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**REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY  
OF SPAIN SUBMITTED IN THE YEAR 2001<sup>1</sup>**

**(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,<sup>2</sup> 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, 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 (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 principal 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 requirement outlined in the UNFCCC reporting guidelines.<sup>3</sup> 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

<sup>1</sup> 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 Spain this is a centralized review report.

<sup>2</sup> 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.

<sup>3</sup> The guidelines for the preparation of national communication by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories (FCCC/CP/1999/7) are referred to as the UNFCCC reporting guidelines in this report.

reporting guidelines and the Revised 1996 IPCC 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 fulfilled 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).<sup>4</sup>

5. The UNFCCC secretariat provided the review team with all necessary technical guidance, information and data, such as national inventory data reported according to the common reporting format (CRF) submitted in the year 2001, national inventory reports (NIRs) for the year 2001, the synthesis and assessment (S&A) reports prepared by the secretariat, and comments from the Parties on the S&A reports.

6. In accordance with the UNFCCC review guidelines, a draft version of this report was communicated to the Government of Spain, 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. Spain submitted a NIR in the Spanish language in May 2001, both as hard copy and in electronic form. Spain submitted national inventory data in the CRF for the years 1990 to 1999 in electronic form and hard copy.

8. The status report 2001, the draft S&A report 2001, the Parties' response to the S&A report and the UNFCCC secretariat's preliminary key source assessment<sup>5</sup> were provided by the secretariat as additional sources of information. In addition, the expert review team (ERT) had access to the secretariat's GHG inventory database through the provision of a data search tool.

9. Other sources of information used during the review include: Spain's 2000 inventory submission, results of the review of the 2000 inventory submission (S&A report 2000), the preliminary guidance for experts participating in the individual review of GHG inventories, and the UNFCCC reporting and review guidelines (FCCC/CP/1999/7).

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

### **C. Emissions profiles, trends, key sources**

11. GHG emissions in Spain have increased by 26% since 1990 (including CO<sub>2</sub> from land-use change and forestry (LUCF)) with carbon dioxide (CO<sub>2</sub>) emissions increasing by 28% (including CO<sub>2</sub> from LUCF), methane (CH<sub>4</sub>) by 30%, nitrous oxide (N<sub>2</sub>O) by 7%, hydrofluorocarbons

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<sup>4</sup> According to the conclusions of the SBSTA at its twelfth session, the IPCC good practice guidance should be applied by Annex I Parties to the extent possible for inventories due in 2001 and 2002, and should be used for inventories due in 2003 and beyond.

<sup>5</sup> The UNFCCC secretariat had identified, for each individual Party, those source categories that are *key sources* in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance. Key sources according to the tier 1 trend assessment were also identified for those Parties that provided a full CRF for the year 1990. The key sources presented in this report are based on the secretariat's preliminary key sources assessment. They might differ from the key sources identified by the Party itself.

(HFCs) by 216% (which almost doubled after 1995), and an increase in sulphur hexafluoride (SF<sub>6</sub>) by 188%; there was a decrease of 16% in perfluorocarbons (PFCs). These increases occur predominantly in the sectors of energy (25%), industrial processes (40%), solvents and other product use (25%), agriculture (7%) and waste (59%).

12. Spain's emissions have increased at a much greater rate than those of the majority of Annex I Parties, average Annex I emissions showing a decrease of 7%.

**Table 1. GHG emissions by gas, 1990-1999 (Gg CO<sub>2</sub> equivalent)**

GHG	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO <sub>2</sub> equivalent (Gg)									
Net CO <sub>2</sub> emissions/removals	196,804	204,005	213,023	200,262	213,027	223,705	211,595	228,460	239,226	251,807
CO <sub>2</sub> (without LUCF <sup>a</sup> )	226,057	233,257	242,275	229,515	242,279	252,958	240,848	257,713	268,479	281,059
CH <sub>4</sub>	34,739	35,291	36,181	36,729	37,716	38,704	40,700	42,580	40,643	45,048
N <sub>2</sub> O	41,236	40,509	39,621	37,169	39,395	38,573	43,235	40,890	41,307	44,019
HFCs	2,894	2,574	2,869	2,258	3,885	5,595	6,412	6,923	7,015	9,146
PFCs	828	787	782	794	785	790	759	784	750	696
SF <sub>6</sub>	78	84	86	90	98	118	127	151	175	225
Total (with net CO <sub>2</sub> emissions/removals)	276,580	283,251	292,562	277,302	294,907	307,487	302,828	319,788	329,117	350,940
Total (without CO <sub>2</sub> from LUCF)	305,832	312,503	321,815	306,554	324,159	336,739	332,080	349,040	358,369	380,193

