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**REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY
OF THE EUROPEAN COMMUNITY SUBMITTED IN THE YEAR 2001¹**

(Centralized review)

I. OVERVIEW

A. Introduction

1. The Conference of the Parties (COP), at its fifth session, by its decision 6/CP.5, adopted guidelines for the technical review of greenhouse gas (GHG) inventories from Parties included in Annex I to the Convention (Annex I Parties), hereinafter referred to as the review guidelines,² for a trial period covering GHG inventory submissions for the years 2000 and 2001. The COP requested the secretariat to conduct individual reviews of GHG inventories for a limited number of Annex I Parties. The secretariat was requested to use different approaches to individual reviews by coordinating desk reviews, centralized reviews and in-country reviews.

2. In response to the mandate by the COP, the secretariat coordinated a centralized review of seven national GHG inventories submitted in 2001 (Austria, Belgium, Estonia, the European Community (EC), Germany, Greece and Spain), which took place from 8 to 12 October 2001. The review was carried out by a team of nominated experts from the roster of experts working at the headquarters of the UNFCCC secretariat in Bonn. The members of the team were: Mr. Charles Russell (New Zealand), Mr. José Ramon Villarin (the Philippines), Mr. Hristo Vassilev (Bulgaria), Ms. Irina Yesserkepova (Kazakhstan), Ms. Nadzeya Zaleuskaya (Belarus), Mr. André Van Amstel (the Netherlands), Ms. Punsalma Batima (Mongolia), Mr. Rizaldi Boer (Indonesia), Mr. Josef Mindas (Slovakia), Mr. Charles Jubb (Australia) and Mr. Emilio Sempris (Panama). The review was coordinated by Ms. Rocio Lichte (UNFCCC secretariat). Mr. Charles Russell and Mr. José Ramon Villarin were lead authors of this report.

3. The principle objective of the review of the GHG inventories was to ensure that the COP had adequate information on the inventories. The review should also further assess the progress of the Parties toward fulfilling the requirements outlined in the UNFCCC reporting guidelines.³ In this context, the review team checked the Parties' responses to questions raised in the previous stages of the review process, and the consistency of inventory submissions with the UNFCCC reporting guidelines and the Revised 1996 Intergovernmental Panel on Climate Change (IPCC)

¹ In the symbol for this document, 2001 refers to the year in which the inventory was submitted, and not to the year of publication. The number (3) indicates that for the European Community this is a centralized review report.

² For the UNFCCC review guidelines and decision 6/CP.5, see document FCCC/CP/1999/7, pages 109 to 114 and 121 to 122, respectively.

³ 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 (FCCC/CP/1999/7) are referred to in this report as the UNFCCC reporting guidelines.

Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the IPCC Guidelines), and identified possible areas for improvement in the inventories of the seven Annex I Parties. Each IPCC sector was reviewed by two experts.

4. The review team also assessed to a certain degree whether the reporting fulfils the requirements included in the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (hereinafter referred to as the IPCC good practice guidance).⁴

5. The UNFCCC secretariat provided the review team with all necessary technical guidance, information and data, such as the national inventory submissions and the results of previous stages of the review process. Sources of data and information used for the review of the European Community's inventory are outlined in paragraphs 7 to 10 below.

6. In accordance with the UNFCCC review guidelines, a draft version of this report was communicated to the European Community, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

B. Inventory submission and other sources of information

7. The European Union (EU) submitted the Annual European Community Greenhouse Gas Inventory 1990-1999 (hereinafter referred to as the EC inventory report) to the UNFCCC secretariat. The report was released on 11 April 2001. It is published as Technical Report No. 60 of the European Environment Agency (EEA). In this technical report only the tables Summary 1.A of the common reporting format (CRF) are published for 1990-1999. Other member States' CRF tables are published on the web site of the EEA. In addition to this technical report the EEA published a trends report in August 2001 entitled *European Community and member States greenhouse gas emission trends 1990-1999* (hereinafter referred to as the EC trends report). This report does not officially form part of the EU 2001 GHG inventory submission, but was made available to the expert review team (ERT) as background information. In this report, the emissions trends are explained in more detail. For each member State and for the EU as a whole, a distance-to-target assessment is made. In addition, the report includes some information on experience with policies and measures in the different EU countries.

8. The secretariat also provided the ERT with the draft synthesis and assessment (S&A) report 2001. A response to the preliminary findings raised in that report was not provided by the EC. The EC's inventory submission of the year 2000 was not covered in the S&A report 2000, since this report covered only those Parties using the CRF for reporting of inventories. As an additional source of information regarding the most recent review undertaken in the EU, the ERT referred to the inventory section of the in-depth review (IDR) of the EC's second national communication.

9. In addition, during the review process the ERT referred to the UNFCCC reporting and review guidelines, and the preliminary guidance for experts participating in the individual review of GHG inventories, prepared by the UNFCCC secretariat.

10. During the review the Party was not contacted to request additional information.

⁴ According to the conclusions of the Subsidiary Body for Scientific and Technological Advice (SBSTA) at its twelfth session, the IPCC good practice guidance should be applied by Annex I Parties as far as possible for inventories due in 2001 and 2002, and should be used for inventories due in 2003 and beyond.

C. Emissions profiles, trends and key sources

11. Overall, total aggregate GHG emissions (including land-use change and forestry (LUCF)) of the EU have decreased by 4.3% between 1990 and 1999. Removals of carbon dioxide (CO₂) from LUCF account for around 5% of these emissions in 1999. Total aggregate GHG emissions without LUCF decreased by 4.0% relative to 1990. CO₂ is the dominant GHG in the EC inventory. CO₂ emissions (including LUCF) decreased by 4.4% from 1990 to 1993; however this was followed by increases up to 1996. Overall, CO₂ emissions (including LUCF) decreased by 1.8% from 1990 to 1999. Methane (CH₄) emissions decreased gradually over the period by 16.7%. Nitrous oxide (N₂O) decreased in stages; the first reduction of 6.7% occurred in 1993, and this was followed by increases until 1996 and then by a much steeper decrease to 14% in 1999. HFCs increased by 66% in the period 1990 to 1999. A significant contribution to this increasing trend is the doubling of emissions between 1990 and 1998. PFC emissions show a decrease of 38% in the period 1990-1999, most of this reduction occurring between 1990 and 1994.

