



FCCC/WEB/IRI(1)/2002/ESP

20 May 2003

**REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY OF
SPAIN SUBMITTED IN THE YEAR 2002¹**

Desk review

I. OVERVIEW

A. Introduction

1. The Conference of the Parties (COP), by its decisions 6/CP.5 and 34/CP.7, requested the secretariat to conduct individual reviews of greenhouse gas (GHG) inventories submitted by Parties included in Annex I to the Convention (Annex I Parties), according to the UNFCCC reporting guidelines for the technical review of GHG inventories from Annex I Parties, hereinafter referred to as the review guidelines.² The principle objectives³ of the review of the GHG inventories is to ensure that the COP has adequate information on GHG inventories and GHG emission trends, and to examine the information submitted by Annex I Parties in accordance with the UNFCCC reporting guidelines⁴ for consistency with those guidelines.

2. The desk review of Spain took place from 9 to 27 September 2002. The desk review was carried out by a team of nominated experts from the roster of experts, working in their own countries. The assignments of the experts were as follows: generalists – Mr. Moussa Cisse (Mali) and Mr. Riccardo De Lauretis (Italy), energy – Ms. Anke Herold (Germany) and Mr. Eilev Gjerald (Norway), industrial processes – Mr. Philip Acquah (Ghana) and Ms. Marian Van Pelt (USA), agriculture – Mr. Mingxing Wang (China) and Ms. Penny Reyenga (Australia), land-use change and forestry – Mr. Wojciech Galinski (Poland) and Mr. Mikhail Gytarsky (Russian Federation), waste – Mr. Eduardo Calvo (Peru) and Mr. Carlos Lopez (Cuba). Ms. Anke Herold and Mr. Moussa Cisse were the lead reviewers for this desk review. The review was coordinated by Ms. Sevdalina Todorova-Brankova (UNFCCC secretariat).

3. 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

4. In its 2002 submission, Spain submitted common reporting format (CRF) tables for the years 1990–2000 together with the national inventory report (NIR) containing information on general methodology, inventory principles, recalculations, key source analysis, and comparison with the 2001

¹ In the symbol for this document, 2002 refers to the year in which the inventory was submitted, and not to the year of publication. The number (1) indicates that this is a desk 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 For the objectives of the review of GHG inventories see document FCCC/CP/1999/7, page 109, paragraph 2.

⁴ 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/P/1999/7), are referred to in this report as the UNFCCC reporting guidelines.

submission. The submission was received in the secretariat on 12 April 2002. The full list of materials used during the review is provided in annex 1 to this report. During the review, Spain provided to the expert review team (ERT) additional information and clarification upon request, which have been taken into account in this report.

C. Emission profile, trends and key sources

5. In the year 2000, the most important GHG in Spain was carbon dioxide (CO₂), contributing 79.4 per cent to total⁵ national GHG emissions expressed in CO₂ equivalent, followed by methane (CH₄) with 9.9 per cent and nitrous oxide (N₂O) with 7.9 per cent. Hydrofluorocarbons (HFCs) contributed 2.6 per cent, whereas perfluorocarbons (PFCs), and sulphur hexafluoride (SF₆) contributed 0.2 per cent to the country's total GHG emissions.

6. Over the period 1990–2000, CO₂ emissions without land-use change and forestry (LUCF) increased by 35 per cent, CH₄ emissions increased by 29 per cent and N₂O emissions increased by 16 per cent. The overall trend for PFCs, HFCs and SF₆ with respect to the year 1995 was upwards, with an increase of 113 per cent for HFCs and 123 per cent for SF₆ emissions and a decrease of 48 per cent for PFCs. The trends showed a fluctuation between 1990 and 2000 in both absolute terms and time index. In the NIR, Spain described the emission trends, but did not explain the underlying reasons for these developments.

7. Spain reports a key source tier 1 analysis, both level and trend assessment, as part of its 2002 submission. This analysis differs for a considerable number of sources from that performed by the secretariat. The variations are due to different activity and fuel disaggregation, particularly for the energy sector. The key sources discussed in this report cover the key sources identified in either of the approaches.

D. General assessment of the inventory

8. The national inventory submitted by Spain is broadly in conformity with the UNFCCC reporting guidelines, with exceptions as provided in the overview and sectoral sections of this report.