**Table 2. GHG emissions by sector, 1990-1999 (Gg CO<sub>2</sub> equivalent)**

GHG SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO <sub>2</sub> equivalent (Gg)									
Energy	216,035	223,957	234,709	222,111	233,279	243,992	231,885	248,623	258,456	270,262
Industrial processes	23,426	22,227	20,683	19,017	23,162	26,045	26,652	27,906	29,084	32,802
Solvent and other product use	1,553	1,577	1,568	1,486	1,535	1,588	1,684	1,767	1,890	1,941
Agriculture	53,240	52,590	52,093	50,253	51,762	50,546	56,175	53,961	51,304	56,826
LUCF	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252	-29,252
Waste	11,577	12,151	12,761	13,685	14,421	14,567	15,683	16,781	17,634	18,362
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

13. As for most sectors the data provided in the CRF was not sufficiently disaggregated to allow for a key source determination according to the tier 1 level assessment of the IPCC good practice guidance using the recommended category disaggregation level, key sources have been identified at the level of category disaggregation as provided in table Summary 1.A of the CRF, instead of at the level of disaggregation recommended by the IPCC good practice guidance. Spain did not provide a list of its key sources.

**Table 3. Key sources Spain 1999: Level assessment (Summary disaggregation level)  
(by UNFCCC secretariat)<sup>(a)</sup>**

KEY SOURCE	GAS	LEVEL ASSESSMENT	CUMULATIVE TOTAL
		per cent	per cent
Energy industries	CO <sub>2</sub>	23.3	23
Transport	CO <sub>2</sub>	22.1	45
Manufacturing industries and construction	CO <sub>2</sub>	14.4	60
Other sectors	CO <sub>2</sub>	7.8	68
Agricultural soils	N <sub>2</sub> O	4.9	72
Mineral products	CO <sub>2</sub>	4.7	77
Manure management	N <sub>2</sub> O	4.2	81
Solid waste disposal on land	CH <sub>4</sub>	4.0	85
Enteric fermentation	CH <sub>4</sub>	3.5	89
Manure management	CH <sub>4</sub>	2.1	91
Production of halocarbons and SF <sub>6</sub>	HFCs	1.7	93
Oil and natural gas	CH <sub>4</sub>	0.7	93
Consumption of halocarbons and SF <sub>6</sub>	HFCs	0.7	94
Chemical industry	N <sub>2</sub> O	0.6	95

<sup>(a)</sup> See footnote 5 of this report.

## **D. General assessment of the inventory**

### **1. Completeness and transparency of reporting**

14. Spain provided a partial inventory for 1990 to 1999 using the CRF. The CRF covers only summary tables, sectoral reports, and recalculation and trends tables.

15. Trend data on a gas-by-gas basis are not provided, and were available only at an aggregate level in CO<sub>2</sub> equivalent (trend tables 10 sheets 1 to 4 were not provided). With the exception of table 1.A(b) (reference approach), no sectoral background data tables are provided, which means that only emissions estimates are provided and no activity data. For all sectors the inventory was therefore found to be incomplete and to lack transparency.

16. The inventory covers direct GHGs CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O and reporting of actual disaggregated HFC, PFC and SF<sub>6</sub> emissions on a gas-by-bas basis. Potential emissions are not reported. The inventory also covers the precursor gases CO, NO<sub>x</sub> and NMVOC, and SO<sub>2</sub>.

17. All the major IPCC source and sink categories are covered in the inventory; however, at the level of sub-sources information is often lacking. Notation keys are not used in the CRF, and in many instances only "0" is used.

18. The values included in the NIR are consistent with the CRF.

19. The NIR contains explanatory information on the status of inventory preparation by Spain, methodological issues, some additional information (temporal homogeneity, coherence, exhaustivity, uncertainty and transparency) and global results.

20. The inventory is not transparent. The background tables have been omitted and the NIR does not provide adequate explanations of methodologies, activity data sources or emission factors.

21. In its response to the draft of this review report, Spain noted that the identified limitations relating to completeness and transparency have been overcome in its 2002 submission.

## **2. Cross-cutting issues**

### Institutional arrangements

22. The Ministry of Environment produced the NIR. No information was provided describing how the inventory was prepared and information collected (e.g. if the Ministry for the Environment was the sole agency involved in the collection of all data or if it worked as a coordinating function for the submissions under the UNFCCC). Information regarding a national system was not included.

### Verification and quality assurance/quality control (QA/QC) approaches

23. No information was submitted by Spain about the use of any self verification or independent review procedures, although it is mentioned that the IPCC good practice guidance for QA/QC will be incorporated in the near future. QA/QC has therefore not been addressed under the respective sectoral sections in this review.

### Recalculations and changes in relation to previous years

24. Spain provided recalculated estimates (table 8 (a)) and explanatory information (table 8 (b)) for all years 1990 to 1999 with changes between the 2001 and the 2000 submissions in CO<sub>2</sub> and CH<sub>4</sub> emissions by 3.3% and N<sub>2</sub>O by 0.4% for the inventory year 1998. The draft S&A report 2001 remarked that the national level recalculations for 1990 and 1998 were in close agreement with the independently estimated percentage changes in the total national GHG emissions calculated by the secretariat.

