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**Report of the individual review of the greenhouse gas inventory of the
European Community 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.

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I. Executive summary

1. This report covers the in-country review of the 2005 greenhouse gas (GHG) inventory submission of the European Community (EC), coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8 of the Conference of the Parties. The review took place from 29 August to 2 September 2005 in Brussels, Belgium, and was conducted by the following team of nominated experts from the roster of experts: Generalist – Mr. William Irving (USA); Energy – Ms. Branca Americano (Brazil); Industrial Processes – Mr. William Agyemang-Bonsu (Ghana); Agriculture – Mr. Vitor Gois (Portugal); Land Use, Land-use Change and Forestry (LULUCF) – Mr. Xiaquan Zhang (China); Waste – Mr. Davor Vešligaj (Croatia). Mr. William Agyemang-Bonsu and Mr. William Irving were the lead reviewers. The review was coordinated by Ms. Astrid Olsson and Mr. Roberto Acosta (UNFCCC secretariat).
2. In accordance with the “UNFCCC guidelines for the technical review of greenhouse gas inventories from Annex I Parties”, (hereinafter referred to as UNFCCC review guidelines), a draft version of this report was communicated to the European Commission, 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 the EC was carbon dioxide (CO₂), contributing 82.5 per cent to total¹ national GHG emissions expressed in CO₂ equivalent, followed by nitrous oxide (N₂O), 8.0 per cent, and methane (CH₄), 7.9 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF₆) taken together contributed 1.6 per cent of the overall GHG emissions in the EC. The Energy sector accounted for 81.2 per cent of total GHG emissions, followed by Agriculture (9.9 per cent), Industrial Processes (6.3 per cent), Waste (2.3 per cent) and Solvent and Other Product Use (0.2 per cent). Total GHG emissions amounted to 4,179,613 Gg CO₂ equivalent and had decreased by 1.4 per cent from 1990 to 2003.
4. The expert review team (ERT) concluded that the EC inventory is much improved in comparison with previous years. The common reporting format (CRF) and the national inventory report (NIR) are largely complete with respect to the coverage and time series of emissions and removals. The NIR in particular has achieved a higher level of transparency and greater consistency with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) in its explanations of trends, methods and data. Tables 1 and 2 provide data on emissions by gas and by sector from 1990 to 2003.

¹ In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO₂ equivalent excluding LULUCF, unless otherwise specified. The EC 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*.

5. Given that individual Member States are responsible for preparing their own estimates, the ERT believes that quality assurance/quality control (QA/QC) at the EC level is particularly important for compiling the inventory. It is the opinion of the ERT that the EC QA/QC procedures are thorough and well designed, and serve as an additional resource for Member States in the improvement of their own inventories. As outlined in section III of this report, the ERT recommends that the EC extend detailed sector-specific QA/QC steps to the Industrial Processes sector.

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

GHG emissions	Tg CO ₂ equivalent														Change 1990–2003 (%)
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	
CO ₂ (with LULUCF) ^a	3 111	3 088	3 023	2 970	2 964	3 004	3 063	3 008	3 053	3 010	3 044	3 086	3 058	3 138	0.9
CO ₂ (without LULUCF)	3 335	3 359	3 285	3 232	3 230	3 267	3 343	3 288	3 331	3 304	3 328	3 394	3 388	3 447	3.4
CH ₄	441	432	426	419	410	408	402	392	383	372	361	351	342	334	-24.4
N ₂ O	408	403	396	383	391	392	398	399	376	352	352	344	336	336	-17.8
HFCs	27	27	29	30	34	40	45	51	53	46	44	44	46	50	85.3
PFCs	16	14	12	10	10	9	9	8	8	7	6	6	6	6	-64.7
SF ₆	10	11	12	12	13	15	15	13	12	10	10	9	10	9	-9.7
Total (with CO₂ from LULUCF)	4 015	3 976	3 897	3 825	3 823	3 868	3 932	3 872	3 884	3 797	3 817	3 839	3 798	3 873	-3.5
Total (without CO₂ from LULUCF)	4 238	4 246	4 159	4 087	4 089	4 131	4 212	4 151	4 162	4 092	4 101	4 148	4 127	4 182	-1.3

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

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

Sectors	Tg CO ₂ equivalent														Change 1990–2003 (%)
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	
Energy	3 310	3 344	3 273	3 221	3 203	3 235	3 316	3 253	3 292	3 264	3 280	3 347	3 339	3 393	2.5
Industrial Processes	313	301	292	283	302	313	315	320	298	265	266	259	258	265	-15.4
Solvent and Other Product Use	10	10	10	10	10	10	10	10	10	10	10	9	9	9	-10.1
Agriculture	462	449	442	433	436	437	440	442	440	437	435	426	420	414	-10.3
LULUCF ^a	-223	-270	-262	-262	-265	-261	-278	-278	-276	-294	-283	-307	-329	-307	37.3
Waste	141	142	141	140	137	133	130	124	120	114	109	104	99	97	-31.5
Other	1	1	1	1	1	1	1	1	1	1	1	1	1	1	29.6

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

6. The institutional arrangements are clear and effective. In particular, the ERT was impressed with the EC inventory team's ability to manage, organize and present large amounts of data in an effective way. During the review, the EC inventory team provided a series of evaluative analyses of the information included in the NIR, which greatly facilitated the ERT's work. The ERT recommends that the EC include these evaluative analyses in its future submissions to facilitate the work of the centralized and desk review teams.

7. The most pressing improvements for the EC are to submit CRF tables for LULUCF that are consistent with decision 13/CP.9 of the Conference of the Parties and to continue to explore mechanisms for following up on major issues identified in the review reports of individual Member States.

II. Overview

A. Inventory submission and other sources of information

8. The EC submitted an NIR on 15 April 2005, and a resubmission on 30 May 2005.

9. In its 2005 submission, the EC has submitted a complete set of CRF tables for the years 1990–2003.

10. During the review the EC provided the ERT with additional information sources. These documents are not part of the inventory submission but are in many cases referenced in the NIR. The full list of materials used during the review is provided in the annex to this report.

B. Key categories

11. The EC has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2005 submission. The EC identified a category as key if it was key according to the level assessment in any one of the years 1990–2003 or if it was key according to the trend assessment for the period 1990–2003. The key category analyses performed by the Party and the secretariat² produced similar results. The differences are largely due to the different level of aggregation used by the EC, and the inclusion by the EC of key categories identified on the basis of the level assessment in any one year. The secretariat's analysis identified fewer key categories than the EC's, and identified only one category (Stationary Combustion – Coal (CH₄) on trend assessment) that was not also identified by the EC. When summed together for the year 2003, the 42 key categories identified by the EC account for 97.1 per cent of total emissions, excluding LULUCF. The EC did not include the LULUCF categories in the analysis because it did not have a complete set of CRF tables consistent with decision 13/CP.9.

12. The EC uses the key category analysis for the application of QA/QC procedures, and focuses on key categories in the NIR (i.e. discussions of methodological choice, data collection and emissions trends). In addition, Member States conduct their own key category analyses, the results of which are used to prioritize national resources and select methodologies.

13. The key category analysis methodology and results are well documented in chapter 1 and annex 1 of the NIR. The ERT recommends that the EC provide an additional results table in chapter 1 to distinguish between key categories identified by level and by trend. In addition, the EC should assess the feasibility of providing summary information on key categories identified by Member States, such as the

² The secretariat identified, for each Party, those source categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance. Key categories according to the tier 1 trend assessment were also identified for those Parties that provided a full set of CRF tables for the year 1990. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

number of Member States that identified a category as key and the share of emissions represented by these Member States.

14. In assessing methodological choice, the ERT focused on Member States that account for a high proportion of emissions in a key category (i.e. Member States cumulatively accounting for up to 60–75 per cent of the total). For some EC key categories, important Member States do not yet use higher tier methods. For example, the EC identified 4.A.1 Cattle as a key category. France and Germany together account for 45.4 per cent of total emissions from 4.A.1 Cattle, but use tier 1 methods for estimating emissions from the subcategory Non-dairy Cattle. However, a larger share of emissions from dairy cattle (>75 per cent) was estimated using higher-tier methods.

C. Cross-cutting topics

1. Completeness

15. Consistent with its current status as a Party to the UNFCCC, the EC includes inventory data for the 15 countries that were members of the EU (European Union) before the enlargement on 1st May 2004 (EU-15): Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom (UK). The EC inventory also includes summary data for the 10 Member States that joined in May 2004: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovakia and Slovenia. Two Member States, Cyprus and Malta, are non-Annex I Parties to the UNFCCC. The ERT took note of the data provided for the 10 new Member States, but provides conclusions only for information on the EU-15.