9. The information on the methodologies included in the NIR is not always sufficient as to assess whether the applied methods are fully consistent with the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, hereinafter referred to as the IPCC Guidelines. The Party has applied some of the elements of the Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, hereinafter referred to as the IPCC good practice guidance, in its submission.

1. Completeness

10. The national inventory submitted by Spain is fairly complete in terms of gases, time series and sectors covered. However, emissions and removals for categories 5.B Forest and grassland conversion, 5.C Abandonment of managed lands, 5.D CO₂ emissions and removals from soil, and potential emissions for fluorinated gases have not been calculated.⁶ With these exceptions, the inventory covers all major sources and sinks as well as all direct and indirect GHGs.

2. Transparency

11. Information reported in the NIR and in the CRF submitted by Spain explains the methodologies used to estimate emissions in a very general way. Frequently the information on the methodologies and underlying data provided in the NIR are insufficient to allow replication of the inventory or to assess conformity with the IPCC Guidelines. Significant improvements are required in the documentation of

⁵ Total national greenhouse gas emissions refer to aggregate emissions of CO₂, CH₄, N₂O, PFCs, HFCs and SF₆, all expressed in terms of CO₂ equivalent, excluding CO₂ emissions/removals from LUCF.

⁶ These gaps are recognized and reported by the Party in the NIR.

the methodologies, data sources, emission factors and activity data used to estimate emissions, including the provision of a reference list with sources of information used.

3. Recalculations

12. The recalculations resulted in changes to CO₂, CH₄ and N₂O estimates in the energy, industrial processes, agriculture and waste sectors. The effect of the recalculation on the base year is a reduction of 7.02 per cent of total emissions including LUCF and of 6.34 per cent without LUCF. Information on recalculations is reported in tables 8(a) and 8(b). Spain provided justifications for the recalculations, which are reported transparently and comprehensively in the CRF and the NIR.

4. Uncertainties

13. Spain used table 7 of the CRF to report quality of estimates (H (high), M (medium), and L (low)). Spain also reported that it is beginning to implement a quantitative estimation of uncertainties in accordance with the approach recommended in the IPCC good practice guidance.

5. Quality assurance/quality control (QA/QC)

14. No information was submitted as to whether the inventory data were subject to QA/QC and verification procedures. The intention to incorporate the IPCC good practice guidance for QA/QC in the near future was mentioned by the Party. An analysis of changes in the results between the last and the previous submission was reported in the NIR.

6. Issues relating to previous reviews

15. Main areas for further improvement, as specified in the report from the centralized review of Spain's inventory in 2001,⁷ are addressed in the current submission. The inclusion of completed background data tables of the CRF, as well as the submission of an NIR in English containing supplementary information are good improvements with regard to completeness and transparency of the inventory.

16. Findings from the draft S&A report 2002 that have already been satisfactorily explained by Spain are not repeated in this review report.

7. Areas for further improvement

17. Spain is beginning to implement a quantitative estimation of uncertainty and plans to incorporate QA/QC procedures in accordance with the approach recommended in the IPCC good practice guidance. Spain also expects future improvements in the LUCF sector once the ongoing IPCC work for this sector is completed.

18. The ERT recommends Spain to include in its next inventory submission further elaboration of the NIR including information concerning institutional arrangements, record keeping, application of any self-verification or independent review procedures for any sectors, and calculation of quantitative uncertainties, in accordance with the approach recommended in the IPCC good practice guidance. The ERT also recommends improved documentation in the NIR relating to the country-specific methods, assumptions, activity data and emission factors used in the inventory, as well as to the methods and criteria used for the compilation and selection of the activity data. Spain should also compile a reference list of all sources used in the preparation of its national GHG inventory.

19. In its comments to the draft review report, Spain provided information that it will consider these recommendations in the next NIR, especially an improved documentation of the methodologies, data sources, emission factors and activity data used.

⁷ See document FCCC/WEB/IRI(3)/ESP.

II. ENERGY

A. Sector overview

20. The energy sector accounted for 76.3 per cent of Spain's total GHG emissions in 2000. During the period 1990–2000, GHG emissions from this sector increased by 35.9 per cent. Within the energy sector the major subsectors are 1.A.1 Energy industries, 1.A.2 Manufacturing industries and construction and 1.A.3 Transport, accounting for 35.6, 20.5 and 29.7 per cent, respectively, of energy-related GHG emissions in 2000.