### Uncertainty

25. The NIR does not include any analysis of uncertainty for 1990-1999 for any sector. However, the NIR discussed a plan to implement quantified procedures following the IPCC good practice guidance and it is recommended that Spain address the matter of uncertainty in a manner consistent with these requirements in future submissions.

26. Table 7 of the CRF (which provides an overview of the completeness and estimated quality of the data submitted) was not provided. As information on uncertainties is not available for any sector, uncertainties have not been addressed in the relevant sections of this report.

## **3. Areas for further improvement**

27. Spain is working on an interface between the CORINAIR inventory and the CRF. As this becomes operational, more background information can be given in the CRF. This work should be done in the same way as all those European countries using CORINAIR software.

28. Spain's inventory is not complete. All necessary tables, including sectoral background data tables for all sectors, are required as the provision of this information that includes activity data and implied emission factors is critically important to allowing a detailed assessment of each sector. Details on the implementation of the IPCC good practice guidance are also recommended and could be stated in the NIR where this has been implemented.

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

29. For the reasons outlined above, the ERT considers that the inventory of Spain did only partly conform to the UNFCCC reporting guidelines. A more detailed assessment is given in the sectoral discussions of this review report.

## **II. ENERGY**

### **A. Sector overview**

30. The sector's share in total aggregate GHG emissions in terms of CO<sub>2</sub> equivalent is 68%. The main key source is CO<sub>2</sub> energy industries, transport, manufacturing industries and construction, other sectors and oil and natural gas fugitive emissions.

31. For energy, no entries were made in table 9 (completeness) of the CRF.

32. The general trend for CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O is 24.8%, 23.9% and 40.3%, respectively from 1990 to 1999.

#### **1. Completeness**

33. Emissions data are reported only at the level of sectoral reports and at summary level (for each of the years from 1990 to 1999). The sector is not completely covered in terms of IPCC source categories, as all IPCC/CRF fuel sources, at the level of subsectors, are missing. Summary estimates for the indirect GHGs are provided.

#### **2. Transparency**

34. There is no indication regarding confidentiality of the data.

#### **3. Methodologies, emission factors and activity data**

35. Spain used the CORINAIR calculation methodology and country-specific methods for quantifying national emissions. The underlying energy source data were derived from the energy balances commonly approved as official. The majority of emission factors were from CORINAIR and were plant-specific. Regarding energy source data, Spain noted in its response to the draft of this report that energy balances used in the inventory are compiled using the best sources of information available (IEA and EUROSTAT balances, national energy statistics and data collected through questionnaires for the main sources of emissions).

#### **4. Recalculations**

36. Recalculated estimates are provided for 1998 only. One of main changes is in energy CH<sub>4</sub> emissions. However, the rationale for these changes is not sufficiently well explained.

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

37. The present GHG energy sector inventory for the period 1990 to 1999 is not reported according to the UNFCCC reporting guidelines.

## **B. Reference and sectoral approach**

### **1. Comparison between reference and sectoral approach**

38. The reference approach is documented for the years 1990-1999 in the CRF but does not include data on all the components of the apparent consumption figures (production, imports, exports, bunkers, stock change). The draft S&A report 2001 indicates that there are some differences between the data used in the reference approach and the sectoral approach, of about 1%.

39. The sectoral approach total value is 258,610 Gg, or 92.0% of total CO<sub>2</sub> emissions for 1999 (excluding land-use change and forestry (LUCF)).

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

40. Information on feedstocks is not reported.

### **3. International bunker fuels**

41. Spain reports estimates for aviation and marine bunkers. No information on the type or quantity of the fuels used is provided.

## **C. Key sources**

42. As disaggregated data for most sectors are not provided, key sources have been identified at the level of category disaggregation as provided in table Summary 1.A of the CRF, instead of at the level of disaggregation recommended by the IPCC good practice guidance.

### **1. Completeness**

43. There are estimates for all years 1990-1999 in the CRF summary tables, but this sector was not complete in terms of detail of the source categories.

### **2. 1.A.1 Energy industries – CO<sub>2</sub>**

#### Emission trends

44. CO<sub>2</sub> emissions from energy industries represent 23.3% of all reported emissions (excluding LUCF) with an increase of 18.4% since 1990.

#### Methodology, emission factors and activity data

45. Emissions estimations are based on CORINAIR and country-specific methods. The time series are consistent.

46. The emission factors used for the CO<sub>2</sub> emissions are CORINAIR and plant-specific and are based on measurements and mass calculations. However, it is not possible to analyse the implied emission factor (IEF) due to the absence of activity data. The source of activity data was National Statistics.

### **3. Mobile combustion: 1.A.3 Transport – CO<sub>2</sub>**

#### Emission trends

47. Emissions from mobile combustion (transport) represent 22.1% of all reported emissions (excluding LUCF), with an increase of 44.7% since 1990.

#### Methodology, emission factors and activity data

48. Emissions estimations are based on CORINAIR methods. The emission factors used for CO<sub>2</sub> emissions estimation are CORINAIR. The values are not referenced and it is not possible to analyse the IEFs due to the absence of activity data. The energy source data are derived from the energy balances provided annually by National Statistics.

