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

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

CONTENTS

I. Executive summary

1. This report covers the in-country review of the 2005 greenhouse gas (GHG) inventory submission of Poland, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 26 to 30 September 2005 in Warsaw, Poland, and was conducted by the following team of nominated experts from the roster of experts: Generalist – Mr. Jan Pretel (Czech Republic); Energy – Mr. Dario Gomez (Argentina); Industrial Processes – Mr. Jos Olivier (the Netherlands); Agriculture – Mr. Joe Mangino (United States of America); Land Use, Land-use Change and Forestry (LULUCF) – Ms. Thelma Krug (Brasil); Waste – Mr. Jos Olivier (the Netherlands) and Mr. Jan Pretel (Czech Republic); Mr. Jan Pretel and Mr. Dario Gomez were the lead reviewers. The review was coordinated by Mr. Stylianos Pesmajoglou and Mr. Matthew Dudley (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 Poland, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

3. In 2003, the most important GHG in Poland was carbon dioxide (CO_2), contributing 83.4 per cent to total[1] national GHG emissions expressed in CO_2 equivalent, followed by methane (CH_4), 9.8 per cent and nitrous oxide (N_2O), 6.3 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) taken together contributed 0.5 per cent of the overall GHG emissions in the country. PFCs contributed 0.07 per cent, HFCs 0.43 per cent and SF_6 0.005 per cent. The Energy sector accounted for 85.5 per cent of total GHG emissions, followed by Agriculture (6.7 per cent), Industrial Processes (4.7 per cent) and Waste (2.9 per cent). Total GHG emissions amounted to 382,642 Gg CO_2 equivalent and decreased by 32.2 per cent from the base year (1988[2]) to 2003.

4. Over the reporting period 1988–2003, CO_2 emissions decreased by 34 per cent, mainly due to decreased emissions from fuel combustion (except for Transport, which saw an increase by 8 per cent) in the Energy sector. Emissions of CH_4 decreased during the same period by 43 per cent, mainly due to decreased emissions from enteric fermentation in the Agriculture sector; N_2O emissions increased by 10 per cent over the same period, in particular due to the inclusion of emissions from manure management in the Agriculture sector, not previously accounted for. HFC, PFC and SF_6 emissions taken together increased by 129 per cent over the period, mainly due to an increase in the use of HFC-134a.

5. Poland has provided a national inventory report (NIR) and almost all the common reporting format (CRF) tables for 2003. The notation keys have not been used fully or consistently across the CRF tables. Trend tables are provided for the years 1988–2003, and for fluorinated gases (F-gases) for the period 1995–2003. Poland provided CRF tables for the years 2000, 2001 and 2002 in previous submissions.

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[1] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding LULUCF, unless otherwise specified. Poland has not provided the tables of the common reporting format for LULUCF as required by decision 13/CP.9 using the land use categories of the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-use Change and Forestry*. Instead it has used the common reporting format tables for Land-use Change and Forestry as contained in the common reporting format adopted by decision 18/CP.8, which are based on the categories of the Intergovernmental Panel on Climate Change *Revised 1996 Guidelines for National Greenhouse Gas Inventories*.

[2] Pursuant to Article 4.6 of the Convention and in accordance with decision 9/CP.2, Poland uses 1988 as the base year for its GHG inventory.

6. The NIR contains only very brief descriptions of some of the methodologies used. The structure of the NIR is not fully consistent with the "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the revised UNFCCC reporting guidelines), since full sectoral descriptions are missing. The NIR does not contain any activity data (AD) (except for the Energy sector) or emission factors (EFs). The information in the NIR is not sufficient to enable a full understanding of the underlying assumptions and methodological choices, in particular for country-specific approaches. The absence of this information makes it difficult to reproduce the estimates reported in the inventory. However, Poland provided comprehensive and useful information to the expert review team (ERT) during the review. The NIR contains a key category analysis, for both level and trend, as well as very brief and general explanations of quality assurance/quality control (QA/QC) approaches. Qualitative uncertainty estimates based on tier 1 for 2003 were also provided (except for LULUCF and F-gases). Poland, in its NIR, acknowledges that full recalculations for the whole 1988–2003 time series is required for many source categories, among them several key categories.

7. Poland is working towards the preparation of a more complete, consistent and transparent inventory, and some progress has been made compared to its 2003 GHG inventory submission (reviewed as part of a centralized review in 2003). During the in-country review the Polish inventory team identified a number of areas for further improvement for each sector. Unfortunately, there are still significant gaps, which will make it difficult for Poland to meet all its reporting requirements under the Convention (this may also apply to the Kyoto Protocol), unless the Party makes significant improvement to its capacities under the current institutional arrangements, and increases the financial resources allocated for the GHG inventory compilation process.

8. The main problems and inconsistencies identified in the Polish inventory are the following:

(a) Different methodologies and EFs have been used for different years, causing time-series inconsistencies in the reporting of trends;

(b) No inventory recalculations have been provided; the GHG inventory data for all years, including the base year (1988), need to be recalculated and provided using the CRF format in order to comply with the UNFCCC reporting requirements. This information would also be important under the Kyoto Protocol;

(c) The structure of the NIR does not follow the revised UNFCCC reporting guidelines and there is not sufficient and transparent documentation in the NIR on methodologies, EFs and AD used, or on underlying assumptions. This limits the transparency of the submission;

(d) Regarding country-specific methodologies and EFs, more information is needed in order to make it possible to assess comparability, accuracy and completeness of the inventory;

(e) Estimated quantitative uncertainties for the main GHGs are surprisingly low, probably because of underestimation of uncertainties for AD and EF, and failure to include all categories;

(f) Because of lack of resources, QA/QC procedures related to tier 1 are implemented only to a certain extent; no formal QA/QC plan has been developed yet.

9. Details on these cross-cutting issues and recommendations for improvements are provided in the relevant sector sections of this report.

Table 1. Greenhouse gas emissions by gas, 1988–2003

GHG emissions	Gg CO_2 equivalent															Change 1990–2003 (%)
	1988	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	
CO_2 (with LULUCF)	441 879	336 034	324 202	330 776	322 954	329 635	305 292	329 914	321 105	307 627	286 233	271 718	264,205	271,668	293 178	–34
CO_2 (without LULUCF)	476 625	380 697	366 959	371 591	363 133	371 588	348 172	372 530	361 626	337 448	329 697	314 812	317,844	308,277	319 082	–33
CH_4	65 954	58 824	54 365	51 957	5 1065	51 811	51 602	47 299	47 850	49 045	47 254	45 852	38,820	37,791	37 686	43
N_2O	2 1840	19 428	16 126	15 562	1 5426	15 574	16 734	16 715	16 743	15 984	23 284	23 895	23,946	22,633	23 936	10
HFCs	0.0	0.0	0.0	0.0	0.0	0.0	22	68	192	224	555	890	1,283	1,257	1 655	7 269
PFCs	0.0	0.0	0.0	0.0	0.0	0.0	820	775	829	810	777	720	881	266	263	68
SF_6	0.0	0.0	0.0	0.0	0.0	0.0	2	1	3	6	17	17	18	18	19	686
Total (with CO_2 from LULUCF)	529 673	414 286	394 693	398 295	389 445	397 020	374 473	394 772	386 722	373 695	358 120	343 092	329,152	319,543	356 737	–33
Total (without CO_2 from LULUCF)	564 419	458 949	437 450	439 110	429 624	438 973	417 353	437 388	427 243	403 516	401 584	386 185	382,791	370,243	382 642	–32

Note: Many sources have not been recalculated consistently for the whole time series.
LULUCF = Land Use, Land-use Change and Forestry.

Table 2. Greenhouse gas emissions by sector, 1988–2003

Sectors	Gg CO_2 equivalent															Change 1990–2003 (%)
	1988	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	
Energy	492 473	394 941	379 652	380 031	375 534	384 141	360 751	386 803	373 994	347 618	338 766	321 907	327 222	318 490	327 169	–34
Industrial Processes	20 141	14 489	13 523	14 779	13 509	14 075	16 128	15 040	16 797	15 718	15 867	18 498	17 319	14 820	18 113	–10
Solvent and Other Product Use	0	0	0	0	0	0	0	0	0	0	0	0	0	0	474	n.a.
Agriculture	31 516	30 476	26 328	24 538	23 085	22 790	22 669	21 856	22 228	21 898	27 940	26 368	25 838	24 982	25 700	–18
LULUCF	–34 736	–44 658	–42 754	–40 811	–40 175	–41 948	–42 877	–42 613	–40 516	–29 817	–43 462	–43 090	8 688	–36 609	–25 902	–25
Waste	20 279	19 038	17 945	19 758	17 491	17 962	17 801	13 685	14 220	18 278	19 008	19 408	12 409	11 947	11 183	–45
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	n.a.

Note: Many sources have not been recalculated consistently for the whole time series.
LULUCF = Land Use, Land-use Change and Forestry.
n.a. = not applicable.

II. Overview

A. Inventory submission and other sources of information

10. Poland submitted CRF tables for the year 2003 on 18 July 2005 and an NIR on 31 August 2005. During the review, the ERT used previous years' submissions, including the CRF tables for the years 2000, 2001 and 2002, where needed.

11. During the in-country visit, Poland provided additional information, including the worksheets used to calculate emission estimates, which were not part of the inventory submission, but in several cases are referenced in the NIR. The full list of materials used during the review is provided in the annex to this report.

B. Key categories

12. Poland has reported a key category tier 1 analysis, for both level and trend assessment, as part of its 2005 submission. The key category analysis performed by the Party and the secretariat[3] produced similar results. Poland identified 28 key categories in total, 26 of them on level assessment, and 16 on trend assessment. The secretariat identified seven key categories, all of them on level assessment.

13. Poland identified more key categories due to its higher level of disaggregation of categories for the Energy sector (16 key categories in total); however, in other sectors it used a lower level of disaggregation. Poland also identified all key categories identified by the secretariat.

14. The ERT identified CO_2 emissions from inputs to the iron and steel industry (category 2.C.1) as an additional key category, which is partly included in the NIR under CO_2 Emissions from Stationary Fuel Combustion of hard coal/coke. The ERT also recommends that CO_2 emissions from Waste Incineration be considered as a key category because these emissions are likely to increase in future.