21. All major emission sources in the energy sector are included in the inventory. The methodology used in the calculation of emissions are noted as country-specific or CORINAIR; however, no further explanation is provided. Energy data were collected basically from the energy balances (which were provided to the review team), as well as from plant-specific data from large point sources and surveys of fuel consumption for coastal traffic and agricultural mobile machinery. It is unclear to the ERT how consistency between the data sources was ensured. The NIR should have included a more detailed description of how energy data are distributed between sectors and source categories, how splits to subsectors have been performed, how national sources correspond to IPCC source categories and how emissions are allocated to energy industries or manufacturing industries for those sources where allocation difficulties are specifically addressed in the IPCC Guidelines or the IPCC good practice guidance (e.g. blast furnaces).

22. According to the NIR some fuel characteristics were revised and the whole emission time series has been recalculated. The ERT notes a lack of more detailed description and documentation of the revisions to the emission factors. The ERT recommends that such documentation is included in Spain's next inventory submission.

B. Key sources

1. Stationary combustion

23. The NIR reports that for fuel characterization both plant-specific data from large point sources and standard fuel specification have been used. It should be clearly distinguished for which fuels and sources plant-specific data was available and what type of standard specifications have been used for the other source categories (including references to the sources of information). In its response to the draft review report, Spain explained that fuel specific data, at plant level, have been used, among others for the following sources: power plants (anthracite, bituminous coal, sub-bituminous coal and brown lignite); oil refineries (residual oil, and refinery gas); and integrated iron & steel plants (coke, coke oven gas and blast furnace gas).

Energy industries: coal, oil, gas and other fuels – CO₂, N₂O⁸

24. Spain reports a CO₂ implied emission factor (IEF) for gaseous fuels for public electricity and heat production for the year 2000, which is the highest of all reporting Parties. Spain explains the high IEF as being due to the use of a mix of natural gas and manufactured gas from the coal and petroleum coke gasification process. The ERT encourages Spain to provide this explanation in its next NIR.

25. There is a typing mistake in table 5.5 (Level contribution by activities – year 2000) in the NIR. For the source 1.A.1.a CO₂ emissions from stationary combustion – public electricity and heat production, the cells for liquid fuels and solid fuels have been erroneously exchanged as confirmed by the Party.

⁸ N₂O emissions from stationary combustion: oil are identified as a key source only according to the UNFCCC key source analysis; CO₂ emissions from stationary combustion: other fuels were identified as a key source only according to Spain's key source analysis.

Manufacturing industries and construction – CO₂

26. The draft S&A report 2002 indicates that the CO₂ IEF for solid fuels for non-ferrous metals is the highest of the reporting Parties. In its response to this report, Spain explained that the emission factors used for copper, lead, zinc and secondary aluminium are referred to tonne of product manufactured, as direct information on amounts of fuel per fuel type was not available. Then a specific ratio of energy required (GJ/tonne of product) was applied and finally this energy requirement was allocated (according to an a-priori mix) among the various types of fuels. Only for aluminium and primary aluminium production emission factors referred to fuel type consumption have been used (the required fuel consumption information was available). The ERT recommends that Spain should use fuel consumption data for non-ferrous metal industry (which is available according to the energy balances provided by Spain to the ERT) in the future as the existing approach that bases emissions from fuel consumption on output data is not consistent with IPCC Guidelines.

2. Mobile combustion

Road transportation – CO₂ and N₂O

27. The lack of documentation on methodology has already been mentioned as a general problem concerning the inventory as a whole. An example of this is the missing information in the NIR on the way the consumption of gasoline and diesel in road transportation has been estimated. In its response to the draft review report Spain explained that for road transport COPERT III methodology was applied. Gasoline and diesel fuel consumption data were taken from the road transport category in the International Energy Agency (IEA) fuel balance. For diesel fuel consumption a small fraction was subtracted (around 5 per cent) which was allocated to fuel consumption of construction and public works mobile machinery.