### **4. 1.A.2 Manufacturing industries and construction – CO<sub>2</sub>**

#### Emission trends

49. CO<sub>2</sub> emissions from manufacturing industries represent 14.4% of aggregated GHG emissions in CO<sub>2</sub> equivalent (excluding LUCF), with an increase of 12.2% since 1990.

#### Methodology, emission factors and activity data

50. Emissions estimations are based on country-specific and CORINAIR methods. The emission factors used for CO<sub>2</sub> emissions are CORINAIR and plant-specific. It is not possible to analyse the IEFs due to the absence of activity data. The energy source data are derived from the energy balances provided annually by National Statistics.

### **5. 1.A.4 Other sectors – CO<sub>2</sub>**

#### Emission trends

51. CO<sub>2</sub> from other sectors represent 7.8% of aggregated GHG emissions in CO<sub>2</sub> equivalent (excluding LUCF). CO<sub>2</sub> emissions from this category decreased by 22.6% in the 1990-1999 period.

#### Methodology, emission factors and activity data

52. Emissions estimations are based on CORINAIR methods. The emission factors used for CO<sub>2</sub> emissions estimations are from CORINAIR. It is not possible to analyse the IEFs due to the absence of activity data.

### **6. Fugitive fuel emissions: oil and natural gas – CH<sub>4</sub>**

#### Emission trends

53. CH<sub>4</sub> emissions from fugitive oil and natural gas represent 0.7% of aggregate GHG emissions (without LUCF). CH<sub>4</sub> emissions have increased in the 1990-1999 period by a factor of about 2.6.



Methodology, emission factors and activity data

54. Emission estimations are based on CORINAIR methods. The emission factors used for CH<sub>4</sub> emissions estimation are from CORINAIR. It is not possible to analyse the IEFs due to the absence of activity data.

**D. Questions and issues from previous review stages**

55. Spain provided a response to the preliminary findings raised in the draft S&A report 2001. As part of this response, Spain provided its energy balance for all years 1990 to 1999.

**E. Areas for further improvements****Issues identified by the ERT**

56. The absence of activity data makes analysis of the IEFs impossible and the ERT recommends Spain to provide this information in future submissions.

57. The lack of transparency in this submission due to the absence of disaggregation in this sector is an important issue and the ERT recommends that this be included in future submissions along with clear descriptions in the NIR concerning the methods used and issues such as confidentiality.

**III. INDUSTRIAL PROCESSES AND SOLVENT USE****A. Sector overview**

58. The share of industrial processes and solvent and other product use sectors to total aggregate GHG emissions (including LUCF) was 9.3% in 1990 and 10.0% in 1999 with solvent and other product use contributing about 0.7% to these totals.

59. The general trend of this sector during 1990-1999 indicates that there is an increase in emissions by 29% with small fluctuations within the period.

60. There is no strong consistency between the categories or activities included in tables 2(I) and (II) and the given key source analysis.

**1. Completeness**

61. According to the sectoral tables, all GHGs and industrial subcategories are covered in the report. Spain reports actual emissions of HFCs, PFCs and SF<sub>6</sub> providing disaggregated data by chemicals and source categories both in units of mass and in CO<sub>2</sub> equivalent. Tables 7 and 9 did not contain any information on completeness for this sector. Therefore it is not possible to assess whether all sources in industrial processes are covered or only part of them. As for halocarbons and SF<sub>6</sub>, only actual emissions are estimated.

**2. Transparency**

62. This inventory sector is not reported in a transparent manner; relevant sectoral background data tables are not provided.

### 3. Methodology, emission factors and activity data

63. Information on methods applied and emissions factors used is pointed out in CRF table Summary 3. Spain used CORINAIR, country-specific and default methodologies and emissions factors for CO<sub>2</sub> emissions, but without specifying for which activities each is used. For example, four activities are reported in the category 2.A Mineral products, but it is not clear where exactly one or another method or emission factor is used.<sup>6</sup> For activities that produce CH<sub>4</sub> and N<sub>2</sub>O emissions CORINAIR methodology and factors were used. T1 and T3 methods are applied to HFC and PFC production, respectively. Correspondingly, T2 and T3 emissions factors are used. T1 and T2 methods and emission factors are indicated for all gases (HFCs, PFCs and SF<sub>6</sub>) in the category 2.F Consumption of halocarbons and SF<sub>6</sub>, however the T2 approach should only be applied when actual emissions are being estimated.

64. No information on activity data is provided in the CRF but this was obtained from the United Nations statistics. Cement production in Spain was 27,860 kt in 1999. When the CO<sub>2</sub> IEF was used, the emissions from cement production were 13,902 Gg, somewhat less than the reported emissions of 15,543 Gg of CO<sub>2</sub>.