16. The EC has provided inventory data for the years 1990–2003 and included all the required CRF tables except the LULUCF reporting tables required by decision 13/CP.9. Notation keys are used throughout the tables. The EC explained that LULUCF tables could not be submitted because a complete set were not available from all EU-15 Member States (five Member States did not submit the new tables).

17. The NIR includes information on key categories, methods, data sources, uncertainty estimates, QA/QC procedures, verification activities. The NIR provides a description of the QA/QC and verification procedures used in the preparation of the GHG inventory.

18. The NIR follows the table of contents in the “Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories” (hereinafter referred to as the revised UNFCCC reporting guidelines) except for sector-specific planned improvements and certain annexes (e.g. detailed discussion of methodology and data for estimating CO₂ emissions from fossil fuel combustion. See FCCC/SBSTA/2004/8, p. 18). The EC should provide an explanation in the NIR as to whether or not annexes are excluded because of the unique nature of the EC inventory or for other reasons.

19. Among the EU-15 submissions, there are a small number of data gaps in the reporting of HFC/PFC/SF₆ emissions in Greece and Ireland, and a larger number of gaps in the Luxembourg inventory.³ Consistent with EC legislation (Decision No. 280/2004/EC), the EC has calculated estimates for these gaps and included these new estimates in the EC totals. The methodologies used for filling these gaps are well documented in the NIR, and the Member States affected have the opportunity to provide feedback. The ERT noted that gap-filling procedures can improve the completeness of Member States’ inventories, particularly where data for early years in the time series are not available. The ERT also believes that the gap-filling procedure should be based on consultation and agreement between the EC and the Member State concerned, and any revised estimates should also be included in both the EC and the Member State’s inventory. However, gap-filling, although useful for minor gaps, does not substitute for a Party’s obligation to report a complete annual inventory.

³ There are more extensive gaps in the inventories compiled by the ten new EU Member States.

20. The ERT noted that, as is the case with all methods used to estimate emissions and removals, all gap-filling methods should be consistent with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines) and the IPCC good practice guidance. The ERT noted that according to the NIR the EC will base its gap-filling procedures on the “Technical guidance on methodologies for adjustments under Article 5.2 of the Kyoto Protocol”, if no consistent time series is available on which to base extrapolation. However, the ERT considers that all gap filling procedures should be consistent with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance, and recommends in future NIRs that the EC demonstrate this consistency in its documentation of methodological choice.

2. Transparency

21. The transparency of the EC inventory has improved significantly thanks to an improvement in the completeness of the sectoral background tables. Tables 1.A, 1.B.1 and 1.C are largely complete; tables 4.A, 4.B, 4.C, 4.D, 4.F and 6.A are partially complete; and tables 1.B.2, 2(I).A-G, 2(II).C,E,F, 5.A–5.D and 6.B are incomplete. The ERT noted that in some cases it is not feasible for the EC to provide aggregated sectoral background data in all cases because Member States may use different units or data types (e.g. clinker production as opposed to cement production). To assist future review teams in the assessment of completeness, the ERT recommends that the EC provide in the NIR a summary list of the types of background data which, due to the unique nature of the EC inventory, cannot be included in a given CRF table, along with a short explanation of the reasons for the exclusion. To increase transparency, the EC should also provide background data for key categories in the NIR for all Member States that have supplied data. This additional information will assist reviewers in understanding the practical limits to the EC’s CRF reporting while also facilitating a review of the calculations and comparisons with other Annex I Parties.

22. The transparency of the EC NIR has also improved since 2004. The NIR provides significantly more detail, particularly for the EC key categories. For each key category the NIR describes the contribution of individual Member States, the methodology used, and the type of emission factors (EFs) and activity data (AD), and gives explanations for the EC trend. This increased transparency assisted the ERT in assessing whether or not estimates for key categories had been prepared according to the IPCC good practice guidance. The ERT also noted that the level of documentation and transparency varies according to sector, with the Waste chapter containing the most background data and analytical discussion.

23. The ERT concluded that the detailed in-country information presented during the review on cross-cutting issues and sector-specific topics enabled a much deeper understanding of the methods, data and trends in the EC inventory. Many questions prepared in advance by ERT members were answered during these presentations, and this allowed for a more efficient focus on specific unresolved review issues. The ERT strongly recommends that the EC include much of the information provided in these presentations in its future NIRs – particularly the evaluative analyses of methods, data and trends performed by EC experts – to increase transparency and facilitate future reviews.

24. If one or more Member States do not report background data in the CRF because of confidentiality, the EC is unable to provide implied emission factors (IEFs) for that category. Therefore, given the large number of Member States, the EC provides very little background data in the CRF for the Industrial Processes sector. Product data and IEFs are provided in the NIR, however, for the subset of reporting countries (e.g. for adipic acid and nitric acid).

3. Recalculations and time-series consistency

25. The ERT noted that recalculations of the time series 1990–2003 had been undertaken to take into account the large number of recalculations from individual Member States. Overall, recalculations were less significant at the EC level than for individual Member States. Estimates of total 1990 and 2002 emissions, excluding Land Use Change and Forestry (LUCF), increased in the latest submission by

0.2 per cent and 0.1 per cent, respectively. Recalculations including LUCF were significantly higher: -2.8 per cent in 1990 and -4.2 per cent in 2002. The main reasons for recalculations in the LUCF sector were estimation of new sources (subcategories), the use of improved AD, the use of new or improved emission/removal factors and the moving of CO₂ from agricultural soils to LUCF.

26. The rationale for the recalculations and their scale are presented for each Member State in the NIR for 1990 and 2002. Chapter 10 of the NIR provides a brief description of significant recalculations for individual Member States, along with a reference to the Member States' CRFs or NIRs where the recalculations are described in more detail. Belgium, France, Finland, Germany, Italy, Portugal and the UK had the largest recalculations in terms of absolute size.

27. As part of QA/QC, the European Topic Centre on Air and Climate Change (ETC-ACC) uses an outlier detection tool to see if recalculations result in a different trend. The results of these checks are sent to Member States requesting them to provide explanations, but there is no formal process for following up on specific issues.

4. Uncertainties

28. The EC has provided uncertainty estimates, using the tier 1 approach, for the first time. Uncertainty is calculated for a subset of total emissions, excluding LULUCF, on the basis of Member States' data available for the period 2001-2003. When combining uncertainties for individual categories, the EC has corrected for correlations if Member States used tier 1 methods.

29. This uncertainty analysis is difficult because not all Member States report uncertainty estimates, and those that do report uncertainty do not provide estimates at the same level of aggregation. As a consequence, the EC provides estimates of the uncertainty for a subset of total EC emissions for one year and for a subset of aggregated categories. Also, the tier 1 uncertainty analysis for emission trends requires the availability of uncertainty estimates of AD and EFs. As the EC emissions are not calculated on the basis of the EC AD and the EC EFs (but are summed up from Member States emissions) there are no uncertainty estimates for AD and EF at EC level available. However, for the next submission, the EC will explore the possibility of using tier 2 uncertainty analysis for the emission trend.

30. The EC plans to hold a workshop on uncertainty analysis in September 2005 at which Member States will discuss ways to improve the EC uncertainty estimates. EC inventory experts noted during the review that such improvements will, in part, be dependent on the submission of detailed uncertainty estimates by Member States. The ERT encourages the EC to work with Member States to improve the completeness of its uncertainty reporting.

31. The ERT recommends that the EC include uncertainty estimates for the LULUCF categories in its next submission and suggests that the EC consider the feasibility of providing uncertainty estimates for the reference approach using EUROSTAT data.

5. Verification and quality assurance/quality control approaches

32. Inventory preparation and QA/QC are very closely linked in the EC because of the significant data management challenge involved in compiling an inventory based on estimates from many Parties. The NIR contains a detailed description of the inventory compilation process and the relevant QA/QC procedures. In addition, individual Member States are required to establish their own QA/QC programmes according to the IPCC good practice guidance. The ERT concludes that its QA/QC system is extensive and effective, is consistent with good practice, and will lead to continued improvements in the overall quality of the inventory.

33. During the review, the EC demonstrated automated checks, outlier detection tools, time-series checks, and database integrity checks on Member States' data and the EC compilation that are very similar to those performed by the UNFCCC secretariat. Errors, outliers and other potential problems are

flagged and reported back to Member States prior to submission of the inventory requesting them to provide explanations. There is no formal process for following up with Member States to resolve these issues.

34. During the review the EC provided the ERT with its QA/QC plan and forms, and identified the QA/QC coordinator. Because the EC inventory compilation and QA/QC processes are closely linked and cannot be managed separately, the ERT believes that it is consistent with good practice to designate a QA/QC coordinator who is also involved in the inventory preparation process.