15. The key category analysis is considered by Poland to be a critical factor for the preparation of its next submissions and for setting priorities for the development of more advanced methodologies.

C. Cross-cutting topics

1. Completeness

16. The Polish inventory includes estimates of emissions from most major sources. However, emissions from 21 sources identified by Poland in the NIR are not included and several source categories are only partially covered. Poland stated that these source categories will probably have only a small impact on total national emissions.

17. Not estimated are CO_2 emissions from industrial processes, in particular from conversion losses in blast furnaces and in coke production; and limestone and dolomite use (e.g. in steel and glass production). Emissions from these sources could amount to several Tg CO_2. Also missing are indirect N_2O emissions from agricultural soils. Notable sources that are partially reported are fugitive emissions

[3] The secretariat identified, for each Party, those source categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Key categories according to the tier 1 trend assessment were also identified for those Parties that provided a full set of CRF tables for the year 1990. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key-category assessment conducted by the secretariat.

(in category 1.B), emissions of F-gases in category 2.F and emissions from waste incineration (in category 6.C). Additional material referring to the year 2002 that was provided during the review indicated that CO_2 emissions from industrial waste incineration may be a very significant source of emissions.

18. The information provided in the NIR on methodologies, AD and EFs is limited, but uncertainties and a key category analysis are quite sufficiently described. In many cases, the information is limited in detail and incomplete, which also influences the transparency of inventory.

2. Transparency

19. The NIR and the CRF are not sufficiently transparent to facilitate the review of the inventory. Detailed information on methodologies used, underlying assumptions and national choices for AD and EFs is missing. It is not clear how the use of national models or country-specific EFs improves the quality of the inventory data, because the rationale for choosing them is not explained in the NIR. In addition, information based on expert judgement is not adequately documented.

20. The CRF methods/EFs table and completeness tables are filled in, but not completely and not always correctly. Notation keys are not always correctly used in the CRF tables (Industrial Processes, Waste). The ERT encourages the national experts to use the notation keys consistently to improve completeness. Specific comments on the use of the notation keys are provided in the relevant sector sections below.

21. Documentation is an area of particular importance that requires improvement. Upon request, Poland provided additional information that was not included in the NIR. The ERT strongly recommends that Poland improve the transparency of the inventory by including such information in the NIR and the CRF documentation boxes, where relevant, in its future submissions. More information is needed on the methodologies used, particularly for the Industrial Processes, Agriculture and Waste sectors.

3. Recalculations and time-series consistency

22. The ERT noted that Poland has reported no recalculations. Several new source categories that were included in the 2005 inventory have not been accounted for in previous submissions. Poland expressed its intention to provide revised estimates for the complete time series subject to availability of human and financial resources. Specific attention will be given to the base year (1988). The ERT recommends that sufficient resources be made available to produce accurate and complete time series of GHG estimates.

23. It was difficult, if not impossible, for the ERT to assess emission trends, because Poland has used the *1995 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories* methodology for inventory estimates for the years 1988, 1990, 1992 and 1994 and because a complete set of CRF tables for the years 1988–1999 is lacking. The time series is incomplete and inconsistent due to the use of different methodologies, and different EFs, for different years. Inter-annual variations have not been explained in the NIR or during the review.

4. Uncertainties

24. Poland has provided qualitative uncertainty estimates using CRF table 7. The majority of emissions estimates are assessed as being of medium or high quality, but there is no further explanation of this assessment in the NIR.

25. In addition, the NIR provides quantitative uncertainty assessment, which was performed with tier 1 methodology. The LULUCF sector and F-gases have not been considered for this assessment. A

simplified methodology based on assumptions that every value is independent and probability distribution is symmetric is used for this assessment. Estimated values for the three main GHG gases (CO_2 – 1.7 per cent, CH_4 – 9.6 per cent, and N_2O – 12.6 per cent) are surprisingly lower than those estimated by the majority of Parties included in Annex I to the Convention (hereinafter referred to as Annex I Parties). This is probably due to the underestimation of uncertainty for AD and EFs of some of the larger sources, the failure to include all categories for which estimates have been reported and the fact that sources such as indirect N_2O emissions from agricultural soils are not estimated in the inventory.

26. In most cases, uncertainty estimates for AD and EFs are based on expert judgement, which Poland considers to be sufficiently reliable. No specific documentation was available to the ERT to support this information. The uncertainty in N_2O from agricultural soils is very low when compared to similar values reported by other Parties, and also given that indirect emissions are not included. The uncertainty in CH_4 from landfills is very low given the tier 1 method applied. Also the uncertainty in the AD on waste incineration will be much higher since the inventory does not capture existing industrial incineration facilities.

5. Verification and quality assurance/quality control approaches

27. Poland states in the NIR that a formal QA/QC procedure, including a verification plan for the national inventory, has not yet been implemented. However, as explained during the review, several checks are routinely carried out to eliminate potential basic errors. Calculated values are compared to the respective figures from previous years and outliers are individually scrutinized in more detail. These procedures are not well documented, and are applied as regular internal and partly external checks. In addition, there is a lack of QA/QC procedures for the establishment of country-specific EFs, which are based on expert judgement.

28. The Party expressed its intention to implement as soon as possible QA/QC procedures in accordance with the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) subject to availability of human and financial resources.

6. Institutional arrangements

29. During the review, Poland explained the institutional arrangements for the preparation of its GHG inventory. The National Emission Centre (NEC), under commission by the Polish Ministry of Environment, has the overall responsibility for preparing the national GHG emission inventory. It compiles the final submission with input from agencies, organizations and individual experts such as the Agency of Energy Market (Energy sector), the Polish Institute of Automobile Transport (ITS) (Transport), Silvatica Research Consultants, the Institute of Ecology of Industrial Areas, Katowice, and Bureau of Forest Management (LULUCF), the Institute of Industrial Chemistry, Warsaw (F-gases). There is also a special arrangement with the Central Statistical Office under which the NEC can obtain preliminary data before they are published. Furthermore, consumption data of HFCs and PFCs per application are collected through regular surveys by the Ministry of Environment under the ozone depleting substance (ODS) licensing system of manufacturers of these applications and of importers of products that contain HFCs and PFCs and of HFCs and PFCs in bulk.

30. This cooperation between the NEC and agencies, organizations and individual experts is based mostly on ad hoc agreements, which could reduce its stability and regularity in future.

7. Record keeping and archiving

31. Poland has a partly centralized but non-systematic archiving system for all documents and information needed for the reconstruction of all years of the inventory. The NEC maintains electronic

and hard copies of all NIRs and CRFs and other data, including calculation sheets and reference studies. The vast majority of background documents and reports are available only in Polish. Some background data and information are available only from cooperating agencies and organizations.

8. Follow-up to previous reviews

32. Compared to previous submissions, the transparency of the inventory has improved, but only slightly. Errors identified in the CRF tables have been corrected and some efforts have been made to improve the uncertainty assessment. The ERT recognized the technical expertise of the team members responsible for the inventory preparation. However, their efforts are hampered by inadequate human and financial resources. The major pending issue is the completion of the full time series, which has already been identified for the Party as a priority for improvement of the inventory. The ERT recognized that for most sectors there exist extensive sets of data as well as systems for data collection and processing.

D. Areas for further improvement

1. Identified by the Party

33. The NIR does not identify any areas for further improvement. In its response to the issues raised during the review, Poland indicated that it is working towards making the following improvements:

(a) Recalculation and revision of the entire time series of the inventory with specific focus on several new source categories, which were included into the 2005 inventory, giving top priority to the recalculation of the base year GHG estimates;

(b) Inclusion of CRF tables for the years 1988–1999, including some additional sources, in the next inventory submission;

(c) Improvement of formal QA/QC procedures;

(d) Improvement of the quality of estimation of CO_2 removals in the LULUCF sector and CO_2 emissions/removals from agriculture soils to facilitate implementation of the IPCC *Good Practice Guidance for Land Use, Land-use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) on time and in a proper manner.

2. Identified by the ERT

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

(a) Provide in the NIR descriptions of methodologies and references for country-specific EFs that differ from the IPCC defaults, giving priority to key categories;

(b) Give top priority to the recalculation of the base year GHG estimates;

(c) In parallel with an improvement of QA/QC procedures, prepare a formal verification plan;

(d) Review and check the correctness and completeness of quantified uncertainty estimates;

(e) Improve transparency by:

(i) Providing a complete recalculated time series using the CFR tables;

(ii) Including all background information and references in the NIR on methodologies, references for AD, underlying assumptions and country-specific EFs, giving priority to key categories;

(iii) Proper and consistent use of the notation keys, and more extensive use of the documentation boxes in the CRF;

(f) Improve transparency on the allocation and verification of the completeness of CO_2 emissions from iron and steel production and from coke production.

35. The ERT recognized that the NEC has the relevant technical expertise to complete the national GHG inventory. However, additional capacity and appropriate resources will be needed if Poland is to implement the improvement plans. In this regard, the ERT urged Poland to consider involving additional national experts for the inventory preparation, particularly for the Industrial Processes, Agriculture, LULUCF and Waste sectors; and to consider increasing the financial resources allocated for the inventory preparation in view of the urgent need to meet the UNFCCC reporting requirements.

36. ERT encourages Poland to give highest priority to the completion of the national inventory and establishing a formal national inventory system by 1 January 2007.

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

III. Energy

A. Sector overview

38. In 2003, emissions from the Energy sector (327,169.28 Gg CO_2 equivalent) constituted 85.5 per cent of the total net emissions of Poland. According to the key category analysis undertaken by the secretariat, this sector includes five key categories, namely four sources for CO_2 (coal, oil and gas from stationary combustion, together with one mobile combustion source, road vehicles) and one source for CH_4 (coal mining and handling from fugitive emissions). Poland performed a key category assessment at a more disaggregated level and 16 key categories were identified for the Energy sector. In general terms, the aggregated results of the Party are in agreement with those of the secretariat, indicating the relevance of the sources mentioned. Two extra key categories for CH_4 have been identified from the Party's level assessment (natural gas systems from fugitive emissions and fuelwood from stationary combustion).