### 4. Recalculations

65. Recalculations for this sector including all source categories have been documented in tables 8(a) and (b). Table 8(b) includes explanatory information for emissions of PFCs, HFCs and SF<sub>6</sub>. The revision of the activity data of SF<sub>6</sub> emissions from electrical equipment for 1990-1996 was made due to new information on SF<sub>6</sub> containment provided by one of the electricity companies. PFC emissions estimates from fire extinguishers had some minor changes in the methodology, emission factor and activity data. For fugitive emissions in HFC production, the revision of activity data was made for the year 1996.

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

66. Spain followed the UNFCCC reporting guidelines (CRF) in part. The IPCC good practice guidance has been used for PFC emissions from fire extinguishers, however, sectoral background data tables were not submitted. The methodologies in general as well as those used for the estimates for each source category are conform to the IPCC methodology.

## B. Key sources

### 1. 2.A Mineral products – CO<sub>2</sub>

67. The contribution of this source to total emissions is the same (4.7%) in both 1990 and 1999. Spain reported cement production, lime production, soda ash production and use, and others under the mineral products source category (table 2(I) of the CRF). CO<sub>2</sub> emissions from mineral products increased by 25.5% since 1990.

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<sup>6</sup> It should be noted that in table Summary 3 of the CRF, information on methods and emission factors used is required at a summary disaggregation level (such as 2.A Mineral products) and does not allow for providing information at a more detailed level of category disaggregation (such as 2.A.1 Cement production, 2.A.2 Lime production, etc).

**2. 2.E Production of halocarbons and SF<sub>6</sub> – HFCs**

68. The contributions were 0.9% and 1.7% in 1990 and 1999, respectively.

**3. 2.F Consumption of halocarbons and SF<sub>6</sub> – HFCs**

69. There was a contribution of 0.7% to total emissions in 1999; however, this was not a key source in 1990. By 1999, HFC emissions from consumption of halocarbons and SF<sub>6</sub> had increased significantly since they were first recorded in 1995, from 2 tonnes to 1,651 tonnes in 1999. This explains why the general trend of this sector is so high.

**4. 2.B Chemical industry – N<sub>2</sub>O**

70. The fourth key source is N<sub>2</sub>O from the chemical industry, which represented 0.95% and 0.6% to the total aggregate GHG emissions in 1990 and 1999, respectively. Emissions in this sector totalled only 568 Gg (CO<sub>2</sub> equivalent). Ammonia and nitric acid production decreased by 11.4% and 18.6% for the period 1990-1999, respectively. Spain noted that the decrease observed in CO<sub>2</sub> emissions in 1993 was due to the shutdown of a production plant. This decrease was compensated for from 1994 onwards by the enlargement in capacity and production of another, existing, plant.

**C. Non-key sources****1. 2.C Metal production – CO<sub>2</sub>**

71. Metal production includes emissions from iron and steel, ferro-alloys and aluminium production. CO<sub>2</sub> emission from this source category is 1,799 Gg. The emissions from iron and steel production increased by 12.7% from 1990 to 1999. The emissions trends from aluminium production were negative for the same period (-16.6%). Data on production for these two activities are available from the United Nations monthly bulletins; however there was no information provided in the CRF.

## IV. AGRICULTURE

### A. Sector overview

**Table 4. Summary overview: Provision of information for the agriculture sector**

Sector overview	
Sectoral report tables	Available
Notation keys	Available
Sectoral background tables	No
NIR	Yes
Methods	T1, T2
Emission factors	IPCC defaults
Explanation of non-IPCC method	-
Uncertainty	No
Emission trends	Yes (1990-1999)
Procedure for QA/QC	No
Complete set of CRF tables - agriculture	No
Plans for future improvements	Automatic translation of CORINAIR inventory to CRF tables

72. In 1999, the agricultural sector contributed 16.2% to the total national emissions. Its share had decreased 3.1% since the base year 1990, but the absolute amount of emissions increased by 6.4% from 1990 to 1999.

#### 1. Completeness

73. The inventory is not complete; sectoral background data tables are missing for the agriculture sector. No information seems to be provided on activity data and emission factors. In the completeness table (table 9) Spain states that the contribution of N<sub>2</sub>O from manure applied to agricultural soils has not been accounted for due to the lack of accurate activity data on manure applied to these soils. Prescribed burning of savannas has not been reported because this activity does not occur in Spain.

#### 2. Transparency

74. The inventory for agriculture is not transparent as no activity data, no emission factors and no background information are provided, either in the CRF or in the NIR.

#### 3. Methodologies, emission factors and activity data

75. Spain has provided table Summary 3 on methods and emission factors used. For CH<sub>4</sub> from enteric fermentation, Spain used tier 1 for animals other than cattle and tier 2 for dairy and non-dairy cattle. For manure management, Spain used tier 1 and tier 2 methods for both CH<sub>4</sub> and N<sub>2</sub>O. A country-specific method was used for CH<sub>4</sub> from rice, and for N<sub>2</sub>O from agricultural soils the tier 1 method was used.