12. The energy sector fluctuations mirror the fluctuations of CO₂. A decrease of 3% occurred between 1990 and 1994; however there was a steep increase in energy emissions up to 1996, and these then fell to an overall reduction in 1999 of 2.0% relative to 1990 levels. Industrial processes emissions decreased by 12% from 1990 to 1993, and then increased annually until 1997, before falling again to give an overall decrease of 17.7% relative to 1990. Solvent and other product use fell by 6% from 1990 to 1994, and then gradually increased up to 1999, resulting however in emissions being 2.1% below 1990 levels. Emissions from agriculture decreased by 4.4% between 1990 and 1999, with most of the reductions occurring in the 1990 to 1995 period. LUCF fluctuated annually with an average annual removal of 197 Mt CO₂. Waste emissions decreased by 19% over the period 1990 to 1999, with the majority of the reductions occurring between 1994 and 1997.

13. While the EC inventory report does not contain an identification of key sources, the EC trends report does present an assessment based on the IPCC good practice guidance tier 1 method. The source categories for this assessment are understandably more aggregated than that suggested by the IPCC. The procedure for identifying these key sources is well documented in the EC trends report (pages 16ff). Eighteen source categories are listed, based on level and trends assessment (see table 3).

14. In addition to an aggregated key source analysis such as the one given here, it might be useful to look at the member State contribution per key source. This member contribution analysis may be done using both level and trends assessment methods.

Table 1. GHG emissions by gas, 1990 - 1999 (Gg CO₂ equivalent)^(a)

GHGs	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO₂ equivalent (Gg)									
CO ₂ (without LUCF)	3,325,370	3,350,679	3,277,471	3,208,245	3,220,706	3,258,070	3,332,938	3,272,091	3,316,965	3,270,520
CO ₂ (with LUCF)	3,125,519	3,128,770	3,068,325	2,989,416	3,014,975	3,060,238	3,126,964	3,067,737	3,121,597	3,069,536
CH ₄	440,063	429,326	417,798	406,423	395,685	394,430	387,377	379,068	370,351	366,353
N ₂ O	394,236	391,812	382,506	367,979	377,853	379,394	388,861	385,563	361,789	338,486
HFCs	25,627	24,954	24,957	27,178	32,174	37,256	41,039	46,851	51,394	42,620
PFCs	13,502	11,847	9,606	8,232	7,524	7,824	7,761	7,415	7,979	8,361
SF ₆	8,365	9,082	9,560	10,516	11,233	11,950	11,711	11,711	11,233	10,994
Total (with CO ₂ from LUCF)	4,007,313	3,995,792	3,912,752	3,809,744	3,839,444	3,891,092	3,963,713	3,898,344	3,924,343	3,836,351
Total (without CO ₂ from LUCF)	4,207,163	4,217,700	4,121,897	4,028,573	4,045,174	4,088,923	4,169,687	4,102,698	4,119,711	4,037,334

^(a) As the EC did not provide aggregate emission estimates in terms of CO₂ equivalent in the corresponding tables of the CRF for the EC 15 as a whole, values shown in this table were taken from table Summary 1.A for the EC15, and converted into CO₂ equivalent emissions.

Table 2. GHG emissions by sector, 1990 - 1999 (Gg CO₂ equivalent)^(a)

GHG SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO₂ equivalent (Gg)									
Total (with LUCF)	4,007,229	3,995,337	3,912,504	3,809,322	3,839,161	3,891,057	3,963,722	3,898,338	3,924,333	3,836,434
Energy	3,308,615	3,342,569	3,271,838	3,203,261	3,202,388	3,239,650	3,315,458	3,252,937	3,291,487	3,241,433
Industrial processes	307,312	295,497	284,020	271,371	286,499	296,083	299,852	302,237	284,283	252,849
Solvent and other product use	9,268	9,255	9,053	8,660	8,715	8,756	8,805	8,999	9,068	9,069
Agriculture	415,458	406,655	396,662	391,424	394,169	392,975	398,988	397,630	394,843	396,976
LUCF	-191,463	-213,715	-198,832	-210,474	-196,783	-188,956	-197,072	-196,503	-187,158	-193,144
Waste	154,743	151,822	146,393	141,669	140,743	139,099	134,093	129,650	128,076	125,487
Other	3,296	3,253	3,369	3,410	3,429	3,450	3,598	3,389	3,733	3,763

^(a) As the EC did not provide aggregate emission estimates in terms of CO₂ equivalent in the corresponding tables of the CRF for the EC 15 as a whole, values shown in this table were taken from table Summary 1.A for the EC15, and converted into CO₂ equivalent emissions.

Table 3. Key sources EC (EC trends report, table 1)

Greenhouse gas source categories	Gas	Sector	GHG emissions in 1990 (million tonnes)	GHG emissions in 1999 (million tonnes)	Cumulative total in 1999 (%)
1.A.1. Energy industries	CO ₂	Energy	1147	1044	25,9
1.A.3. Transport	CO ₂	Energy	698	825	46,4
1.A.4. Other sectors	CO ₂	Energy	631	631	62,1
1.A.2. Manufacturing industries	CO ₂	Energy	638	582	76,5
4.D. Agricultural soils	N ₂ O	Agriculture	194	188	81,2
4.A. Enteric fermentation	CH ₄	Agriculture	142	131	84,4
2.A. Mineral products	CO ₂	Ind. processes	108	108	87,1
6.A. Solid waste disposal on land	CH ₄	Waste	136	106	89,7
2.B. Chemical industry	N ₂ O	Ind. processes	110	48	90,9
HFCs (total)	F-gases	Ind. processes	26	43	91,9
4.B. Manure management	CH ₄	Agriculture	42	40	92,9
1.B.2. Fugitive emissions from oil and gas	CH ₄	Energy	34	32	93,7
4.B. Manure management	N ₂ O	Agriculture	28	29	94,5
1.A.3. Transport	N ₂ O	Energy	12	25	95,1
1.B.1. Fugitive emissions from solid fuels	CH ₄	Energy	51	24	95,7
SF ₆ (total)	F-gases	Ind. processes	8	11	95,9
PFCs (total)	F-gases	Ind. processes	14	8	96,2
1.A.5. Other	CO ₂	Energy	20	7	96,3