35. The EC does not apply tier 2 QA/QC to key categories in all sectors (e.g. it does not do so for Industrial Processes). As noted below in the section on the Industrial Processes sector, the ERT recommends that the EC implement sector-specific QA/QC across the entire inventory.

36. EUROSTAT compiles an independent estimate of EC and Member States' CO₂ emissions data from fossil fuels using the IPCC reference approach, based on EUROSTAT energy balance data. EUROSTAT compares these data with Member States' and the EC's data, and prepares a report summarizing the major differences, which is included in the EC NIR. This is consistent with the IPCC good practice guidance.

6. Institutional arrangements

37. During the in-country visit, the EC presented a description of its institutional arrangements for preparation of the inventory. The NIR also describes these arrangements in detail in chapter 1. The Directorate General Environment of the European Commission (DG Env) has overall responsibility for the EC inventory. The Climate Change Committee of the Council assists DG Environment supported by its working group on annual inventories (Working Group 1). The European Environment Agency (EEA) also assists DG Env in the compilation and reporting of the inventory through the work of ETC-ACC. The ETC-ACC prepares the NIR and CRF tables, maintains the inventory database and archives, implements QA/QC procedures, and consults with Member States on technical issues related to the inventory. The DG Joint Research Centre (JRC) and DG EUROSTAT also play a direct role in the inventory compilation process. Individual Member States choose methodologies, select data and prepare their own emissions and removals estimates. DG Env and its assisting organizations do not themselves prepare emissions and removals estimates other than the EC reference approach for CO₂ emissions from fossil fuels.

38. The EC institutional arrangements are well developed, with clearly defined roles and responsibilities. In addition, the institutional arrangements are reinforced by legislation. Decision No. 280/2004/EC incorporated UNFCCC reporting obligations into European Union law. The rules for implementing Decision 280 include an annual 15 January deadline for submission of Member States' draft inventories to the European Commission, and an annual deadline of 15 March for the final inventory. The Commission can, at its discretion, take legal action to ensure that Member States comply with this legislation.

39. In compiling the inventory, the EEA, supported by the ETC-ACC, interacts with Member States through informal means to resolve questions or get clarification concerning data and documentation. The timeliness and responsiveness of individual Member States to these technical communications vary. The EC explained that, in some cases, delayed responses make it impossible for the ETC-ACC to correct or explain problems or issues before the deadline for submission of the inventory to UNFCCC. The ERT believes that a more effective process would improve the completeness and transparency of the EC inventory.

7. Record keeping and archiving

40. The EC has a comprehensive centralized archiving system which is managed by the ETC-ACC in Vienna, Austria on behalf of the EEA. The electronic archive consists of a catalogue of spreadsheets

used both to compile the inventory from Member States' submissions and to perform QA/QC checks. The electronic archive also includes all correspondence between the EEA, including the ETC-ACC, and Member States and other organizations involved in the preparation of the inventory (e.g. EUROSTAT). NIRs are also kept in hard copy but, because actual estimates are not made by the EC, Member States are responsible for archiving all country-specific reference materials. Member States' inventories, the EC inventory and EC NIR and other official EC inventory publications are published on the EEA web site.

8. Follow-up to previous reviews

41. The EC has addressed a large number of the issues raised in previous reviews. On cross-cutting issues, the EC has made the following improvements:

- (a) Provision of significantly more information in the NIR on methods used by Member States for key categories;
- (b) Additional data provided in the CRF sectoral background tables;
- (c) Quantitative uncertainty estimates for a large fraction of EC emissions;
- (d) Provision of the reference approach for the latest year (2003);
- (e) Additional sector-specific QA/QC programmes in the Waste (the holding of a workshop on waste) and in the LULUCF sectors (organisation of an expert meeting on improving the quality of GHG inventories in the LULUCF sector).

D. Areas for further improvement

1. Identified by the Party

42. In the NIR and in its response to the issues raised during the review, the EC indicated that it is working to implement the following improvements:

- (a) QA/QC and sector-specific programmes for the Industrial Processes sector;
- (b) Internal "desk review" of the EC inventory by Member States;
- (c) EC experts have considered ways to follow up on issues raised in review reports of individual Member States' inventories, and concluded that such follow-up is made difficult by the amount of information involved. The EC proposes that at the sectoral workshops organised under the Climate Change Committee review findings could be addressed for individual sectors.

2. Identified by the ERT

43. The ERT identifies the following cross-cutting issues for improvement:

- (a) Reporting of LULUCF CRF tables consistent with decision 13/CP.9;
- (b) Evaluative analyses of estimates for key categories, as presented during the in-country review;
- (c) Sectoral QA/QC and improvement in transparency for the Industrial Processes sector;
- (d) Documentation in the NIR that describes which data cannot be reported in the CRF sectoral background data tables;
- (e) A more interactive approach to filling in the gaps in Member States' data, and more active involvement by Member States;

- (f) An assessment of the consistency of gap-filling methods with the IPCC good practice guidance;
 - (g) Increased interaction between Member States and the EC on findings from Member States reviews, including the possibility of focusing on areas for further improvement identified in section 1.D of each Member State's review report;
 - (h) Examination by the EC of the reporting of CH₄ oxidation in soils by some Member States and of whether or not this is consistent with the IPCC good practice guidance.
44. Recommended improvements relating to specific source categories are presented in the relevant sector sections of this report.

III. Energy

A. Sector overview

45. The Energy sector contributes 81.2 per cent of total GHG emissions in the EC (EU-15). Total GHG emissions from the sector have increased by 2.5 per cent since 1990, from 3,310,470 Gg CO₂ equivalent in 1990 to 3,393,320 Gg in 2003. In 2003 emissions increased by 1.6 per cent compared to 2002.
46. The most important energy-related gas is CO₂: CO₂ from the Energy sector accounts for up to 78.6 per cent of total EU-15 GHG emissions. CH₄ and N₂O are each responsible for 1.3 per cent of total GHG energy-related emissions.
47. There are 18 key categories in the Energy sector. The six largest are CO₂ and account for about 90 per cent of the energy-related emissions and 74 per cent of the overall GHG emissions from the EC countries.
48. In absolute terms, from 1990 to 2003, the largest increase has been in CO₂ emissions from Road Transportation (+152 Tg CO₂) and the largest decrease has been in CO₂ emissions from Manufacturing Industries and Construction (-69 Tg CO₂). The increase in Road Transportation comes from almost all Member States, while the decrease in the Manufacturing Industries and Construction subsector occurred mainly in Germany.

1. Completeness

49. The EC CRF is a compilation of the Member States' CRFs. It includes estimates of all gases and sources of emissions from the Energy sector, as recommended by the Revised 1996 IPCC Guidelines. Nevertheless, some data are not included, such as subsectoral background data for Manufacturing Industries and Construction. Also data from Luxembourg for other years than 2003 come from gapfilling because Luxembourg did not submit CRFs for these years.
50. The information in the NIR is very well structured and well correlated with the CRF.
51. During the in-country review a very complete and structured presentation highlighted the main aspects of the inventory.

2. Transparency

52. Taking into account that the EC inventory is a compilation of the EU-15 Member States' data, it can be considered to be very transparent because all the CRF tables are available and all the criteria and methods for compilation are well described and documented.

3. Recalculations and time-series consistency

53. Recalculations are presented in a very transparent way and justified for each Member State for which recalculations have been done. The changes resulting from the recalculations range from -0.1 per cent for CO₂ in 1990 and 2002 to -7.8 per cent for N₂O in 1990.

54. Time series are not always consistent. Many outliers were identified due to the fact that they are outliers in one or more Member States. Some of them are discussed below under the corresponding key categories in part C of this section (below). The ERT identified a problem, already identified by the EC, in that the procedure used to deal with this issue is not satisfactory. Communication between the EC and Member States with the aim of correcting problems is not always efficient and this results in some inconsistencies between the EC's CRFs and the Member States' CRFs. The ERT strongly recommends improving the communication between the EC and the Member States not only to resolve time-series inconsistencies but also to enhance the quality of all Member States' inventories, as well as the EC's.

4. Uncertainties

55. The approach used is satisfactory. See section I of this report (above) for a more general discussion of the uncertainty analysis in the EC inventory.

5. Verification and quality assurance/quality control approaches

56. Internal consistency tests are performed and are satisfactory.

57. There should be better quality control of Member States' CRFs regarding outliers in order to identify situations in which there is an outlier for each Member State. In some (sub)categories there is no outlier for the EC but there is an outlier for a Member State.

