



**UNITED  
NATIONS**

---



**Framework Convention  
on Climate Change**

Distr.  
GENERAL

FCCC/ARR/2008/BLR  
31 March 2009

ENGLISH ONLY

---

**Report of the individual review of the greenhouse gas inventories of Belarus  
submitted in 2007 and 2008\***

---

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

## CONTENTS

	<i>Paragraphs</i>	<i>Page</i>
I. EXECUTIVE SUMMARY .....	1–14	4
II. OVERVIEW .....	15–40	8
A. Inventory submission and other sources of information.....	15–16	8
B. Key categories .....	17	8
C. Cross-cutting issues .....	18–37	9
D. Areas for further improvement .....	38–40	13
III. ENERGY .....	41–87	15
A. Sector overview .....	41–53	15
B. Reference and sectoral approaches.....	54–59	17
C. Key categories .....	60–65	18
D. Non-key categories .....	66–82	19
E. Areas for further improvement .....	83–87	21
IV. INDUSTRIAL PROCESSES AND SOLVENT AND OTHER PRODUCT USE .....	88–107	22
A. Sector overview .....	88–95	22
B. Key categories .....	96–97	24
C. Non-key categories .....	98–105	24
D. Areas for further improvement .....	106–107	26
V. AGRICULTURE .....	108–129	26
A. Sector overview .....	108–115	26
B. Key categories .....	116–125	28
C. Non-key categories .....	126–127	29
D. Areas for further improvement .....	128–129	30
VI. LAND USE, LAND-USE CHANGE AND FORESTRY .....	130–148	30
A. Sector overview .....	130–136	30
B. Key categories .....	137–141	32
C. Non-key categories .....	142	33
D. Areas for further improvement .....	143–148	33

VII.	WASTE .....	149–162	34
	A. Sector overview .....	149–155	34
	B. Key categories .....	156–157	36
	C. Non-key categories .....	158–160	36
	D. Areas for further improvement .....	161–162	36
VIII.	CONCLUSIONS AND RECOMMENDATIONS .....	163–166	37

Annex

	Documents and information used during the review .....		39
--	--	--	----

## I. Executive summary

1. This report covers the in-country review of the 2007 and 2008 greenhouse gas (GHG) inventory submissions of Belarus, coordinated by the UNFCCC secretariat, in accordance with decision 19/CP.8. In accordance with the conclusions of the Subsidiary Body for Implementation, at its twenty-seventh session,<sup>1</sup> the focus of the review is on the most recent (2008) submission. The review took place from 13 to 18 October 2008 in Minsk, Belarus, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalist – Mr. Marius Țăranu (Republic of Moldova); energy – Ms. Kristien Aernouts (Belgium); industrial processes – Mr. Țăranu; agriculture – Ms. Hongmin Dong (China); land use, land-use change and forestry (LULUCF) – Mr. Vladimir Korotkov (Russian Federation); and waste – Ms. Violeta Hristova (Bulgaria). Ms. Natalya Parasyuk (Ukraine) and Ms. Dong 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”, a draft version of this report was communicated to the Government of Belarus, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

3. In 2006 (as reported in the 2008 inventory submission), the main GHG in Belarus was carbon dioxide (CO<sub>2</sub>), accounting for 73.1 per cent of total GHG emissions<sup>2</sup> expressed in CO<sub>2</sub> eq, followed by methane (CH<sub>4</sub>) (16.5 per cent) and nitrous oxide (N<sub>2</sub>O) (10.3 per cent). Hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF<sub>6</sub>) together accounted for 0.04 per cent of total GHG emissions, most of that (0.037 per cent) being HFCs, while the share of SF<sub>6</sub> is only 0.002 per cent. Emissions of perfluorocarbons (PFCs) are reported as not applicable (“NA”), not estimated (“NE”) and not occurring (“NO”) in the Party’s common reporting format (CRF) tables. The energy sector accounted for 71.2 per cent of the total GHG emissions, agriculture for 17.2 per cent, waste for 6.3 per cent, industrial processes for 5.2 per cent, and solvent and other product use for 0.1 per cent. Total GHG emissions amounted to 80,995.70 Gg CO<sub>2</sub> eq and decreased by 36.4 per cent between 1990 (base year<sup>3</sup>) and 2006. In 2005 (as reported in the 2007 inventory submission) total GHG emissions amounted to 75,593.76 Gg CO<sub>2</sub> eq. The shares of gases and sectors in 2006 (2008 inventory submission) were similar to those in 2005 (2007 inventory submission).

4. Emissions of the main GHGs showed a decreasing trend since 1990: CO<sub>2</sub> by 41.9 per cent, N<sub>2</sub>O by 18.6 per cent and CH<sub>4</sub> by 11.5 per cent. Since 1995, emissions of SF<sub>6</sub> have shown the largest increase, 25,980 per cent; emissions of HFCs increased by 957.2 per cent. The largest increase in emissions was in the waste sector, 98.8 per cent (the key driver for this increase, in particular since 1995, was an increase in the generation of municipal solid waste); the next largest increase in emissions was in the industrial processes sector (88.0 per cent), due to accounting for the first time in 2006 for CO<sub>2</sub> emissions from ammonia production, and to increases of some industrial outputs, such as electric furnace steel production, cement production and nitric acid production. Emissions from the energy sector decreased by 43.5 per cent between 1990 and 2006 due to structural changes in the economy (e.g. an increase in the share of less energy-consuming branches of the economy, such as services and trade, the active introduction of energy saving technologies in nearly all branches, the transition from coal and residual fuel oil to natural gas as fuel, and a more intense use of a biomass in the municipal service and industrial areas); emissions from agriculture decreased by 31.5 per cent due to a decline in animal populations and

---

<sup>1</sup> FCCC/SBI/2007/34, paragraph 104.

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

<sup>3</sup> Base year refers to the base year under the Convention.

the use of nitrogen fertilizer; and emissions from solvent and other product use sector decreased by 9.3 per cent due to a decline in the use of N<sub>2</sub>O for anaesthesia. Removals in the LULUCF sector increased by 18.0 per cent; the key driver is the increase of removals in forest land and the decrease of emissions from cropland. The drivers for the above trends are generally poorly documented in the national inventory report (NIR). The emission trends for different gases and sectors are analysed more in detail separately in the respective sections of this report.

5. The Ministry of Natural Resources and Environmental Protection (MoNREP), as the country's focal point for the UNFCCC, has the overall responsibility for organizing and coordinating the inventory preparation process, and for overseeing the annual inventory submission to the UNFCCC secretariat, whereas the Belarusian Research Centre "Ecology" (hereinafter referred as the BelRC "Ecology") has overall responsibility for the planning, preparation and management of the national inventory. The National Committee on Statistics (former Ministry of Statistics and Analysis) and many other institutions (Ministry of Energy, Ministry of Transport and Communications, Ministry of Industry, Ministry of Housing and Communal Services, etc.) collaborate with the BelRC "Ecology" in the preparation process, mainly by providing activity data (AD).

6. The institutional framework for preparation of the inventory still needs to be enhanced in Belarus in order to maintain a sustainable inventory preparation process. In this respect, Belarus may consider:

- (a) Increasing the number of qualified staff in the BelRC "Ecology";
- (b) Providing enough financial resources and wide support for the inventory team in order to ensure a sustainable compilation of inventories in accordance with the UNFCCC reporting requirements;
- (c) Ensuring the participation in the inventory preparation of highly qualified experts and institutions available in Belarus and using their recommendations in order to improve estimates of emissions and removals at sectoral and national levels;
- (d) Formalizing and strengthening current procedures for official consideration and approval of the inventory by MoNREP;
- (e) Developing a solid system for collection of AD and emission factors (EFs) with the goal of improving estimates and closing all gaps, including with respect to categories not yet covered;
- (f) Improving, completing and enhancing the organization of the archive and "paper-trail" (documentation) information following good practices and international standards for records;
- (g) Developing and implementing a national quality assurance/quality control (QA/QC) plan that involves all institutions participating in preparation of the inventory.

7. The inventory is generally in line 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).

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

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

Greenhouse gas emissions	Gg CO <sub>2</sub> eq								Change Base year–2006 (%)
	Base year	1990	1995	2000	2003	2004	2005	2006	
CO <sub>2</sub>	101 946.79	101 946.79	56 233.42	51 910.88	51 396.28	54 919.64	55 292.25	59 202.66	–41.93
CH <sub>4</sub>	15 121.53	15 121.53	11 719.13	11 479.11	12 126.45	12 646.76	12 805.55	13 386.93	–11.47
N <sub>2</sub> O	10 292.67	10 292.67	4 985.27	6 398.47	6 208.18	6 717.67	7 468.29	8 374.19	–18.64
HFCs	NA,NE,NO	NA,NE,NO	2.84	9.35	19.24	23.14	26.19	30.05	957.18
PFCs	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO	NA,NE,NO
SF <sub>6</sub>	NA,NE,NO	NA,NE,NO	0.01	0.41	0.69	1.03	1.48	1.87	25,980.00

*Abbreviations:* NA = not applicable; NE = not estimated; NO = not occurring.

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

Sector	Gg CO <sub>2</sub> eq								Change Base year–2006 (%)
	Base year	1990	1995	2000	2003	2004	2005	2006	
Energy	102 097.70	102 097.70	56 962.37	52 470.90	51 638.30	55 078.92	55 244.38	57 634.39	–43.55
Industrial processes	2 249.29	2 249.29	1 209.28	1 683.01	2 114.87	2 363.86	2 640.65	4 228.28	87.98
Solvent and other product use	74.40	74.40	62.33	76.04	79.30	80.91	69.19	67.49	–9.29
Agriculture	20 364.89	20 364.89	12 569.04	12 612.70	11 850.32	12 320.92	13 019.30	13 946.89	–31.52
LULUCF	–22 028.43	–22 028.43	–26 673.76	–27 248.32	–24 124.30	–23 711.56	–24 932.18	–25 996.91	18.02
Waste	2 574.73	2 574.73	2 137.64	2 955.57	4 068.05	4 463.63	4 620.24	5 118.65	98.80
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
<b>Total (with LULUCF)</b>	<b>105 332.57</b>	<b>105 332.57</b>	<b>46 266.91</b>	<b>42 549.89</b>	<b>45 626.54</b>	<b>50 596.67</b>	<b>50 661.58</b>	<b>54 998.79</b>	<b>–47.79</b>
<b>Total (without LULUCF)</b>	<b>127 361.00</b>	<b>127 361.00</b>	<b>72 940.67</b>	<b>69 798.21</b>	<b>69 750.84</b>	<b>74 308.24</b>	<b>75 593.76</b>	<b>80 995.70</b>	<b>–36.40</b>

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

9. The expert review team (ERT) noted that Belarus has, in its 2008 inventory submission, made substantial improvements since its 2005 inventory submission. The NIR has been extended to include more information on: legal and institutional arrangements and the data-flow structure for the inventory preparation; on references and sources of information for the AD, methodologies and EFs used; on QA/QC and verification activities performed; and on anticipated future improvements. Belarus also provided full CRF tables from 1990 to the latest year; have used the new LULUCF reporting tables in its more recent submissions; and undertook independent peer reviews for all sectors. However, the NIR is not yet transparent enough. No additional information was included in the NIR on the selection of methodologies, on identification of EFs used, on assumptions on parameters used, on AD used for all years from 1990 onwards, on the issue of AD confidentiality (e.g. energy balance for 1990), or on the rationale and impact of the recalculations performed.

10. The inventory covers almost all source and sink categories for the period 1990–2006 and it is complete in terms of years and geographical coverage. However, Belarus did not provide CRF table 8(a) (Recalculation – recalculated data) for some years (as described in para. 23 below), table 8(b) (Recalculation – explanatory data) for the complete time series, or table 9(b) (Completeness) for the complete time series. In 1990, Belarus has not estimated actual and potential emissions of fluorinated gases (F-gases), and in the latest reported years, potential emissions and most of the actual emissions have not been estimated, in particular from the category 2.F consumption of halocarbons and SF<sub>6</sub>. Some categories were reported as “NE” (as described in para. 19 below). In some cases the notation keys were not applied consistently (as described in para. 20 below).

11. Belarus has reported a key category tier 1 analysis, both level and trend assessment. Belarus has not included the LULUCF sector in its key category analysis, which was not performed as required by the IPCC good practice guidance and the IPCC good practice guidance for LULUCF.

12. Belarus has carried out a tier 1 uncertainty analysis as part of its 2008 submission. The NIR contains only limited documentation on the analysis. The uncertainty analysis is based to a great extent on the default uncertainties included in the IPCC good practice guidance and on expert judgment. The ERT considers many of the uncertainty values of the EFs used to be low (see para. 27 below).

13. A formal QA/QC plan in accordance with the IPCC good practice guidance is not yet available. The documentation on QA/QC procedures in the NIR is very limited, comprising only some basic information on QA/QC procedures and verification for the energy, industrial processes, agriculture and LULUCF sectors.

14. The ERT identified a need for further improvements; Belarus should consider:

- (a) Improving the transparency of the inventory and the NIR structure to fully reflect the requirements of 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);
- (b) Enhancing consistency between the NIR and the CRF;
- (c) Preparing and reporting estimates for all the missing categories and providing in the NIR discussion of these categories and of other potential sources or sinks not addressed in the current inventory submission;
- (d) Developing a solid system for collection of AD and EFs with the goal of improving estimates and closing all gaps, including with respect to categories not yet covered;
- (e) Using higher tier methods for key categories where appropriate;

- (f) Reporting in the NIR and relevant CRF tables detailed information on recalculations performed, with explanatory information, including justification for recalculations;
- (g) Improving the uncertainty analysis by using more adequate EF uncertainty values; Developing a national QA/QC plan and including descriptions of the QA/QC and verification procedures in the sectoral chapters of the NIR.