D. General assessment of the inventory

15. The review of the EC's inventory, including the general assessment, conclusions and sectoral discussions, is based on the inventory for the EC as a whole as a separate Party. This EC review does not cover a review of each individual member State's inventory.⁵

1. Completeness and transparency of reporting

Common reporting format and national inventory report

16. CRF table Summary 1.A was provided for the years 1990-1999 for the EU15 as part of the annex to the EC inventory report describing how the EU15 emissions estimates were compiled. The technical report references the CRF tables prepared by each individual country as the source of the emissions data used to compile the EU15 summary data. The technical report describes how the EC and the member States' emission inventories are compiled annually for the EU report.

Completeness

17. The European Community submission is complete in so far as the sectoral tables and background tables of the national reports of the member States are available (also published on the web site of the EEA). The reason is that each European country has its own set of CRF tables, methods and emission factors. The EC inventory report cites the EEA web site as the repository of CRF tables from each member State up to 1 April 2001. The EC report also states that for the first time, a complete time series of the emissions has been compiled, including F-gas

⁵ Each EC member State is subject to an individual review.

emissions. However, data gap-filling procedures were applied for several years in the cases of Ireland, Luxembourg and Belgium.

18. The EC inventory is submitted with completed CRF tables for each member State. To this extent, the inventory is complete. In order to make a fully informed judgement on the overall completeness of the inventory in terms of reporting or noting all gases, sinks and sources, the CRF tables and national inventory report (NIR) for each member State would need to be reviewed.

19. The EC inventory report (Technical Report No. 60) provides information on the status of each member State's submissions and includes CRF table Summary 1.A for the EC as a whole.

20. The EC trends report includes more detailed information than the EC inventory report, with member State specific information and analysis included in annex 1. For each member State, annex 1 provides information on various GHG emissions performance indicators: distance to target indicators, main driving force indicators, key source trend indicators, sectoral background activity indicators, and sectoral driving force and policy indicators. The EC trends report provides a comprehensive profile of EC emissions and trends.

Transparency

21. The EC submission is transparent if all the underlying CRF tables, methods, emission factors and assumptions are published in the individual national inventories of member States.

22. The inventory is transparent at the sectoral level in summary form. Supporting summary tables are provided for each member State as part of the EC summary. Background tables, to the extent that member States have completed these tables, are available from member States' CRFs. In that there is no single EC methodology, source of activity data, or set of emission factors, such information can not be reviewed for the EC as a whole, but would require a review of each country's CRF and NIR. The review of the EC inventory at an aggregate level does not of itself, therefore, lead to a conclusion as to whether or not the inventory is transparent. A conclusion on overall transparency would require a review of each country's CRF and NIR.

23. The EC trends report with supplementary trend data for each member State provides detailed and transparent information on GHG emissions performance from 1990 to 1999.

2. Cross-cutting issues

Institutional arrangements

24. The EC inventory has been compiled under Council Decision 99/296/EC regarding a monitoring mechanism for Community GHG emissions and is based on data delivered by the member States by 1 April 2001. As the data are revised and updated for all years, they replace previously published EC data.

25. The present annual EC GHG inventory 1990-1999 was prepared by the EEA, which was assisted by the European Topic Centre on Air and Climate Change (ETC/ACC) for the European Commission.

26. Under the Monitoring Mechanism the European Commission has to make an annual assessment as to whether the actual and projected progress of member States is sufficient to ensure fulfilment of the EC's commitments under the UNFCCC. For this purpose, the

Commission prepares a progress evaluation report for the European Parliament and the Council by October each year under Decision 99/296/EC. The EU trends report was prepared by the EEA, assisted by the ETC/ACC, both for the European Commission and as input for other EEA reports.

Quality assurance/quality control (QA/QC) and verification procedures

27. There is an annual process of submission and review to compile the EU15 summary report. These involve checks by the EEA and circulation of a draft EU15 inventory to member States for review and finalization. Otherwise, the EU15 report relies on the national systems in place in each country for their QA/QC procedures. Regarding QA/QC activities, the EC, in its response to the draft of this review report, referred to the EC report, which states that the EEA, assisted by ETC/ACC, performs initial checks (similar to those performed by the UNFCCC secretariat as part of the technical review process) on each member State's GHG inventory submitted by 31 December. Results of these initial checks are communicated to the member States, indicating any major inconsistencies and/or gaps in their national inventories. Based on the data provided by the member States, the EEA prepares a draft EC inventory by 1 March, which is provided to member States for comment, giving them the opportunity to provide updated information by 1 April. The EEA compiles the EC inventory from the member States' data available on 1 April.

28. The EC inventory report briefly describes a data gap procedure for control of inventory data and explains that the EU has developed guidelines (Guidelines for Member States on EC Annual Inventories under the Monitoring Mechanism (1999/196/EC)) for improving the timeliness and quality of the annual EC inventory. The EU15 report also states that Eurostat estimates are used as a data gap filling procedure, specifically for CO₂ emissions from fossil fuel combustion. These estimates are compiled using the IPCC reference approach and energy balance data collected by Eurostat from the member States.