39. Overall GHG emissions from the Energy sector in 2003 showed a decrease of 33.6 per cent compared to 1988 and an increase of almost 3 per cent with respect to 2002. These trends are dominated by CO_2 emissions from fuel combustion activities. The variations between 1998 and 2003 for each gas are: CO_2 (–33.7 per cent), CH_4 (–34.7 per cent) and N_2O (+ 4.4 per cent). Poland indicates in the NIR that the most important decrease in emissions occurred in the period 1988–1990 and is largely a consequence of the decline in industrial activity. The remaining reduction is mostly ascribable to fuel use switching and to a lesser degree to an increase of energy efficiency in the industrial sector. The increasing trend in N_2O emissions is dominated by the incremental emissions in manufacturing industries and construction (71 per cent) and transport (56 per cent).

40. Within the Energy sector, a substantial amount of GHG emissions (56 per cent) derive from energy industries, followed by contributions from other sectors (15.4 per cent), manufacturing industries and construction (13.3 per cent), and transport (9.5 per cent). Fugitive emissions from fuels contributed the remainder (5.8 per cent) of total GHG emissions.

41. In 2003, CO_2 emissions from fuel combustion represented 93.8 per cent of the total GHG emissions of the Energy sector. Most of the CO_2 emissions from fuel combustion (73.5 per cent) arise from the use of coal with lesser shares of liquid (19.2 per cent) and gaseous fuels (7.3 per cent).

1. Completeness

42. The CRF contains estimates of emissions for all direct and indirect GHGs related to fuel combustion. Fugitive emissions arising from coal mining are only estimated for CH_4. Fugitive emissions for CO_2 and CH_4 from oil and natural gas systems are only included for the production of oil and the production, transmission and distribution of natural gas. Poland does not report in the NIR the reasons for not providing the complete set of estimates for fugitive emissions. The ERT encourages Poland to make the necessary efforts to report estimates of all fugitive emissions.

2. Transparency

43. Although key features concerning the methodological approaches used to estimate emissions for the Energy sector, particularly those arising from stationary combustion, are summarized in the NIR, the information available is not sufficient to facilitate the review of the sector. Furthermore, the information reported in CRF Summary table 3 on methods and EFs used is not always consistent with that provided in the NIR. While the CRF indicates that only tier 2 methods are used to estimate emissions arising from fuel combustion, and that only country-specific methods are used to estimate fugitive emissions, the NIR indicates (although not in a transparent manner) that different tier approaches are used in the different subcategories. The ERT encourages Poland to provide a complete discussion on the methodologies used in its future submissions and also to show in CRF Summary table 3 the nature of the multiple tiers used in the different subcategories.

44. The sources for AD used to estimate emissions for the Energy sector are listed in the NIR for all subcategories of Stationary Combustion and at the category level for Mobile Combustion and Fugitive Emissions. The NIR includes the national energy balance from two sources, namely the Polish Central Statistical Office, published in Poland, and the data report by Poland to the International Energy Agency (IEA), in both mass and energy units. The so-called energy budgets that are key to estimating emissions from stationary combustion are also provided in the NIR for the main fuel used in Poland. The ERT commends Poland for the thorough presentation of the data sources used to estimate emissions from stationary combustion and encourages it to provide similar information for the AD used to estimate emissions from mobile combustion and fugitive emissions.

45. CRF Summary table 3 indicates that only country-specific EFs for all GHGs are used to estimate emissions in the Energy sector. The NIR provides only a reference (in Polish) for the sources for these country-specific EFs. During the review visit, Poland informed the ERT that the EFs used are a combination of country-specific EFS, IPCC default values and international references. The ERT recommends that Poland include the complete set of EFs used to estimate the emissions for all subcategories of the Energy sector in its future submissions and also discuss the background information concerning the derivation of the country-specific values.

3. Uncertainties

46. Uncertainty analysis was performed using the IPCC tier 1 method. The estimated uncertainties for the Energy sector are (in percentages) 1.6 (CO_2), 3.7 (N_2O) and 10.2 (CH_4). The uncertainty values calculated, particularly those for non-CO_2 gases, appear to be rather low. This may be related to the uncertainties selected for CH_4 EFs (10.5–41.8 per cent) and N_2O (2.3–37 per cent). Poland indicates in the NIR that AD uncertainty depends on the consumption level (the higher the consumption, the lower the associated uncertainty) and that EF uncertainties are based on expert judgement and also on an analysis made by the inventory team of the GHG inventory of other countries. Concerning AD uncertainty, the ERT recommends that Poland include in its future NIRs a discussion relating the quality of fuel consumption surveys (*Energy Statistics 2002–2003*, 2004) to the uncertainty values adopted. For EF uncertainties, the ERT recommends that Poland re-examine the values adopted to perform the

analysis and compare these values with other available information for different countries (Charles et al., 1998; EIA, 1999; Monni et al., 2004; Rypdal, 1999; Rypdal and Winiwater, 2001; van Amstel et al., 2000; and Winiwarter and Rypdal, 2001). It is also suggested that, when selecting EF uncertainties, the nature of the EF (country-specific, IPCC default or taken from international reference) be carefully considered and that information be provided on the rationale for adopting the values, including the procedures used for eliciting expert judgement.

B. Reference and sectoral approaches

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

47. In 2003, the difference in CO_2 emissions from total fuel combustion using the reference and the sectoral approaches was 0.9 per cent. By type of fuel, the differences were 0.54 per cent for solid fuels, –0.71 per cent for liquid fuels and 8.79 per cent for gaseous fuels. IPCC default values are used to estimate the fraction of carbon stored. During the review visit, the ERT discussed with the inventory team the manner in which the use of fuels as feedstock and the non-energy use of fuels are handled, both in the reference and in the sectoral approaches. It became apparent that Poland uses detailed energy statistics that allow disaggregation of the fraction of carbon stored. The ERT encourages Poland to revise the calculation performed and, in light of the available data on non-energy products, consider whether it is appropriate to use a value of 1 for the fraction of carbon stored in CRF table 1.A(d).

48. Poland has added two extra rows in CRF table 1.A(b) to deal with the two types of natural gas (high-methane and nitrified). Although these two types of fuel are dealt with in a transparent manner, for comparability purposes it is recommended that Poland provide the information on natural gas in an aggregated manner without modifying the CRF table, leaving the disaggregated treatment of gaseous fuels for the NIR.

2. International bunker fuels

49. No information is provided either in the NIR or in the documentation box of CRF table 1.C about the allocation of fuel consumption between domestic and international transportation. During the review visit, Poland indicated to the ERT that energy statistics from the Polish Central Statistical Office consider bunker fuels as those purchased abroad by the Polish shipping fleet (including the fishing fleet), aircraft and other transport vehicles, while sales of fuels in Polish harbours to foreign shipping fleets and in Polish airports to foreign aircraft are included as exports (*Energy Statistics* 2002–2003, 2004). For the purposes of the GHG inventory and to line with the suggestions of the IPCC good practice guidance, the AD for international aviation are compiled ad hoc from disaggregated (non-published) information available from the Polish Energy Market Agency. Fuel consumption in international navigation is adopted from the IEA database. To improve transparency, the ERT reiterates previous recommendations indicating that a description of the methodology used to estimate bunkers should be included in the NIR, and encourages Poland to incorporate at least the specific information on bunker fuels in the table on data sources on fuel consumption for category 1.A Fuel Combustion that has been already included in the NIR.

3. Feedstocks and non-energy use of fuels

50. Activity data on feedstock and non-energy use of fuels are available from the Central Statistical Office and the Energy Market Agency. For the Polish energy statistics, the so-called non-energy products include bitumen, kerosene, lubricants, motor oil, naphtha, paraffin, raw benzole, solvents, tar, tar residues, vaseline, wax and other oil products. A fraction of these products is burned for energy purposes in different energy transformation and industrial activities. The inventory team, combining the data available from the two information sources cited, distinguished between the combustion and the non-energy use of non-energy products. The ERT commends Poland for implementing and maintaining

this detailed information system and recommends that a summary on how these data are handled to compile the inventory be included in its future submissions.

C. Key categories

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

51. CO_2 emissions from fuel combustion are calculated in the Polish GHG inventory on the basis of a disaggregated bottom–up approach. The availability of comprehensive fuel consumption data (*Energy Statistics* 2002–2003, 2004) is key in the implementation of the country-specific method. Each subcategory of category 1.A Fuel Combustion is further subdivided, depending on its structure, its characteristics and the availability of specific fuel consumption data. At the lowest disaggregation level and for each fuel, the net calorific value (NCV) is calculated as the ratio of the fuel consumption data available in both energy and mass units. The national average NCV is used instead of the estimated calorific value when the fuel consumption is very low, and the estimation may have large errors. Next, the CO_2 EF is estimated using a country-specific equation for the carbon content of the main fuels (as a function of the NCV) and oxidation factors that are sectoral means over weighted IPCC default values for specific technologies. The CO_2 emissions of each lowest-level activity are then calculated. From this lowest level, the emissions and the fuel consumption are summed up at each higher-level step. In this way, the resulting CO_2 EF at each higher level is the weighted average of emissions and fuel consumptions of the immediate lower level. Although the description of this method is not included in the NIR, during the review visit Poland provided the ERT with the dendogram representing the flow of the calculations of the bottom–up approach, the country-specific equations used to estimate the carbon content of the fuels, and the whole set of worksheets used to calculate the emissions. The ERT commends Poland on its efforts to develop and implement this detailed bottom–up approach and encourages it to include a description of its country-specific method in its future submissions.

52. The CO_2 EF for each fuel is estimated using a country-specific equation that has been derived as a linear function of the NCV of the fuel (Radwánski, 1995). Equations are available for coking coal, other bituminous coal, lignite, natural gas, coke, motor gasoline, diesel oil, and light and heavy fuel oil. Since this information was obtained a decade ago and is not available either in the open literature or the NIR, the ERT recommends that Poland document and report the main characteristics of the derivation. To improve the transparency and comparability of its reporting, the ERT also recommends that Poland clarify whether the whole carbon content of the fuel (except the fraction that remain non-oxidized) is included in the CO_2 EF, and provide the complete set of EF equations together with the range of applicability of each correlation in terms of the NCV of the corresponding fuel and the corresponding confidence limits.