58. As well as better follow-up of Member States, resubmission must be implemented to guarantee the consistency of the EC submission with the Member States' submissions. As it is now, the EC submission is not consistent with all Member States' submissions because some Member States resubmit their inventory to the UNFCCC and do not communicate this fact to the EC properly, or fail to do so in good time.

B. Reference and sectoral approaches

59. The reference approach is based on a EUROSTAT energy balance which is compiled from data furnished by Member States. The difference between the reference and the sectoral approach for the year 2003 is 0.9 per cent.

60. On the other hand, if a comparison is made for each Member State using the EUROSTAT energy balance and the national data for the reference approach, important differences can be detected (more than 10 per cent), as shown in table 3.47 of the NIR.

61. A harmonization project has been launched to identify the sources of discrepancies and propose solutions for them. A workshop on energy balances and energy-related GHG emissions has also come out with some conclusions as to how comparability between the Member States' inventories can be improved. The problems identified can be attributed to small differences in the data reported by Member States to EUROSTAT (joint questionnaires) and to UNFCCC and the EC (CRF tables), small differences for net calorific values (NCVs), differences in the treatment of non-energy use of fossil fuels and carbon stored, and the use of country-specific EFs. The ERT encourages the EC to continue the effort to harmonize the different Member States' data.

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

62. There are no international statistics available for the EC, so no comparison can be made.

2. International bunker fuels

63. International bunker emissions of the EC are the sum of Member States' international bunker emissions. However, Member States use different methodologies for estimating these emissions. Some are based on fuel consumption alone while some are based on traffic data and fuel consumption. Special difficulties are also identified in almost all Member States in separating domestic and international emissions.

64. The EC does report emissions from international aviation bunkers split by fuels. However, Germany has not reported its AD and emissions split by fuel, which is reflected in the reported totals of aviation bunkers (the reported total is larger than the sum of jet kerosene and aviation gasoline). The ERT encourages the EC to provide AD and emissions by fuel from Germany.

65. A workshop on GHG emissions from aviation and navigation was held in Copenhagen in May 2004 which resulted in important conclusions regarding legal arrangements, emissions estimations methods and data used to improve the quality of those emissions. Most relate to cooperation within Member States and the use of compatible methods and criteria. The ERT encourages the EC to follow the recommendation of the workshop to improve the quality of the international bunker and national emissions estimates.

3. Feedstocks and non-energy use of fuels

66. CRF table 1.A(d) lists many fuels in the category Non-energy Uses. For all of them the fraction 0.5 is used to calculate the carbon stored. There is no explanation for this assumption. The ERT encourages the EC to adopt fractions for carbon stored that correspond to fuel characteristics and specific uses, in line with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance.

4. Country-specific issues

67. The fraction of carbon oxidized is reported as 1.0 in table 1.A(b), and the EFs are not the IPCC EFs. The explanation is that the fraction of carbon oxidized was taken into account in the EFs. Nevertheless some EFs were not modified taking into account the fraction of carbon oxidized. Additionally there is no explanation in the documentation box for the fact that all fractions of carbon oxidized have the same value, 1.0. Even if this change might not modify the results in terms of emission estimates, the ERT encourages the EC to split the EFs and the fraction of carbon oxidized for the sake of the comparability of these tables with other countries' tables.

C. Key categories

1. Public Electricity and Heat Production: all fuels – CO₂

68. CO₂ emissions from Public Electricity and Heat Production are the largest key category, accounting for 24.2 per cent of overall EC emissions in 2003. These emissions grew by 6.3 per cent between 1990 and 2003, while fuel consumption grew by 17.9 per cent in the same period, which reflects the switch from coal to gas in many power plants.

69. Germany was responsible for 31.9 per cent of these emissions in 2003, followed by the UK (17.3 per cent) and Italy (12.7 per cent).

2. Mobile Combustion – Road Vehicles: all fuels – CO₂

70. CO₂ emissions from Road Transportation are the second-largest key category, accounting for 18.9 per cent of overall EC emissions in 2003. More than that, these emissions grew by 23.8 per cent from 1990 to 2003 and increased in all Member States.

3. Manufacturing Industries and Construction: all fuels – CO₂

71. CO₂ emissions from Manufacturing Industries and Construction are the third-largest key category, accounting for 13.8 per cent of overall EC emissions in 2003. These emissions decreased by 10.8 per cent between 1990 and 2003, fuel consumption having decreased by 2.5 per cent over the same period, which reflects the switch from solid fuels to gas in many industries.

72. In some countries, such as Germany, France, Belgium, the UK and the Netherlands, emissions declined in absolute terms.

73. Although this is a key category, there are no background data at subcategory level for some of the main Member States which contribute to these emissions. Germany, which has the highest share and contributes 22.4 per cent of these emissions, does not have disaggregated data for the different Manufacturing Industries and Construction subsectors. The UK, which contributes 15.2 per cent of these emissions, has disaggregated data only for the Iron and Steel subsector and all other emissions go to subsector Other. Some other countries have some gaps. The ERT encourages the EC to work with the Member States to make it possible to report disaggregated emission estimates.

4. Residential: all fuels – CO₂

74. CO₂ emissions from the Residential subsector are the fourth-largest key category in the sector, accounting for 10.2 per cent of overall EC emissions in 2003. These emissions increased by 4.8 per cent between 1990 and 2003, while fuel consumption increased by 13.1 per cent over the same period, which reflects changes in efficiency and the switch from coal and oil to gas.

5. Commercial/Institutional: all fuels – CO₂

75. CO₂ emissions from the Commercial/Institutional subsectors are the fifth-largest key category in the sector, accounting for 3.8 per cent of overall EC emissions in 2003. These emissions decreased by 1.2 per cent between 1990 and 2003, while fuel consumption increased by 10.0 per cent over the same period, which reflects changes in efficiency and the switch from coal and oil to gas.

6. Petroleum Refining: coal, oil, gas – CO₂

76. CO₂ emissions from Petroleum Refining are the sixth-largest key category in the sector, accounting for 2.8 per cent of overall EC emissions in 2003, but showing a significant increase of 11.7 per cent between 1990 and 2003.

D. Non-key categories

Fugitive emissions: Coal mining and handling – CO₂

77. CO₂ fugitive emissions from 1.B.1(a) Coal Mining and Handling are not estimated even though CH₄ emissions from this activity are estimated. In tables 1.B.1 and the sectoral report they are reported as “0”. If they were not estimated, the notation key “not estimated” (“NE”) should be used.

E. Areas for further improvement

1. Identified by the Party

78. Most of the main problems were already identified by the EC and are related to the need to improve communication between the Member States and the EC during the compilation of the inventory.

2. Identified by the ERT

79. The ERT considers that the main area for further improvement regards the communication between the EC and the Member States, as well as the implementation of the workshop results. They should be effective in time to be implemented in the next (2006) EC submission.

IV. Industrial Processes and Solvent and Other Product Use

A. Sector overview

80. Industrial Processes is the third-largest emitting sector, contributing 6.3 per cent to total EU-15 GHG emissions in 2003. The largest sources of emissions from the sector are CO₂ emissions from Cement Production (30.8 per cent), HFC emissions from Consumption of Halocarbons and SF₆ (15.5 per cent), Other (13 per cent), and N₂O from Nitric Acid Production (10.9 per cent). Emissions from this sector have decreased by 15.4 per cent since 1990, from 313,317 Gg CO₂ equivalent in 1990 to 265,030 Gg in 2003. In 2003, the emissions increased by 2.9 per cent compared to 2002. It was not clear to the ERT which Member States and subcategories contribute to the Other category (13 per cent) in figure 4.1 of the NIR. The ERT recommends that the EC provide details of this category in its next submission.

1. Completeness

81. The CRF includes estimates of all gases and sources of emissions from the Industrial Processes sector, as recommended by the Revised 1996 IPCC Guidelines. However, the EC does not provide emission estimates at a disaggregated level for the subcategories for HFCs and PFCs, even though in some cases it knows which specific countries report emissions for these subcategories and therefore could provide these data. The ERT recommends that the EC provide emission estimates for all subcategories for the fluorinated gases (F-gases). For subcategories where some Member States have indicated that the information is confidential, the EC could provide this information in the documentation box and provide a summary table in the NIR.

2. Transparency

82. For the Industrial Processes sector the EC reports AD and IEFs in the CRF tables as "NE". To enhance the transparency of its reporting, the ERT recommends that the EC provide the AD and IEFs where possible. When this is not possible an explanation should be provided indicating why. This issue has also been raised in section I above.