Uncertainties

29. The EC inventory report does not present any information on uncertainties for any sector for the EC inventory, nor is any analysis included in the EC trends report. The level of uncertainty of the EC inventory depends on the level of uncertainty in the inventory of each member State. Until such time as all member States have undertaken assessments of uncertainty, it would be difficult for the EC to present an assessment of aggregate uncertainty. Comment was provided on the difficulty of assessing aggregate uncertainty for non-CO₂ gases in the IDR report (p. 5). The EC considered that any estimate would be unreliable.

30. The EC inventory report states that uncertainties remain high in industrial GHG emission estimates (e.g. HFCs, PFCs, and SF₆) because of remaining data gaps reported by member States (see table 4 of the EC inventory report).

Recalculations and comparison with previous submissions

31. Recalculation tables are not provided in the EC inventory submission for any sector. The last section of the EC inventory report briefly describes the changes that were made relative to the previous (2000) EC inventory submission.

32. Most member States submitted revised and updated time series from 1990-1998. The revisions led to minor changes (below 1%) in EC total emissions for 1990-1998. For CH₄ and

N₂O the changes were slightly higher (up to 4%) due mainly to methodological changes in the waste and agricultural sectors. Comparison with earlier submissions is not provided in the EC submission.

33. The EC inventory report includes a table indicating the state of data for each member State and the CO₂ equivalent emissions of F gases from each member State. No recalculation tables are provided which would show the impact of more comprehensive data on submissions for earlier years.

34. The EC trends report does not contain any information on recalculations or their impact on either the EC inventory or the inventories of member States (where relevant). Where there have been recalculations, consideration could be given to including comment on the recalculations and the impact on trend analyses both for the EC and for the member State(s) (where relevant). This would enable a better understanding of the impact of recalculations in terms of the extent to which they alter Parties' emissions trends.

Time series consistency

35. There is no consistent trend identified in EU15 emissions, as the totals fluctuate up and down through the 1990-1999 time series. The EC inventory report does not evaluate the trends in emissions or elaborate on sector changes. As this report is a compilation of member States' inventories, it is difficult to ascertain whether the values reflect a particular trend, since each country has different national trends. The ERT considers that analysis of trends could enable potential problems with regard to consistency in the time series to be identified (such as in methods used for the different years of the inventory), and therefore suggests that the EC consider providing more information on trend analysis in its NIR.⁶ This would facilitate assessment of the overall consistency in time series of the EC inventory as a whole. Given that the consistency in time series of the EC inventory would depend on the consistency of each member State's inventory, the EC might include in its NIR information on whether the inventory of each individual member State is consistent, with explicit indication as to whether changes in methods or any input data and parameters have occurred in any of the member States. A comparison between the member States' reported trends and the collective trend reflected in the EC report might be beneficial (weighted for the impact of each country's emissions on the whole community).

36. The ERT, however, takes note of the EC trends report, which is not part of the EC's inventory submission but was provided to the ERT as background information for the review (see paragraph 7). This report includes a description of current trends through the use of a distance-to-target index (DTI), which gives an indication of important patterns in the overall total and individual member States' contributions to these trends.

Methodologies, emission factors and activity data

37. According to the EC inventory report, the summary table is a simple sum total of emission estimates of the 15 EC member countries. Methods, emission factors and activity data could not be assessed thoroughly in the context of this review report, as this would require a complete review of each individual member State's inventory.

⁶ The revised UNFCCC reporting guidelines on annual inventories, which were agreed upon by the SBSTA at its sixteenth session, provide guidance on the type of information to be included in the NIR with regard to trends in GHG emissions.

Consistency of information between the CRF and the NIR

38. The emission data as reported in the CRF summary tables for the fifteen countries of the EC and the summary table provided in the technical report are consistent. A comparison was also made between the summary 1999 inventory year CRF tables provided for the fifteen countries of the EC and the 1999 inventory year CRF summary tables provided for each of the individual EC countries in their 2001 submissions. The results were compared for CRF table Summary 1.A, for the total national emissions for CO₂, CO₂ removals, CH₄, and N₂O. The comparison was made utilizing exactly the same cells in the CRF tables, by summing the totals from each of the individual country CRFs and then comparing that total with the EC CRF report total. The results of this comparison are as follows:

	Sum of countries' CRFs	CRF EU15 (Gg)	Difference (Gg)
CO ₂	3,284,922	3,270,520	14,402
CO ₂ removals	-139,918	-200,984	61,066
CH ₄	17,387	17,445	58
N ₂ O	1,098	1,092	6

Note: Values are in Gg of GHG and are for the inventory year 1999.

In its response to the draft of this report, the EC explained the observed differences as being due largely to late submissions from two member States, to which the data gap filling procedure had to be applied (see also paragraph 88 below) and differences due to the net accounting of CO₂ emissions and removals from LUCF.⁷

3. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines

39. The reporting for the EC is not consistent with the UNFCCC reporting guidelines, in that a single CRF for the EC as a whole including, in addition to table Summary 1.A, all sectoral background data tables, sectoral reports and other tables included in the CRF, together with supporting information on methodologies, activity data and emission factors, has not been submitted. It is arguable that as a separate and distinct Party the EU should provide a full CRF. However, it is also arguable that the EC is unique as a Party in that the inventory is a compilation of the inventories of member States and, provided that each member State submits a fully compliant CRF and NIR, the summary material, NIR and trends analysis might be adequate.

40. For example, in respect of member State methodologies, table Summary 3 of the CRF or a similar table could be provided summarising for each subsector whether the methodology is IPCC default, country-specific or CORINAIR or some combination of methodological approaches. This would facilitate a preliminary judgement of the extent to which member States are fulfilling their reporting requirements.

41. Not all countries use the IPCC good practice guidance as yet. Information on this is to be available in the individual NIRs, if submitted.⁸

⁷ Further details are available in the response provided by the EC to the draft of this review report.

⁸ The following member States of the EU did not provide a NIR as part of their 2001 inventory submission: Belgium, Germany, Ireland, Italy, Luxembourg and Portugal.