## II. Overview

### A. Inventory submission and other sources of information

15. The 2008 annual inventory was submitted on 14 May 2008; it contains a complete set of CRF tables for the period 1990–2006 and an NIR. Belarus resubmitted its CRF tables on 6 June and 24 July 2008. In its 2007 submission, submitted on 25 May 2007, Belarus included a complete set of CRF tables for the period 1990–2005 and an NIR. Belarus resubmitted its CRF tables on 15 August 2007. Where necessary, the ERT also used the 2006 submission during the review.

16. During the review, Belarus provided the ERT with additional information. The documents concerned are not part of the inventory submission. The full list of materials used during the review is provided in the annex to this report. After the in-country review, Belarus informed the ERT that it will implement most of the recommendations for general and cross-cutting aspects of inventory preparation and detailed recommendations for all sectors in its next submissions. The ERT acknowledges this information and encourages Belarus to implement all these recommendations, as far as possible, in its next submission.

### B. Key categories

17. Belarus has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2008 submission. The key category analyses performed by Belarus and by the secretariat<sup>4</sup> produced different results because categories and aggregation levels used by Belarus in its analysis differ from those used by the secretariat (e.g. in the Party's analysis there is no distinction by fuel type for fuel combustion categories in the energy sector). Furthermore, Belarus has not included the LULUCF sector in its key category analysis, which was not performed as required by the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The following key categories were identified in the 2008 submission but not in the 2007 submission for the latest reported year: 1.A.3.e other transportation – CO<sub>2</sub> (only in the secretariat analysis) and 2.B.1 ammonia production – CO<sub>2</sub> (in both analyses). The ERT reiterates the recommendation of the report of the review of the 2005 GHG inventory submission, and encourages Belarus to perform its key category analysis at a more disaggregated level, distinguishing between fuel types for categories in the energy sector; it also recommends that Belarus include the LULUCF sector in its key category analysis and provide a more detailed discussion of its analysis in its next inventory submission. In addition, the ERT recommends that Belarus use its key category analysis as a driving factor for the preparation of the inventory, using the analysis to prioritize the development and improvement of the inventory, and if possible identify additional key categories using a qualitative approach.

---

<sup>4</sup> The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance for LULUCF. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year. 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.

## C. Cross-cutting issues

### 1. Completeness

18. The 2008 inventory submission covers almost all source and sink categories for the period 1990–2006 and it is complete in terms of years and geographical coverage. Belarus has provided inventory data in the CRF tables for the years 1990 to 2006, but did not provide the following CRF tables: 8(a) for 1990–1992, 1994–1995, 1997–1998, 2000–2002 and 2004–2005 (Belarus explained that it could not fully provide them because of problems with the CRF Reporter software); 8(b); and 9(b) (complete time series). Belarus has not estimated actual and potential emissions of F-gases for 1990, and it has not estimated potential emissions of F-gases from category 2.F consumption of halocarbons and SF<sub>6</sub> in the latest reported years. The ERT encourages Belarus to estimate actual and potential emissions from F-gases for the complete time series, in particular for 1990 and for the 2.F consumption of halocarbons and SF<sub>6</sub> category, and complete the reporting of CRF tables 8(a), 8(b) and 9(b) in its next inventory submission. There are no specific differences or changes between the 2007 and 2008 submissions.

19. No estimates have been reported for the following categories: CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from 1.A.3.d navigation; CO<sub>2</sub> and CH<sub>4</sub> emissions from 1.B.1 fugitive emissions from solid fuels; CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from 1.B.2(c) venting and flaring for oil; CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O emissions from marine bunkers; CO<sub>2</sub> emissions from 2.A.7 other (e.g., bricks and ceramic production for which AD are available in national statistics); N<sub>2</sub>O emissions from 2.B.5 other (e.g., fertilizer production for which AD are available in national statistics); CO<sub>2</sub> and CH<sub>4</sub> emissions from 2.C.2 ferroalloys production; actual emissions of F-gases from 2.F.2 foam blowing, 2.F.3 fire extinguishers, 2.F.4 aerosols/metered dose inhalers and 2.F.5 solvents; CH<sub>4</sub> and N<sub>2</sub>O emissions from 5.B.2 land converted to cropland; CO<sub>2</sub> emissions/removals from 5.C grassland remaining grassland; CO<sub>2</sub> emissions/removals from 5.E settlements remaining settlements; CH<sub>4</sub> emissions from 6.A.3 solid waste disposal on land – other (e.g. industrial wastes for which AD are available in national statistics); and CH<sub>4</sub> and N<sub>2</sub>O emissions from 6.B wastewater handling (except N<sub>2</sub>O emissions from 6.B.2 domestic and commercial wastewater).

20. In some cases, in particular in the CRF tables of the industrial processes, solvent and other product use, and agriculture sectors, the notation keys were not applied consistently (e.g. CO<sub>2</sub> emissions from 2.A.3 limestone and dolomite use were reported as included elsewhere (“IE”) instead of “NE”; CO<sub>2</sub> emissions from 2.A.4 soda ash use and 2.A.7 other – other non-specified (flat glass production) were reported as “NO” instead of “NE”; CO<sub>2</sub> emissions from 3.A–D solvents and other product use were reported as “NA” instead of “NE”; CH<sub>4</sub> emissions from 4.A.7 and 4.B.7 mules and asses were reported as “NO” instead of “NE”). The ERT encourages Belarus to apply the notation keys consistently and make appropriate use of the documentation boxes in the CRF tables; and to prepare and report estimates for all the missing categories and provide in the NIR a discussion of these categories and of other potential sources or sinks not addressed in the current inventory submission, and of the possibilities of including them in future submissions.

### 2. Transparency

21. Although the NIR has been expanded compared with its 2005 submission, it is not yet transparent enough. The ERT noted that between the 2005 and the 2007 and 2008 submissions no additional information was included in the NIR with regard to explanations on the selection of methodologies, identification of EFs used, assumptions on parameters used, information on AD used for all years from 1990 onwards, the issue of AD confidentiality (e.g. energy balance for 1990), and rationale and impact of the recalculations performed. The ERT reiterates the recommendation of the 2005 review report and encourages Belarus to improve the transparency of the inventory by providing complete information in the NIR and the CRF tables, following the requirements of the UNFCCC reporting guidelines, Part I.

22. Most categories are reported at the level of detail required in the CRF tables; however, the exception is the energy sector, where the notation keys “C” (confidential) and “IE” are widely used (in particular for 1990 and for the manufacturing industries and construction category) in CRF tables 1.A(a) and 1.A.(b) because the Energy Balance is considered confidential in Belarus (for official use only). The issue of confidentiality has been not treated in the NIR; however, Belarus was able to provide the documents and information requested by the ERT during the in-country review, including confidential data according to national procedures. The ERT encourages Belarus to provide in its future submissions detailed information on how confidential data are collected and how they are included in the inventory.

### 3. Recalculations and time-series consistency

23. No recalculations have been reported by Belarus in its 2008 submission in CRF table 8(a). However, Belarus reported recalculations performed in two sectoral chapters of the NIR (chapter 3 “Energy sector” and chapter 4 “Industrial processes”). Belarus reported some very small recalculations (probably due to rounding problems) for 1993, 1996, 1999 and 2003 in CRF table 8(a), whereas for 1990–1992, 1994–1995, 1997–1998, 2000–2002 and 2004–2005 no data are reported. CRF table 8(b) is not reported for the complete time series. The ERT recommends that Belarus improve the consistency between the NIR and the CRF tables and complete the reporting of CRF tables 8(a) and 8(b) in its next inventory submission.

24. The recalculations reported by Belarus in the 2007 submission for the time series from 1990 to 2004 have been undertaken to take into account the updated information received from the National Committee on Statistics (the former Ministry of Statistics and Analysis) on fuel consumption by types and country-specific national data on fugitive emissions from natural gas. In addition, Belarus included accounting of CO<sub>2</sub> emissions from glass production, CO<sub>2</sub> emissions from steel production in electric arc furnaces and actual emissions of F-gases; revised AD on nitrogen input to soils and average annual growth rates of woody biomass stocks; used the IPCC good practice guidance for LULUCF instead of the Revised 1996 IPCC Guidelines; and updated information on annual municipal solid waste at the solid waste disposal sites (SWDS) and revised degradable organic carbon (DOC) degraded values. For 1990 the recalculated emissions were 0.01 per cent lower excluding LULUCF and 9.24 per cent lower including LULUCF; for 2004 the recalculated emissions were 0.07 per cent lower excluding LULUCF and 19.00 per cent lower including LULUCF.

25. Overall, the recalculations resulted in an improvement of the inventory. The ERT noted, however, that the rationale and impact of the recalculations are not properly addressed in the chapter on recalculations and improvements, or in the sectoral chapters of the NIR. The ERT recommends that Belarus report in the NIR and relevant CRF tables detailed information on performed recalculations and give explanatory information, including the rationale for the recalculations.

### 4. Uncertainties

26. Belarus has estimated quantitatively the uncertainties for all 60 source and sink categories included in the current inventory following a tier 1 uncertainty analysis, in accordance with the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The quantitative uncertainty for the total emissions was estimated to be 15.1 per cent excluding the categories from the LULUCF sector and 28.0 per cent including the categories from the LULUCF sector, and the uncertainty of the trend was estimated to be 5.7 per cent excluding the categories from the LULUCF sector and 14.3 per cent including the categories from the LULUCF sector. The ERT noted that the uncertainty estimates have not changed much between the 2007 and 2008 submissions.

27. The uncertainty analysis is based to a great extent on the default uncertainties included in the IPCC good practice guidance and on expert judgment. The documentation in the NIR on the uncertainties is very limited. The ERT considers many of the uncertainty values of the EFs used to be low. For example, the tier 1 EF uncertainty of CO<sub>2</sub> from 2.A.7 other – glass production is 10 per cent,

whereas the default EF uncertainty range may be in the order of  $\pm 60$  per cent; the tier 1 EF uncertainty of CO<sub>2</sub> from 2.C.1 iron and steel production (electric furnace steel production) is 15 per cent, whereas the default EF uncertainty range is  $\pm 25$  per cent; the EF uncertainty of N<sub>2</sub>O from 4.B manure management is 50 per cent, whereas uncertainties associated with the default EF for this category range from  $-50$  to  $+100$  per cent; the EF uncertainty of N<sub>2</sub>O from 4.D.1 direct soil emissions is 40 per cent, whereas uncertainties associated with the IPCC default EF<sub>1</sub> and EF<sub>2</sub> for this category are at least an order of magnitude higher; the EF uncertainty of N<sub>2</sub>O from 4.D.2 pasture, range and paddock manure is 50 per cent, whereas uncertainties associated with default EF<sub>3</sub> for this category range from  $-50$  to  $+100$  per cent; and the EF uncertainty of N<sub>2</sub>O from 4.D.3 indirect soil emissions is 40 per cent, whereas uncertainties associated with default EF<sub>4</sub>, EF<sub>5</sub> and EF<sub>6</sub> for this category are at least an order of magnitude higher and with volatilization fractions are about  $\pm 50$  per cent.

28. The ERT reiterates the recommendation of the 2005 review report and encourages Belarus to include more documentation of uncertainties in the NIR and to use the uncertainties as a tool for setting priorities (i.e. identify sectors which are important for the overall quality of the inventory and which should be given high priority for future improvements). The ERT also recommends that Belarus improve the uncertainty analysis by using more adequate and/or country-specific uncertainty values for a range of categories, especially in the industrial processes sector (e.g. 2.A.7 other – glass production, 2.C.1 iron and steel production) and the agriculture sector (4.B manure management, 4.D.1 direct soil emissions, 4.D.2 pasture, range and paddock manure, 4.D.3 indirect soil emissions).

#### 5. Verification and quality assurance/quality control approaches

29. A formal QA/QC plan in accordance with the IPCC good practice guidance is not available yet. The documentation on QA/QC procedures in the NIR is limited. Some basic information on QA/QC procedures and verification is given in the NIR for the energy, industrial processes and agriculture sectors. The NIR presents an overview of the QA/QC procedures for all categories in the respective sectoral chapters. No QA/QC and verification information is reported in the NIR for the solvent and other product use and the waste sectors. For the LULUCF sector some QC and verification information is reported only for the 5.A forest land category. The ERT recommended that Belarus develop, as soon as possible, a QA/QC plan for meeting all the requirements for the inventory planning, preparation and management, and include more category-specific information on the QA/QC procedures and verification in all sectoral chapters of the NIR. After the in-country review, Belarus informed the ERT that a national QA/QC plan had been developed and approved. The ERT further recommends that Belarus fully implement the QA/QC plan and provide detailed information on QA/QC procedures and their implementation in its next inventory submission.

30. The QA/QC plan should include: general QC procedures (tier 1); source/sink category-specific procedures (tier 2) for key categories; identification of the QA/QC manager within the BelRC “Ecology”; requirements for data collection and developing estimates; procedures for independent review by staff who have not been involved with preparing the inventory; procedures for official consideration and approval of the inventory submission; procedures for post-submission review; and time lines and an annual schedule for QA/QC procedures and verification.

31. Belarus explained during the in-country review that the BelRC “Ecology” and the National Committee on Statistics regularly carry out internal cross-checks. The ERT also noted that Belarus implemented QA procedures for its 2008 submission by conducting basic expert peer reviews for all sectors; however, the valuable results of the independent peer review undertaken in April 2008 were not taken into consideration for the 2008 submission. Basic expert peer reviews have not been conducted for the 2007 submission.