#### 4. Recalculations

76. Spain has provided recalculated estimates for agriculture. New data are provided for 1997 and 1998. No explanation is given for the reasons for the updates. Changes within agriculture were considerable. It is not clear how consistency in the time series is ensured.

## 5. Trends

77. No trend table for CH<sub>4</sub> and N<sub>2</sub>O emissions from agriculture is provided.

## 6. Conformity with the UNFCCC reporting guidelines and the IPCC Guidelines

78. The ERT considers that the inventory by Spain does not conform to the UNFCCC reporting guidelines and that at the moment it is not complete. Only table 4, and no background tables (4A to 4F) for agriculture for 1990-1999 are provided. The information provided is not transparent as it lacks activity data, emission factors and background information.

### B. Key sources

79. According to the preliminary key source analysis by the secretariat the agriculture sector includes four key sources (see table). The percentage contribution to the national total of these four sources has slightly decreased for each of these sources from 1990 to 1999.

	1990	1999
	% contribution	% contribution
N <sub>2</sub> O from agricultural soils	5.9	4.9
N <sub>2</sub> O from manure management	5.0	4.2
CH <sub>4</sub> from enteric fermentation	4.0	3.5
CH <sub>4</sub> from manure management	2.3	2.1

### 1. 4.D Agricultural soils – N<sub>2</sub>O

80. Only the total emission estimate is provided for N<sub>2</sub>O from agricultural soils.

81. Trends: N<sub>2</sub>O emissions from agricultural soils increased by 2.4% but there were large fluctuations between 1992 and 1997, oscillating from –13.5 to +20%.

#### Methodology, emission factors and activity data

82. A tier 1 methodology was used and only aggregated emissions are given. No information on emission factors and no activity data are provided.

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

83. CH<sub>4</sub> emissions from manure management are given for different animal types with the largest contribution from swine and cattle. N<sub>2</sub>O emissions from manure management are estimated for liquid systems, solid storage and dry lot and other (but not specified). The largest contribution came from other unspecified systems.

#### Methodology, emission factors and activity data

84. Tier 1 and 2 methodologies were used. No information on emissions factors or activity data is provided.

#### Issues relating to previous reviews

85. Preliminary findings from the draft S&A report 2001:

(a) *Trend in N<sub>2</sub>O emissions: Annual changes of 9% from 1995 to 1996 and from 1998 to 1999;*

(b) *Trend in CH<sub>4</sub> emissions: Large annual changes of -36 % (from 1997 to 1998) and +60% (from 1998 to 1999); total CH<sub>4</sub> emissions from this source increased by 15% in the period 1990 to 1999.*

86. Spain explained this in its response to the draft S&A report. The N<sub>2</sub>O emissions from manure management fluctuate because of fluctuating numbers of dairy versus non-dairy cattle, and the age class mix of swine and poultry.

87. This explanation was not clear enough and could not be assessed, as background information was lacking in the CRF and the NIR.

88. Spain explained in its response to the draft S&A report that for CH<sub>4</sub> the methane conversion factor (MCF) is sensitive to the climate category assignment cool versus to temperate. Because of yearly changes in annual average temperatures, many provinces pass from the cool to the temperate class and vice versa. This explanation was not clear enough and could not be assessed due to the background information's being insufficient.

### **3. 4.A Enteric fermentation – CH<sub>4</sub>**

89. Methane emissions from enteric fermentation are given for different animal types. The largest contributions are from cattle and sheep.

#### Methodology, emission factors and activity data

90. The methodology used for this source is tier 1 for sheep, horses and swine and tier 2 for dairy and non-dairy cattle. No information on emission factors or activity data is provided.

#### Issues relating to previous reviews

91. Preliminary findings from the draft S&A report 2001:

(a) *Trend in emissions: Increase of 8.3% in enteric fermentation CH<sub>4</sub> emissions with annual percentage change of 7.8% between 1995 and 1996.*

(b) *CH<sub>4</sub> emissions from swine increased 40% from 1990 to 1999, with an annual increase of 15% from 1998 to 1999.*

92. The fluctuations were related to fluctuating animal numbers, according to the response from Spain on the draft S&A report. However, the Party did not provide background data and the response could therefore not be assessed.

## **C. Non-key sources**

### **1. 4.C Rice cultivation – CH<sub>4</sub>**

93. Irrigated rice cultivation can be defined as a non-key source for CH<sub>4</sub> and N<sub>2</sub>O emissions. NO<sub>x</sub> emissions were also reported for rice.

Methodology, emission factors and activity data

94. The country-specific methodology for rice cultivation is not explained in the NIR and no activity data are provided.

Issues relating to previous reviews

95. Preliminary findings from the draft S&A report 2001:

(a) *Trends in emissions: Large annual fluctuations in CH<sub>4</sub> emissions are noted, ranging up to annual increases of 93% between 1995 and 1996; annual variations of around 40% from 1992 and 1993 and from 1993 to 1994 are also noted.*

96. The fluctuations related to large annual changes in cultivated areas, according to the response from Spain to the draft S&A report. This, however, was not a clear explanation as no background information was available.