4. Areas for further improvement

Planned or ongoing work by the Party

42. There are no specific plans, or references to areas for future improvement of the EC's inventory, noted by the Party. It is accepted that to a large extent the EC is dependent on the actions of member States in order to implement improvements to the inventory.

43. An improved interface between the CORINAIR inventory and the CRF will automatically translate CORINAIR inventories into the CRF tables for individual countries. The EEA is coordinating the development of such an interface. In its response to the draft of this report the EC informed the ERT that in 2001 the EEA made available to all its member countries, including the EU member States, a revised software tool providing this interface between the EMEP/CORINAIR inventory compilation methodology and the CRF tables.

Issues identified by the ERT

44. There is scope for improving reporting of the EC inventory. Annex I Parties are required to use the CRF to report their inventories. This includes completion of all tables in the CRF. It is recognized that the EC is unique as a Party. The EC has provided all member States' CRFs although there is no assessment by the EC of the completeness of these CRFs as submitted by the individual member States. The EC inventory report indicates the timetable to be met by member States (p. 7), and the performance of member States with respect to this timetable (p. 8). Annex 1 of the EC Guidelines (1 September 2000) outlines the initial checks that the EC undertakes for each member State's inventory. The checklist is comprehensive in terms of the broad requirements of the inventory. It would be of assistance if the EC were to submit the completed checklist for each member State with the EC's inventory report. The EC inventory is comprehensive in that aggregate summary tables are provided along with the EC inventory report and detailed trends analysis. In its response to the draft of this report, the EC informed the ERT that in future the EC would submit the completed checklists for each member State, starting with the inventory submission due by 15 April 2002.

45. The EC inventory does not provide information on methodologies, activity data and emission factors. This information can be accessed from member States' NIRs and CRFs, where provided by the individual Parties. The ERT considers that a compilation of summary tables based on the information provided by member States would provide reviewers with a useful overview. Such tables could be completed for each source category (e.g. at the level of category disaggregation of that in Summary 1.A of the CRF) and could include, for each individual member State, concise qualitative information on methodologies (default, country-specific, etc.), activity data (data source and frequency of collection, etc.), and factors relevant to implied emission factors (DOC , DOC_f) and emission factors, as well as cross-references to the relevant sections of the member State's NIR, as appropriate.

46. The Party should also ensure agreement between the sum of each CRF report and the aggregate sum reported for the EC. In addition to the explanation provided by the EC in response to paragraph 38 above, the EC further informed the ERT that the EC aims to establish a procedure within its inventory system which would no longer require a gap filling procedure at the EC level, which is currently responsible for the largest discrepancies. Differences due to the net accounting of emissions and removals from LUCF may remain in future, depending on the outcome of the work by the IPCC on good practice guidance on land use, land-use change and forestry (LULUCF).

47. The ERT suggests that high priority should be given to the development of the interface between the CORINAIR and the CRF, described in paragraph 43 above. It will improve the completeness of reporting by the member States.

48. For verification purposes, the development of some cross-checking method might be considered. For example, independently compiled bottom-up emission estimates for the EC as a whole could be used for comparison with the emission estimates totals reported by the EC obtained by adding the individual member States' data. Such independently compiled data sets could be developed using, for example, Eurostat and other international statistics for activity data and default tier 1 emission factors, where available, following the recommendations outlined in section A2.1.2 of the IPCC good practice guidance.

II. ENERGY

A. Sector overview

49. The sector's share in total 1999 emissions was 84.5%. The main key sources are CO₂ from energy industries, transport, other sectors, and manufacturing industries and construction.

50. The general 1990 to 1999 trend for CO₂, CH₄ and N₂O is respectively -1.5%, -31% and +20.8%.

51. Information on recalculations, uncertainties, QA/QC approaches and areas for further improvement in the EC inventory is provided in the overview section of this report.

1. Completeness

52. The emission data reported (for each year from 1990 to 1999) are only at summary level. The sector is not completely covered in terms of IPCC source categories; sector and background tables were not provided for the EC as a whole (see also paragraphs 7 and 15). Summary level estimates for indirect GHG and trend tables are provided.

53. For all source categories mentioned below under C. Key sources, emissions estimates for 1990-1999 are provided in the summary CRF tables, including estimates for indirect GHGs.

2. Transparency

54. An overall assessment of transparency is provided in paragraphs 21 – 23 of the overview section of this report.

3. Methodologies, emission factors and activity data

55. The EC GHG inventory is compiled according to the Council Decision Guidelines and the UNFCCC reporting guidelines.

56. The majority of emission factors are CORINAIR and country-specific.

57. The sources of activity data are the individual member States, national statistics and Eurostat data.

4. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines

58. The present 1990 to 1999 GHG energy sector inventory, for the EC as a whole and noting that the EC is unique as a Party and that individual member States' inventories were not subject to this review, was not reported according to the recommendations for inventories set out in the UNFCCC reporting guidelines which, inter alia, request the provision of CRF sectoral background data tables. An overall assessment is given in paragraph 39 of the overview section of this report.

B. Reference and sectoral approach

1. Comparison between reference and sectoral approach

59. There were only Parties' reference approaches with different degrees of completeness. The sectoral approach total value is: 3,133,575 Gg, or 94.2% of total CO₂ emissions (excluding LUCF) for 1999.

2. Treatment of feedstocks and non-energy use of fuels

60. Feedstocks were not reported.

3. International bunker fuels

61. The EC report provides estimates from international bunker fuel emissions, aviation and marine which are the sum of the 15 member States' reports. The share of CO₂ emissions for aviation is 36.6% and for marine -63.4%.

C. Key sources

1. 1.A.1 Energy industries – CO₂

62. CO₂ from energy industries is a key source for the EC, representing 26.2% of all reported emissions (excluding LUCF); there was an 8.9% decrease compared to 1990.

Methodologies and emission factors

63. Estimation of emissions is based on CORINAIR, IPCC and country-specific methods.

64. The emission factors used for CO₂ emissions are CORINAIR, country-specific and plant-specific. They are based on measurements and mass calculations. It is not possible to analyse the implied emission factor (IEF) due to the lack of activity data.