28. In the draft S&A report 2002 the CO₂ and N₂O IEFs for diesel are reported to be the highest of all Parties. In its response to this report, Spain commented that this was due to the use of 40 GJ/tonne of diesel in the estimates, which is a low net calorific value (NCV). According to the CRF it seems that Spain has used a conversion factor of 42.40 TJ/Gg of diesel in the reference approach calculation. With regard to this inconsistency, Spain explained in its response to the draft review report that different diesel oil types are used in different final consumption sectors and announced that an average conversion factor based on the consumption of each type of diesel oil will be used for the next submission. The ERT encourages Spain to implement the proposed approach, although this inconsistency does not influence the reported CO₂ estimate.

29. The N₂O IEF (5.41 kg/TJ) for gasoline from road transport is among the lowest of countries within the European Union (EU) (the EU average for 2000 is 9.3 kg/TJ), where a common regulation with regard to the use of catalytic converters is in place which should result in comparable emission factors. In its response to the draft review report Spain explained that this low estimate results from estimation with COPERT III and pointed out that distribution of cars with catalytic converters developed slower in Spain than in other EU countries.⁹

Navigation – CO₂¹⁰

30. The discrepancy between the consumption of residual oil and gas/diesel oil in the CRF 2000 and the IEA statistic is very high. Spain commented that it will investigate the subject further.

⁹ Spain pointed out that the distribution of catalytic converters within the EU is reported in “Environmental signals 2002-Benchmarking the millennium”, EEA 2002. According to this report distribution of catalytic converters in Spain was about 35 per cent in 1999 whereas the EU-15 average is 63 per cent.

¹⁰ Defined as a key source in Spain’s key source analysis only.

3. Fugitive emissions

Fugitive emissions from coal mining – CH₄¹¹

31. The NIR notes that CH₄ emissions from the source decreased by almost 33 per cent. It explains that national methods have been used to estimate CH₄ emissions from mining and the use of coal, but these methods are not described. It cannot, therefore, be assessed whether the methods used are consistent with the IPCC Guidelines. Supporting information requested by the additional table in the CRF is also not provided (e.g. number of active underground mines). In its response to the draft review report Spain explained the emissions reduction with declining coal production and announced further methodological information in future NIRs.

32. The IEF 0.21 kg CH₄/tonne coal produced for surface mines and 3.66 kg CH₄/tonne coal for underground mines is rather low and is not documented. For underground mines the IEF was the second lowest and for surface mines the third lowest of the Parties. This was explained with low CH₄ contents of Spanish coal during the review. The ERT recommends that Spain improve documentation of the low emission factors and their sources.

33. Indirect emissions of CO₂ (oxidized CO₂) from CH₄ are not included for this emission source. The ERT encourages the Party to make efforts to include these emissions in its next submission. Spain announced to assess and possibly include these emissions in the next inventory submission.

Fugitive emissions from solid fuel transformation – CO₂ and CH₄

34. The NIR explains that national methods have been used to estimate CO₂ emissions from fuel transformation, mainly in coke plants. These national methods are not described. Therefore it is not possible to assess whether the methods used are consistent with the IPCC Guidelines or whether correct sectoral allocation of emissions occurred.

35. CO₂ emissions from this source are relatively high. Spain explains that CO₂ emissions were derived from a full carbon mass balance which could explain the comparatively high CO₂ estimates. Since this is a key source in level and trend assessment the ERT recommends that the Party investigate this subject further, which is planned by the Party according to the response to the draft review report.

Fugitive emissions from oil and natural gas – CH₄¹², oil refining – CO₂¹³

36. The NIR explains that national methods have been used to estimate CO₂ emissions from transportation and distribution of natural gas and other gaseous fuels. However, the methods are not described and it cannot be assessed whether the methods used are consistent with the IPCC Guidelines. The NIR states that for the remaining activities under fugitive emissions the IPCC or EMEP/CORINAIR emission factors have been used. This is not consistent with summary 3 of the CRF where no use of default IPCC emission factors is indicated in the energy sector for CO₂, CH₄ or N₂O. The ERT recommends consistent reporting on the issue and better documentation of the sources of data. In its response to the draft review report, Spain explained that for estimating CH₄ and CO₂ emissions in the activities of transportation and distribution of natural gas, data was gathered through questionnaires to the respective two largest firms operating in this sector in Spain. The emissions estimated are based in emissions measurements in corresponding representative samples of the transportation and distribution networks of the country. Therefore methods and emission factors are considered as country-specific and supplementary to EMEP/CORINAIR.