**2. 4.F Field burning of agricultural residues**

97. According to table 4, burning of agricultural residues from cereals is a source which contributes to emissions of CH<sub>4</sub>, N<sub>2</sub>O and indirect GHGs such as NO<sub>x</sub>, CO and NMVOC.

Methodology and emission factors

98. The country-specific methodology used is not explained.

**3. 4.D Agricultural soils – NMVOC**

99. The estimated value of NMVOC emissions from agricultural soils is very high, 10-30 times that of other Annex I countries.

100. The amount decreased more than three times from 1990 to 1999. No explanation is provided as to why these emissions are so high and why they declined so rapidly during the period 1990-1999.

101. In its response to the draft of this review report, Spain indicated that the causes for the high levels of NMVOC emissions are currently being investigated. The observed trend in NMVOC emissions is explained by Spain with an inconsistency for the 1990 – 1996 period, where emission estimates were higher than for the 1997 – 1999 period. Spain indicated that this inconsistency has been corrected in its 2002 submission.

**D. Areas for further improvement**

102. The Spanish inventory could be made more complete by including sectoral background tables for agriculture for 1990-1999 and providing all required information on activity data and emission factors in order to make a proper assessment of its validity.

## V. LAND-USE CHANGE AND FORESTRY

### A. Sector overview

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

<b>Sectoral overview</b>	
Notation keys	No information
Sectoral background data	For part 5.A only
NIR	Available
Methods	Country-specific
Emission factors	Country-specific
Explanation of non-IPCC method	Yes (Annex III of NIR)
Uncertainty	No information
Emission trends	No (same values for 1990-1999)
Procedure for QA/QC	No information
Complete set of CRF tables (LUCF)	No (table 5 only)
CO <sub>2</sub> reported	Yes
Non-CO <sub>2</sub> gases reported	No
Plans for future improvements	No information

103. Estimates of GHG emissions and removals are provided for the whole period 1990-1999. The LUCF category represents more than 8% of total non-LUCF CO<sub>2</sub> emissions. Net CO<sub>2</sub> emissions/removals are the same for the whole period 1990-1999 and represent 29,252 Gg CO<sub>2</sub>. In table 5, Spain reports CO<sub>2</sub> emissions and removals from 5.A (Changes in forest and other woody biomass stocks) for temperate forests. It uses country-specific methods and emission factors for reporting net emissions/removals in table 5. The methodology is described in the NIR (Anexo III: Captacion de dióxido de Carbono – in Spanish). Estimates of non-CO<sub>2</sub> gas emissions are not reported. There is no information about emissions from forest fires. Detailed information about LUCF activities are not provided, and there are no estimates provided for categories 5.B to 5.D.

#### 1. Completeness

104. Estimates of GHG emissions and removals are provided for 1990 and 1999. The CRF sectoral table 5 gives the data for net CO<sub>2</sub> emissions/removals for temperate forests only, but in the NIR Spain provides a table with calculations of gross emissions and removals as well as net removals. This table is consistent with IPCC table 5.A. Sectoral background data tables (5.A-5.D) are not provided, and there are no estimates provided for categories 5.B to 5.D. Also, Spain does not submit any information on non-CO<sub>2</sub> gases.

#### 2. Transparency

105. The reporting of this sector is not very transparent. The NIR gives information about the calculation method, but only one value is reported in table 5 (net CO<sub>2</sub> emissions/removals) without individual data for emissions and removals. Relevant activity data for land use and land-use change are omitted.



### **3. Recalculation**

106. There is no information about recalculations. No changes are identified with respect to the previous year's submission because the same data for 1990 to 1999 were reported in the 2000 submission.

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

107. A country-specific method was used for calculation of net emissions/removals in temperate forest biomass stocks. This method corresponds well with the IPCC method for category 5.A. Information about the methods is provided in the NIR (Annex III).

## **B. Source and sink categories**

### **1. 5.A Changes in forest and other woody biomass stocks**

108. In table 5 net emissions/removals only are reported. Net removals are reported as a constant value for the whole time series (-29,252.2 Gg CO<sub>2</sub>) (submission 2001 as well as submission 2000). Information about gross values of emissions and removals from temperate forests are available in Annex III of the NIR (gross removals: 30,071.5 Gg CO<sub>2</sub> and gross emissions: 819.3 Gg CO<sub>2</sub>). These values should be reported together with the net CO<sub>2</sub> emissions/removals value. The country-specific calculation is based on the results of the 2<sup>nd</sup> Forest National Inventory (1986-1995).

#### Methodology, emission factors and activity data

109. The country-specific method for calculation of net emissions/removals from temperate forests in Spain was used. The method is consistent with the IPCC methodology.

110. The country-specific emission factors are used, based on the results of the 2<sup>nd</sup> Forest National Inventory (1986-1995); these factors correspond with the range of IPCC default values.

111. In relation to activity data, the NIR gives information only about total volume of forest trees, total volume increment and total annual harvest, structured according to geographical regions. There is no information about land use and land-use change activities data.