2. 1.A.3 Transport – CO₂

65. CO₂ from transport is the second key source for the EC, representing 20.7% of all reported emissions (excluding LUCF); there was an 18.2% increase compared to 1990.

Methodologies and emission factors

66. Estimation of emissions is based on CORINAIR, IPCC and country-specific methods.

67. The emission factors used for CO₂ emissions estimation are CORINAIR, country-specific and plant-specific. The values are not referenced. It is not possible to analyse the IEF due to the lack of activity data.

3. 1.A.4 Other sectors – CO₂

68. CO₂ emissions from other sectors are the third key source for the EC, representing 15.9% of all reported emissions (excluding LUCF). CO₂ emissions increased from 1990 to 1999 by 0.16%.

Methodologies and emission factors

69. Estimation of emissions is based on CORINAIR, IPCC and country-specific methods.

70. The emission factors used for CO₂ emissions estimation are CORINAIR, country-specific and plant-specific. The values are not referenced. It is not possible to analyse the IEF due to the lack of activity data.

4. 1.A.2 Manufacturing industries and construction – CO₂

71. CO₂ from manufacturing industries is the fourth energy key source for the EC, representing 14.6% of all reported emissions (excluding LUCF); there was a 8.8% decrease compared to 1990.

Methodologies and emission factors

72. Estimation of emissions is based on CORINAIR, IPCC and country-specific methods.

73. The emission factors used for CO₂ emissions estimation are CORINAIR, country-specific and plant-specific. The values are not referenced. It is not possible to analyse the IEF due to the lack of activity data.

5. 1.B.2 Fugitive fuel emissions: oil and natural gas – CH₄

74. CH₄ emissions from fugitive oil and gas is the lowest energy key source for the EC, representing 0.8% of all reported emissions (without LUCF). CH₄ emissions decreased from 1990 to 1999 by 5%.

Methodologies and emission factors

75. Estimation of emissions is based on CORINAIR and IPCC methods. The emission factors used for CH₄ emissions estimation are country-specific and from CORINAIR and the IPCC. It is not possible to analyse the IEF due to the lack of activity data.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

76. Information on recalculations, QA/QC approaches and areas for further improvement in the EC inventory is provided in the overview section of this report.

77. Regarding consistency of information between the CRF and the NIR, the ERT found that the emission data reported in the CRF summary tables for the EU15, and the summary table provided in the technical report for the industrial processes sector, are consistent.

1. Time series consistency

78. For the industrial processes sector no consistent trend in the EU15 emissions is discernible, as the totals fluctuate throughout the 1990-1999 time series. Further discussion on the time series consistency of the EC inventory is provided in paragraphs 35 and 36 of the overview section of this report.

79. The EC inventory report does not evaluate the trends in emissions nor does it elaborate on changes in the sector.

2. Trends analysis

80. National trends of member States vary substantially in the industrial processes sector. This makes any general trends analysis difficult in this sector.

81. For example, a comparison analysis of CO₂ emissions from industrial processes would reveal the following results:

(a) Mineral products: 1990 to 1993 – tendency to decrease (1993 gives the lowest level for all time series); 1993 to 1999 – tendency to increase with the exception of 1996, when a drop was reported.

(b) Chemical industry: 1990 to 1994 – tendency to decrease (1994 gives the lowest level); then fluctuation and a drop in 1999.

(c) Metal production: 1990 to 1992 – tendency to decrease; 1992 to 1995 – increase; then annual fluctuations.

(d) Other production: A noticeable drop in 1991 in relation to the base year 1990 (980 down to 554 Gg) and a rise again in 1992 (761 Gg); stable growth 1993 to 1996, slight decrease until 1998 and increase again in 1999.

(e) Other: In this subcategory a difference of great concern is from 1996 to 1997 (3,899 down to 398). Assuming that prior and later data are consistent, the reason for such a difference could hardly be a calculation/report error.

82. It seems beneficial to analyse the impact of each country's emissions on the totals for individual sectors and for activities within each sector. When undertaking such a procedure, the weighting of each country can reveal trends which indicate how substantial are the emissions

from various branches of industry within each country in relation to the total emissions of the whole Community.

83. This analysis by country-specific impact and by different branches of industry within each country would seem to be useful as a background for further analysis.

84. For example, if the impact of countries on actual HFC, PFC and SF₆ emissions is compared, the following result is revealed (for the five countries, producing the greatest emissions):

Impact position	1990	1999
1	United Kingdom	Germany
2	Germany	the Netherlands
3	France	Spain
4	the Netherlands	United Kingdom
5	Spain	France

Country contributions to total emissions have changed substantially and countries' impact positions have changed correspondingly, as shown in the above table.

85. As not all countries provided information, the possible extent of comparison analysis is limited.

3. HFC emissions

86. With regard to HFC emissions, the following significant annual changes are noted:

(a) United Kingdom: decrease in emissions between 1998 and 1999 (from 20,183 Gg to 6,206 Gg).

(b) Austria: increase in emissions between 1994 and 1995 (from 17 Gg to 546 Gg).

(c) Spain: increase in emissions between 1994 and 1995 (from 3,885 Gg to 5,595 Gg).

(d) Italy: increase in emissions between 1998 and 1999 (from 1,332 Gg to 2,885 Gg).

(e) Germany: increase in emissions between 1992 and 1993 (from 2,470 Gg to 3,750 Gg).

(f) Denmark: increase in emissions between 1992 and 1993 (from 3 Gg to 30 Gg).

4. Uncertainties

87. The EC inventory report states that uncertainties remain high in industrial GHG emission estimates because of remaining data gaps reported by member States.