2. Mobile combustion: road transportation – CO_2

53. A country-specific model is used for estimating emissions from road transportation. The NIR does not include a discussion on the key assumptions and the input data that are used to run the model. During the review visit, Poland provided the ERT with information about the model and the background references (ITS, 2004). The model uses distance-based AD to estimate the disaggregated fuel consumption of vehicles organized in the following subcategories: passenger cars, light-duty vehicles, heavy-duty vehicles, buses, motorcycles and tractors. In the relevant subcategories, vehicles are further disaggregated according to the presence (or absence) of catalytic converters. To improve transparency, it is recommended that Poland provide in its future submissions information on the main characteristics of the model, including at least a summary of the relevant AD, EFs used and decisions adopted for key features, such as fuel use balance.

54. The CO_2 EFs (as well as those for CO, non-methane volatile organic compounds (NMVOCs) and nitrogen oxide (NO_X)) are based on exhaust gas measurements performed by the ITS. The emission measurements are obtained in transient test cycles that are representative of local conditions. Poland has chosen to report emission estimates based on the measured CO_2 EFs that exclude the carbon present in the remaining carbonaceous compounds of the exhaust gas. These estimates are not in line with the Revised 1996 IPCC Guidelines and are not consistent with the approach followed for stationary combustion. To improve consistency and comparability, the ERT recommends that Poland estimate and report CO_2 emissions from road transport, including all carbon contained in the fuel (excluding only the fraction of carbon non-oxidized). The ERT further recommends that Poland consider the suggestion of the IPCC good practice guidance that emissions of CO_2 are best calculated on the basis of the amount and type of fuel combusted and its carbon content, and reassess the convenience of using distance-based AD to estimate CO_2 emissions.

3. Fugitive emissions: coal mining and handling – CH_4

55. The amount of other bituminous coal and coking coal produced in 2003 (*Energy Statistics* 2002–2003, 2004) was selected as the AD to estimate CH_4 emissions from underground coal mining and handling, while emissions from surface mines were estimated on the basis of the production of lignite. During the review visit, Poland informed the ERT that, emission estimates for underground mining include degasification and ventilation systems, post-mining activities, process waste dumps and abandoned mines; estimates for surface mines only take into account ventilation systems from the coal seam and the surrounding rocks; and EFs are adopted from the study by Gawlik and Grzybek (2001). To improve transparency, it is recommended that Poland provide a description of the method used to estimate these emissions as well as the supporting information in its future submissions. It is also suggested that a brief discussion on the appropriateness of using sales statistics instead of raw coal production as AD be included.

56. Gawlik and Grzybek (2001) compiled CH_4 emissions from 52 Polish underground mines to estimate the corresponding CH_4 EFs, while the EFs for surface mines were adopted from an earlier paper by the same authors that was published in a Polish scientific journal (*Gospodarka Surowcami Mineralnymi*, Management of Mineral Materials). The EFs for surface mines are one order of magnitude lower than both the IPCC default EFs and the implied emission factors (IEFs) of reporting Annex I Parties (except Germany). The ERT suggests that Poland re-examine the adoption of these EFs and, if satisfactory, provide a description of their derivation and make efforts to provide access to this information.

4. Fugitive emissions: natural gas – CH_4

57. Emissions are estimated on the basis of country-specific EFs from the national study on sources and sinks of GHG (Radwański, 1995). These EFs are below the range of IPCC default values for Eastern Europe and the former USSR. To improve transparency, the ERT recommends that Poland provide the whole set of country-specific EFs and the main features of the way in which they are derived.

58. Emissions arising from transmission and distribution systems are estimated using the amount of consumed gas as AD. The ERT suggests that Poland consider the recommendation in the IPCC good practice guidance that these emissions be estimated on the basis of lengths of pipeline, particularly considering the increasing trend of CH_4 fugitive emissions from natural gas systems.

59. Fugitive emissions from coke gas systems are reported under subcategory 1.B.2.b Natural Gas. To improve comparability, the ERT recommends that Poland reallocate these estimates to category 1.B.1 Fugitive Emissions from Solid Fuels under subcategory 1.B.1.c Other.

D. Non-key categories

1. Mobile combustion: road transportation – CH_4 and N_2O

60. The same model as is described in paragraph 53 is used to estimate CH_4 and N_2O emissions. In this case, the EFs applied are not derived from country-specific measurements but are based on CORINAIR and the Revised 1996 IPCC Guidelines. To improve transparency, the ERT recommends that Poland provide in its future submissions information on the rationale for the selection of EFs, a summary of the EFs used and the manner in which catalyst deterioration is accounted for by the model. It also recommends that Poland specify appropriately in the CRF, Summary table 3, the use of EFs adopted from reference guidelines.

61. N_2O emissions arising from mobile combustion in road transport show an increasing trend. The ERT recommends that Poland follow these emissions closely, as they may become a key source category in future.

2. Mobile combustion: civil aviation, railways, navigation, other transportation – CO_2, CH_4 and N_2O

62. The NIR provides no information on the methods, AD and EFs used to estimate the emissions of these subcategories. During the review visit, Poland explained that tier 1 methods combined with literature sources have been used to estimate these emissions. To improve transparency and consistency, it is recommended that Poland include a brief discussion on this information in its future submissions and that it also report appropriately in CRF Summary table 3 the use of tier 1 methods and non-country-specific EFs.

3. Coke production – CO_2

63. Poland provides no net CO_2 emissions from conversion losses in coke production, which can be calculated using a carbon balance approach (coking coal input and coke and coke oven gas produced). The ERT recommends Poland to estimate and report these emissions under 1.B.1.b Solid Fuel Transformation.

E. Areas for further improvement

1. Identified by the Party

64. Although the NIR does not provide a discussion on future improvements, several of the areas for general improvement presented by the inventory team during the review visit also apply to the Energy sector. They include providing background information on the country-specific methods and EFs, filling in gaps and dealing with inconsistencies in the time series, performing the associated recalculations and implementing a formal QA/QC process.

2. Identified by the ERT

65. Poland has made efforts to develop country-specific methods and EFs, but this information has not been included in the NIR. This is unfortunate because not only does it impair transparency; it also does not allow other Parties access to these data. The plans for improvements summarized above involve further demands for the inventory team. The ERT encourages the Party to allow the inventory team to play the key role in reviewing, critically assessing, reporting and documenting the information required for compiling the inventory and also in trying to reconcile the data provided by different information sources and further strengthening the data QA/QC procedures.

IV. Industrial Processes and Solvent and Other Product Use

A. Sector overview

66. In 2003, emissions reported as being due to industrial process accounted for 18.1 Tg CO_2 equivalent or about 5 per cent of total CO_2 equivalent emissions (without LULUCF), 1 per cent more than in the base year (1988). In 2003, CO_2 emissions represented about 63 per cent of the sector's emissions (mostly from cement, but also from ammonia and lime production). N_2O emissions (from nitric acid production) accounted for about 24 per cent and actual emissions of F-gases accounted for 11 per cent. In the period 1990–2003, industrial processes CO_2 equivalent emissions fell by 10 per cent, mainly due to a decrease of 30 per cent in CO_2 emissions from minerals production and a decrease of 12 per cent in N_2O emissions from nitric acid (and not yet reported adipic acid) production, partly compensated by an increase in F-gas emissions due to increasing emissions from ODS substitutes. For 2003, only actual emissions of HFC-23, C_4F_{10} and SF_6 are provided; no potential emissions were reported. For other individual compounds both potential and actual emissions are provided.

67. For the Industrial Processes sector, Poland identified four key categories (the secretariat found none): CO_2 from Cement Production, from Lime Production and from Ammonia Production; and N_2O from Nitric Acid Production. In addition, the ERT identified CO_2 from Carbon Inputs in the Iron and Steel Industry (category 2.C.1) as a large level key category, which is reported in the NIR as CO_2 from Stationary Fuel Combustion of Blast Furnace Gas (8 Tg CO_2 in 2003).

1. Completeness

68. The CRF includes estimates for all gases and most sources in the Industrial Processes sector. Not included are: CO_2 emissions from Limestone and Dolomite Use (2.A.3), Soda Ash Use (2A.4.2), Glass Production (2.A.7), Coke/Coal Conversion Losses in Blast Furnaces (2.C.1), and Food and Drink (2.D.2) (except for 1988, 1990, 1992 and 1994), which could amount to several Tg CO_2; N_2O emissions from Adipic Acid Production (for 1988–1994, decreasing from 1.5 to 0.3 Gg N_2O); and, for 1988–1994, PFC emissions from Aluminium Production and and SF_6 emissions from Use in Gas Insulated Switchgear (GIS). The ERT recommends Poland to include these sources in the inventory when AD are readily available, for example, using the IPCC default EFs.

69. Although they are reported as "not estimated" ("NE"), Poland informed the ERT that no HCFC or F-gas production occurs, and thus neither HFC by-product emissions nor fugitive emissions of F-gases occur. In addition, the ERT was informed that soda ash is only produced using the Solvay process, which has no associated CO_2 emissions, so these emissions should be reported as "0". The ERT recommends Poland to correct this in its next NIR/CRF, including the accidental switching the allocation of reporting CO_2 from Soda Ash Production and from Soda Ash Use.

2. Transparency

70. The NIR does not provide information on country-specific methods (e.g. the equivalent IPCC tier) and country-specific EFs used (determination method and references to data sources used) so that the reported emissions estimates are transparent and the steps in their calculation can be retraced. The documentation boxes in the CRF do not specify when different methods/EF types are used within a source category. The ERT strongly recommends Poland to include this information in its next submission.

71. The Methods table and Completeness tables in the CRF are not completely (F-gases in tables 2.B and 2.E; CO_2 and CH_4 in table 3) and not always correctly (CO_2 "ALL" in table 2.A) filled in. The notation keys in the CRF tables are not always correctly used (for F-gases in tables 2.E and 2.F, and others in table 3); and many entries of "NE" should be "not occurring" ("NO"), "not applicable" ("NA")

or "included elsewhere" ("IE"). The ERT recommends Poland to correct, update and complete these tables.

3. Recalculations and time-series consistency

72. In response to recommendations of previous reviews, recalculations have been performed for HFCs from mobile air-conditioners and for PFCs from aluminium production due to a revision of the EFs to the latest IPCC defaults in the good practice guidance, but only for 2000 and 2001. This reduced the estimates of HFC emissions in 2000 by 0.4 Tg CO_2 equivalent and increased the estimates of PFC emissions in 2001 by 0.6 Tg CO_2 equivalent.