37. CO₂ emissions from oil refining increased by about 28 per cent in the period 1990–2000 while the amount of oil refined increased by about 10 per cent. In its response to the draft review report Spain

¹¹ Defined as a key source in Spain's key source analysis only.

¹² Defined as a key source in Spain's key source analysis only.

¹³ Defined as a key source in Spain's key source analysis only.

explained that the increase in CO₂ emissions is due to the emissions from fluid catalytic cracking processes (there is a new plant in 1992) and to the coke calcining process carried out in a refinery.

C. Non-key sources

38. The draft S&A report 2002 poses some questions regarding the IEFs that differ from other reporting Parties. Spain provided satisfactory answers in its response to this report. However, the ERT recommends better documentation of the emission factors in the next NIR.

D. Reference and sectoral approaches

39. CO₂ emissions from fuel combustion were calculated using both the reference and sectoral approaches. In 2000, these emissions were 1.1 per cent higher and energy consumption 13.91 per cent higher using the reference approach. According to the CRF a difference of less than 2 per cent does not need a specific explanation. However, comparison with previous years shows that the differences were larger and therefore it would be useful to get some further explanations of the differences and the reasons for their fluctuations across the time series. In its comments to the draft review report, Spain explained that generally discrepancies are caused by the use of default emission factor in the reference approach and plant-specific emission factor in the sectoral approach and by calculating the sectoral approach on the basis of production data in some areas.

40. A comparison of all fuel-specific carbon emission factors provided in table 1.A(b) (reference approach) with those of other Annex I Parties indicates the following differences: for refinery feedstocks and other oil Spain reported the lowest carbon emission factors (18.2 and 18 t C/TJ) of all Parties (range from 18 to 20.5 t C/TJ); for other bituminous coal the Spanish emission factor (26.8 t C/TJ) was the highest of the range reported by Parties (23.5–26.8 t C/TJ); for coke oven/gas coke, the emission factor (25.2 t C/TJ) was slightly revised in the 2002 submission but it was still the lowest of all Parties (25.2 to 32.6 t C/TJ). In its response to the draft review report, Spain explained that it is considering revising the emission factor for refinery feedstocks and other oil to 20 t C/TJ depending on information from the Spanish Association of Oil Refineries. Anthracite could not be separated from “Other bituminous coal” used, therefore a weighted emission factor of 26.8 t C/TJ was re-estimated. The emission factor for coke will also be revised upwards, up to 29.5 t C/TJ.

41. The carbon emission factor for coke oven/gas coke needs to be clarified by the Party. Comparison with table 1.A(d) seems to indicate that carbon stored was added from coke oven gas and blast furnace gas to the category coke oven/gas coke. A weighted emission factor that takes into account the underlying fuel quantities as provided in table 1.A(d) would result in 43 t C/TJ, whereas table 1.A(b) indicates 25.2 t C/TJ. In its comments to the draft review report Spain explained that the emission factor for coke oven/gas coke will be revised and that coke oven gas and blast furnace gas currently included under this heading, will not be included in a weighted emission factor.

42. Notation keys indicate that anthracite is included elsewhere in table 1.A(b) but no explanation is provided as to where it is included. In its response to the draft review report, Spain explained that anthracite is included with Other Bituminous Coal.

E. Bunker fuels

43. Spain does not explain (neither in the documentation box to table 1.C or in the NIR) how the consumption of international marine and aviation bunker fuels has been estimated and separated from domestic consumption. In the NIR, however, Spain explains that the amount of international bunker fuels reported in table 1.C was directly taken from the national energy balance.