## 6. Institutional arrangements

32. Belarus included in the NIR of its 2008 submission a brief overview of the legal and institutional arrangements and data-flow structure for inventory preparation. During the in-country visit, the ERT was informed that a legal framework for a sustainable inventory process had been put in place in Belarus through two resolutions of the Council of Ministries of the Republic of Belarus: Resolution No 485 of 10 April 2006 “On approval of the regulation on the development of the state greenhouse gas inventory”, and Resolution No. 585 of 4 May 2006 “On approval of the regulation on the national inventory system”. According to Resolution No. 585, MoNREP has overall responsibility for the organization and coordination of the functioning of the system for inventory preparation. Through the Order of the MoNREP No. 417 of 29 December 2005, the BelRC “Ecology” was appointed as a key institution responsible for development of annual GHG inventories, and of national communications under the UNFCCC.

33. The ERT noted that the institutional framework for preparation of the inventory still needs to be enhanced in Belarus in order to maintain sustainable inventory preparation. In order to achieve this, Belarus may consider: increasing the number of qualified staff in the BelRC “Ecology”; providing enough financial resources and wide support for the inventory team in order to ensure sustainable compilation of inventories in accordance with the UNFCCC reporting guidelines and to ensure the participation in the inventory preparation of the highly qualified experts and institutions that are available in Belarus; and using the recommendations of these experts and institutions in order to improve the estimates of emissions and removals at sectoral and national levels.

34. Legal power to request institutions to provide data currently rests with MoNREP. Standard forms requesting data are sent annually through official letters from MoNREP to various data suppliers, the most important of which is the National Committee on Statistics. Other important data suppliers include the Ministry of Energy, the Ministry of Transport and Communications, the Ministry of Industry, the Ministry of Housing and Communal Services, and the Ministry of Agriculture and Food. The responses received, including completed data forms, are then collected and archived by the BelRC “Ecology”. The ERT encourages Belarus to implement a framework “Data Supply Agreement” with data suppliers (e.g. with the National Committee on Statistics) that will formalize the type, quality and format of data to be provided and the time line for submission, in order to make this process more sustainable.

## 7. Inventory management

35. Belarus has a centralized archiving system that still is under development. It contains inventory submissions, spreadsheets for individual category calculations used to compile the inventory, references, comments and responses to the peer reviews. At the end of each reporting cycle, all the documentation used to prepare the inventory is archived. Electronic information is stored on hard disks and regularly backed up; paper-trail information is archived; and there is a simple database of all items in the archive (although in some cases not for the full time series). These archived materials at the BelRC “Ecology” are available to inventory reviewers and other stakeholders upon request. However, the ERT believes that the organization of the archive should be completed and improved, following good practices and international standards for records management.

36. Belarus was able to provide archived documents requested by the ERT during the in-country review, including some confidential data according to national procedures. However, some of the primary sources of data and documentation were not present in the archive and it was necessary to request other institutions to provide them. The ERT recommends that Belarus extend the paper-trail to all data used for compiling the inventory in order to cover all information used for the complete time series, as well as develop a system for collection of AD and EFs with the goal of improving estimates and closing all gaps, including with respect to categories not yet covered.

## 8. Follow-up to previous reviews

37. Belarus has made substantial progress since its 2005 submission. A full set of CRF tables was provided for the whole time series. The LULUCF CRF tables were provided in accordance with decision 13/CP.9. A revised key category analysis was provided in the NIR. Recalculations have been undertaken in the 2007 submission to take into account the updated information received from the National Committee on Statistics (the former Ministry of Statistics and Analysis), the emissions from some categories, notably actual emissions of F-gases, the revised AD and updated information collected from other sources of information and the use of the IPCC good practice guidance for LULUCF. Independent peer reviews were undertaken in 2008 for all sectors. A brief overview of legal and institutional arrangements and data-flow structure for the inventory preparation was included in the NIR. The ERT acknowledges this progress and notes the Party's strong commitment to developing the inventory further.

### **D. Areas for further improvement**

#### 1. Identified by the Party

38. The NIR of the 2008 submission identifies several areas for improvement in the sectoral chapters:

- (a) Improve the quality of basic information received from enterprises and organizations and enhance the collection and processing of data;
- (b) Collect more detailed information on land-use categories and on the process of conversion of lands;
- (c) Collect the AD necessary for evaluating the carbon stock change in dead organic matter for the forest land category;
- (d) Collect the AD necessary for evaluating the net carbon stock changes in mineral soils for the cropland category;
- (e) Use higher tier methods for key categories, in particular where appropriate within the industrial processes sector;
- (f) Estimate the potential and actual emissions of F-gases from category 2.F consumption of halocarbons and SF<sub>6</sub>;
- (g) Further develop and use national EFs in the industrial processes, LULUCF and waste sectors;
- (h) Include more category-specific information in the sectoral chapters of the NIR;
- (i) Conduct an independent peer review of the LULUCF sector;
- (j) Continue the improvement of the QA/QC system;
- (k) Revise the uncertainty analysis by taking into consideration more precise uncertainty values for the AD used;
- (l) Perform a key category analysis at a more disaggregated level.

## 2. Identified by the expert review team

39. The ERT identifies the following cross-cutting issues for improvement:
- (a) Improve the NIR structure to fully reflect the requirements of the UNFCCC reporting guidelines;
  - (b) Enhance consistency between the NIR and the CRF tables in accordance with the UNFCCC reporting guidelines;
  - (c) Improve the transparency of the inventory by including in the NIR additional information and explanations on the selection of methodologies, identification of EFs, assumptions for choosing parameters and sources of AD for all years from 1990, and improve descriptions of individual sectors;
  - (d) Prepare and report estimates for all the current missing categories, and provide in the NIR discussions of these categories and other potential sources or sinks not addressed in the current inventory submission, including an assessment on their inclusion in future submissions;
  - (e) Develop a system for collection of AD and EFs with the goal of improving estimates and closing all gaps, including with respect to categories not yet covered. Particular attention should be given to the availability of detailed and complete energy balances starting from 1990;
  - (f) Use higher tier methods for key categories where appropriate (e.g. for stationary combustion, cement production, ammonia production, enteric fermentation, agricultural soils, and solid waste disposal on land);
  - (g) Report in the NIR and relevant CRF tables detailed information on recalculations performed, and include explanatory information and justification for recalculations for 1990 (base year) and all subsequent recalculated years;
  - (h) Improve the uncertainty analysis by using more adequate and/or country-specific uncertainty values for a range of categories, especially in the industrial processes sector (e.g. 2.A.7 other – glass production, 2.C.1 iron and steel production) and agriculture sector (4.B manure management, 4.D.1 direct soil emissions, 4.D.2 pasture, range and paddock manure, 4.D.3 indirect soil emissions);
  - (i) Develop and implement a national QA/QC plan. After the in-country review, Belarus informed the ERT that a national QA/QC plan had been developed and approved. The ERT further recommends that Belarus fully implement the QA/QC plan and provide detailed information on QA/QC procedures and their implementation in its next inventory submission;
  - (j) Include descriptions of the QA/QC and verification activities and procedures in specific sections of sectoral chapters of the NIR, following the structure outlined in the UNFCCC reporting guidelines;
  - (k) Increase the number of qualified staff in the BelRC “Ecology”;
  - (l) Ensure financial resources and wide support for the inventory team of the BelRC “Ecology” in order to ensure sustainable compilation of inventories in accordance with the UNFCCC reporting requirements;

- (m) Ensure participation in the inventory preparation of the highly qualified experts and institutions that are available in Belarus and use their recommendations in order to improve estimates of emissions and removals at sectoral and national levels, in particular for the energy and LULUCF sectors;
- (n) Devote particular attention, efforts, staff and resources to the planning, preparation and management of the LULUCF inventory;
- (o) Fully take into the consideration for its next submission the valuable results of the independent peer review undertaken in April 2008 for all sectors.

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

### **III. Energy**

#### **A. Sector overview**

41. The energy sector is the main sector in the GHG inventory of Belarus. In 2006, emissions from the energy sector amounted to 57,634.39 Gg CO<sub>2</sub> eq, or 71.2 per cent of total GHG emissions. Emissions from the sector decreased by 43.5 per cent between 1990 and 2006.

42. After the break-up of the Soviet Union, there was a reduction in almost all energy-related activities. The key driver for the fall in emissions is explained in the NIR. There were structural changes in the economy of Belarus, in particular in the energy sector; the share of less energy-consuming branches of the economy, such as services and trade, is larger in 2006 than in 1990; there was an active introduction of energy-saving technologies in almost all branches; there was a transition from coal and residual fuel oil to natural gas as fuel; and biomass was used more intensively in the municipal service and industrial areas.

43. Within the sector in 2006, 56.4 per cent of the emissions were from energy industries, 14.9 per cent were from manufacturing industries and construction, 14.9 per cent were from other sectors and 9.7 per cent were from transport. Fugitive emissions from fuels accounted for 2.9 per cent and the category other accounted for 1.1 per cent. No major changes or differences in the estimates were observed between the 2007 and 2008 inventory submissions.

#### **1. Completeness**

44. The CRF contains estimates of most gases and categories of emissions from the energy sector, as recommended by the Revised 1996 IPCC Guidelines. However, some fuels and subcategories are reported using only notation keys: liquefied petroleum gas (LPG) use and related emissions in road transportation are reported as "NO", even though they do occur in Belarus; CH<sub>4</sub> and N<sub>2</sub>O emissions from use of other fuels in manufacturing industries and construction are reported as "NE" and "IE", whereas CO<sub>2</sub> emissions are reported in 1990 and 2006; AD and CH<sub>4</sub> and N<sub>2</sub>O emissions from use of other fuels in other sectors are reported as "NO", whereas AD and CO<sub>2</sub> emissions are reported for 1990; AD and emissions for aviation gasoline and jet kerosene are reported as "C" for 1990 to 2000, and CH<sub>4</sub> and N<sub>2</sub>O emissions for 2001 to 2006 are reported to be "NA"; energy use and related emissions for navigation are reported as "NE" for all years; energy use and related emissions for natural gas pipeline transport (other transportation) are reported to be "NE" for 1990 to 1999; fugitive emissions from solid fuels – solid fuel transformation (CH<sub>4</sub> emissions for peat production) are reported as "NE". The ERT recommends that Belarus make efforts to report emissions from these fuels and subcategories for the complete time series in its next submission. These issues are further discussed in the category-specific sections below.

## 2. Transparency

45. The information provided in the NIR on AD, EFs and methods used is general and limited. The ERT recommends that Belarus include in its next NIR more detailed information, references and explanations on the choice of methods and EFs and background information on data used by category, and improve transparency in the CRF tables (e.g. by using documentation boxes).

46. In general, Belarus used tier 1 methods and default EFs from the Revised 1996 IPCC Guidelines for the estimates of the energy sector. However, in the first national communication of Belarus, information on region-specific EFs for gas and liquid fuels is reported. The ERT recommends that Belarus use higher tier methods and collect information on region- or country-specific EFs for key categories, and use these in its next submission.

47. In the CRF tables some categories are aggregated at a higher level. For example, all energy use of manufacturing industries and construction is reported under category 1.A.2f other. Allocation of fuels by category is not always clear. Notation keys are used in the CRF tables, but are not explained; for example, petroleum refining and manufacture of solid fuels and other energy industries categories are reported as "IE", but no explanation is given in the NIR or CRF table 9(a). During the in-country review it became clear that these categories were included under 1.A.2f other. However, data for the years 1990, 2000 and 2003 onwards that were shown to the ERT during the in-country review made it clear that more detailed AD are available, and the ERT recommends that Belarus use these data to provide disaggregated estimates by category for manufacturing industries and construction in its next submission.

48. There are no clear references in the NIR for the AD used before the year 2003. Belarus made efforts to obtain these data during the in-country review, and energy balances for 1990 and 2000 were provided to the ERT in a confidential report (for official use only). However, a first analysis of the report showed that some data, needed to perform a complete estimate of the emissions of the energy sector, seemed to be missing; for example, a full balance for kerosene and other fuels is missing. For 1990, some balance tables seemed incomplete (residual/fuel oil and diesel oil), because there was a large difference between the apparent consumption of the fuels ( $= \text{import} - \text{export} + \text{production} + \text{stock changes}$ ) and the summation of the bottom-up sectoral consumption. The ERT recommends that Belarus check these data with the statisticians of the National Committee on Statistics of Belarus, and make the necessary efforts to find the missing data and to obtain more details for the energy balance for 1990 to ensure completeness of the next inventory submission. Details can include a split of transport fuels into different subcategories, and a split between refineries and other facilities manufacturing fuels. The ERT also recommends that Belarus obtain full energy balances from the National Statistical Committee for all years possible. Missing data should be estimated following the recommendations of the IPCC good practice guidance. After the in-country review, Belarus informed the ERT that energy balances for 1990–2004 have been obtained from the National Committee on Statistics. All data have been checked and some inconsistencies were found with respect to previously used data. Belarus also informed the ERT that it will continue these verification procedures and make all necessary recalculations.

## 3. Recalculations and time-series consistency

49. For the energy sector, no recalculations were reported in the CRF tables between the 2007 and 2008 submissions. However, the NIR reports recalculations for all categories of the energy sector and for the 1990–2005 period. Future NIRs should clearly specify which recalculations were made.

50. Time series for some categories are not consistent (e.g. road transportation, railways, other transportation, aviation bunkers). These are discussed in more detail in the category-specific sections below.

#### 4. Uncertainties

51. The uncertainty analysis for the energy sector is based to a great extent on the default uncertainties included in the IPCC good practice guidance and on expert judgment. The documentation in the NIR on the uncertainties is limited.

52. The ERT reiterates the recommendation of the 2005 review report and encourages Belarus to conduct a more elaborated analysis, including country-specific uncertainty values as much as possible, and to include more documentation of uncertainties in the NIR and use them as a tool for setting priorities – identifying categories that are important for the overall quality of the inventory and that should be given high priority for future improvements.