73. However, often different methodologies or different EFs are used for different years, thereby introducing inconsistencies in the time series that could have been avoided by a full recalculation of the complete time series. Virtually all sources in this sector therefore require a full recalculation of the time series, to be performed after subsequent updates of default EFs and, possibly, methodologies, and after the addition of sources previously not estimated. The ERT recommends Poland to check the values for default EFs used for recent years with the IPCC good practice guidance and subsequently to fully recalculate all sources using the same methodology and consistent EFs for the complete time series.

4. Uncertainties

74. In the uncertainty assessment no uncertainties have been assigned to F-gas emissions. The ERT recommends that these be included, for example, using default values provided in the IPCC good practice guidance.

5. Verification and quality assurance/quality control approaches

75. Net consumption figures of F-gases from import statistics are compared with total consumption per application estimated from surveys conducted under major F-gas users.

B. Key categories

1. Cement production – CO_2

76. The reported CO_2 EF of 0.50 Gg/Gg clinker is country-specific and very close to the IPCC default for the tier 2 method (0.51), but no reference to the data source has been provided. The ERT recommends Poland to include in the NIR the lime (CaO) fraction and the reference to the primary data source for the country-specific fraction as described in the IPCC good practice guidance, including a description of the determination of the CaO fraction in the clinker. In addition, the ERT recommends that Poland correct the AD description in the CRF (now "cement production" instead of "clinker production").

2. Lime production – CO_2

77. For lime production reported under 2.A.2 – and soil lime production, which is reported separately under source category 2.A.7 instead of under 2.A.2 – country-specific EFs are used, but no reference to the data source has been provided. During the review the ERT was informed that the default CORINAIR EFs from the early 1990s are used, which differ from the defaults in the IPCC good practice guidance. The ERT recommends that Poland include soil lime production emissions under source category 2.A.2 (irrespective of how the data are domestically monitored and reported and use of different EFs) and update the EFs to the latest IPCC default. The ERT also recommends that Poland provide in the NIR a description of the country-specific EFs and underlying factors and corrections used, for example, by type of lime, and references to the data sources.

3. Ammonia production – CO_2

78. The emissions trend of the chemical industry shows a very large increase in 2000 and a doubling of emissions in 2003, which are not explained in the NIR. During the review the ERT was informed that the default CORINAIR EF of 1 kg/kg ammonia (NH_3) from the early 1990s is used, which differs from the IPCC default. The ERT recommends Poland to update the EF to the latest IPCC defaults and provide this information in the NIR, which should also include a summary of the method used and references to source data so that the emissions estimates reported are transparent.

4. Nitric acid production – N_2O

79. The ERT was informed that from 2000 onwards a country-specific EF has been used, of 6.44 kg/tonne nitric acid, being the weighted average EFs of five plants, based on measured emissions, while for earlier years an EF of 3.4 kg/tonne is used based on measurements carried out in 1995, and references are provided for these factors. The ERT recommends Poland to provide this information in the NIR, including a summary of the type of production technology, any emission abatement technology used and references to data sources. Moreover, Poland may consider using interpolated EF values for the years between these measurements. In addition, the ERT recommends explaining in the NIR the causes of the rather large inter-annual changes in emissions since 1997.

5. Iron and Steel Industry – CO_2

80. The ERT identified this as a level key category of the Industrial Processes sector, but it is not identified as such by Poland since it reports the fuel carbon inputs in the blast furnace of the CO_2 emissions from this source under Energy (1.A.2.a). The Party explained that all fossil fuel-related CO_2 emissions (combustion and coke/coal as reducing agent) are reported under Energy (1.A.2.a), while CO_2 emissions from the carbon content in limestone, dolomite and iron ore in the blast furnace charge (and not contained in the final products) are reported by process under Industrial Processes (2.C.1), using EFs based on measured CO_2 emissions. The ERT recommends Poland to provide this information in the NIR. More importantly, the ERT recommends Poland to report net CO_2 from the fuel carbon inputs into blast furnaces (coke, coal) plus limestone, dolomite other carbon sources under Industrial Processes (2.C.1) (also subtracting blast furnace gas/oxygen furnace gas combustion from sector 1.A) as recommended by the IPCC good practice guidance (or leaving blast furnace gas combustion in 1.A.2.a and allocating only the remaining fuel carbon emissions from the iron and steel industry under 2.C.1). This carbon balance approach may capture several Tg CO_2 due to conversion losses which are not captured by the present approach. The same recommendation applies to the emissions from non-combustion processes in coke production, which should be calculated using a carbon balance approach and reported under 1.B.1.b Solid Fuel Transformation.

C. Non-key categories

1. Limestone and dolomite use, glass production, soda ash use – CO_2

81. Since these sources are not estimated, and emissions reported by other Annex I Parties suggest that emissions may amount up to 1 Tg CO_2, the ERT recommends that Poland estimate all significant sources of limestone and dolomite use, if AD are readily available, and allocate all CO_2 emissions from limestone and dolomite use here, except for uses to be reported elsewhere (in 2.A.1 (Cement Clinker), 2.A.2 (Lime), 2.A.7 (Glass), 2.C.1 (Iron and Steel) and 5.D (Liming of Soils)), as recommended by the Revised 1996 IPCC Guidelines.

2. Adipic acid production – N_2O

82. During the 2003 review Poland explained that production of adipic acid stopped in 1994. No official production data are published since there is only one plant, but AD are available through personal communication. The ERT was informed that these N_2O emissions, which decreased from 1.5 to 0.3 Gg N_2O between 1988 and 1994, are not included in the trends reported, and therefore recommends that Poland add this missing source in its next submission.

3. Calcium carbide, ferroalloys and aluminium production – CO_2

83. During the review the ERT was informed that for carbide production since 1998 a country-specific EF has been used of 1.1 kg/kg carbide. This EF is based on a study in 1998, and differs significantly from the IPCC default. The 2003 values of the CO_2 EFs of 3.9 t/t for ferroalloys production and 1.8 t/t for aluminium production are relatively high compared to those of other reporting Parties. Poland explained that for these two processes default EFs from the Revised 1996 IPCC Guidelines were used for selected years and for other years a country-specific EF for aluminium production, of 0.8 kg/kg, was used. The ERT recommends Poland to include this information and the data sources in its next NIR and CRF and explain how time-series consistency is maintained while different EFs are used over time. The ERT encourages Poland to reassess the data on which the EFs are based and to consider updating to the latest IPCC defaults and providing this information in the NIR, which should also include a summary of the method used and references to the source data. More importantly, the ERT recommends recalculation of the whole time series.

4. Aluminium production – PFCs

84. In response to recommendations from the 2003 review, a recalculation has been carried out following a revision of the EFs to the latest IPCC default for the Vertical Stud Sødeberg (VSS) technology in the IPCC good practice guidance, but only for the years 2000–2003. Since for other years the obsolete EF from the Revised 1996 IPCC Guidelines is still used, the ERT recommends Poland to recalculate the complete time series back to 1988 using a consistent EF. In addition, the ERT encourages Poland to check whether process controls have changed significantly over time and whether time-series information is available that will make it possible to estimate possible trends in the EFs.

5. Other production – CO_2

85. In the CO_2 trend table, Poland reports CO_2 emissions from the food and drink industry of about 0.8 Tg in 1988, 1990 and 1992 only; it reports "NE" for the other years. The ERT recommends that Poland add emission estimates for the years that have not been estimated in order to complete the time series.

6. Consumption of halocarbons and SF_6 – HFCs, PFCs, SF_6

86. In response to previous reviews, HFC emissions have been recalculated after updating EFs to the latest IPCC defaults in the IPCC good practice guidance, but only for the years 2000–2003. However, the product life factors for stationary air-conditioners and for hard foam/closed cell have not been updated (they are now twice or three times as high as the IPCC good practice guidance defaults); this has probably been overlooked by the inventory compilers. The product life factor for aerosols/inhalers of 50 per cent is low compared to what most other Annex I Parties report (most use 100 per cent) and the product manufacturing factors for fire extinguishing and aerosols/inhalers appear (very) high compared to other reported values. Poland explained that the fractions of HFC-134a per HFC-containing product are its own estimates. The accuracy of these values could be improved by having them reviewed by the product manufacturers. The ERT also recommends recalculating the complete time series back to 1988 using consistent up-to-date EFs. Moreover, the ERT recommends that Poland provide in the NIR a

summary description of the country-specific EFs and underlying factors used and references to the data sources, for example, of the surveys of importers and users, including a explanation of why no potential emissions could be reported for specific compounds.

7. Solvent and other product use – CO_2

87. In response to recommendations from the 2003 review, Poland has now included these indirect CO_2 emissions, based on the NMVOC emissions from this category. Poland considers the NMVOC emissions estimate to be fairly complete. It explained that the carbon fraction used (0.85) is based on the values reported by 11 other Annex I Parties.

8. Anaesthesia – N_2O

88. Although this source category is reported under 3.D as "NE", it is reported under 2.B as "N_2O for medical use". The ERT recommends that Poland allocate these emissions under 3.D in accordance with the Revised 1996 IPCC Guidelines.

D. Areas for further improvement

1. Identified by the Party

89. Recalculations of PFC emissions from aluminium production and HFC emissions from mobile air-conditioners back to the base year (1988), as required in the revised UNFCCC reporting guidelines (par. 22), irrespective of the base year chosen for reporting of F-gases under the Kyoto Protocol.

90. Correction of the allocation of CO_2 emissions from soda ash use (now accidentally switched and reported as soda ash production) and changing CO_2 from soda ash production from "NE" to 0, since the Solvay process is used which does not give raise to net CO_2 emissions.

2. Identified by the ERT

91. Describing in the NIR the methodologies and EFs used for CO_2, CH_4 and N_2O in the categories 2.A (Mineral Products), 2.B (Chemical Industry), 2.C (Metal Production) and 2.D (Other Production), for country-specific methods (including the equivalent IPCC tier), and including references to data sources. In cases where emissions or EFs/IEFs change significantly over time, the ERT recommends that the Party provide summary information in the NIR that explains these changes.

92. Performing a full recalculation of virtually all sources using the same methodology and consistent EFs for the complete time series 1988–2003, after checking or updating the values for default EFs used for recent years with the IPCC good practice guidance.

93. Checking with industry experts the occurrence of technologies used in Poland, and in particular the occurrence of source categories that are currently not estimated. Involving national sectoral experts for the review of the methodologies and emissions would lead to benefits such as gaining technical insights from the industries.