F. Feedstocks and non-energy use of fuels

44. Spain has reported the use of feedstock and non-energy use of fuels in table 1.A(d) in accordance with the UNFCCC reporting guidelines. The default IPCC methodology for stored carbon has been used

for all feedstock and fuels with some exceptions mentioned in the documentation box to the table. Additional information is given in table 1.A(d) explaining from which sectors feedstocks and fuels for non-energy purposes have been subtracted. The information could have been more useful if the source categories had been further specified.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

45. Industrial processes accounted for 8.9 per cent of Spain's net emissions in the year 1990, and 9.2 per cent in the year 2000. Emissions from this sector decreased from 22.8 Tg CO₂ equivalent (1990) to 18.9 Tg CO₂ equivalent (1993) and thereafter grew steadily to 32.8 Tg CO₂ equivalent (2000). The emissions in 2000 represent an increase of 44 per cent over the year 1990. The main subsectors and their contribution to national net emissions in 2000 are: 2.A Mineral products (4.9 per cent), 2.E Production of halocarbons and SF₆ (1.8 per cent) and 2.F Consumption of halocarbons and SF₆ (1.0 per cent). These three subsectors account for 84 per cent of the sectoral emissions in 2000.

46. The overall trends for PFCs, HFCs and SF₆ show a decrease of 48 per cent for PFCs, an increase of 113 per cent for HFCs and 123 per cent for SF₆ emissions compared to 1995. Spain does not provide explanations for these trends. In its response to the review Spain explained that the decrease in PFC emissions is mainly due to increased abatement-efficiency in the primary aluminium industry, while increasing emissions of HFCs and SF₆ reflect the increased use of those gases.

47. The NIR includes information on general methodologies used for industrial processes and a description of any recalculations organized by gas and activity. All source categories and gases are covered with the exception of the potential emissions of HFCs, PFCs and SF₆.

48. In general, estimation methodologies are not fully explained within Spain's inventory. To increase transparency, Spain should endeavour to explain in the NIR changes in methodologies, activity data and choice of country-specific emission factors which are significantly different from IPCC defaults and from those of other Parties. For instance, the IEA methodology leading to readjustment of coke usage as a reducing agent is mentioned, but not explained. Similarly, the NIR indicates a review of emission factors for CO₂ emissions for production of aluminium from pre-baked anode technology but the reasons are not indicated.

B. Key sources

1. Cement production – CO₂

49. Clinker production is used to estimate emissions from this source. The CO₂ IEF (0.54 t/t) provided is higher than the IPCC default (0.51 t/t). In its response to the draft review report, Spain explained that according to the Spanish Cement Producers' Association the mean content of CaO in clinker is around 66.4 per cent which results in a theoretical ratio of 0.52 t CO₂/t clinker. This ratio was further corrected¹⁴, resulting in an emission factor of 0.54 t CO₂/t clinker. Transparency would be improved if this correction procedure will be provided in the methodological part of the NIR in the future together with further details on the input data.

2. Lime production – CO₂¹⁵

50. The 2000 CO₂ IEF for emissions from lime production is slightly lower than the IPCC default value. Spain indicates that the emission factor was adjusted using the weighted average of emission factors for the four different lime materials that Spain considered (quicklime, hydrated lime, dead-burned dolomite, other) and in the comments to the draft review report more detailed information on emission

¹⁴ A correction factor of 1.035 was applied to take into account the amounts of CaO in clinker which does not come from carbonates and other oxides in clinker which originate from carbonates.

factor and data sources was provided.¹⁶ The estimation methodologies used to obtain aggregate emission factor should be detailed in an appendix, and also summarized in the NIR to increase transparency of reporting and to facilitate review activities.

3. Chemical industry – CO₂¹⁷

51. The draft S&A report 2002 observed that the CO₂ IEF for 2.B.1 Ammonia production is lower than the IPCC default (0.9 t/t and 1.5–1.6 t/t, respectively) and is the lowest reported of all Parties. Spain indicates that the value is an average of (old) emission factors provided by some ammonia-producing plants. The ERT notes that verification of these factors at plant level would increase transparency. In its response to the draft review report, Spain announced that this issue will be further investigated.

4. Iron and steel production – CO₂¹⁸

52. The CO₂ IEF (0.05 t/t steel) for the iron and steel industry is very low compared to the IPCC default (1.5–1.6 t/t) for integrated iron and steel. It is also lower than the IPCC default for coke consumption as a reducing agent in blast furnace operation (0.45 t/t hot metal). The NIR indicates only the upward adjustment of the proportion of coke consumption as a reducing agent for pig iron production in blast furnaces based on revised IEA methodology. Spain should provide some explanation of the methodology, the selection of emission factors and activity data in considering the carbon balances in the various unit processes and technologies for pig iron production and steel making in order to increase transparency. In its response to the draft review report, Spain announced that this issue will be further investigated.