#### 5. Verification and quality assurance/quality control approaches

53. Belarus implemented some QC checks for the energy sector, but these are not performed in a systematic way. There have been peer reviews for the inventory in 2006 and 2008 in Belarus, including a review of the energy sector. The recommendations were not included in the 2008 submission because the inventory had already been submitted before the results became available. The ERT recommends that these reviews be continued and that the recommendations be taken into consideration. The ERT further recommends that Belarus formalize and implement QA/QC procedures for the energy sector.

### **B. Reference and sectoral approaches**

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

54. The comparison between estimates obtained using the reference approach and the sectoral approach shows no major differences. The difference between the reference approach and sectoral approach only for 2006 (2008 submission) exceeds 2 per cent. However, the reference approach tables are not complete. For example crude oil imports and export are reported as “NE”, LPG use is reported as “NO” (even though it is used in Belarus), and there is frequent use of “C”. Table 1.A(d) (feedstocks and non-energy use of fuels) is filled in with notation keys “NE” and “NO”. There is also an inconsistent use of notation keys; for example, naphtha is reported as “NO” in table 1.A(b) and “NE” in table 1.A(d).

55. For 1990 the difference between the reference approach and sectoral approach is almost zero. The fact that some data in the reference approach table are incomplete and unclear, and coincide with data from the sectoral approach, suggests that for 1990, at least, the reference approach table has probably been filled in using some of the estimates from the sectoral approach. This could not be confirmed or denied during the in-country review by the Belarusian experts. The ERT suggests that Belarus check and revise both reference approach and sectoral approach for all years using data in the correct way, based on energy balances from the National Committee on Statistics.

56. A comparison between reference approach data and international data is at this time not relevant. A comparison should be performed again after checks and recalculations that would be needed for the next inventory submission, as is required by the Revised 1996 IPCC Guidelines. Where possible notation keys “NE” and “C” should be replaced with data for the estimations in the reference approach, especially for 1990, where the tables are not complete. All notation keys should be checked each year and not taken over from previous years. Belarus should attempt to identify and explain any differences between the reference approach and international data in its next inventory submission.

#### 2. International bunker fuels

57. Belarus does not report AD or emissions for marine bunkers or navigation. However, it was confirmed during the in-country review that river-based navigation occurs in the country. The 2005 review report indicated that marine bunkers also take place in the river-based navigation to the Black Sea and the Baltic Sea. In the submissions of 2007 and 2008, marine bunkers are reported as “NE”. The

ERT recommends that Belarus collect AD for navigation, collect information on a split of the fuel use between internal navigation and marine bunkers, and report the emissions in its next submission by providing the relevant information in the NIR and the CRF tables.

58. Aviation bunkers have been estimated for all years, except for 1991. There is, however, no clear explanation in the NIR on the split between civil aviation and international aviation. During the in-country review, a possible split provided by the Ministry of Transport and Communication (prepared by the State Aviation Committee) for recent years was shown to the ERT. The ERT recommends that Belarus investigate further a possible split and clearly explain the method used in its next NIR. Emissions for 1991 for aviation bunkers should also be included to complete the time series.

### 3. Feedstocks and non-energy use of fuels

59. Most of the fuels used as feedstocks and for non-energy purposes have been reported in CRF table 1.A(d) as "NE". However, during the in-country review the ERT confirmed that a number of fuels are used as feedstocks and for non-energy purposes in Belarus. The ERT recommends that Belarus collect AD on non-energy use and feedstocks from energy statistics or plant-specific information, if necessary (e.g. for ammonia production), and include the resulting estimates in CRF table 1.A(d). The information and estimates obtained should be used to complete the reference approach and be described in the NIR and the CRF tables.

## C. Key categories

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

60. A tier 1 method with IPCC default EFs was used to calculate emissions from these key categories. In the first national communication of Belarus, information is provided on region-specific EFs for gas and liquid fuels. The ERT recommends that Belarus use higher tier methods and country-specific or, if this is not possible, region-specific EFs for these categories in its next submission.

61. The AD and emissions for petroleum refining are reported as "IE", but no explanation is given in the CRF tables or in the NIR on where they are included. During the in-country review it became clear that fuels used for energy purposes in petroleum refining (in this case refinery gas) were allocated in category 1.A.2f other, under manufacturing industries and construction. The ERT recommends that Belarus allocate these emissions under the correct category for all years, based on the energy statistics. If this remains impossible, notation key "IE" should be clearly explained in the CRF and the NIR.

62. The AD and emissions for manufacture of solid fuels and other energy industries are reported as "IE", but no explanation is given in the CRF tables or in the NIR on where they are included. During the in-country review, it became clear that fuels used for manufacturing solid fuels (in this case production of peat bricks) were allocated in category 1.A.2f other manufacturing industries and construction. The ERT recommends that Belarus allocate these emissions under the correct category for all years based on the energy statistics. If this remains impossible, notation key "IE" should be clearly explained in the CRF and the NIR.

63. The AD and emissions for all categories under manufacturing industries and construction are reported aggregated under category 1.A.2f other. Under each fuel (including other fuels) for all categories, AD and emissions are reported as "IE". No explanation is given in the NIR or the CRF tables. The ERT recommends that Belarus improve reporting and transparency by allocating AD and emissions into the corresponding categories, based on the energy statistics shown to the ERT during the in-country review. This is easily possible for the latest reported years.

## 2. Road transportation: liquid and gaseous fuels – CO<sub>2</sub>

64. There is a strong decline (68.6 per cent) in energy use in, and corresponding CO<sub>2</sub> emissions from, road transportation in Belarus from 1990 to 2006. Inter-annual changes of energy use are also large for some years (for example from 61,640 TJ of diesel oil in 1993 to 36,350 TJ in 1994). During the in-country review, Belarusian experts explained that gasoline and diesel oil allocated to “road transport” and “sold to the public” sectors in the energy statistics are reported under the road transportation category in the latest years of the inventory. It is unclear from discussion with the experts if the same allocation is used in the early years of the time series. The ERT recommends that Belarus check AD for all fuels used in road transportation and their allocation in the energy statistics, and apply the same allocation of fuels consistently across the complete time series in its next inventory submission. The ERT also recommends that Belarus allocate all gasoline used in the country to road transportation and report on all these improvements and changes in its next submission.

65. Use of LPG for road transportation is reported in the CRF tables as “NO”, for both the sectoral approach and the reference approach. It was confirmed during the in-country review that there is LPG use in Belarus covering the complete inventory time series. The ERT recommends that Belarus include emissions from LPG use in its next submission.

### D. Non-key categories

#### 1. Stationary combustion: other fuels – CH<sub>4</sub> and N<sub>2</sub>O

66. In 1990 and 2006, use of other fuels is reported in the manufacturing industries and construction category (for other years, other fuels are reported as “IE” or “NE”); corresponding CO<sub>2</sub> emissions are also reported. However, estimates for CH<sub>4</sub> and N<sub>2</sub>O emissions are reported as “IE” and “NE” in the CRF tables for the complete time series. The ERT recommends that Belarus include these emissions in its next submissions and explain what other fuels are used in the country.

67. Belarus reports the use of other fuels and corresponding CO<sub>2</sub> emissions in 1990 in the other sectors category, but CH<sub>4</sub> and N<sub>2</sub>O emissions are reported as “NO” for the complete time series. The ERT recommends that Belarus include these emissions in its next submission.

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

68. The implied emission factors (IEFs) reported in the CRF tables for both gasoline and diesel oil for CH<sub>4</sub> and N<sub>2</sub>O are declining (gasoline – CH<sub>4</sub>: from 20.00 kg/TJ in 1990 to 1.76 kg/TJ in 2006; gasoline – N<sub>2</sub>O: from 0.60 kg/TJ in 1990 to 0.05 kg/TJ in 2006; diesel oil – CH<sub>4</sub>: from 5.69 kg/TJ in 1990 to 1.79 kg/TJ in 2006; diesel oil – N<sub>2</sub>O: from 0.59 kg/TJ in 1990 to 0.21 kg/TJ in 2006). This is not possible, because it was explained during the in-country review that a tier 1 approach and default constant EFs are used for the complete time series. During the in-country review it became clear to the ERT that this is a mistake. The ERT recommends that Belarus correct this mistake in its next inventory submission. During the previous in-country review (2005) the ERT was provided with detailed data on the vehicle fleet, collected nationally on annual basis. Comprehensive data on fuel consumption supporting these detailed data were not provided in 2005. However, the ERT considers that the recommendation from the previous review report, to aspire to a higher tier estimation of these emissions, is still relevant and recommends that Belarus make the necessary efforts to use a higher tier method for the estimates, particularly for N<sub>2</sub>O emissions, which would probably be a key category in the latest reported years as a result of the changes in the vehicle fleet and the wide use of catalytic converters.

#### 3. Civil aviation: liquid and gaseous fuels – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

69. AD (consumption of aviation gasoline and jet kerosene) for 1990 to 2000 are reported as “C”. However, AD for jet kerosene aviation bunkers are reported for all years (except 1991), and AD for aviation gasoline are reported as “NE” for the complete time series. A possible split for jet kerosene and

aviation gasoline between international and civil aviation, estimated by the Ministry of Transport and Communication, was shown to the ERT during the in-country review for 2007. The ERT recommends that Belarus collect detailed AD for aviation for all years, establish an appropriate split between civil and international aviation, include AD and emission estimates for these categories in its next submission, and give clear explanations in the NIR on the method used for the split.

70. CH<sub>4</sub> and N<sub>2</sub>O emissions for liquid fuels in this category are reported as “NA”. The ERT recommends that Belarus estimate and include these estimates in its next submission.

#### 4. Railways: liquid and solid fuels – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

71. The trend for the use of liquid fuels in this category is unusual, as the consumption rises from 213.58 TJ in 1990 to 10,358.61 TJ in 2006 (4,750 per cent). The ERT recommends that Belarus check the AD and the correct allocation of fuels from energy statistics, and provide explanations in its next NIR.

72. The IEF for CO<sub>2</sub> from liquid fuels for 1990 (76.59 t/TJ) is higher than in the other years of the time series (range 73.13 to 73.33 t/TJ). The ERT recommends that Belarus check the EFs used, and correct the estimates if necessary, or provide clear explanations for this discrepancy in its next submission.

73. The IEFs for CH<sub>4</sub> and N<sub>2</sub>O from solid fuels increase from 2001 onwards (CH<sub>4</sub>: from 10.00 kg/TJ in 2000 to 12.81 kg/TJ in 2006; N<sub>2</sub>O: from 1.40 kg/TJ in 2000 to 1.79 kg/TJ in 2006). The EFs are, however, reported in the NIR and the CRF as default values, so the reported increase is incorrect. During the in-country review, it became clear to the ERT that this is a mistake; it should be corrected in the next inventory submission.

#### 5. Navigation: liquid fuels – CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O

74. AD and emissions from navigation are reported as “NE” for all years of the time series. During the in-country review it was confirmed that there is river-based navigation in the country. The 2005 review report mentions that there may also be marine bunkers in Belarus from river-based navigation to the Black Sea and the Baltic Sea. The ERT recommends that Belarus collect AD, investigate the need for a split between navigation and marine bunker fuels, and report the AD and emission estimates in its next submission.

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

75. From 1990 to 1999, emissions from energy used in pipeline transport of natural gas are reported as “NE”. Estimates for later years are reported in the CRF tables. The ERT recommends that Belarus collect AD and include emission estimates for all years in its next submission.

#### 7. Solid fuel transformation: solid fuels – CH<sub>4</sub>

76. There is peat production in Belarus, where potentially CH<sub>4</sub> fugitive emissions can be associated with this activity. These are currently reported as “NE”. In the 2005 review report, the ERT was informed that these emissions occur in the country, but have not been estimated so far. There is no guidance on a methodological approach in the Revised 1996 IPCC Guidelines, and the ERT encourages Belarus to make the necessary efforts to report these emissions in future submissions, if possible, making use of experiences in other countries.

#### 8. Oil and natural gas: liquid and gaseous fuels – CO<sub>2</sub> and CH<sub>4</sub>

77. The IEFs for 2005 and 2006 for CH<sub>4</sub> for production (oil) and for refining/storage (oil) are not consistent with other values in the time series (IEF for CH<sub>4</sub> from oil production is 2,650.00 kg/PJ for 1990 to 2004, and then increases to 2,673.44 kg/PJ in 2005 and to 2,680.61 kg/PJ in 2006; the IEF for

CH<sub>4</sub> from refining/storage is 745.00 kg/PJ from 1990 to 2004 and then changes to 750.49 kg/PJ in 2005 and to 740.95 kg/PJ in 2006). Belarus reports the use of default EFs, so these should be the same in all years of the time series. During the in-country review it became clear to the ERT that these were mistakes, and the ERT recommends that Belarus correct them in its next submission.

78. The default EF for production/processing (natural gas) for the complete time series used by Belarus (288,000 kg/PJ) seems low and should be corrected in accordance with the tier 1 default EF recommended in table I-58 of the Revised 1996 IPCC Guidelines for all years of the time series.

79. CH<sub>4</sub> fugitive emissions from natural gas transport are allocated under 1.B.2.d other, whereas the correct allocation for these emissions is under 1.B.2.b.iii transmission. AD and emissions (for 2006 at least) are provided by the state company Beltransgas. No explanations on data or methods are reported in the NIR. The ERT recommends that Belarus contact the data supplier to obtain AD for all years of the time series and explanations on the methods used to calculate these emissions, and re-allocate these data to the 1.B.2.b.iii transmission category. These explanations should be included in the next submission, in the NIR and, where relevant, in the CRF tables.