V. Agriculture

A. Sector overview

94. In 2003 emissions from the Agriculture sector accounted for 6.7 per cent of total GHG emissions in Poland, 24.6 per cent of total CH_4 emissions, and 70 per cent of total N_2O emissions. Emissions from enteric fermentation were responsible for approximately 90 per cent of CH_4 emissions from agriculture. Direct emissions of N_2O from agricultural soils contributed 64 per cent of the N_2O emissions from agriculture and 44.2 per cent of total N_2O emissions from all sectors.

95. Based on Poland's tier 1 quantitative uncertainty analysis, the following agricultural sources were identified as key categories: CH_4 emissions from Enteric Fermentation in Livestock; CH_4 emissions from Manure Management; N_2O emissions from Manure Management; and direct N_2O emissions from Agricultural Soils (Poland also separately identified N_2O emissions from pasture/range/paddock animals as a key category, but this is a subcategory under Direct N_2O Emissions from Agricultural Soils according to the Revised 1996 IPCC Guidelines).

96. A full set of CRF tables is provided for the year 2003 only, so that an analysis of the trend data is limited to the time series of emissions presented in CRF table 10. Poland presents emissions for the years 1988–2003 in CRF table 10. Notable trends include a 51 per cent drop in CH_4 emissions from enteric fermentation between 1988 and 2003, which was the major reason for an overall decrease of 49 per cent in CH_4 emissions from the Agriculture sector during that period. There was an overall 23 per cent increase in N_2O emissions from the sector between 1988 and 2003; the largest contributor to this trend was the addition of N_2O from manure management as a source category starting in 1999. Countering that trend was a 21 per cent decrease in direct N_2O emissions from agricultural soils for the period 1988–2003.

1. Completeness

97. The CRF includes estimates of most gases and sources of emissions from the Agriculture sector, as recommended by the Revised 1996 IPCC Guidelines. Not included are indirect emissions of N_2O under the Agricultural Soils category, CH_4 from enteric fermentation and manure management for goats, and CH_4 from agricultural soils. There are some omissions of data and coding errors in the CRF tables. Significant omissions affecting the review of the data included the absence of related information and additional information in tables 4.A, 4.B(a) and 4.D. The information missing from these tables is not presented in the NIR either.

98. The NIR includes sector and category summary emissions data, and reference lists for the methodologies used to develop estimates for each category. However, it does not present descriptions of the methodologies used, assumptions, and key input parameters used in calculating emissions for agricultural source categories.

2. Transparency

99. Information on methods, EFs, input parameters, and assumptions used in developing the emissions estimates in this sector is not reported in the NIR. The absence of descriptions of the methodology used for estimating emissions made it difficult for the ERT to determine the reasonableness of country-specific factors used throughout the Agriculture sector and to understand how emissions were derived. Background data provided by Poland during the review allowed for substantial clarification of the methods used, but elaboration in the NIR is still badly needed. The ERT recommends the Party to include more detailed information on methods, assumptions, data sources and estimation steps in both the CRF and the NIR. Regarding missing information in the CRF, the ERT recommends Poland to fill in the additional information boxes in its future inventories, where applicable.

3. Recalculations and time-series consistency

100. There are no recalculations reported for this sector in the CRF. Since a full set of CRF tables has not been provided for the years prior to 2003, and the NIR does not provide a transparent description of methodologies used throughout the time series, it was not possible for the ERT to fully review issues related to recalculations and time-series consistency. From discussions with Polish staff during the review, it is clear that recalculations will be necessary within the Agriculture sector to reflect the most recent improvements to inventory methodologies adopted since the 1999 inventory. Recalculations will also be necessary to address changes such as the adoption of a new manure management system allocation in 2003, the inclusion of N_2O emissions from manure management for all years, and the

addition of the missing source of indirect N_2O emissions from agricultural soils. The ERT recommends that, when Poland prepares its full recalculations and CRF tables for all years, it should carefully review the applicability of the current methods to previous years. Particular attention should be given to those input parameters that may not be readily available but which could have changed through the time period (e.g. the type of feed used for livestock, average livestock subcategory weights).

4. Uncertainties

101. The NIR shows a tier 1-based uncertainty value of ± 6 per cent for N_2O emissions from agricultural soils, and an EF uncertainty for this category of ±4 per cent. These uncertainty values seem extremely low in the light of the IPCC good practice guidance and the scientific understanding of these emissions since these factors were last updated in Poland's inventory (Poland's EFs originate from studies conducted in the early 1990s). The IPCC good practice guidance suggests a default uncertainty of ±25 percent for emissions based on measurements from this category. There can be substantial uncertainty introduced due to the inherent limitations of the measurement techniques used and when measurements of N_2O do not fully represent all cultivated areas, or do not fully account for seasonality and other climate influences (see box 4.1 of the IPCC good practice guidance for a description of considerations for country-specific factors). The ERT recommends that Poland review and re-evaluate the basis of the uncertainty estimation for this category as it is a key category in the inventory.

5. Verification and quality assurance/quality control approaches

102. From discussions held during the review, it is apparent that Poland should consider more frequent expert peer review of the methodologies and calculations used in the Agriculture sector. Although there has been important input from technical experts from previous years (e.g. enteric and manure EFs in studies carried out in 2001 and 2002) there is a need for more frequent and strategic involvement of agricultural experts in different areas of the sector. Poland recognizes this need and expressed its desire to retain more expert involvement from agricultural research institutions within the country if resources allow.

B. Key categories

1. Enteric fermentation – CH_4

103. Country-specific EFs are used for cattle and sheep and are based on IPCC tier 2 methodologies from the Revised 1996 IPCC Guidelines. Key input parameters and enhanced characterization data used to develop the factors were made available for the review from background development documents. The background documentation showed that a combination of default and country-specific input parameters is used to develop the tier 2 EFs for cattle and sheep. Poland should include critical descriptive information extracted from these background reports in its NIR in order to document these methods effectively.

104. Some of the equations and default parameters used to develop the EFs need to be updated based on the IPCC good practice guidance. These include tier 2 equations for cattle for NE_g and NE_{preg}, and Y_m updates for non-dairy cattle.

105. The daily feed intake for non-dairy cattle (97.1 MJ/day) and the animal mass (101 kg) listed in CRF table 4.A are the lowest reported values from reporting countries. Table A-2 of the Revised 1996 IPCC Guidelines shows a range in mass of 230 to 500 kg for Eastern Europe, and table B-1 lists an 'average non-dairy cattle' energy intake value for Eastern Europe of 134.4 MJ/day and an 'average non-dairy cattle' mass of 391 kg. Poland presented background documentation during the review that shows that the relatively low weight value listed for 'non-dairy cattle' is actually just the value for the 'calf'

subcategory, and the actual average weighted value for all non-dairy cattle is 246 kg. This will be corrected in the next revision to the CRF table.

106. The IEF for non-dairy cattle (38.2 kg CH_4/hd/yr) is the fourth-lowest value of the reporting Parties and is also relatively low compared to the IPCC default for Eastern Europe (56 kg CH_4/hd/yr). A review of the background documentation cited in the NIR revealed that Poland has a significant proportion of calves in its non-dairy population (33 per cent of all non-dairy cattle); calves have a much lower EF than other cattle subcategories. Also, the average livestock weights for most subcategories of non-dairy cattle in the Polish inventory are generally lower than the average weights upon which the IPCC defaults are based, and as a result the factors calculated are lower. These conditions explain the lower IEF for non-dairy cattle in Poland and should be summarized in the NIR to clarify the development of the EF.

107. A significant improvement in the data on livestock populations has occurred. The figure for swine populations has been brought into agreement with the Food and Agriculture Organization of the United Nations (FAO) reported populations, and the data on all categories of livestock populations are now in agreement with FAO published data, which, based on discussions with Poland during the review, should be the case since the national statistical values used in the inventory are the same as those reported to FAO. Also, the poultry population estimate has been increased significantly for 2003 to account for the addition of chickens younger than six months. This is a significant improvement in the statistical accounting for poultry since there is high proportion of broiler chickens (i.e. chickens for meat production) which live less than six months.

2. Manure management – CH_4

108. The dairy, non-dairy cattle and swine IEF values are the fourth-, third- and third-lowest values, respectively, of the reporting Parties, and are very low compared to the IPCC default for cool Eastern Europe (3 kg compared to 6 kg CH_4/hd/yr for dairy cattle, 0.95 compared to 4 kg CH_4/hd/yr for non-dairy cattle, and 1.11 kg compared to 4 kg CH_4/hd/yr for swine). There are no background parameters for typical animal mass, volatile solid excretion (VS), methane-producing capacity (B_o) , or methane correction factor provided in CRF table 4.B(a) or in the NIR. Review of the background documentation cited in the NIR indicates that the country-specific factors for manure management are derived from tier 2 IPCC equations using a combination of country-specific and IPCC default input parameters. A review of these parameters indicated that the proportion of solid storage and pasture systems used in Poland is high since the agriculture industry consists mainly of small, dispersed operations that tend to use these types of system. However, for the small percentage of liquid systems in the inventory Poland used the methane correction factor value of 10 per cent from the Revised 1996 IPCC Guidelines instead of the updated value of 39 per cent in the IPCC good practice guidance. The combination of the small percentage of liquid systems and the outdated methane correction factor value explain the lower IEF values for Poland. The ERT recommends that Poland document in the NIR the key parameters and assumptions taken from the background report and that it update the liquid system methane correction factor to the 39 per cent value.

3. Agricultural soils – N_2O

109. The IEF value for direct N_2O emissions from synthetic fertilizers (0.008 kg N_2O/kg nitrogen (N)) is the lowest value of the reporting Parties. Background documentation provided during the review showed that country-specific factors were used for this subcategory, as well as for animal waste applied to soils, N-fixing crops, and crop residue. Experts from the Institute of Construction, Mechanization, and Electrification of Agriculture in Poznan base the factors on results of regional measurement studies published in peer-reviewed journals and adapted for use in 2001. However, key information on the

derivation of these factors should be documented in the NIR and additional information should be provided in CRF table 4.D where applicable.

110. The EF (5 kg N_2O-N/ha-yr) used for the estimating emissions from the cultivation of histosols is the default value from the Revised 1996 IPCC Guidelines. This factor has been updated in the IPCC good practice guidance to a value of 8 kg N_2O-N/ha-yr. Poland should use the updated default factor for this source.

