excessively high). Belarus has defined all solid waste disposal sites (SWDS) as unmanaged because of absence of control of scavenging at the landfills, although all other control measures are implemented accordingly. The ERT considers classification of landfills a major problem for Belarus' inventory and recommends that the Party reconsider it using the definitions of the IPCC good practice guidance. The ERT further recommends that Belarus consider the possibility of using a higher tier for estimating CH_4 emissions from SWDS.

128. It is good practice to apply a DOC fraction in municipal solid waste (MSW), which is equal to 0.5 instead of 0.77. Moreover, the AD such as annual amounts of MSW at the SWDS included in reporting table 6.A are indicated as being higher by a factor of 1000 (this has caused the corresponding inappropriate high IEF). There are also mistakes in the data included in the tables for additional information. The ERT recommends that Belarus fill in the reporting table more accurately.

C. Non-key categories

Waste-water handling – N_2O

129. The N_2O IEF (0.0000026) for human sewage is the lowest of all the reporting Parties. The ERT recommends that Belarus cross-check the AD entries and calculation procedures for the waste-water handling to avoid omissions and typing errors in its next inventory submission.

D. Areas for further improvement

1. Identified by the Party

130. The NIR does not include any areas for further improvements.

2. Identified by the ERT

131. The ERT recommends that Belarus re-assess its estimates of CH_4 emissions from solid waste disposal on land. The ERT further commends using the IPCC good practice guidance FOD model for the future inventory submissions based on national historical data, if available. The ERT further recommends that Belarus undertake consistency checks for the input data and calculation results in order to avoid mistakes and omissions.

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/>.

IPCC. Good practice guidance for land use, land-use change and forestry, 2003. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

IPCC/OECD/IEA. Revised 1996 IPCC Guidelines for national greenhouse gas inventories, volumes 1–3, 1997. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

UNFCCC. 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/2004/8. Available at <http://unfccc.int/resource/docs/2004/sbsta/08.pdf>.

UNFCCC. 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>.

UNFCCC secretariat. Status report for Republic of Belarus. 2005. Available on the following web site: <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/2005_status_report_belarus.pdf>.

UNFCCC Secretariat. Synthesis and assessment report on the greenhouse gas inventories submitted in 2005. Part I: FCCC/WEB/SAI/2005. Available on the following web site: <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/sa_2005_part_i_final.pdf>.

UNFCCC secretariat. Republic of Belarus: Report of the individual review of the greenhouse gas inventory submitted in the year 2004. FCCC/WEB/IRI/2004/BLR. Available on the following web site: <http://unfccc.int/resource/webdocs/iri/2004/blr.pdf>.

B. Additional information provided by the Party

Additional material on background data, institutional framework and data gathering was provided by the BelRC Ecology, as below.

Baginsky, V. F. and Esimchik, L.D., 1996. *Forest Utilization in Belarus*. Minsk, 367 pp. (in Russian).

European Commission, EuropAid Cooperation Office, Regional Action Programme 2002 Environment, Terms of Reference, Technical assistance to Ukraine and Belarus.

Ministry for Natural Resources and Environmental Protection. Instructions on organized collection of information for the preparation the greenhouse gas inventory (emissions and removals) (in Russian).

Ministry for Natural Resources and Environmental Protection, Ecology Scientific and Research Centre, 2003. *National Inventory of Greenhouse Gas Sources and Removals*. Minsk, 87 pp. (in Russian).

Ministry of Statistics and Analysis, 2004. *Republic of Belarus: Statistical Yearbook 2004*. Minsk.

Reference Book for Forestry Workers. Minsk, 1986, -623 pp. (in Russian).

Sachok, G. I. and Tatyanyuk, D. M., 1994. *The Imitation Modelling of Forest Ecosystems in Belarus*. Minsk, 48 pp. (in Russian).

World Bank, Ministry of Natural Resources and Environmental Protection, Republic of Belarus: First National Communication in Response to Belarus' Commitments under the UN Framework Convention on Climate Change.

The presentations given by Belarusan inventory experts (in Russian) have been made available to the ERT. They included some additional information, not covered by the NIR.

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