80. CH<sub>4</sub> fugitive emissions from natural gas distribution are currently reported as "IE" and should be re-allocated to 1.B.2.iv distribution. The EFs used for 2005 and 2006 for natural gas distribution (allocated under 1.B.2.b.v other leakages) are not consistent with those used in other years of the time series. During the in-country review, it became clear to the ERT that this is a mistake, and the ERT recommends that Belarus correct the EFs in accordance with the default values from table I-58 of the Revised 1996 IPCC Guidelines, in its next submission.

81. The EF used by Belarus for CH<sub>4</sub> fugitive emissions from venting during gas production in 2006 (5,965.78 kg/PJ) is not in line with the EFs used for other years of the time series. This is a mistake that Belarus should correct in its next submission. It is also not clear to the ERT what AD for gas production are reported in the CRF tables and used by Belarus for estimation of CH<sub>4</sub> emissions from venting. The AD reported are much lower than the gas production reported in the CRF tables under production/processing category. The ERT recommends that Belarus revise these data and if necessary clearly explain this discrepancy in its next NIR and, where relevant, in the CRF tables.

82. Belarus reports emission estimates for venting and flaring from oil production and oil refining under the oil category as "NE" and CO<sub>2</sub> emissions from natural gas production and processing under the gas category as "NA". As flaring in refineries and natural gas production probably occurs in the country, the ERT recommends that Belarus contact the companies involved in these activities, or the Belarus State Oil and Chemical Industry Alliance, to obtain the relevant data on their activities, and include estimates of these emissions in its next submission.

## **E. Areas for further improvement**

### **1. Identified by the Party**

83. The NIR identifies the following planned improvements in the energy sector: conduct a more careful analysis of all sources of GHG emissions, giving priority to key categories, and continue the development of QA procedures.

### **2. Identified by the expert review team**

84. The ERT recommends that Belarus revise its emission estimates for the energy sector for its next submission, covering both the reference approach and sectoral approach, using solid documented national data. Belarusian experts should therefore gather all information available on energy balances from the National Committee on Statistics for all years of the time series, with particular attention to 1990. Some assumptions might be necessary, for example, on the split of fuel consumption between aviation bunkers and civil aviation or the allocation of fuels between subcategories, but the basis and

rationale for these assumptions should be clearly explained and documented in the NIR and, where relevant, in the CRF tables.

85. In addition to the energy statistics, the ERT considers that specific and detailed information is needed, and should be collected, for emission estimates of some categories under fugitive emissions and non-energy use of fuels, such as emissions relating to transmission of natural gas. The ERT encourages Belarus to obtain this information from individual companies or industrial alliances in the country, and to report estimates in its next submission.

86. The ERT recommends that Belarus explore the possibility of using country-specific or regional EFs, in particular for key categories, in its future inventory submissions. Explanations should be provided in the NIR and, where relevant, in the CRF tables on AD, EFs, methods and assumptions that are used in the inventory estimates, in order to improve transparency, in accordance with the UNFCCC reporting guidelines and the IPCC good practice guidance.

87. The ERT considers that recommendations from previous review reports or peer reviews performed in the country should be taken into account when preparing the next inventory submission.

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

### **A. Sector overview**

88. In 2006, emissions from the industrial processes sector amounted to 4,228.28 Gg CO<sub>2</sub> eq, or 5.2 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 67.49 Gg CO<sub>2</sub> eq, or 0.1 per cent of total GHG emissions. Between 1990 and 2006 emissions from the industrial processes sector increased by 88.0 per cent and emissions from the solvent and other product use sector emissions decreased by 9.3 per cent. The key drivers for the rise in emissions between 1990 and 2006 are the accounting, for the first time in 2006, for CO<sub>2</sub> emissions from ammonia production, and the increase of some industrial outputs (e.g. electric furnace steel production increased by 106.5 per cent, cement production by 57.6 per cent and nitric acid production by 18.2 per cent).

89. In 2006, CO<sub>2</sub> made the largest contribution to GHG emissions from the sector, accounting for almost 88.4 per cent of sectoral emissions. The contributions of CH<sub>4</sub>, N<sub>2</sub>O, HFCs and SF<sub>6</sub> were 1.1, 9.8, 0.7 and 0.04 per cent, respectively. Within the industrial processes sector, 52.9 per cent of GHG emissions were from mineral products, 45.0 per cent were from chemical industry, 1.3 per cent were from metal production, and 0.8 per cent were from consumption of halocarbons and SF<sub>6</sub>. Most of the CO<sub>2</sub> emissions (40.7 per cent) came from cement production; ammonia production accounted for 39.8 per cent, lime production for 18.0 per cent, glass production for 1.1 per cent, and iron and steel production for 0.3 per cent. CH<sub>4</sub> emissions from iron and steel production accounted for 93.7 per cent of CH<sub>4</sub> sectoral emissions and ethylene production accounted for 6.3 per cent. N<sub>2</sub>O emissions were generated only from nitric acid production. The ERT noted that there were no specific differences or changes between the 2007 and 2008 submissions, except for Belarus accounting for CO<sub>2</sub> emissions from ammonia production in 2006 for the first time in its 2008 submission.

#### 1. Completeness

90. The CRF tables include estimates of emissions for most gases and categories from the industrial processes sector, as recommended by the Revised 1996 IPCC Guidelines. However, some categories are reported as "IE", "NE" or "NO". In particular the ERT noted that the following were not provided: emissions from limestone and dolomite use; soda ash use; asphalt roofing; bricks, ceramics and fertilizer production (for which there are no methodologies in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance, although AD are available in national statistics); CO<sub>2</sub> and CH<sub>4</sub> from ferroalloys production; actual and potential emissions of HFCs, PFCs and SF<sub>6</sub> for 1990 (base year); emissions from

consumption of HFCs, PFCs and SF<sub>6</sub> for other years of the time series (potential HFCs and actual PFCs and SF<sub>6</sub> from refrigeration and air conditioning equipment; potential and actual HFCs, PFCs and SF<sub>6</sub> from foam blowing, fire extinguishers, aerosols/metered dose inhalers and solvents; potential and actual HFCs and PFCs and potential SF<sub>6</sub> from electrical equipment); emissions from solvents and other product use (CO<sub>2</sub> from paint application, degreasing and dry cleaning and chemical products, manufacture and processing; and N<sub>2</sub>O from the category other, except use of N<sub>2</sub>O for anaesthesia (for which there are no methodologies in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance, although AD are available in national statistics)).

91. In some cases, the ERT believes that the notation keys used were not applied consistently, for example, “NO” is used instead of “NE” for CO<sub>2</sub> emissions from soda ash use, 2.A.7 other (e.g. bricks and ceramics production), and for N<sub>2</sub>O emissions from 2.B.5 other (e.g. fertilizer production); “IE” is used instead of “NE” for CO<sub>2</sub> emissions from limestone and dolomite use and asphalt roofing; and “NA” is used instead of “NE” for CO<sub>2</sub> emissions from solvents and other product use. The ERT encourages Belarus to apply the notation keys consistently and to make appropriate use of the documentation boxes in the CRF tables; to prepare and report estimates for all the missing categories; and to provide in the NIR a discussion of the missing categories, of other potential sources not addressed in the current inventory submission, and of the possibilities of including them in future submissions. In the case of categories for which there are no methodologies in the Revised 1996 IPCC Guidelines and the IPCC good practice guidance, the ERT encourages Belarus to review the experiences of other Parties in reporting emissions for these categories and to make the necessary efforts to report them in its next inventory submission.

## 2. Transparency

92. The inventory information provided by Belarus is not fully detailed and transparent, either in the NIR or in the CRF. For example, AD used are provided only in the CRF tables, but no explanations are given in the NIR; no discussion is provided on the missing categories and other potential categories not currently addressed in the inventory; methodologies applied are poorly documented; for ammonia production it is not clear whether the volume of natural gas used as a feedstock is subtracted from the energy sector in order to avoid double counting; and the rationale for selection of the EF used for nitric acid production is not provided in the NIR. The ERT encourages Belarus to improve the transparency of the inventory by including clear and concise information on methods, EFs and AD in the NIR, as well as other additional information to fully reflect the requirements of the UNFCCC reporting guidelines.

## 3. Recalculations and time-series consistency

93. No recalculations have been reported by Belarus in its 2008 submission for the industrial processes sector in the CRF tables. However, in chapter 4 “Industrial processes” of the NIR, Belarus reported recalculations performed under 2.A.7 other – glass production and 2.F consumption of halocarbons and SF<sub>6</sub>. The ERT recommends that Belarus enhance the consistency between the NIR and the CRF tables for its next submission.

## 4. Uncertainties

94. The NIR provided only limited documentation on uncertainties for the industrial processes sector. The ERT considers many values of uncertainty for EFs used by Belarus to be low. For example, the EF uncertainty value for CO<sub>2</sub> emissions from 2.A.7 other – glass production is taken as 10 per cent, which would be reasonable only if emissions are calculated according a tier 2 methodology, based on quantity of melted glass in each manufacturing process, and taking into consideration the cullet ratio for different glass types produced; for other circumstances the uncertainty associated with use of the tier 1 EF may be in the order of ±60 per cent. The tier 1 EF uncertainty value for CO<sub>2</sub> from 2.C.1 iron and steel production – other – electric furnace steel production is taken as 15 per cent, whereas the default EF uncertainty range is ±25 per cent. And the EF uncertainty value for CH<sub>4</sub> was taken as

5 per cent, which corresponds to a tier 3 methodology EF uncertainty range, but Belarus reported the use of a default EF for CH<sub>4</sub> in the CRF table 3. The ERT recommends that Belarus properly support its choices of uncertainty values and include more documentation on uncertainties in the industrial processes sectoral chapter of the NIR. The ERT also recommends that Belarus improve the uncertainty analysis by using more adequate and/or country-specific uncertainty values for the above-mentioned range of categories in the industrial processes sector.

#### 5. Verification and quality assurance/quality control approaches

95. The documentation on QA/QC procedures in the NIR is limited (e.g. chapter 4 “Industrial processes” presents only an overview of the QA/QC procedures for all categories, and chapter 5 “Solvent and other product use” contains no QA/QC and verification information). The ERT noted that, unlike in the 2007 submission, for its 2008 submission Belarus implemented QA procedures by conducting basic expert peer review for industrial processes sector, but that the valuable results of the independent peer review undertaken in April 2008 could not be taken into consideration for the 2008 submission. The ERT recommends that Belarus implement QA/QC procedures and include more category-specific information on the QA/QC and verification measures in its next NIR.

### **B. Key categories**

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

96. Belarus has used the IPCC tier 1 methodology and the default IPCC value for calcium oxide (CaO) content by weight in clinker (64.6 per cent). The ERT noted, however, that in Belarus lime content in clinker may be in the range of 60–67 per cent, and that a certain fraction of magnesium oxide (MgO) is also used (MgO content in clinker would be around 2 per cent). The EF used (0.5071 t CO<sub>2</sub>/t clinker) does not take into consideration the cement kiln dust (CKD) correction factor (default value is 2 per cent, but in some countries in the region this value is within the range of 3–5 per cent). As this category is a key category in Belarus, the ERT recommends that Belarus, in its next submission, use a tier 2 methodology for estimating CO<sub>2</sub> emissions from cement production, take into account the country-specific data on CaO and MgO content in clinker, use a CKD correction factor, and recalculate CO<sub>2</sub> emissions for the complete time series.

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

97. In 2006 Belarus estimated CO<sub>2</sub> emissions from ammonia production following the IPCC tier 1b approach. For its next inventory submission Belarus is recommended to estimate these emissions following the most accurate methodology (tier 1a), based on natural gas input and applying plant-specific EFs based on the carbon content of natural gas. For the rest of the time series (1990–2005), all CO<sub>2</sub> emissions from this category were reported as “recovered”. Explanations on this are provided in the NIR of the 2005 submission, indicating that “the only ammonia manufacturer in Belarus, which is “AZOT” Production Association in Grodno, is recovering all the emitted CO<sub>2</sub>, using it as a raw material for urea production”. This explanation is not provided in most recent submissions. However, according to the Revised 1996 IPCC Guidelines, this carbon will be stored only for a short time, so no adjustment should be made for intermediate binding of CO<sub>2</sub> in downstream manufacturing processes and products. For this reason the ERT recommends that Belarus, in its next submission, estimate and report CO<sub>2</sub> emissions from this category for the complete time series using the methodology indicated above.

### **C. Non-key categories**

#### 1. Lime production – CO<sub>2</sub>

98. Belarus did not disaggregate the AD by lime types for its estimates of lime production. This disaggregation is required by the IPCC good practice guidance, which provides default values for high calcium/dolomitic lime with a default breakdown of lime types of 85/15. The ERT recommends that

Belarus use the default IPCC value for the breakdown into lime types if no country-specific value is available, and provide revised calculations for the category lime production for the entire time series in its next submission.

99. Both high-calcium and dolomitic limes can be slaked and converted to hydrated lime ( $\text{Ca}(\text{OH})_2$  or  $\text{Ca}(\text{OH})_2 \cdot \text{Mg}(\text{OH})_2$ ). The ERT recommends that Belarus, in its next submission, take into consideration the correction for the proportion of hydrated lime by multiplying the production data by the IPCC default correction factor of 0.97.

100. The default EFs in the Revised 1996 IPCC Guidelines correspond to 100 per cent of CaO or CaO·MgO in lime (stoichiometric ratio) and can lead to an overestimation of emissions because the CaO and MgO (if present) content may be less than 100 per cent according to the lime purity. The ERT recommends that Belarus adjust the EFs and account for the CaO or the CaO·MgO content in its next submission.