C. Non-key categories

Field-burning of agricultural residues – CH_4 and N_2O

111. A detailed subcategorization of crops and associated emission parameters is used; however, there is no description of the factor or parameter development in the NIR. The country-specific values are close to the IPCC defaults and within the ranges of values reported by other Parties for similar crop categories. During the review Poland responded that factors were developed as part of a historical country study report, "Country Case Study on Sources and Sinks of GHG in Poland", conducted in 1995. The factors for burning of agricultural residues in that report are referenced from earlier (1990) studies.

D. Areas for further improvement

1. Identified by the Party

112. In discussions during the course of the review Poland recognized the need for more institutional arrangements with agricultural research institutes and technical experts to provide more frequent peer review and input to the agricultural inventory process. The current inventory team does not include expertise in this area that would be able to provide regular evaluation and update of parameters and factors used in these categories.

113. During the review discussions Poland recognized that the low level of uncertainty associated with the N_2O EF for agricultural soils may not be representative of the varying conditions in this category and will investigate modifications to this value.

2. Identified by the ERT

114. More frequent and strategic input from country experts in the Agriculture sector would be beneficial to provide regular review and update of emissions and the parameters used in this sector. This will be particularly important in terms of recalculations to determine appropriate set of data to use at different periods in the time series. Also, the experts engaged in this area to determine their current and future applicability for inventory development should review the use of previous historical studies for EF development.

115. The ERT recommends that Poland consider the use of the IPCC default method as an option in order to prepare estimates for indirect N_2O emissions from agricultural soils. At least in this way estimates can be made until further in-country research supports the development of an alternative country-specific approach.

VI. Land Use, Land-use Change and Forestry

A. Sector overview

116. Poland reports net removals of 25,904.6 Gg CO_2 in 2003, corresponding to approximately 8 per cent of total national emissions in that year, and representing a decrease of approximately 29 per cent relative to year 2002 (removals of the order of 36,609.2 Gg CO_2 were reported in the

recalculated data for that year). CO_2 emissions in 2003 had increased relative to 2002 (29.8 per cent) due to larger emissions resulting from the cultivation of mineral soils (an increase of approximately 100 per cent) and from increased harvesting. CO_2 removals were approximately the same in 2002 and 2003.

1. Completeness

117. The CRF includes estimates of all gases and sources and sinks from the LULUCF sector, as recommended by the Revised 1996 IPCC Guidelines. The NIR does not provide any information regarding any of the estimates provided. It is recommended that Poland improve the information and transparency on AD, emissions and expansion factors used, to allow an appropriate evaluation of the sectoral report.

2. Transparency

118. The information provided in the NIR does not make it possible to conduct an appropriate evaluation of the sectoral report. Additional data and information provided during the in-country review improved the knowledge of the data used in the inventory. However, the specialized literature relevant to the work is in Polish, so that the ERT was not able to gain a full understanding of the additional information provided. It was clear during the in-country review that the data collection process for the state forests is very comprehensive, and this is also clear from the updated literature provided in English. State forests account for approximately 83 per cent of the forest cover in the country. Little information and data are available for the forests in privately-owned land (17 per cent of the total). Worksheets and references to data collection should be provided in Poland's future inventories to facilitate its reconstruction. No explanations of the methods used and the sources of the data used are included in the NIR. It is recommended that coordination between the data compilers and the inventory developers be developed or strengthened, since it seems that there is only limited access to the full database, restricting better analysis by the inventory developers.

3. Recalculations and time-series consistency

119. Poland provided recalculations only at the end of the in-country review, and only for year 2002 and table 5.A (Sectoral Report for Land-use Change and Forestry). This limited the analysis that the ERT should have been able to make from the detailed tables 5.A (Changes in Forest and Other Woody Biomass Stocks), 5.B (Forest and Grassland Conversion), 5.C (Abandonment of Managed Lands) and 5.D (CO_2 Emissions and Removals from Soil). In particular, in 2003 (and in the recalculated table 5), an additional source has been included under table 5.D regarding emissions and removals from other land. No estimates are provided under this category prior to the recalculated 2002 estimates. In addition, the time series for some categories are not complete or consistent because different methodologies have been used. For instance, recalculations are needed for table 5.A prior to 2003 due to methodological changes: whereas Poland used to apply distinct average annual growth rates for state and private forests, as well as for coniferous and deciduous forests prior to 2003, in 2003 a single value was applied for all. Poland should present recalculated estimates for table 5.A. The ERT recommends that Poland check the data for the year 2001 and possibly provide relevant recalculations in its next submission.

4. Uncertainties

120. Uncertainties are provided based only on expert judgement, and only a qualitative assessment is carried out. Poland should develop methods to provide a quantitative assessment of uncertainty, in particular in the categories where these uncertainties seem to be most relevant (e.g. emissions from intensively managed organic soils, changes in soil carbon from mineral soils). Poland should make an effort to provide uncertainty ranges for the emissions and removals. This may require facilitating access to data collection procedures and disaggregated data for the inventory compilers.

5. Verification and quality assurance/quality control approaches

121. No formal QA/QC procedures are presently in place for the LUCF sector. It is recommended that a more institutionalized approach be implemented in Poland's future inventories.

B. Sink and source categories

122. Poland applies a tier 1 or tier 2 approach in the 2003 reporting, based on the methodologies provided in the Revised 1996 IPCC Guidelines. All AD used are country-specific, although their levels of accuracy differ. The soil data and associated emissions (in particular emissions from intensively managed organic soils) are considered to be the most uncertain. However, country-specific factors, such as the factor used to convert the volume of merchantable wood to aboveground biomass (BEF) or biomass expansion factors, have been estimated from expert judgement and literature. There are no national data available, and the uncertainty is high. For wood density and the fraction of carbon in dry matter, Poland uses data from the literature and the default IPCC values in the Revised 1996 IPCC Guidelines, with medium to low uncertainty. A country-specific estimate for the average annual growth rate has been used (4.37 tonnes dry matter per hectare per year). This value is within the range provided in the Revised 1996 IPCC Guidelines and in close agreement with values provided by other countries with similar forest covers. The factors used to estimate emissions and removals from soil (table 5.D) are the default values in the Revised 1996 IPCC Guidelines, with high associated uncertainty.

1. Forest and grassland conversion

123. The reporting in table 5.B (Forest and Grassland Conversion) relates only to CO_2 and non-CO_2 (CH_4 and N_2O only) emissions from fires. Poland uses an average carbon stock in aboveground carbon stock of 139 t dry matter per hectare. This value is below the default value provided in the Revised 1996 IPCC Guidelines, which is in the range of 200–295 t dry matter per hectare. However, since the data reported are from national sources, they should better reflect national conditions and species and mode of planting, as well as management practices. However, it is recommended that Poland indicate in the NIR the methodology used to generate this estimate (sampling approach, sampling measurements, methodology used to generate the mean dry matter content). Explanations on the fraction of biomass burned adopted (0.27) should also be provided, indicating its source (literature, national data, sampling scheme). The AD used to generate estimates in table 5.B are consistent with data in publications that were made available during the in-country review. It is recommended that the non-CO_2 emissions reported in table 5.B, relative to emissions from forest fires, be included under the category 5.E Other.

2. Abandonment of managed lands

124. Poland does not report under table 5.C (Abandonment of Managed Lands), having indicated that it is not applicable. It is recommended that the notation key "NO" be used, instead of the value 0.00. Since Poland used to report under this category in previous years (as a result of a misunderstanding of the Revised 1996 IPCC Guidelines), it should indicate where the estimates previously reported in table 5.C are now being reported, and indicate how recalculations have been carried out. In the Summary table 3 (Summary Report for Methods and Emission Factors Used), Poland should leave blank the two columns relating to Method Applied and Emission Factor for CO_2, instead of indicating the use of IPCC defaults, since it does not report under this category.

3. CO_2 emissions and removals from soil

125. The estimates reported under table 5.D (CO_2 Emissions and Removals from Soil) indicate that this subcategory is a sink that represents approximately 31.5 per cent of the sector's net CO_2 emissions/removals. In 2003, Poland introduced, for the first time, estimates of CO_2 emissions/removals from the subcategory Other Land. Recalculations for the year 2002 have been provided for table 5.A,

which includes emissions/removals from this subcategory. However, it is not clear how the recalculations were developed. Lack of transparency makes it impossible to understand significant changes (a 200 per cent increase) in the removals reported under Other Land from 2002 and 2003. It is recommended that Poland present recalculations for all years. During the in-country review, extensive explanations were provided on the development of a more consistent soil database, particularly with respect to the land use and management practices in the inventory year as well as 20 years prior to the inventory year. The refinements being introduced in the database will very likely reduce uncertainties, leading to more consistent and reliable estimates in future. However, nowhere in the NIR is this effort reflected. Since soil is considered to be a significant sink, Poland should provide detailed information on the methods used to generate the estimates, and provide recalculations for the previous years.

126. Poland has not reported under the category 5.E Other.

C. Areas for further improvement

1. Identified by the Party

127. Poland identified the following improvements for its future inventories: need for data on young forests (<20 years) and on privately-owned forests; increased knowledge on belowground biomass; additional data on changes in carbon stock following afforestation/ reforestation; and improved data on the cultivation of mineral soils.

128. Poland is aware of the difficulties of reporting in the LULUCF sector and of the additional efforts that will be necessary to improve its estimates, particularly the incremental needs to adjust the reporting to follow the IPCC good practice guidance for LULUCF.

2. Identified by the ERT

129. Poland has not reported in 2005 according with the requirements of decision 13/CP.9 (on the use of the IPCC good practice guidance for LULUCF and corresponding tables). The estimates provided for 2003 are based on the Revised 1996 IPCC Guidelines and the reporting provided in sectoral tables 5.A to 5.D. Poland should immediately initiate efforts to report using the IPCC good practice guidance for LULUCF and associated tables.

130. Poland should strive to improve interaction between the data compilers/processing units and the inventory developers. In particular, the lack of complete access to data and methods used makes it difficult to provide uncertainty estimates and uncertainty ranges. Changes in forest classification and methods used should all be reported, to allow recalculations where and when necessary.