88. For data gaps a special procedure was applied: emissions reported for the most recent previous year were taken as first estimates for the missing year. For CO₂, CH₄ and N₂O, the data gap procedure was applied for Luxembourg (1991-1993, 1999) and Belgium (1999). For fluorinated gas emissions, the data gap procedure was applied for Belgium. In its response to the draft of this report, the EC further explained that for CO₂ emissions from energy, the above outlined data gap filling procedure is as follows: the latest data reported by the member State is

used and extrapolated on the basis of percentage changes of CO₂ emissions from fossil fuel combustion as estimated for more recent years by Eurostat for that member State. The Eurostat estimates are compiled using the IPCC reference approach and energy balance data provided annually by member States. The EC also explained that in cases where no data are available for any previous year, a data gap filling procedure is not undertaken.

IV. AGRICULTURE

A. Sector overview

Table 4. Summary overview: Provision of information for the agricultural inventory

Sectoral report tables	No
Notation keys	No
Sectoral background data	Not available
NIR	Available
Methods	No information
Emission factors	No information
Explanation of non-IPCC method	-
Uncertainty	Not available
Emission trends	Yes (1990-1999)
Procedure for QA/QC	Yes
Complete set of CRF tables for agriculture	No (Summary tables only)
CO ₂ reported	Yes
Non-CO ₂ gases reported	Yes
Plans for future improvements	No information

89. Information on recalculations, uncertainties, QA/QC approaches and areas for further improvement in the EC inventory is provided in the overview section of this report.

B. Key sources

90. According to the key source analysis for 1999 provided in the EC trend report, the following three main key sources were identified in the agriculture sector: N₂O emissions from agricultural soils, CH₄ emission from enteric fermentation, and CH₄ emissions from manure management.

Activity data

91. No disaggregated data were provided in the EC report for the period 1990 to 1999.

1. 4.D Agricultural soils – N₂O

92. As indicated in the EC trends report, N₂O from agricultural soils is the single largest source of N₂O emissions in the EC, accounting for 4.7% of total EC GHG emissions in 1999. N₂O emissions from agricultural soils occur from the application of mineral nitrogen fertilizers and organic nitrogen from animal manure.

93. N₂O emissions from agricultural soils decreased slightly (-3% or -5 Tg) between 1990 and 1999 in the EU15.

2. 4.A Enteric fermentation – CH₄

94. Enteric fermentation is the largest single source of CH₄ emissions in the EC and accounts for 3.2% of total CO₂ equivalent GHG emissions in 1999.

95. CH₄ emissions from enteric fermentation decreased by 8% or 11 Tg of CO₂ equivalents between 1990 and 1999, mainly owing to a reduced number of animals.

3. 4.B Manure management – CH₄

96. CH₄ emissions from manure management are the third largest source in agriculture in the EC, accounting for 1% of total EC GHG emissions.

97. CH₄ emissions were 40 Tg of CO₂ equivalents in 1999 and reduced by 5% or 2 Tg of CO₂ equivalents between 1990 and 1999. In 1999 the greatest emitters from manure management in the EC were Germany and Spain, accounting for 26% and 20% of these emissions respectively. Between 1990 and 1999, in absolute terms, Germany reduced CO₂ equivalents by 3 Tg, whereas Spain increased CO₂ equivalent emissions by 1 Tg.

Methodology and emission factors

98. In the EC report no information is given on methods or emission factors. Some observations are repeated here from the centralized review of the 2001 NIRs of Spain and Germany. The methodology in Spain leads to rather large fluctuations during the years 1990-1999. Some provinces, according to their average annual temperature, are in the cool climate class in some years, and in other years are in the temperate class, as defined in the IPCC Guidelines. The review team notes that the climate dependency of the methane conversion factor for methane from manure needs attention in the IPCC Guidelines. Germany's 2001 submission did not give information on underlying data and assumptions.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

Table 5. Summary overview: Provision of information for the LUCF inventory

Sectoral report tables	No
Notation keys	No
Sectoral background data	Not available
NIR	Available
Methods	No information
Emission factors	No information
Explanation of non-IPCC method	-
Uncertainty	Not available
Emission trends	Yes (1990-1999)
Procedure for QA/QC	Yes
Complete set of CRF tables for LUCF	No (Summary tables 7.A only)
CO ₂ reported	Yes
Non-CO ₂ gases reported	Yes
Plans for future improvements	No information

99. GHG inventory data for the LUCF sector were reported in the EC inventory report only; not in the EC trends report. During the period 1990-1999, mean annual GHG emissions from all sectors and gases excluding LUCF was about 4,105,290 Gg CO₂ equivalent. Trend analysis suggests that the rate of GHG emissions in the EC tended to decrease at a rate of about 11,066 Gg per year (0.27%).

100. LUCF could offset CO₂ equivalent emissions from other sectors by about 4.8% (equivalent to about 197,419 Gg CO₂ equivalents per year). Trend analysis indicates that in the period 1990 to 1999, the capacity of this sector to offset emissions from the other sectors decreased slightly, at a rate of about 0.71% per year (equivalent to 1,399 Gg CO₂ equivalent).

1. Completeness

101. The EC submitted only the summary table of its GHG inventory (table Summary 1.A). However, GHG inventories of the member States were also supplied except for that of Luxembourg. Eight States provided all inventory tables following the CRF (Austria, Denmark, Finland, France, the Netherlands, Portugal, Sweden and the United Kingdom). However, some of the tables were left blank, in particular tables Summary 3 (Summary report for methods and emission factors used), 5.A-D (Sectoral background data), 7 (Overview table showing the estimate and quality of the estimate) and 8 (Recalculations).

102. The notation keys were used by only nine countries. Emissions of non-CO₂ trace gases were reported by four countries (Belgium, France, Greece and Italy).

2. Transparency

103. Based on GHG inventory tables of its member States, provided by the EC, nine States used country-specific methods and/or emission factors (Austria, Finland, France, Germany, Ireland, the Netherlands, Spain, Sweden and the United Kingdom). However, only a few countries provided further explanation of the methodology used to estimate GHG emissions/removals and to estimate emission factors.