## **C. Areas for further improvement**

### **1. Planned or ongoing work by the Party**

112. There is no information from the Party about planned improvements to its LUCF inventory.

### **2. Issues identified by the ERT**

113. During this review, the following elements for improvements have been identified: The preparation of a complete set of the CRF tables, especially tables 5.B, 5.C, 5.D, which are focused on land use and land-use change activities. In the near future it should be possible to analyse the land-use activities relating to GHG emissions and to create a complete set of CRF tables for the LUCF sector, or alternative data formats with equivalent information, if non-IPCC

methods are used. Information about emissions from forest fires is also needed. Special attention should be paid to land use and land-use change activities in Spain because there is no information at present available. Also any additional information on methods or techniques used to estimate or develop emission factors (expert judgement, field measurement, remote sensing, and so on) should be reported in order to improve the quality and comprehensibility of the estimates.

## **VI. WASTE**

### **A. Sector overview**

114. Emissions from waste contributed 4.8% to total emissions in 1999 compared with 3.8% in 1990. Total emissions from the waste sector increased by 58.6% over the period 1990 to 1999. CH<sub>4</sub>, the main GHG emitted in this sector, increased by 68.3% from 1990 to 1999. CH<sub>4</sub> emissions from managed solid waste disposal sites (SWDS) increased by 91.7% and CH<sub>4</sub> emissions from unmanaged waste disposal sites increased by 29.1%. The NIR notes that the large increase in SWDS emissions is attributable to an increase in disposal of waste to managed waste disposal sites and a reduction in uncontrolled waste disposal. The waste sector has one key source: 6.A Solid waste disposal on land which contributed 4.0% of total emissions in 1999 compared to 2.8% in 1990.

#### **1. Completeness**

115. The CRF is not complete. Background data tables for the waste sector have not been submitted. Notation keys from several cells in table 6 have been omitted. This means that the completeness of the coverage of gases could not be assessed. The coverage of gases reported for unmanaged waste disposal sites (6.A.2) is complete. For other subsectors it is not clear whether emissions are not estimated (NE), not applicable (NA) or not occurring (NO). Because the background tables were not presented, no information was available on whether methane was recovered from solid waste and wastewater handling. Summary 3s2 has been completed but without additional supporting information the notations did not assist the review.

116. Although the NIR includes overview information it does not assist understanding of methodologies, emission factors or identification of data sources. Summary 3s2 notes that the methodology for solid waste disposal on land is tier 2. There is no further information on the model parameters in the NIR and consequently the model cannot be assessed. Further explanation is required.

#### **2. Results from previous review**

117. Previous reviews commented on the requirement for additional information to be provided. The Party has yet to comply with the need for more explanatory information. This should be addressed in the submission for 2002.

118. The Party should ensure that background tables are completed and presented in future. This requirement was highlighted in the S&A report 2000 and again in the draft S&A report 2001. No response was provided.

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

119. The inventory is not consistent with the reporting guidelines. Explanatory tables have been omitted and, where tables are included, in some cases notations are not entered (for example, table 6 Managed waste disposal on land). The information provided is not sufficient to determine whether or not the inventory is consistent with the IPCC Guidelines in that there is no explanation of methodologies either in supporting CRF tables (although Summary 3s2 does state whether the method is T2, D, or C) or in the NIR. More detailed explanations are required.

#### B. Key sources

##### 1. 6.A Solid waste disposal on land – CH<sub>4</sub>

###### Methodology, emission factors and activity data

120. CRF Summary 3s2 shows the methodology as tier 2. The NIR does not provide any additional information nor is any information available from the background tables. More detail is required.

121. No information is available on emission factors. No information on activity data is provided in the CRF or NIR. It is not known whether methane recovery is estimated and included.

#### C. Non-key sources

122. 6.B Wastewater handling and 6.C Waste incineration are non-key sources. As with SWDS, there is no explanation of the methodology, activity data or emission factors. In its response to the draft S&A report 2001, the Party commented that CO<sub>2</sub> emissions from waste incineration increased from 608 Gg in 1990 to 729 Gg in 1999. Examination of the CRFs indicated that the opposite is the case, or that there is an error in the CRFs. The 1990 CRF shows a value of 729 Gg and the 1999 CRF shows a value of 608 Gg. This needs to be reviewed by the Party in order to establish whether there is an error in reporting. In its response to the draft of this review report, Spain clarified that the numbers given in the CRF are correct, which means that CO<sub>2</sub> emissions from waste incineration decreased from 729 Gg in 1990 to 608 Gg in 1999.

#### D. Areas for further improvement

123. The Party responded to some of the issues raised in the draft S&A report 2001 but did not comment on the absence of background tables for waste. In future inventories the Party should:

- (a) Include background tables for the waste sector;
- (b) Ensure that all relevant cells of tables contain relevant data or notations;
- (c) Provide more explanation in the NIR on the methodologies, activity data sources and emission factors;
- (d) Indicate whether or not methane recovery is estimated.

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