## 2. Limestone and dolomite use – CO<sub>2</sub>

101. Belarus reported CO<sub>2</sub> emissions from limestone and dolomite use as “IE”, explaining that emissions from liming of soils were estimated in the LULUCF sector; limestone used for cement and lime production was taken into account in the categories cement production and lime production. However, according the Revised 1996 IPCC Guidelines, all other use of limestone and dolomite should also be reported; for example a certain amount of limestone and dolomite is used in glass production, in sugar production, in metallurgy (e.g. iron and steel), in agriculture, in construction and in environmental pollution control. The ERT recommends that Belarus report, in its next submission, the CO<sub>2</sub> emissions from limestone and dolomite use.

## 3. Soda ash use – CO<sub>2</sub>

102. Belarus reported CO<sub>2</sub> emissions from soda ash use as “NO”. However, sodium carbonate ( $\text{Na}_2\text{CO}_3$ ) is used as raw material in a large number of industries, including glass manufacture, soap and detergents, pulp and paper production and water treatment. According to the 2007 Statistical Yearbook, all these industries operate in Belarus. The ERT recommends that Belarus report, in its next submission, the CO<sub>2</sub> emissions from soda ash use.

## 4. Asphalt roofing – CO<sub>2</sub>

103. Belarus reported CO<sub>2</sub> emissions from asphalt roofing as “IE”, but no explanations are provided in the NIR or CRF tables on where these emissions have been included. The ERT encourages Belarus to estimate and report CO<sub>2</sub> emissions from asphalt roofing under the corresponding category in the CRF tables; if this is not possible the notation key “NE” should be used in its next submission.

## 5. Glass production – CO<sub>2</sub>

104. Belarus reported CO<sub>2</sub> emissions from 2.A.7 other – glass production (container glass production), but it used the notation key “NO” for CO<sub>2</sub> emissions from 2.A.7 other – other non-specified (flat glass production). In national statistics AD for flat glass production are available, expressed in thousands of m<sup>2</sup> (according the National Committee on Statistics, one conventional m<sup>2</sup> of flat glass weighs 5 kg). Belarus is encouraged to estimate CO<sub>2</sub> emissions from flat glass production; if this is not possible these emissions should be reported as “NE”.

105. The EF used by Belarus for estimating CO<sub>2</sub> emissions from container glass production (140 kg CO<sub>2</sub>/t of glass produced) comes from the core inventory of air emissions (CORINAIR) emission inventory guidebook, but it was reported in the CRF summary 3 table as an IPCC default EF. The ERT encourages Belarus to apply the notation keys more consistently in the CRF tables.

## **D. Areas for further improvement**

### **1. Identified by the Party**

106. Belarus identified, in its NIR, the need to improve its emission estimates and to apply higher-tier methodologies for key categories; to use country-specific EFs for a range of categories; to collect new data on exports and imports of HFCs, and on exports and imports of equipment containing F-gases; and to recalculate the emission estimates of F-gases under the category consumption of halocarbons and SF<sub>6</sub>.

### **2. Identified by the expert review team**

107. The ERT identifies the following issues for improvement in the Belarus GHG inventory within the industrial processes sector:

- (a) Improve the transparency of the inventory by including additional information and explanations in the NIR on the selection of methodologies, on the identification of EFs used, on assumptions on parameters used, and on the sources of AD for all years of the time series, and provide improved descriptions of individual categories. Also, report, in the NIR and relevant CRF tables, detailed information on recalculations performed, with explanations of the rationale for recalculations made;
- (b) Collect AD and EFs with the goal of improving estimates and using higher tier methods for key categories, and prepare and report estimates for all the missing categories; provide, in the NIR, discussions of these categories and of other potential categories not addressed in the current inventory submission, and indicate possibilities of including them in future submissions;
- (c) Improve the uncertainty analysis by using more adequate and/or country-specific uncertainty values and include descriptions of the QA/QC and verification activities and procedures in specific sections of chapter 4 “Industrial processes” and chapter 5 “Solvents and other product use” of the NIR;
- (d) Enhance consistency between the NIR and the CRF tables.

## **V. Agriculture**

### **A. Sector overview**

108. In 2006, emissions from the agriculture sector amounted to 13,946.89 Gg CO<sub>2</sub> eq, or 17.2 per cent of total GHG emissions. Emissions from the sector decreased by 31.5 per cent between 1990 and 2006. The key driver for the fall in emissions is a decline in animal populations and nitrogen fertilizer application resulting from the change in the political and economic situation in Belarus in the early 1990s.

109. Within the sector, 53.8 per cent of the GHG emissions were from agricultural soils, 40.7 per cent were from enteric fermentation and 5.4 per cent were from manure management. The remaining 0.1 per cent were from field burning of agriculture residues. The ERT noted that there are no specific differences or changes between the 2007 and 2008 submissions.

### **1. Completeness**

110. In general the information contained in the CRF tables is complete and includes estimates of emissions of most gases and categories from the agriculture sector, as recommended by the Revised 1996 IPCC Guidelines. There is no rice production and no burning of savannas in Belarus, and for this reason CH<sub>4</sub> emissions from rice cultivation and CH<sub>4</sub> and N<sub>2</sub>O emissions from prescribed burning of savannas are reported as “NO”. Some notation keys in the CRF tables need to be revised; for example, for CH<sub>4</sub>

emissions from mules and asses the notation key should be “NE “ instead of “NO”, and “IE” for option B in table 4.B(b) should be replaced by “NA”. After the in-country review, Belarus informed the ERT that there is no population of mules and asses on the territory of the country. This fact was confirmed by the National Committee on Statistics. The ERT recommends that Belarus make efforts to submit emission estimates for missing categories in its next submission.

## 2. Transparency

111. The NIR provides basic information on the inventory estimates, such as the methodology, EFs and AD used. This information was helpful for the review of the inventory, but the ERT noted that transparency could be further improved by providing information or explanations on the reasons for choice of methods and EFs; for example, a tier 1 method with IPCC default EFs was applied to all categories in the sector, but the NIR does not provide information to support this selection. The ERT recommends that Belarus follow closely the UNFCCC reporting guidelines and the IPCC good practice guidance, and provide information on the assumptions for selection of methodologies, parameters and EFs in its next submission.

112. The information provided in the NIR on AD for agricultural soils and manure management categories is not sufficient to support the inventory review. Improvements are required in the documentation provided for manure management usage in waste management systems for different animal species, for AD on area of harvested organic soils and for AD and parameters for calculating emissions from nitrogen (N) input for manure applied to soil and pasture. The ERT recommends that Belarus improve the information and documentation in the NIR on AD for all categories of the agriculture sector in its next submission.

## 3. Recalculations and time-series consistency

113. Belarus does not report recalculations in the agriculture sector in its 2007 and 2008 inventory submissions.

## 4. Uncertainties

114. Belarus has estimated quantitatively the uncertainties in the agriculture sector using a tier 1 uncertainty analysis. The uncertainty analysis is largely based on the default values of uncertainties included in the IPCC good practice guidance and expert judgment. Given the wide range of IPCC default uncertainty values, the documentation provided in the NIR on the rationale for choice of respective uncertainty value is limited. The ERT recommends that Belarus include explanations on the rationale for using certain uncertainty values in its future submissions. The ERT also recommends that Belarus improve the uncertainty analysis by using more adequate and/or country-specific uncertainty values, particularly for key categories in the agricultural sector.

## 5. Verification and quality assurance/quality control approaches

115. The documentation on QA/QC implementation in the sector is limited. During the in-country review, Belarus explained that one external expert from the National Academy of Sciences has been invited to perform an external review, but this information is not included in the NIR. The ERT recommends that Belarus establish and implement QA/QC procedures for the sector in accordance with the IPCC good practice guidance, and document the implementation of these procedures in its future submissions.

## B. Key categories

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

116. The CH<sub>4</sub> emissions from enteric fermentation were estimated based on a tier 1 methodology and IPCC default EFs for Eastern Europe that were constant for the complete time series. There is no information in the NIR to explain the choice of methodology and EFs or background information on AD used. During the in-country review, Belarus provided the ERT with the forms for statistical data collection. The ERT noted that Belarus has extensive data on animal production, including detailed animal population data for different ages and data on milk production per cow. Data on animal production are collected monthly by the National Committee on Statistics, but these data have not been considered in the inventory development. The ERT believes that these data could be of great help in future inventory development. According to the IPCC good practice guidance, the frequency of data collection and assumptions on AD development should be documented, and if data are available or can be collected without excessive cost, the tier 2 method should be applied to significant subcategories. The ERT encourages Belarus to make efforts in its next submission to apply a higher tier methodology for estimating emissions from dairy and non-dairy cattle according to the IPCC good practice guidance.

117. The NIR stated that the detailed data on the animal populations come from official annual statistics data of the National Committee on Statistics. During the in-country review, the ERT noticed that there was a confusion on cattle population numbers; the total number of dairy cows and beef cows was used as the dairy cattle population for the estimates, and the non-dairy cattle population was calculated by subtracting the dairy and beef cow populations from the total number of cattle. The ERT recommends that Belarus correct the population numbers for dairy cattle and non-dairy cattle, and consider recalculation of CH<sub>4</sub> emissions from this category for the whole time series in its next submission.

118. As indicated above, default values of EFs for Eastern Europe, which were constant for the complete time series, were applied for CH<sub>4</sub> estimates from dairy cattle, but no information on milk yield and other related animal productivity parameters is provided in the NIR to justify this choice. During the in-country review, Belarus provided related information on these parameters. To improve transparency, the ERT recommends that Belarus include milk production information in the NIR for all years in its next submission. The ERT also noticed that milk production per cow has increased from 1990 to 2006, and encourages Belarus, for its future submissions, to develop country-specific EFs by applying a tier 2 methodology to reflect these country-specific circumstances.

119. In the period 1990–2006, CH<sub>4</sub> emissions from non-dairy cattle decreased by 46.2 per cent, considerable inter-annual changes (ranging from –11.7 to –7.6 per cent) were identified for 1990–1991, 1992–1995 and 1998–1999. The NIR stated that these inter-annual changes are a result of the decline in the non-dairy cattle population. During the in-country review, Belarus further explained that these changes are due to a deficit of animal fodder; the fodder was brought from Kazakhstan and became very expensive after the disintegration of the Soviet Union. The ERT recommends that Belarus, in its next submission, include this information in the NIR and make a comparison with the beef and milk production to support its explanation.

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

120. N<sub>2</sub>O from direct soil emissions is the largest key category in the agricultural sector. There is no clear description in the NIR on the choice of methodology, so it is not clear whether Belarus used a tier 1a or tier 1b methodology for its calculations; tier 1a and tier 1b are both reported in the CRF table summary 3. During the in-country review, Belarus explained that the tier 1 method of the Revised 1996 IPCC Guidelines was applied and also that it plans to use the tier 1b according to the IPCC good practice guidance in its future submissions. The ERT recommends that Belarus include detailed information on

the choice of methodology in its future NIRs, and encourages Belarus to make efforts to apply the tier 1b methodology for its next submission.

121. The NIR provided limited information on AD used for the estimates. There is no information on AD and related parameters on manure N applied to soil, on N excretion on pasture of animals or on area of cultivated organic soils. The ERT recommends that Belarus include all relevant AD and related parameters according to the IPCC good practice guidance in the NIR of its next submission.

122. The NIR stated that data sources on area of cultivated organic soils are the first national communication of Belarus and the National Academy of Sciences of Belarus. During the in-country review, Belarus explained that there are no statistical data in the country on area of harvested organic soils for the complete time series, and only data for year 2000 are published. The reported data are based on expert assessment in conjunction with the published data for 2000. In addition, Belarus provided a spreadsheet containing data on area of harvested organic soils for 1990, 1995, 1999, 2000 and 2005, but these data are different from the data on area reported in the CRF tables. Belarus also provided the document "Soils of agricultural land", which includes detailed data on area of harvested organic soils for 2000. During the in-country review an invited expert from the National Academy of Science introduced the approach used to calculate this area, based on the available data for 2000, but this information was not included in the NIR. The ERT recommends that Belarus improve the time series consistency of its estimates of N<sub>2</sub>O emissions from organic soils by consistently using the same data sources and approach, and provide data on area of harvested organic soils for the complete time series, and information on the approach used to estimate the area, in the NIR of its next submission.

123. The ERT identified an inconsistency between N excretion on pasture and the fraction of N input from manure applied to soils. In the calculation of N input from manure applied to soils, the value of  $Frac_{PRP}$  (or  $Frac_{GRAZ}$ ) used is 0.02, but the N excretion on pasture reported in CRF table 4.B(b) does not match the N excretion calculated by multiplying total N excretion from manure by 0.02; the fraction of N excretion on pasture from the total N input from manure should be around 0.14. The ERT recommends that Belarus make efforts to have appropriate data on N from manure application and keep consistency between related categories in its next submission.

124. In the 2007 and 2008 submissions, the EF value of 5 kg N<sub>2</sub>O-N/ha per year, taken from the Revised 1996 IPCC Guidelines, is used to calculate N<sub>2</sub>O emissions from organic soils, instead of the updated value of 8 kg N<sub>2</sub>O-N/ha per year from the IPCC good practice guidance. The ERT recommends that Belarus use the updated EF in its next submission, as appropriate.

### 3. Indirect emissions – N<sub>2</sub>O

125. In the 2007 and 2008 submissions, the NIR contained no information on the methods and AD used to estimate indirect N<sub>2</sub>O emissions from agricultural soils. During the in-country review, Belarus provided the ERT with the spreadsheet containing calculations. The ERT noticed that the calculation of N<sub>2</sub>O emissions from N leaching and run-off in 1990 was probably overestimated by using the equation of the Revised 1996 IPCC Guidelines instead of the equation of the IPCC good practice guidance. The ERT recommends that Belarus consider revising and recalculating emission estimates using the updated equation in the IPCC good practice guidance, and provide detailed information on the methodology, AD and parameters in its next submission.