104. None of the countries providing notation keys gave further explanations of the keys (such as reasons why GHG emissions/removals from certain sources were not estimated).

3. Recalculations

105. Most member States revised and updated the time series GHG inventory from 1990 to 1998. However, which sectors were subjected to recalculation was not fully described. From GHG inventory sheets of the member States provided by the EC, it was found that only three States provided recalculation tables for LUCF (France, Sweden and the United Kingdom).

4. Uncertainties

106. Quality analysis of the GHG emissions and removals estimates of the EC is not provided and no information is given as to why this analysis has not been performed. From the GHG inventory tables of the member States provided by the EC, it was found that seven States provided uncertainty information regarding the estimates (Finland, France, Ireland, the Netherlands, Portugal, Sweden and the United Kingdom). Most of this information were qualitative estimates.

5. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines

107. Most of the member States of the EC provided GHG inventory tables consistent with the IPCC Guidelines and the CRF reporting requirements.

B. Source and sink categories

108. The main source and sink category of the EC member States is 5.A Changes in forest and other woody biomass stock. Member States did not provide estimates for activities under categories other than 5.A except for Belgium, France, Greece, Italy and Portugal. Estimates of non-CO₂ emissions were provided only by Belgium, France, Greece and Italy .

109. About half the member States did not use solely the IPCC methodology (Finland, France, Germany, Spain, Sweden and the United Kingdom). Most of the member States used national emission factors (Austria, Finland, France, Germany, Ireland, the Netherlands, Spain, Sweden and the United Kingdom). Some of the States provided activity data (Austria, France, Finland, Greece, Ireland, Italy and the Netherlands).

110. Some important findings from the GHG reports of the member States are as follows:

(a) Belgium: In the sectoral report (table 5), CO₂ emissions from 5.E have been estimated at 3,359.5 Gg; however, the sign used for the value is negative (-) indicating removal. This estimate has not been taken into account in the calculation of total net CO₂ removals from the sector. No explanation is given in the report. Table 5 also shows that the LUCF emitted non-CO₂ gases. No information is given, however, regarding the types of activities or categories leading to these emissions. Sectoral background data tables 5.A-5.D were left blank.

(b) Finland: This State has estimated CO₂ emissions/removal from soils. However, these estimates are included in the agriculture sector.

(c) Portugal: In the sectoral report (table 5), Portugal reports activities under forest and grassland conversion that led to CO₂ removal, not to CO₂ emissions.

C. Areas for further improvement

Issues identified by the ERT

111. The above findings seem to indicate a need for the ETC (European Topic Centre) to check for encoding errors which may occur when transferring the estimates into the CRF.

VI. WASTE

A. Sector overview

112. CH₄ emissions from the waste sector contributed 31.8% of the EC's CH₄ emissions in 1999 compared to 32.9% in 1990. Solid waste disposal on land accounted for 28.8% of total EC CH₄ emissions in 1999 and wastewater handling comprised 1.6% of total EC CH₄ emissions. CH₄ is the main GHG emitted from the waste sector, contributing 116,529 Gg CO₂ equivalent emissions in 1999 compared to 4,388 Gg CO₂. The percentage contribution of the waste sector to total EC CO₂ equivalent emissions (excluding CO₂ from LUCF) is shown in the table below. The contribution of the waste sector has declined from 3.7% in 1990 to 3.1% in 1999, with a

steady downward trend from year to year.

Percentage contribution of the waste sector to total EC CO₂ equivalent emissions (excluding CO₂ from LUCF)

1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
3.7	3.6	3.6	3.5	3.5	3.4	3.2	3.2	3.1	3.1

113. According to the key source analysis provided in the EC trends report, solid waste disposal on land is the only key source in the waste sector, contributing 2.6% of total EC CO₂ equivalent emissions in 1999 (compared to 3.2% in 1990).

114. Information on recalculations, uncertainties, QA/QC approaches and areas for further improvement in the EC inventory is provided in the overview section of this report, which also includes an assessment of the completeness and the transparency of the EC's submission (paragraphs 17 to 23).

Results from previous reviews

115. The draft S&A report 2001 does not make any specific reference to waste. The report does note a discrepancy between the EU15 CRF aggregate for CH₄ and the sum of member State CRF reports for CH₄. In its response to the draft of this report, the EC explained the reasons for this discrepancy; see paragraph 38 of the overview section.

B. Key sources

1. 6.A Solid waste disposal – CH₄

116. CH₄ emissions from 6.A Solid waste disposal on land is the only key source in the waste sector, contributing 2.6% of total EC emissions in 1999.

Methodology

117. There is no single EC solid waste methodology. Some member States use the IPCC default methodology (tier 1) and other member States use time dependent decay functions or CORINAIR (tier 2). As noted in paragraph 45 above, a summary table specifying the methodologies used by each member State would be useful.

Activity data

118. There is no single source of information on activity data. The quality of activity data for solid waste depends on the systems in place for collecting data in each of the member States. A summary table specifying the source of activity data for each member State, together with the frequency with which data are updated, as described in paragraph 45 above, would be useful for reviewers. For example, the table could indicate the source of the data (such as survey, solid waste disposal sites (SWDS) regular reporting, ad hoc data collection, estimates using population data) and the frequency with which data are updated (annually, estimated from time series dating from a particular year and so on).

Emission factors

119. IEFs differ across the EC depending on the methodology used to estimate emissions. Fractions of degradable organic carbon will differ because waste composition will be different

from member State to member State. A summary table specifying the values of common parameters would be informative, as described in paragraph 45 above.

C. Non-key sources

120. The waste sector includes three non-key sources: 6.B Wastewater handling, 6.C Incineration and 6.D Other. The methodologies, activity data and emission factors used differ from member State to member State. A detailed review would require an assessment of the CRF and NIR of each member State. As with solid waste disposal on land, summary tables for each subsector as described in paragraph 45 above, referring to the methodologies, activity data sources and emission factors used, would be helpful for the review.

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