131. The most important element that is currently missing relates to the transparency of Poland's reporting. The NIR does not include any information on data collection that could make it possible to assess the reliability and consistency of the activity data used, making it difficult to carry out an appropriate evaluation of the overall sectoral report. More national emission factors and conversion factors should be derived.

VII. Waste

A. Sector overview

132. In 2003, the Waste sector accounted for a total of 11.2 Tg CO_2 equivalent, or 2.9 per cent of total national emissions, compared with 20.3 Tg CO_2 equivalent (3.6 per cent) in the base year (1988). Methane from Solid Waste Disposal on Land (category 6.A) represents 74 per cent of the sector's emissions, mostly from unmanaged landfills, 19 per cent comes from CH_4 from Waste-water Handling (category 6.B), both domestic and industrial, while N_2O from Domestic Waste-water Handling

contributes another 7 per cent. Emissions CO_2 from Waste Incineration (category 6.C) contribute less than 1 per cent to the sectoral total. In the period 1988–2003, reported emissions decreased by 45 per cent. Emissions of CH_4 from landfills and from waste-water handling decreased by 53 per cent and 23 per cent, respectively. The NIR notes that the decrease in landfill emissions, which are calculated using the IPCC tier 1 method and not the first order decay (FOD) method, are mainly due to a decrease in the amount of waste disposed to landfills. The CRF trend tables report N_2O from waste-water handling from 2001 and CO_2 from waste incineration from 2000 only.

133. For waste handling, using a tier 1 analysis without uncertainties, Poland identified three key categories (the secretariat found none): CH_4 from Solid Waste Disposal Sites (level and trend); and CH_4 and N_2O from Waste-water Handling (level). These two methane sources account for 27 per cent of all CH_4 emissions.

1. Completeness

134. The CRF includes estimates of all gases and most sources from the Waste sector, as recommended by the Revised 1996 IPCC Guidelines. However, emissions of N_2O from industrial waste water and N_2O and CH_4 from incineration have not been estimated. Also emissions from industrial and medical waste incineration have not been included (only emissions from one municipal waste incineration plant are reported). On the other hand, methane recovered and subsequently flared from landfills and waste-water handling has not been accounted for. Moreover, methane recovered from industrial waste-water handling does not include recovery from sludge. In the CRF trend table 10, N_2O emissions from waste-water handling are only reported since 2000 and CO_2 from waste incineration is only reported since 2001. Historical CRF tables are not provided and no recalculations have been performed. The ERT recommends that recalculations be undertaken for the previous years and that complete CRF tables be provided for all years.

2. Transparency

135. The NIR does not provide information on the country-specific EFs used (how they are determined and references to data sources used). The NIR does not provide adequate basic information about the approaches used in the calculation of CH_4 from managed solid waste on land. The assumptions made, basic calculation methods and parameters used are also not provided. On waste water and waste incineration, the NIR does not elaborate on how the country-specific EFs for all gases have been derived, including the main assumptions made, the type of facilities available and so on. However, relevant information was provided to the ERT during the review. The ERT strongly recommends Poland to include this information in a transparent way in its next NIR and the CRF for the entire period, and for all subcategories, with a focus on how the country-specific EFs are determined and the explanation of emission trends.

3. Recalculations and time-series consistency.

136. The ERT noted that new methods and data have been used in the calculations from 2001, but no recalculations have been reported by the Party (except for 2001–2003). Due to the implementation of National Plan on Waste Management and changes of methodology used, and the present use of the IPCC tier 1 method for landfills, which is the key category, a comprehensive recalculation is needed. Poland expressed its intention to provide final backward recalculations and revisions of the entire sectoral inventory pending availability of human and financial resources. Specific attention should be given to the base year (1988) and to the consistency of the parameters used for the time series.

137. The ERT observed that in the CO_2 equivalent trend tables the CH_4 emissions of the Waste sector for 2001 and 2002 are wrong due to the insertion of an incorrect link, which Poland will correct in its next submission. The ERT recognized an omission in the calculation of trends in table 10 for the years

2001 and 2002, where the reported values were 6,338 Gg CO_2 and 6,169 Gg CO_2, respectively. The correct values should be 12,409 Gg CO_2 and 11,947 Gg CO_2, respectively. The reason for this was an error in the calculating formula. Nevertheless, the time series are not complete and are inconsistent due to the use of different methodologies.

4. Uncertainties

138. Poland provides quantitative uncertainty estimates in annex 6 of the NIR, among them 34 per cent for CH_4 from landfills, 16 per cent for CH_4 from waste-water handling, and 14 per cent for CO_2 from waste incineration of 14per cent. These values may be regarded as rather low, considering that, for landfills the FOD method is not used, and no account is taken of methane flaring; no estimate is made of CH_4 recovery from sludge of industrial waste water; and the AD for waste incineration could be significantly underestimated. The ERT encourages Poland to review the present uncertainties and the underlying assumptions used in the calculation.

5. Verification and quality assurance/quality control approaches

139. Poland expressed its intention to implement QA/QC procedures for the Waste sector as part of QA/QC procedures for the entire inventory in accordance with reporting requirements, depending on personnel capacities and financial resources. The ERT encourages Poland to develop and implement a QC plan that includes appropriate verification procedures.

B. Key categories

1. Solid waste disposal on land – CH_4

140. In response to previous reviews, the CRF data on waste generation per capita and the fractions of waste allocations and number of sites with CH_4 recovery have been corrected. During the review Poland explained that the values for CH_4 recovery from landfills were indirectly determined from biogas energy statistics and that CH_4 flaring data are not available. However, the latter may influence the net CH_4 emissions considerably.

141. Large inter-annual changes are observed in 1996 (–23 per cent), in 1998 (+29 per cent) and in 2001 (–45 per cent). The change in 2001 is explained in the NIR as mainly due to country-specific data since 2001 on the waste composition used to calculate the amount of degradable organic carbon (DOC), whereas for earlier years IPCC default values were used. The ERT recommends Poland to recalculate the whole time series, including the period 1988–2000, using consistent input data to achieve consistency over time, and to provide in the NIR references to the data sources and explanations of the resulting trends. More importantly, for this key category Poland uses the IPCC tier 1 method for estimating annual CH_4 emissions and not the FOD method, although statistics for the AD (amounts of municipal waste disposed to landfills) are available for a long time series. Since the tier 1 method is known to be much more uncertain than the FOD method, and figures for the amounts being deposited each year are available, the ERT recommends Poland to use the FOD method for estimating CH_4 emissions, as recommended by the IPCC good practice guidance, where necessary using IPCC default values or values used by other countries where landfill conditions can be presumed to be similar. This should also include estimates of methane recovered, including the fraction not utilized but subsequently flared, and an update of the methane oxidation factor (OX) for managed landfills.

142. The ERT observed that Poland uses a methane OX of 0 for managed landfills instead of the default IPCC value of 0.1 for covered, well-managed landfills in industrialized countries (category 6.A.1); this factor is documented in a background report on emissions from landfills. The uncertainty estimate does not reflect the extra uncertainty introduced by using the simplifying method instead of the FOD method nor the use of an OX of 0 factor for all landfills. The ERT suggests that Poland use a

higher uncertainty (e.g. 50 per cent) for the present method and document in the NIR – and possibly update – the OX factor used for covered, well-managed landfills.

2. Waste-water handling – CH_4 and N_2O

143. Poland uses a country-specific EF of 0.01 kg CH_4/kg DOC from domestic waste water, which is one of the lowest among reporting Parties and also differs significantly from the IPCC default. The ERT encourages Poland to reassess the data on which this factor is based, to consider updating the value to the latest IPCC defaults, and in the interests of greater transparency to provide this information in the NIR, which should also include a summary of the method used and references to the source data.

144. Methane recovered and flared from sludge industrial waste-water handling is not estimated because of lack of data. During the review the ERT was informed that, although they are presently not reported, industrial sludge statistics are available since 1988. The ERT recommends Poland to include industrial sludge DOC data and related CH_4 emissions, and to check the extent of methane recovery/flaring from industrial sludge and include it in the calculation if it appears to be significant (if necessary extrapolating to other years). Since no N_2O emissions from effluent of industrial waste-water treatment plants are reported, the ERT recommends Poland to include these emissions using the IPCC default methods and default factors, and correcting for N removed (in the sludge).

145. Large inter-annual changes in CH_4 emissions are observed in 1996 (–26 per cent), in 1998 (–33 per cent) and in 2001 (+39 per cent). During the review the change in 2001 was explained as a change in the AD for industrial waste-water treatment plants due to methodological changes, including sludge, and by a change in biochemical oxygen demand (BOD) value for domestic waste-water treatment plants. Emissions of N_2O are only reported since 2000. The ERT recommends Poland to recalculate the complete time series for CH_4 and N_2O using consistent input data in order to achieve consistency over time, to provide in the NIR references to the data sources, and to explain the resulting trend.

C. Non-key categories

Waste incineration – CO_2

146. During the review Poland explained that it reported emissions from one municipal waste incineration plant which started in 2001, which explains the CO_2 trend. The ERT was informed that in 2002, in addition to the reported 56 Gg municipal waste incineration, Poland incinerated about 248,000 Gg of industrial waste, 18,000 Gg of medical waste and some sewage sludge. To achieve completeness, the ERT recommends Poland to include these waste incineration activities in this category and to provide in the NIR a detailed description of the methodology and data sources used. In addition, the ERT recommends Poland to add CH_4 and N_2O emissions, for example, using IPCC default EFs.

147. The EF for non-biogenic CO_2 (1 kg CO_2/kg waste) is based on a German study, not the IPCC default, as mentioned in the CRF methods table. Since the IEFs reported by other Parties vary considerably (between 0.5 and 3.5), the ERT encourages Poland to determine country-specific carbon contents in the fossil and biogenic component of the different waste types, for example, using the default IPCC methodology. The ERT recommends Poland to consider treating this as a key category in view of the likely increasing trend driven by future legislation on waste management.

D. Areas for further improvement

1. Identified by the Party

148. To do recalculations of CH_4 emissions from Landfills (6.A) and N_2O emissions from Human Sewage (6.B) from 2001 back to the base year (1988).

2. Identified by the ERT

149. To implement planned improvements, recalculations, the addition of other sources, notably of industrial waste incineration and methane flared, identified by the Party to enable comprehensive and consistent coverage of all sources over time in Poland's next submission.

Annex

Documents and information used during the review

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