3. Uncertainties

83. During the review the EC provided information as to how it handles uncertainty issues for the Industrial Processes sector. Where a Member State reports an uncertainty estimate at the category level (e.g. Mineral Products), the EC allocates this uncertainty to the subcategories (e.g. Cement Production). The ERT encourages Member States to report their uncertainty estimates at a more disaggregated level, which will improve reporting of overall EC uncertainty.

4. Verification and quality assurance/quality control approaches

84. The EC does not have sector-specific QA/QC procedures for the Industrial Processes sector as it has for other sectors. To ensure transparency and completeness in reporting, the ERT recommends that QA/QC procedures be put in place for this sector.

B. Key Categories

1. Cement Production – CO₂

85. The EC provides a quantitative estimate of the IEF for cement production for the EU-15 (0.53t/t) in the NIR (table 4.3), but uses the notation key “NE” in CRF table 2(I).A-G. The EC responded that the IEF in table 4.3 refers to EU-12 (EU-15 without BE, DK, LU), because these 12 Member States report clinker production as background AD. There is no estimate of IEF available for EU-15 (based on all 15 Member States) and therefore the notation key “NE” was used in the CRF. The ERT recommends that the EC provide this additional information in the NIR for future submissions.

2. Lime Production – CO₂

86. Germany, which makes the highest contribution (30.7 per cent) to the CO₂ emissions in this subcategory, uses the IPCC default methodology. Among the EC Member States, only those which account for about 30 per cent of emissions use higher-tier methods for estimating CO₂ emissions from Lime Production. The ERT recommends that the Member States whose contributions amount to 60–75 per cent of the emissions for a key category use higher-tier methods for the estimation of emissions. Table 4.4 of the NIR indicates that Portugal’s share of CO₂ emissions from Lime Production is 46.2 per cent, whereas during the in-country review it was clarified by the EC that Portugal’s contribution to CO₂ emissions from this subcategory is only 2.4 per cent. The ERT recommends that this error be rectified.

3. Production of Halocarbons and SF₆ – HFC

87. Greece is the largest emitter (with 34.5 per cent) of HFCs from Production of Halocarbons and SF₆ among the Member States, and uses a tier 1 methodology for the estimation of the emissions. The ERT recommends that Greece use a higher-tier methodology for the estimation of emissions for this source category.

4. Consumption of Halocarbons and SF₆ – HFCs and SF₆

88. The EC uses gap-filling in deriving emissions estimates for Member States that do not provide any data on their HFC and SF₆ emissions arising from the consumption of halocarbons and SF₆. As noted in section I of this report above, the ERT believes that any revised estimates should also be included in both the EC and the Member State’s inventory, and that all gap-filling techniques should be consistent with the IPCC good practice guidance. The ERT recommends that the EC encourage Member States to provide national estimates of HFC emissions based on actual consumption and to use higher-tier methods.

C. Non-key categories

Solvent and Other Product Use – CO₂, N₂O, NMVOC

89. The sectoral background data table is provided, but the notation key “NE” has been used for paint application and degreasing and dry cleaning. The NIR does not provide detailed information about the sector. The ERT recommends that the EC provide more information for this sector in the NIR and fill in the sectoral background data table with quantitative data in its next submission, if possible.

D. Areas for further improvement

1. Identified by the Party

90. The EC has not identified any specific areas for improvement for the Industrial Processes sector.

2. Identified by the ERT

91. The ERT recommends that the EC implement sector-specific QA/QC procedures. The ERT also recommends that the EC further develop its:

- (a) Uncertainty management, especially the determination of uncertainties for subcategories and use of uncertainty estimates in the key category analysis;
- (b) Data gap-filling strategies, in line with the IPCC good practice guidance, especially for the F-gases, in order to address the increasing trend in HFC emissions vis-à-vis meeting Member States' commitments under the Montreal Protocol;
- (c) Treatment of confidential information, to improve on the transparency of the EC inventory for the Industrial Processes sector; the EC should make transparent all emission estimates where at least one Member State reports the notation key "C" (e.g. by listing for each source category the Member States that report "C").
- (d) Use of higher-tier methodologies for the EC key categories.

V. Agriculture

A. Sector overview

92. Total GHG emissions from the Agriculture sector in the EC were estimated to be 461,887 Gg CO₂ equivalent in 1990, and decreased by 10.3 per cent to 414,427 Gg CO₂ in 2003. In 2003, CH₄ accounted for 46.9 per cent and N₂O for the remaining 53.1 per cent of total emissions from the Agriculture sector. The major source categories were Agricultural Soils (responsible for 47.5 per cent of total agricultural emissions), Enteric Fermentation (31.5 per cent) and Manure Management (20.2 per cent). Emissions from rice cultivation, field burning of crop residues and emissions reported under category Other (4.G) were responsible for the remaining 0.7 per cent of emissions from this sector.

93. The EC has identified the following key categories in the Agriculture sector: CH₄ from enteric fermentation from cattle; CH₄ from enteric fermentation from sheep; CH₄ from manure management from cattle; N₂O from manure management under solid storage and dry lot; CH₄ from manure management from swine; direct N₂O emissions from soils; N₂O from animal production; and indirect N₂O emissions from soils.

1. Completeness

94. The inventory includes emissions estimates for all gases and sources from the Agriculture sector, as recommended by the Revised 1996 IPCC Guidelines. Emissions of CO₂ from agricultural soils, reported under the Agriculture sector in previous submission, are now reported under LUCF. Prescribed burning of savannas is reported as "not occurring" ("NO") in CRF table 4.E. The EC reports net removals of CH₄ from agricultural soils and N₂O emissions from Other, although these include emissions from a minority of Member States.

95. All the CRF tables for the Agriculture sector have been provided. Some background information which would have been useful for the review process is not available in the tables: the allocation by climate region; the methane conversion factor (MCF) by animal type and animal waste management system (AWMS) in table 4.B(a); nitrogen (N) excretion per head, N excretion per animal waste system and IEFs in table 4.B(b); and AD and IEFs for N-fixing crops and crop residues and the additional information table (Fractions) in table 4.D. The EC explained during the review that some Member States did not report this background information. Nevertheless, in the case of tables 4.B(a) and 4.D, only information from a minority of Member States is not provided in Member States' inventories, and in the case of table 4.B(b), concerning N excretion per animal waste system, the required information was

indeed reported in the EC's NIR. The ERT recommends that the EC make efforts together with the Member States to obtain the missing information and complete the tables. In the case of table 4.B(b), the EC should report total N excretion at the EC level, in that way making it possible to calculate IEFs.

96. Because the inventory of Luxembourg was not available for all years at the required level of detail, the EC has used gap-filling procedures to estimate emissions from this Member State. The EC explained during the review that the following gases/years were gap-filled for Luxembourg: (1) sector totals of CH₄ and N₂O for 1991-1993; (2) category estimates of CO₂, CH₄ and N₂O for 1991-1993; (3) subcategory estimates of CO₂, CH₄, N₂O for the years 1990-1997, 1999, 2001. The ERT concludes that providing the detailed information listed above in the NIR would improve transparency.

2. Transparency

97. The NIR is significantly more transparent than that of the previous submission, which is in accordance with the recommendations of the last review process. The NIR includes a new discussion of "Methodological Issues and Uncertainties" for manure management, rice cultivation and CH₄ emissions from agricultural soils, and more detailed information concerning AD, parameters and related information helpful for the inventory review.

98. However, the explanation of methodologies and tier levels is mainly a compilation of information from the Member States that has not been integrated into a harmonized and structured set. This makes the review more difficult because it requires an analysis of Member States' NIRs. Additional information provided to the ERT during the in-country review shows that the EC inventory team has in fact carried out a comparative analysis of the methodologies and EFs that were used by the several Member States, and has made a consistent classification of methodological tiers. The ERT found this very informative and recommends that the EC discuss it in more detail in its future NIRs.

3. Recalculations and time-series consistency

99. Recalculations in estimates of emissions and removals in the Agriculture sector have resulted in a substantial decrease in the estimates of overall GHG emissions from agriculture for all years, largely as a consequence of one Member State moving CO₂ emissions from soil from the Agriculture sector to LULUCF. Excluding CO₂, however, the recalculation was less significant, resulting in a 1.4 per cent increase of total emissions from agriculture in 1990 and 0.3 per cent in 2002. The increase in the estimated emissions is higher for base year (1990) than for 2002, resulting in a larger decrease of the emissions trend. The ERT encourages the Party to give more explanations in the NIR for the trend recalculations.