### C. **Non-key categories**

#### Manure management – CH<sub>4</sub> and N<sub>2</sub>O

126. Belarus uses the tier 1 methodology for its estimates for this category. The NIR does not contain sufficient information on AD and the percentage of manure management usage by different waste systems available for estimation of CH<sub>4</sub> emissions for this category, or on the EFs and AD used to

estimate N<sub>2</sub>O emissions. The ERT recommends that Belarus include this information in the NIR of its next submission.

127. The ERT identified a mistake in the additional information table of CFR table 4.B(a), as the total for different manure management systems for several animal categories is more than 100 per cent. During the in-country review, the correct sheet for calculations on manure management usage for different animal species was provided to the ERT. The ERT noticed that there is an inconsistency between data in this sheet and calculations reported in the 2008 inventory submission. The ERT recommends that Belarus, in its next submission, correct this mistake and recalculate estimates using appropriate data on manure management usage.

#### **D. Areas for further improvement**

##### **1. Identified by the Party**

128. No planned sector-specific improvements are reported in the NIR. During the in-country review, Belarus provided a paper with the improvement plan for the inventory of the sector, including actions to correct data on dairy cattle and non-dairy cattle populations, disaggregating them by age groups; the application of a tier 2 methodology for enteric fermentation in its next submission; checking AD and EFs for all categories and making all necessary recalculations; and involving a special agricultural expert in the preparation of the GHG inventory.

##### **2. Identified by the expert review team**

129. The ERT encourages Belarus to follow the UNFCCC reporting guidelines and the IPCC good practice guidance in the preparation of its inventories and to improve the NIR of its next submission. In addition, the ERT recommends that Belarus make the following improvements:

- (a) Improve consistency between the NIR and the CRF tables;
- (b) Revise and perform recalculations of N<sub>2</sub>O emission estimates from agricultural soils based on appropriate and detailed AD in accordance with the plan mentioned in paragraph 128;
- (c) Improve the transparency of the inventory by including detailed information, descriptions and assumptions used for selection of methods, EFs and AD, as well as related parameters;
- (d) Make efforts to apply higher tier methodologies for key categories.

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

### **A. Sector overview**

130. In 2006, the LULUCF sector was a net sink of 25,966.91 Gg CO<sub>2</sub> eq, offsetting 32.1 per cent of total GHG emissions. Removals from the sector increased by 18.0 per cent between 1990 and 2006. The key driver for the rise in removals is the increase of removals in forest land and the decrease of emissions from cropland. According to the 2008 inventory submission, the forest land remaining forest land category in 2006 was a net sink of 27,195.13 Gg CO<sub>2</sub>, and CO<sub>2</sub> emissions from agricultural lime application (in cropland) and wetlands remaining wetlands were sources of 997.26 and 157.12 Gg CO<sub>2</sub>, respectively. Based on these figures the UNFCCC secretariat identified both CO<sub>2</sub> from forest land remaining forest land and CO<sub>2</sub> emissions from agricultural lime application (under cropland) as key categories for the level and trend assessment in 2006. The ERT noticed that Belarus still does not have in its inventory an adequate, consistent, complete and transparent approach to represent land areas and a land-use conversion matrix in accordance with the IPCC good practice guidance for LULUCF. The ERT

strongly recommends that Belarus develop these and provide detailed information in the NIR of its next submission.

131. The ERT noted that there are no changes between the 2007 and 2008 inventory submissions and no improvements have been made.

#### 1. Completeness

132. The CRF tables include estimates of all gases and only some sources and sinks from the LULUCF sector, which is not completely in line with the IPCC good practice guidance for LULUCF. Belarus reports CO<sub>2</sub> emissions/removals for 1990–2006 for mandatory category 5.A.1. forest land remaining forest land and optional categories 5.D.1. wetlands remaining wetlands and 5(IV) CO<sub>2</sub> emissions from agricultural lime application (in cropland). During the in-country review, Belarus informed the ERT that it has estimated N<sub>2</sub>O emissions from wetland converted to forest land, but these data were not included in the CRF tables. The ERT encourages Belarus to include these estimates in its next inventory submission. The CRF tables do not contain emission and removal estimates from 5.A.2 land converted to forest land, 5.B.1 cropland remaining cropland, 5.B.2 land converted to cropland, 5.C. grassland, 5.D.2. land converted to wetlands, 5.E. settlements or 5.F.2 land converted to other land, as these categories are reported as “NE” and “NO”. Direct N<sub>2</sub>O emissions from N fertilization are reported as “NO”. N<sub>2</sub>O emissions from disturbance associated with land-use conversion to cropland are reported as “IE”, “NE” and “NO”. Biomass burning for 5.B cropland, 5.C grassland and 5.D.2 land converted to wetlands are reported as “NE” and “NO”. The ERT recommends that Belarus, in its next inventory submission, make the necessary efforts to include missing categories that are likely to be relevant for the country.

#### 2. Transparency

133. The NIR of Belarus provides only limited information on the inventory estimates for this sector. Some parts of the emission/removals estimates were not documented at all. Descriptions provided were not sufficiently detailed for all categories with regard to methods, AD, EFs and data sources. Large parts of the information needed to understand the inventory estimates were provided only orally during the in-country review by invited external experts. The ERT recommends that Belarus include in the NIR all relevant information on methods, assumptions and parameters for the estimation of emissions and removals in its next submission.

#### 3. Recalculations and time-series consistency

134. The ERT noticed a large decrease of CO<sub>2</sub> emissions from agricultural lime application (in cropland) for 1990–2004 resulting from recalculations in the 2007 and 2008 submissions in comparison with the 2006 submission. These recalculations have resulted in an increase of total CO<sub>2</sub> removals in the LULUCF sector during the period 1990–2006. Recalculations and their rationale are not explained in the NIR. The ERT recommends that Belarus explain and clarify the reasons for the recalculations, and report on the changes made on methods and/or parameters used in recalculations, including a clear explanation for the large decrease of CO<sub>2</sub> emissions, in its next submission.

#### 4. Uncertainties

135. Belarus has not provided in the NIR descriptions and relevant data used for the tier 1 uncertainty analysis for the LULUCF sector. It is not clear to the ERT whether Belarus has provided the uncertainty analysis for the sector fully in accordance with the IPCC good practice guidance for LULUCF. The ERT recommends that Belarus include in the NIR all the relevant information on assumptions and parameters used for the uncertainty analysis in its next inventory submission.

## 5. Verification and quality assurance/quality control approaches

136. In the 2007 and 2008 submissions Belarus reports the implementation of QC procedures for the forest land category. A QA/QC plan for the LULUCF sector is not yet in place. External verification by qualified Belarusian experts has been conducted for the 2008 inventory submission, but no information was included in the NIR because the results did not become available before the submission of the inventory to the UNFCCC secretariat. The ERT recommends that Belarus develop and implement QA/QC procedures and provide information on them in its next inventory submissions.

### **B. Key categories**

#### 1. Forest land remaining forest land – CO<sub>2</sub>

137. The calculation of annual increases in carbon stocks due to biomass increment in the forest land remaining forest land category is based on the IPCC good practice guidance for LULUCF tier 1 method. References for conversion and expansion factors used in the estimates are not provided in the NIR. The forest area data that were used to develop emission and removal estimates were taken from aggregated national forestry statistics (data of State Forest Fund Account of the Republic Belarus for 1988, 1994, 2001, 2005 and 2006), and are reported for only three types of forests (coniferous, hard-wooded broad-leaved, soft-wooded broad-leaved) without differentiation of the tree species and age groups. The ERT considers that it is possible to improve the estimates and to make more precise calculations of carbon stocks in forest land using existing disaggregated data of the national forest cadastre (area of forest stands with differentiation of dominant tree species and age groups) and using specific conversion factors for tree species and age groups. During the in-country review, the Belarusian external experts informed the ERT that it is possible to improve the inventory estimates, using national conversion and expansion factors according tier 2 or tier 3. The ERT welcomes this initiative and recommends that Belarus further develop its inventory using the tier 2 or tier 3 approaches, using disaggregated data from available national forestry statistics, in its next inventory submission.

138. All areas of forests in Belarus seem to be included in the estimates, including unmanaged forests in natural reserves, where timber is not harvested or which are in a natural state. According to the IPCC good practice guidance for LULUCF it is necessary to include in calculations of carbon stock changes only the areas of managed forests. The ERT recommends that Belarus, in its next submission, divide forests into managed and unmanaged for its emissions/removals estimates, in accordance with the IPCC good practice guidance for LULUCF. After the in-country review, Belarus informed the ERT that all areas of forest in Belarus are managed, that human activities are taking place on territory of forest reserves and that on-line monitoring is being performed on the whole territory of forest reserves.

139. Estimates of annual decreases of carbon stocks due to biomass loss in forest land remaining forest land included losses from commercial fellings, fuelwood gathering and forest fires. The ERT considers that this calculation of annual decreases in carbon stocks is incomplete and is not in accordance with the recommendations of the IPCC good practice guidance for LULUCF. The calculation of annual carbon loss due to forest fires is based on timber volume of dead stands and does not include areas of different types of fires (for example, emissions from ground fires with living stands was not estimated). Data on annual carbon loss due to other factors (pests and diseases, windstorms, etc.) are not included in the calculations. According to the IPCC good practice guidance for LULUCF the calculation of annual decreases in carbon stocks should be based on the data on forest areas affected by different types of disturbances. For example, the ERT considers that Belarus may use available national statistical data on different types of forest fires (crowning, ground, underground) for its calculations. During the in-country review, Belarusian external experts indicated that it is possible to improve calculations of carbon stock decreases according the tier 2 or tier 3 approaches. The ERT welcomes this initiative and recommends that Belarus use available statistical data on areas of forests subject to different types of disturbance in its

calculations and fully implement the IPCC good practice guidance for LULUCF for its next inventory submission.

140. For the forest land remaining forest land category the net carbon stock change in dead organic matter (DOM) and the net carbon stock change in soils are reported as “NE”. Some of these carbon pools may be subject to significant changes due to human activities (e.g. erosion due to forest operations), and thus they may be important sources or sinks. The ERT recommends that Belarus estimate and report these emissions and removals in its next submission.

## 2. CO<sub>2</sub> emissions from agricultural lime application (cropland) – CO<sub>2</sub>

141. In CRF table 5.B emissions/removals and carbon stock changes are reported as “NE” for 5.B.1 cropland remaining cropland and “NE”/“NO” for 5.B.2 land converted to cropland, for the complete time series. Net CO<sub>2</sub> emissions for this category are reported only in CRF table 5 and reflect a decrease of 56.6 per cent (from 2,297.33 to 997.26 Gg) for the period 1990–2006. However, these emissions correspond to CO<sub>2</sub> emissions from agricultural lime application category (CO<sub>2</sub> emissions from liming in cropland) reported in CRF table 5(IV). The trend of these emissions is unstable (from 2,297.33 Gg in 1990 to 641.21 Gg in 2000 and 997.34 Gg in 2006). The ERT was not able to find explanations on this trend in the NIR and recommends that they be included in next submissions. Regarding the cropland category, Belarus explained in the NIR that statistical data on carbon content in arable soils for the last 20 years are not available and it was assumed that the change in soil carbon for cropland is zero. The ERT would like to remind the Party that “0” change in soil carbon is an estimation and could not be an assumption, because of the absence of AD. Besides this, due to the large decrease in lime application in the period 1990–2006, the ERT concludes that the input of organic fertilizers decreased in the country as well. In that situation, the balance of soil carbon on cropland should be negative and CO<sub>2</sub> emissions from soils should be reported. The ERT encourages Belarus to make efforts to estimate and report these emissions in its next inventory submission.

### C. Non-key categories

#### Biomass burning – CH<sub>4</sub> and N<sub>2</sub>O

142. Belarus reports non-CO<sub>2</sub> emissions from forest fires. The ERT acknowledges this effort because considerable emissions can occur from forest fires, especially in years when the frequency of fires is high. The methodology for the estimation used by Belarus conforms with the recommendations of the IPCC good practice guidance for LULUCF. However, the ERT suggests that, in its next submission, Belarus further verify the area of forest fires and the EFs used, and develop uncertainty estimates for this category to assess the accuracy of the reported emissions.

### D. Areas for further improvement

#### 1. Identified by the Party

143. The NIR of the 2008 inventory submission of Belarus identifies several areas for improvement in the LULUCF sector, but in some cases the indicated improvements are lacking in detail or are very general. The areas for improvement include:

- (a) Obtaining national forest inventory data;
- (b) Developing country-specific parameters and improving the methodology used to calculate emissions/removals in the LULUCF sector;
- (c) Collecting more precise data on land use and land-use change;
- (d) Collecting necessary AD for calculation of changes in the deadwood carbon pool in forest land;

- (e) Collecting necessary AD for calculation of changes in carbon contents in mineral soils;
- (f) Developing and using QA/QC procedures for the LULUCF sector, and ensuring independent review and assessment of the LULUCF estimates.

## 2. Identified by the ERT

144. The ERT encourages Belarus to make efforts to have an adequate, consistent, complete and transparent approach to represent land areas in its LULUCF inventory in accordance with the IPCC good practice guidance for LULUCF. The ERT recommends using aggregate data from regional or lower level statistics available in Belarus to develop a consistent land representation in the form of a land-use change matrix, and reporting on all the mandatory land conversion categories. The ERT noted that the existing procedures for inventory preparation in the LULUCF sector should be further developed and enhanced in order to enable the provision of accurate information on land areas subject to activities such as deforestation, reforestation, afforestation and forest management, to meet future reporting needs.