4. Uncertainties

100. For the first time the EC has carried out a quantitative uncertainty analysis at tier 1 level and, although it covers only 12 Member States, the analysis encompasses 97 per cent of total EC GHG emissions from agriculture. The uncertainty values for the AD and EFs that were used for each Member State and for each key category were presented during the in-country review. The information given in the NIR for uncertainty is not comprehensive because there is no separate reporting of uncertainties for EFs and AD for each Member State. From the available information given during the in-country review, it is evident that there is significant variation among Member States in the uncertainties for EFs, even when they use the IPCC default EFs: this is particularly apparent for the source category Agricultural Soils. The ERT recommends that the EC present more detailed information in the NIR, separating the uncertainties for AD from the uncertainties in EFs for the Member States, and make efforts to ensure more consistent uncertainty estimates among Member States.

5. Verification and quality assurance/quality control approaches

101. The EC has included specific QA/QC procedures in the NIR. The EC has held two workshops: one on Inventories and Projections of Greenhouse Gas Emissions from Agriculture, held at the EEA in February 2003, and an expert meeting on “improving the quality for greenhouse gas emission inventories for category 4.D”, held in October 2004 at Ispra, Italy (the JRC).

B. Key categories

1. Enteric Fermentation – CH₄

102. According to the information received during the in-country review, about 58 per cent of total emissions from cattle were estimated using tier 2 methods and 73 per cent of emissions from sheep were estimated using tier 2. The percentage of tier 2 is much higher for dairy cattle than for other cattle because countries with significant emissions, such as France and Germany, use tier 2 for dairy cattle but tier 1 for other cattle. Because emissions from other cattle are more significant (50 per cent of emissions from enteric fermentation) than from dairy cattle (34 per cent), and because both are significant sources according to the IPCC good practice guidance, the ERT considers that it would be preferable, through Member State action, to achieve high levels of higher-tier methodologies for both animal categories independently.

103. There is considerable variation in the Member States' EFs for dairy cattle and other cattle. The highest EF for dairy cattle is 60 per cent higher than the lowest value, and for other cattle the difference is bigger (the highest EF is 2.2 times the lowest EF for 2003). Apart from differences that are explained solely by different aggregation in livestock numbers, this pattern, according to the EC, is possible and is explained by differences in productivity between Member States. The ERT recommends that the EC include in its NIR a comparative analysis of the regional differences in IEFs using productivity indicators, such as milk yield (preferably using independent data from the inventory), from all Member States, which could improve the quality of the inventory and help in assessing its consistency. The EC should make efforts to reduce the differences in the class definitions reported by Member States.

104. Although emissions from dairy cattle have been decreasing due to a reduction in livestock numbers in almost all Member States, this has been accompanied by an increase in overall IEFs, by 9.6 per cent between 1990 and 2003. As recognized by the EC, this increase may be slightly underestimated because not all Member States consider the effects of increases in productivity in their choice of EFs (e.g. Greece, Ireland and Portugal). The ERT expresses satisfaction at the fact that the Party has performed the analysis of trends independently for AD and IEFs, and further recommends that efforts should continue at EC level to estimate and reduce this possible underestimation of emissions.

2. Manure Management – CH₄

105. Swine (48.5 per cent), dairy cattle (23.6 per cent) and other cattle (23.2 per cent) are the significant sub-sources of manure management. During the in-country review, the EC explained that 19 per cent of cattle emissions and 42 per cent of swine emissions were estimated using a tier 2 method.

106. The EC reports related information in CRF table 4.B(a) as “NE” and does not provide the additional information table. The NIR provides comprehensive information on the allocation of animal types to AWMS, but only partial information is given for climate allocation, and no information is given for important parameters such as volatile solid excretion (VS), methane-producing capacity (Bo) and MCF.

107. The ERT recommends that the EC provide comparative analysis among Member States at a more disaggregated level than only IEFs. For example, the Party could report tables and discuss values of the allocation of animal types, AWMS, VS, Bo and MCF per climate region for each Member State. Evaluative analyses of the differences between Member States, and between their values and the IPCC

defaults, in particular for MCFs, would help future ERTs conduct their reviews. The EC is also encouraged to obtain missing information from the few Member States that had not reported in order to include complete information at EC level, particularly for AWMS and the MCF.

108. Information in the NIR concerning trends in emissions is scarce. The ERT recommends that the EC provide more information and a more detailed analysis of the reasons for the emission trends.

3. Manure Management – N₂O

109. The EC estimates that only 13 per cent of total emissions from this source category are estimated using higher-level methodologies (country-specific EFs or N excretion rates). The ERT recommends that, in accordance with the decision tree in the IPCC good practice guidance, the EC work with Member States to promote the use of more country-specific data and of enhanced livestock population characterization, particularly for the major emitter Member States (France, Italy, Germany, Spain, the UK and Portugal) and for the most significant sub-source, Solid Storage and Dry Lot.

110. The EC does not report N excretion rates at the EC level because not all Member States report these rates in their own inventories. In the NIR the EC describes the range of possible values among Member States, but does not present the actual N excretion rates or trends for each Member State. During the review the EC stated that the differences in N excretion rates among Member States are due to livestock characteristics or to the fact that some Member States include young animals in livestock numbers whereas others do not. The ERT considers that the transparency of the inventory would be enhanced if the EC could present or discuss in more detail in the NIR the Member States' N excretion rates and their trend. Also, the EC should make efforts to report N excretion rates in table 4.B(b) at EC level and by animal type.

111. The EC reports a comparatively high percentage of N₂O emissions from Other, which accounted for about 16.1 per cent of total N₂O emissions from manure management in 2003. According to the EC this result is due to the fact that Germany reports using this category in its own inventory. The ERT recommends that efforts be made to reallocate emissions from Other to the different AWMS, thereby improving the transparency of the reporting.

4. Direct N₂O Emissions from Agricultural Soils – N₂O

112. All but two Member States use default EFs for this category. However, an important fraction of Member States use country-specific ammonia volatilization rates (eight use country-specific $Frac_{GASF}$ and eight use CS $Frac_{GASM}$), demonstrating efforts by Member States to improve their estimates for this important source. The NIR does not provide information on the different procedures Member States used to determine AD, such as data on synthetic fertilizer use and manure management. In this respect, the ERT encourages the EC to improve the transparency of its reporting.

113. The EC does not report overall AD and IEFs for N-fixing crops and crop residue because Member States use different units. The ERT recommends that the EC work with the Member States to ensure that AD are reported in comparable units.

114. Due to incomplete reporting in the CRF tables of additional information (fractions) by a minority of Member States, the EC has not reported overall values, thus impairing the review process. The ERT recommends that the EC make every effort to ensure that this information is delivered by all Member States and that overall fractions be reported.

5. Indirect N₂O Emissions from Agricultural Soils – N₂O

115. About 53 per cent of emissions from this key category have been calculated using country-specific information and methods. In 2003, N₂O emissions from N from fertilizers and animal wastes that are lost through leaching and run-off were the most important sub-source of the source category

Agricultural Soils, about 26.7 per cent, and special care must therefore be given to this sub-source, particularly for the Member States that contribute the most to it.

116. Substantial differences exist between the Member States concerning EFs and concerning the fractions used to estimate AD. Recognizing the importance of country- and region-specific data for inventory improvement, the ERT encourages the EC to discuss these differences in more detail in the NIR, particularly with respect to the fractions of N from application of synthetic fertilizers and manure that are volatilized ($\text{Frac}_{\text{GASF}}$ and $\text{Frac}_{\text{GASM}}$) and the fraction of N that is lost through leaching and run-off ($\text{Frac}_{\text{LEACH}}$).

117. Almost all Member States use EFs that are equal or close to the IPCC default EF for atmospheric deposition, while France, in 2003, used an EF (0.004 kg N-N₂O/kg N) that is only 40 per cent of the IPCC default. In previous submissions the EC and all Member States used the default EF, and the most recent time series therefore shows a decreasing trend observable only in the most recent year, 12.1 per cent less in 2003 than in 2002. The EC noted during the review that France reported an incorrect EF for 2003, and in fact used the default EF. While the mistake did not affect reported emissions, the EC plans to ensure correct reporting next year.

C. Areas for further improvement

1. Identified by the Party

118. Although the Party does not explain in a detailed form in the NIR the improvements it is implementing, the Party has promoted a workshop with Member States about agricultural soils, with recommendations on both reporting and methodological development. The ERT recommends that the EC include a summary of the recommendations in the NIR as future improvements and also identify in more detail the efforts it is making with Member States to improve the reporting and inventory quality at EC level.

2. Identified by the ERT

119. The ERT recommends that the EC ensure that Member States whose contributions amount to 60–75 per cent of emissions in an EC key category use higher-tier and more country-specific methodologies.

120. The ERT recommends that, to improve transparency, the EC provide evaluative analysis of the information collected from the Member States. The EC should also give special attention to the presentation and discussion of country-specific methodologies and EFs, and to parameters that are used differently by different Member States, in particular when there is major deviation from the IPCC defaults or the EFs of other Member States, and when particular Member States or regions are responsible for a substantial fraction of total emissions from the EC. The ERT recommends that the EC include this analysis in its NIR.

VI. Land Use, Land-use Change and Forestry

A. Sector overview

121. The EC has not provided the LULUCF reporting tables as required by decision 13/CP.9. Instead it has used the old LUCF reporting tables as contained in decision 3/CP.5 of the Conference of the Parties. The reason for this is that only 10 out of the EU-15 Member States reported using the new LULUCF CRF tables and that it was not possible to convert the data provided from the remaining Member States to the correct reporting format. The ERT strongly encourages the EC and its Member States to report the LULUCF sector using the revised CRF tables. The EC informed the ERT that the new CRF and the IPCC *Good Practice Guidance for Land Use, Land-use Change and Forestry* (LULUCF) (hereinafter referred to as IPCC good practice guidance for LULUCF) will be adhered to in the 2006 submission.

122. The remainder of this section is based on the reporting of the LUCF sector as contained in decision 3/CP.5, as the EC mapped back the information provided in the LULUCF CRF to the LUCF format (the Revised 1996 IPCC Guidelines framework) to make comparison with the previous submission possible.

123. In accordance with decision 13/CP.9 of the Conference of the Parties, all Parties should provide a mapping back of their LULUCF inventory to the LUCF inventory. However, not all Member States which reported LULUCF provided the mapping back. As in the case of gap-filling procedures, the ERT considers that the mapping back should be done in close cooperation with the individual Member States and that the same information should be reported by both the EC and the individual Member States.

124. The comparison with the previous submission is possible due to the mapping back and does not always reflect the actual reporting by individual Member States in the LUCF source categories 5.A–5.E, as several Member States reported using the new LULUCF source categories.

125. The emissions/removals data and relevant information have been updated since the submission to the UNFCCC secretariat. As a result, the figures given below are different from those submitted in the 2005 NIR and CRF. The updated information will be included, as appropriate, in the 2006 submission.

126. The EC reports both sources and sinks of GHG emissions. Overall, however, the LUCF sector is reported as a net removal since 1990. Net removals increased by 47.0 per cent, from 182,376 Gg CO₂ in 1990 to 268,092 Gg in 2003, while they decreased by 6.7 per cent from 2002 to 2003. As a result, the percentage of the net removals from the LUCF sector over total emissions (without LUCF) increased from 4.3 per cent in 1990 to 6.4 per cent in 2003. Changes in Forest and Other Woody Biomass Stocks contributed 83.0 per cent to the net increase in removals, and the reduction in emissions from soils contributed 9.7 per cent. Net GHG emissions from LUCF have been below 1990 levels for the past decade.

1. Completeness

127. The CRF includes estimates of all gases, sources and sinks from the LUCF sector, as recommended by the Revised 1996 IPCC Guidelines, including CO₂, CH₄, N₂O, carbon monoxide (CO) and nitrogen oxide (NO_x), and in the applicable categories. All 15 Member States reported emissions/removals from the category Changes in Forest and Other Woody Biomass Stocks, while 11 reported emissions/removals in the category Emissions from Soils, which is the second most important category after Changes in Forest and Other Woody Biomass Stocks. Five Member States reported all five categories (including Other). Seven Member States reported all categories from 5.A to 5.D. This is an improvement compared to the 2004 submission.

128. CRF tables 5.A, 5.B, 5.C, 5.D and 5.E are filled in with “NE” because the EC inventory is a compilation or summation of inventories of Member States and not all Member States provided relevant background data. CRF Summary 3 and table 7 were filled in using the notation key “NE”, although relevant information is provided in the NIR.

2. Transparency

129. During the review process, the EC provided updated CRF reporting tables of each category of the 15 Member States (both LUCF CRF and revised LULUCF CRF, if any) and of the EC as a whole from 1990 to 2003, allowing the ERT to examine how total emissions/removals of the EC countries have been calculated.

3. Recalculations and time-series consistency

130. All source/sink categories from 1990 to 2003 have been recalculated using consistent methodologies, EFs and AD throughout the whole time series. The recalculation has been documented and justified in the EC's NIR.

131. There is an inconsistency in the reporting table from Germany (between the LUCF CRF table and the revised LULUCF table). The inconsistency was corrected by the EC during the in-country review.

4. Uncertainties

132. The uncertainties of the source/sink categories in the LUCF sector of the EC as a whole are not provided because most Member States did not estimate relevant uncertainties. The ERT recommends that the EC estimate a range of uncertainties in its future submission based on available data from the Member States or by means of expert judgement.

5. Verification and quality assurance/quality control approaches

133. There is a comprehensive QA/QC procedure in the EC inventory process. In addition, several projects have been implemented for harmonizing the inventory and the Member States' reporting in the LUCF sector, and these activities have already resulted in important improvements to the current inventory. However, more careful checking of internal consistency within and between the reporting of Member States is desirable, in order to avoid possible inconsistencies or to explain the large differences.

B. Sink and source categories

1. Changes in Forest and Other Woody Biomass Stocks – CO₂

134. CO₂ emissions/removals from Changes in Forest and Other Woody Biomass Stocks are the major component of emissions/removals in the LUCF sector. Eight Member States evaluated their reporting for this category as complete, representing 88 per cent of the net emissions/removals of the EC. Four Member States evaluated it as partly complete, while only three do not provide an evaluation of completeness. Most Member States used higher-tier methods and/or country-specific EFs.

135. The definition of harvested wood in the category Changes in Forest and Other Woody Biomass Stocks differs between the Member States. For example, the UK reported it as the carbon stock change in harvested wood products, whereas Portugal reported it as the harvesting stock. The ERT expects that this issue will not arise in future submissions if the LULUCF reporting tables are used in next year's submission.

2. Forest and Grassland Conversion – CO₂, CH₄, N₂O

136. Emissions/removals from Forest and Grassland Conversion in 2003 are small compared to other categories in the LUCF sector. Eight Member States reported this category, compared to three in the 2004 submission.

137. The UK figure for CO₂ emissions from forest conversion in its revised LULUCF CRF table (under the Information item of table 5) is larger than the category 5.B CRF table for LUCF. The ERT recommends more careful mapping back.

3. Abandonment of Managed Land – CO₂

138. Emissions/removals from this category in 2003 were also small compared to those from other LUCF categories. However, the reporting is more complete as nine Member States reported this category compared to three in the 2004 submission.

4. Emissions and Removals from Soils – CO₂

139. The importance of this category in the LUCF sector has been increasing as 11 Member States have reported emissions/removals in this category compared to seven in the 2004 submission.

5. Other – CO₂, CH₄, N₂O, CO

140. Eleven Member States reported emissions/removals in this category compared to two in the 2004 submission. CH₄ is a removal in the Other category for France from 1990 to 1993. N₂O is also a removal in Other for Italy from 1993 to 1998. This seems to be odd and needs clarification. Source/sink subcategories in the category Other should be specified as required in the CRF table as well as in the NIR.

C. Areas for further improvement

1. Identified by the Party

141. The ongoing Carbon Europe Integrated Project will provide many parameters for improving EFs. The ongoing COST E43 project is aiming to harmonize definitions, measuring practices, and estimation procedures for carbon pools and carbon pool changes.

142. An expert meeting on improving the quality of GHG inventories and projections for the LULUCF sector is to be held on 22–23 September 2005 in Ispra.

2. Identified by the ERT

143. The ERT strongly encourages the EC to report the LULUCF sector using the revised CRF tables and the IPCC good practice guidance for LULUCF.

144. The ERT encourages the EC to improve the use of its established QA/QC procedures for consistency checking and comparing the data from Member States.

VII. Waste

A. Sector overview

145. In 2003, emissions from the Waste sector represented 2.3 per cent of total GHG emissions of the EC. Emissions from this sector decreased by 31.5 per cent between 1990 and 2003. Emissions from Solid Waste Disposal on Land contributed 77.1 per cent of total Waste sector emissions in 2003, while emissions from Waste-water Handling, Waste Incineration and Other accounted for 17.8, 4.0 and 1.1 per cent, respectively. Methane is the predominant gas, contributing 86.1 per cent of emissions from the sector.

1. Completeness

146. The CRF and the NIR include estimates of all gases and sources of emissions from the Waste sector, as recommended by the Revised 1996 IPCC Guidelines.