145. The ERT recommends that Belarus investigate and clarify the existence of areas with managed and unmanaged forest in the country and report the estimates for the forest land category in accordance with the IPCC good practice guidance for LULUCF in its next inventory submission.

146. The ERT recommends that Belarus use disaggregated data from forestry statistics (with differentiation of areas of forest stands according to dominant tree species and age classes) to estimate annual increases in carbon stocks due to biomass increment in forest land remaining forest land, and use country-specific conversion and expansion factors according the tier 2 or tier 3 approaches of the IPCC good practice guidance for LULUCF.

147. The ERT recommends that Belarus use complete statistical data on areas of forests subject to different types of disturbances and report estimations in accordance with the IPCC good practice guidance for LULUCF in its next inventory submission.

148. The ERT recommends that Belarus include DOM and soil pools in its LULUCF estimates, and provide estimates of change of soil carbon on cropland in its next inventory submission. The ERT would like to note that a modelling approach may be applied for these estimates if other data are unavailable.

## **VII. Waste**

### **A. Sector overview**

149. Emissions in the waste sector reported by Belarus include CH<sub>4</sub> emissions from solid waste disposal on land and N<sub>2</sub>O emissions from human sewage. The other categories in the sector are not estimated or do not occur in Belarus.

150. In 2005, as reported in the 2007 submission, emissions from the waste sector amounted to 4,620.24 Gg CO<sub>2</sub> eq, or 6.1 per cent of total GHG emissions; in 2006, as reported in the 2008 submission, they amounted to 5,118.65 Gg CO<sub>2</sub> eq, or 6.3 per cent. Overall emissions from the sector increased by 98.8 per cent between 1990 and 2006. The key driver for the rise in emissions of the sector is the increase of emissions in the solid waste disposal on land category due to changes in the composition of waste and an increase of waste production by the population (due to changes in the economy). In 2005, as reported in the 2007 submission, CH<sub>4</sub> emissions from solid waste disposal on land made up 95.0 per cent of the total emissions of the sector, and in 2006, as reported in the 2008 submission, they made up 95.4 per cent. The remaining 5.0 per cent in 2005 (submission 2007) and 4.6 per cent in 2006 (submission 2008) was N<sub>2</sub>O emissions from human sewage. The ERT noted that there are no specific differences or changes between the 2007 and 2008 submissions.

### 1. Completeness

151. The CRF includes estimates of most gases and categories of emissions from the waste sector, as recommended by the Revised 1996 IPCC Guidelines. CH<sub>4</sub> emissions from wastewater handling and N<sub>2</sub>O emissions from wastewater handling excluding N<sub>2</sub>O from human sewage are reported as “NE”. CH<sub>4</sub> emissions from managed waste disposal on land and emissions from waste incineration are reported as “NO”. The ERT recommends that Belarus, in its next inventory submission, make the necessary efforts to report emissions from the categories that are currently not estimated.

### 2. Transparency

152. The NIR does not provide enough information on the methodologies, AD and EFs applied in estimating emissions from the waste sector, and in some cases is not consistent with data reported in the CRF tables. For example, Belarus did not provide explanations of calculations of DOC and N<sub>2</sub>O emissions from human sewage reported in the NIR, which were inconsistent in some respects with the CRF tables. The ERT recommends that Belarus provide more detailed information on methodologies, AD and EFs, and related background information such as estimation of DOC, in the NIR of its next inventory submission, and correct all inconsistencies between the NIR and the CRF tables to improve transparency of the inventory.

### 3. Time-series consistency

153. There are some significant inter-annual variations in the estimates of CH<sub>4</sub> emissions from solid waste disposal on land in the period 1990–2006. In this period, Belarus reports an increase in emissions from 111.83 to 232.63 Gg (108.0 per cent). However, for 1993–1994 Belarus reports an unusual decrease of 19.9 per cent in CH<sub>4</sub> emissions, whereas for 1995–1996 the emissions increase by 22.6 per cent and for 2002–2003 they increase by 34.5 per cent. During the in-country review, Belarus provided acceptable explanations for inter-annual variations based on statistical data and DOC analysis. Belarus explained that DOC is analysed once every 5 years. In addition, Belarus informed the ERT that it is conducting research for the development of national EFs in the waste sector and as a result it is expected to have more accurate data for DOC. The ERT recommends that Belarus ensure time series consistency for the inventory estimates, using available data and country-specific parameters, and that it include information on inter-annual variations in its next inventory submission.

### 4. Uncertainties

154. In the 2007 and 2008 submissions the uncertainty for emission estimates in the waste sector is reported as  $\pm 33.5$  per cent. The ERT considers that uncertainties for the sector could be higher than reported. It recommends that Belarus provide more accurate estimates, based possibly in country-specific values, for its uncertainty estimation, and provide more detailed explanations on uncertainty calculations (tier, parameters, etc.) in the NIR of its next submission.

### 5. Verification and quality assurance/quality control approaches

155. No QA/QC plan or verification procedures are reported in the NIR. During the in-country review, Belarus informed the ERT of the verification activities carried out by external qualified experts on the 2008 inventory submission, but no information was included in the NIR because the results were not available before the submission of the inventory to the UNFCCC secretariat. The ERT recommends that Belarus establish a QA/QC plan for the waste sector and implement QA/QC procedures, including continuation of the verification activities, and that it report on these in its next submission.

## **B. Key categories**

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

156. Belarus has defined all SWDS as unmanaged for the complete time series because of the absence of control of scavenging at the landfills, but it informed the ERT during the in-country review that all other control and management measures are implemented. The ERT recommends that Belarus reconsider the current classification of SWDS, and use for its estimations all available statistical data and results from researches available in the country, including country-specific data, and definitions and recommendations of the IPCC good practice guidance.

157. Belarus reported that the methodology used for estimates of this category is the IPCC tier 1. The ERT notes that it is good practice to apply the tier 2 method (first order decay) for key categories and it recommends that Belarus apply a higher tier for estimating CH<sub>4</sub> emissions from solid waste disposal on land in its next inventory submission.

## **C. Non-key categories**

### 1. Wastewater handling – CH<sub>4</sub>

158. CH<sub>4</sub> emissions and recovery from industrial, domestic and commercial wastewater handling are reported as “NE”. Belarus explained in the NIR that the basic way of treating domestic and industrial sewage in the country is biological under aerobic conditions. The ERT recommends that Belarus use all available statistical data and results from researches in the country, which indicate that a small amount of anaerobic wastewater treatment exists, and report emissions from industrial, domestic and commercial wastewater handling in its next inventory submission.

### 2. Wastewater handling – N<sub>2</sub>O from human sewage – N<sub>2</sub>O

159. Belarus reported N<sub>2</sub>O emissions from human sewage in the NIR of the 2007 submission with some inconsistencies compared with CRF table 6.B. In table 8.6 of the NIR the N fraction reported is 0.61, whereas Belarus calculated the N<sub>2</sub>O emissions with an N fraction of 0.16 (CRF table 6.B). During the in-country review, Belarus indicated that the correct value of 0.16 is used in calculations. This mistake was corrected in the 2008 NIR. The ERT recommends that Belarus fully implement QA/QC procedures and improve consistency between the NIR and the CRF tables in its next inventory submissions.

160. Belarus reports an increase in protein consumption of 9 per cent for the period 1990–2006 (28.3 kg/person per year in 1990 and 30.84 kg/person per year in 2006), which is an unusual trend for a country with an economy in transition. The ERT recommends that Belarus investigate and explain reported changes of protein consumption in the period from 1990 to 2006 in its next inventory submission.

## **D. Areas for further improvement**

### 1. Identified by the Party

161. Belarus has identified some areas for improvement in the waste sector in the 2007 NIR, such as the need to improve and develop country-specific EFs, and to improve data collection procedures and estimates of emissions from wastewater handling. Belarus also identified the need to improve its QA/QC procedures and implement verification activities. In its 2008 NIR, Belarus has identified some additional areas for improvement in the waste sector, such as the need to determine the amount of managed and unmanaged SWDS in the country and to develop country-specific EFs.

## 2. Identified by the expert review team

162. The ERT recommends that Belarus revise and recalculate estimates of solid waste disposal on land and wastewater handling in its next submission, to take into account the waste management practices in the country and the IPCC good practice guidance. In addition, the ERT recommends that Belarus provide more detailed information on methodologies, AD and EFs in the NIR of its next inventory submission in order to improve the transparency of the estimates; that it implement QA/QC procedures, including consistency checks for the input data and calculation results, in order to avoid mistakes and omissions; and that it continue with verification activities using external experts.

## VIII. Conclusions and recommendations

163. The 2008 inventory submission covers almost all source and sink categories for the period 1990–2006 and it is complete in terms of years and geographical coverage. Belarus has provided inventory data in the CRF tables for the years 1990 to 2006, but did not provide CRF table 8(a), table 8(b) and table 9(b). Belarus has not estimated actual and potential emissions of F-gases for 1990 and in the latest years it has not estimated potential emissions of F-gases from the category 2.F consumption of halocarbons and SF<sub>6</sub> and some probably minor categories. The ERT recommends that Belarus report in the NIR and relevant CRF tables detailed information on recalculations performed, with explanatory information, including the rationale for recalculations, report estimates for all missing categories, in particular actual and potential emissions from F-gases for the complete time series, and provide in the NIR discussions of these categories and other potential sources or sinks not yet addressed.

164. The emissions from all categories were estimated mainly using a tier 1 methodology and IPCC default EFs that are constant for the complete time series. The ERT encourages Belarus to make efforts to apply higher tier methodologies for key categories according to the IPCC good practice guidance, and in particular to make use of country-specific parameters in its next inventory submission.

165. The ERT also encourages Belarus to implement the following key recommendations:

- (a) Increase the number of qualified staff in the BelRC “Ecology” and ensure financial resources and wide support for the inventory team of the BelRC “Ecology” in order to ensure a sustainable compilation of inventories in accordance with the UNFCCC reporting requirements;
- (b) Ensure participation in the inventory preparation of the highly qualified experts and institutions available in Belarus and use their recommendations to improve estimates of emissions and removals at sectoral and national levels, in particular for the energy and LULUCF sectors;
- (c) Improve the NIR structure and transparency by including additional information and explanations on methodologies, EFs, assumptions for choosing parameters and sources of AD, as well as better descriptions of individual sectors, to fully reflect the requirements of the UNFCCC reporting guidelines;
- (d) Develop and implement a national QA/QC plan and include descriptions of the QA/QC and verification activities and procedures in the sectoral chapters of the NIR;
- (e) Develop a system for collection of AD and EFs with the goal of improving estimates and closing all gaps. Particular attention should be given to the availability of detailed and complete energy balances starting from 1990;
- (f) Devote particular attention, efforts, staff and resources to the planning, preparation and management of the LULUCF inventory.

166. After the in-country review, Belarus informed the ERT that it will implement most of the recommendations for general and cross-cutting aspects of inventory preparation and detailed recommendations for all sectors in its next submissions. The ERT acknowledges this information and encourages Belarus to implement all these recommendations, as far as possible, in its next submission.

Annex**Documents and information used during the review****A. Reference documents**

Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <<http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at <<http://www.ipcc-nggip.iges.or.jp/public/gp/english/>>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <<http://www.ipcc-nggip.iges.or.jp/public/gp/landuse/gp/landuse.htm>>.

“Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories”. FCCC/SBSTA/2006/9. Available at <<http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>>.

“Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention”. FCCC/CP/2002/8. Available at <<http://unfccc.int/resource/docs/cop8/08.pdf>>.

Status report for Belarus 2007. Available at <<http://unfccc.int/resource/docs/2007/asr/blr.pdf>>.

Status report for Belarus 2008. Available at <<http://unfccc.int/resource/docs/2008/asr/blr.pdf>>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2007. Available at <<http://unfccc.int/resource/webdocs/sai/2007.pdf>>.

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

FCCC/ARR/2006/BLR. Report of the individual review of the greenhouse gas inventory of Belarus submitted in 2005. Available at <<http://unfccc.int/resource/docs/2006/arr/blr.pdf>>.

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

Responses to questions during the review were received from Mr. Ivan Narkevitch (Belarusian Research Centre “Ecology”), including additional material on the methodology and assumptions used. The following documents were also provided by Belarus:

Republic of Belarus, 2007. Statistical Yearbook. [Minsk, 2007], 620 pp. ISBN 978 985 6858 17 1.

Republic of Belarus, 2008. Agriculture in the Republic of Belarus. Statistical Yearbook. [Minsk, 2008], 150 pp. ISBN 978 985 6858 04 1.

Spreadsheet on areas of organic soil area, which included data for years 1990, 1995, 1999 and 2000, and spreadsheet for 2005 (officially provided by the Ministry of Agriculture of Belarus).

Spreadsheet of data on manure management system usage for years 1990, 2005, 2006 and 2007 (officially provided by the Ministry of Agriculture of Belarus).

Spreadsheets of data on nitrogen fertilizer for years 2005 and 2006 (officially provided by the Ministry of Agriculture of Belarus).

“Soils of agricultural land” including data of harvested organic soil area of year 2000. Published by the State Property Committee of Belarus in 2001.

“Agriculture of the Republic of Belarus” including data on fertilizer and animal production. Published by the Ministry of Statistics and Analysis of Belarus in 2008.

“First national communication in response to Belarus’s commitment under the UN Framework Convention on Climate Change”. Published by World Bank and Ministry of Natural Resources and Environmental Protection of Belarus in 2003.

Table formats for statistical data collection for monthly livestock farming, yearly livestock farming and mineral and organic fertilizer application. Ministry of Statistics and Analysis of Belarus.

-----