2. Transparency

147. The transparency of the NIR has improved significantly compared to previous submissions. It includes overview tables and figures with information on completeness, emissions trends, methodologies, EFs, key parameters used in models, sources of AD, time-series consistency, uncertainty estimates, recalculations and QA/QC activities for each Member State as recommended by previous review reports. The NIR explains the emission trends for all source categories. The ERT noted some minor editorial errors in the NIR which will be corrected in the next submission. The EC experts provided additional information and background documents which enhance the transparency of the emissions estimation in

the Waste sector. In this regard the ERT made specific recommendations for each source category in the Waste sector which could further improve the transparency of the NIR.

3. Recalculations and time-series consistency

148. According to information provided in the NIR and the CRF, recalculations in the Waste sector were made for each year in the period 1990–2002. The most significant recalculations were made in 1990 and 2002 due to changes in methodologies in some Member States. The consistency of the time series for municipal solid waste (MSW) AD is explained in the NIR for some Member States. The result of the recalculations is an increase in the estimates of total emissions from the Waste sector by 2.3 per cent in 1990 and a decrease by 0.9 per cent in 2002 in comparison to the previous (2004) submission.

4. Uncertainties

149. Uncertainty in the Waste sector for the EU-15 as a whole has been estimated for all source categories based on uncertainty analysis carried out by each Member State, and equals 17 per cent. The highest uncertainty was estimated for CH₄ emissions from source category Other, which equals 200 per cent, and the lowest for Solid Waste Disposal on Land, 15 per cent. The ERT recommends the EC to enhance the completeness of emissions for which uncertainty is estimated, particularly for the following source categories: Waste incineration, Wastewater handling and Other.

5. Verification and quality assurance/quality control approaches

150. The NIR and the CRF state that the quality of the estimates in the Waste sector is assessed to be medium to low. Sector-specific QA/QC procedures have not been applied for the Waste sector at the EU-15 level, but some Member States have advanced QA/QC programmes in place for their inventory preparation, which could facilitate improvement of the quality of estimates in the sector. A European Climate Change Committee workshop was held in May 2005 on inventories and projections of GHG emissions from the Waste sector. The recommendations from the workshop encourage Member States to improve the completeness of their estimation and to improve their use of the first order decay (FOD) model (tier 2) for estimating CH₄ emissions for solid waste disposal sites.

B. Key categories

1. Managed Waste Disposal on Land – CH₄

151. All EU-15 Member States, with the exception of Greece and possibly Luxembourg, have applied the FOD method (tier 2) or a modified version of this model adjusted to country specifics for the estimation of CH₄ emissions, which is in line with the IPCC good practice guidance. The ERT recommends that the EC encourage Greece to apply a tier 2 method and clarify which method was applied by Luxembourg. According to the NIR, these two countries represent 3.4 per cent of total EU-15 emissions from Managed Waste Disposal on Land.

152. The NIR provides a detailed description of the data sources in each Member State used for generating a time series of amounts of MSW disposed to solid waste disposal sites (SWDS). There are two main sources: national institutions responsible for collecting data and/or various research programmes, studies or reports prepared by specialized institutions. Some Member States have described the consistency of their time series.

153. The composition of landfilled MSW for each Member States is briefly described in the NIR. It can be concluded that Member States are using different waste classification systems and that the composition of waste which is ultimately disposed to SWDS is strongly influenced by waste management practices and policies. Directive 1999/31/EC on landfill of waste and Packaging Waste Directive

94/62/EC are the key items of legislation at the EU-15 level; they prescribe mandatory reduction targets for biodegradable municipal waste and packaging waste.

154. The NIR provides a comparison of degradable organic carbon (DOC) values across Member States. The DOC value for Germany appears to be significantly higher than that for other Member States. However, during the review process it was explained that this entry was incorrect and that the correct value is 0.185, which is within the range of DOC values from the IPCC good practice guidance. A brief explanation was also provided for the UK value for DOC, which is significantly smaller than those of the majority of Member States. The ERT recommends the EC to include the correct value for DOC in the case of Germany and to provide a detailed explanation of the DOC estimation method applied in the UK.

155. Data on methane recovery and sources of data are provided in the NIR. The largest share of recovery is achieved in the UK (69 per cent). The fraction of CH₄ recovered in Greece is not consistently presented in the NIR since the value presented in the figure equals 46 per cent and in the table is considered to be 0. The ERT recommends that the EC check the data on methane recovery rate in Greece.

156. The NIR explained that data on industrial waste were difficult to obtain and only a few Member States have considered this type of waste in their estimates of emissions. The ERT believes that the main reason could be the inconsistency in industrial waste categorization in Member States which is ultimately landfilled.

157. Some Member States have applied different CH₄ generation rate constants (k) for different types of waste or SWDS. The ERT recommends the EC to provide more detailed explanations for France since background information on k values is missing in the NIR.

2. Unmanaged Waste Disposal on Land – CH₄

158. CH₄ emissions from unmanaged solid waste disposal on land were reported by six Member States. All six had applied the tier 2 method except Greece. The NIR provides country-specific information on unmanaged solid waste disposal. The MCF for deep unmanaged SWDS was reported as “included elsewhere” (“IE”) for Portugal. It is not clear from the NIR which criteria have been applied by each Member State to classify waste disposal sites as unmanaged. The ERT recommends that the EC include the list of criteria or characteristics used by Member States in categorizing unmanaged SWDS.

3. Domestic and Commercial Waste Water – CH₄

159. Member States apply different methods for estimating CH₄ emissions from Domestic and Commercial Waste Water. The NIR provides information on CH₄ emission sources and different methods applied to determine CH₄ emissions from domestic and commercial waste water and sludge handling. The ERT recommends the EC to present the key parameters used by each Member State for estimating emissions from this subcategory, particularly the biochemical oxygen demand (BOD) or chemical oxygen demand (COD) value and fraction of waste water treated anaerobically.

4. Waste Incineration – CO₂

160. Emissions from waste incineration without energy recovery decreased by 41.7 per cent from 1990 to 2003. Eight Member States which reported emissions from this source category applied different methods and EFs for emissions estimation, including the CORINAIR methodology, plant-specific EFs, IPCC default and tier 2 methodologies. The NIR provides brief explanations on types of waste incinerated and methods applied for most of the Member States. The ERT recommends the EC to provide data on the amounts of waste incinerated and the IEFs applied by Member States.

C. Non-key categories

1. Industrial Waste Water – CH₄

161. The NIR reports that the Member States have difficulty in estimating emissions from this category. Methods for determining CH₄ emissions are explained in the NIR. The ERT recommends the EC to further explain the key parameters (Bo, MCF) used in emissions estimation in cases when these values are significantly different from those given in the Revised 1996 IPCC Guidelines.

2. Other – CH₄

162. Under the source category Other, some Member States reported emissions from composting, open burning of industrial waste (Portugal) and sludge spreading (Spain). According to the IPCC good practice guidance, if sludge is used in agriculture then emissions from this subcategory should be reported in the Agriculture sector. The ERT recommends that the C explain in the NIR that sludge in Spain had been used in agricultural activities.

D. Areas for further improvement

1. Identified by the Party

163. Areas for further improvement of the EC inventory were identified during the workshop on inventories and projections of emissions from waste held in May 2005. The key recommendations include:

- (a) The Party should improve the completeness of the estimates of emissions for all source categories and all GHGs in the Waste sector;
- (b) The FOD model (tier 2) should preferably be used for the estimation of CH₄ emissions from solid waste disposal;
- (c) Member States should achieve consistency in the categorization of waste types included in their estimation;
- (d) Parameters used in models should be further clarified and documented (MCF, DOC, k, recovered CH₄ (R), oxidation factor (OX)).

2. Identified by the ERT

164. The ERT recommends the EC to:

- (a) Further explore options to harmonize classification of waste across Member States by using the European Waste Catalogue (Decision 2000/532/EC) for the purposes of Member States' estimation of methane emissions estimation in the Waste sector;
- (b) Check the consistency of the time series for landfilled MSW;
- (c) Improve the completeness of the CRF tables where possible and/or reasonable (provide the additional information tables);
- (d) Improve the completeness of the CRF tables where possible and/or reasonable (provide the additional information tables).

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

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

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

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UNFCCC secretariat. “2005 Status report for the EUC”. Available at: <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/2005_status_report_european_community.pdf>.

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UNFCCC secretariat (2005). “Report of the individual review of the greenhouse gas inventory of EUC submitted in the year 2004”. FCCC/WEB/IRI/2004/EUC. Available at: <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/2004_irr_centralized_review_european_community.pdf>.

B. Additional information provided by the Party

European Environment Agency European Topic Centre on Air and Climate Change. “Quality Management System”.

Staff Working Paper. “Community Inventory System”, March 2005.

Decision No. 280/2004/EC of the European Parliament and the Council, 11 February 2004.