5. Aluminium production – PFCs

53. The IEFs for hexafluoride (C₂F₆) and tetrafluoride (CF₄) decreased by 48 per cent and 45 per cent respectively between 1999 and 2000. Aluminium production has remained relatively constant during the entire time series 1990–2000. In its response to the draft review report, Spain explained that the decreases in both IEFs are due to the reduction in the anode effect frequency in year 2000 in one of the aluminium production plants (Side Worked Prebaked technology). The ERT recommends including this information in future NIRs.

6. Production of HCFC-22 – HFC-23

54. The 2000 IEF for by-product emissions from production of HCFC-22 is higher than the other countries' IEFs, and is higher for the year 2000 than for any other year. However, this IEF is lower than the IPCC default emission factor. Spain has explained in its response to the draft S&A report 2002 that the emission factor used is that reported by HCFC-22 producers. Spain also indicated that only two plants are involved in the production in this source category and that it may not be possible to offer more insight in production data in future reports because of confidentiality reasons.

7. Consumption of halocarbons and SF₆ – ozone depleting substances (ODS) substitutes

55. Actual emissions are estimated by gas, and emission factors for product manufacture and lifetime emissions are all on a par with the IPCC defaults. However, actual emissions from several end-use categories are not estimated, including: foams, solvents, transport refrigeration, industrial refrigeration,

¹⁵ Defined as a key source in Spain's key source analysis only.

¹⁶ CO₂ emissions from lime production are based on information supplied by the Spanish Association for the Lime Manufactures Industry, in which the emission factors are distinguished depending on the type of lime manufactured. For quicklime the emission factor is 750 kg CO₂/t; for dead-burned dolomite, 800 kg CO₂/t; and 568 kg CO₂/t for hydrated lime. For lime produced in other industries, the IPCC default emission factor was used (790 kg CO₂/t).

¹⁷ Defined as a key source only in Spain's key source analysis in table 5.7, page 38 of the NIR based on qualitative judgement and therefore not captured in tables 5.5 and 5.6.

¹⁸ Defined as a key source in Spain's key source analysis only.

stationary air conditioning, and disposal emissions from refrigeration and air conditioning. Potential emissions are not estimated. The ERT recommends Spain to prepare actual emission estimates for the missing end-uses, or to describe why estimates are not provided. In its comments to the draft review report Spain explained that for some sub-categories notation key “NO” (not occurring) will be reported in the future while for others missing data will not allow for more detailed reporting.

56. Spain indicates that estimation of potential emissions of PFCs, HFCs and SF₆ is not feasible because of the limitation of data sources, particularly the identification of importers, distributors and exporters. It is proposed that Spain may consider the possibility of using customs data (especially material safety data sheets that may provide information on individual chemicals) as a potential source of information. Spain could consider reporting HFC and PFC imports and exports in aggregate, if customs data do not allow identification of individual species.

C. Non-key sources

1. Aluminium production – CO₂

57. Spain indicates in CRF table 8(b) and in the NIR that the CO₂ emission factor for prebaked anode production plants for the period 1990–1996 has been revised. In its response to the draft review report, Spain explained that the emission factor for the period 1990–1996 was corrected from 2200 kg CO₂/t aluminium produced to 1550 kg CO₂/t. An explanation for the changes should be provided to increase transparency.

IV. AGRICULTURE

A. Sector overview

58. Agricultural emissions of CH₄ and N₂O contributed 11.9 per cent (42,569 Gg) of total emissions in 2000. Between 1990 and 2000 there was an increase in emissions associated with enteric fermentation (12.6 per cent), manure management (27.8 per cent), rice cultivation (27.6 per cent) and agricultural soils (15.9 per cent). Emissions from the burning of agricultural residues declined by 5.5 per cent over the period. By 2000, total sector emissions had increased by 17.0 per cent from 36,378 Gg in 1990.

59. Emission reporting in the CRF is complete, however, the use of notation keys not estimated (NE), not occurring (NO) and not applicable (NA) should be checked and reported as appropriate in all tables. A mix of IPCC and country-specific methodologies and data are used to estimate emissions. Insufficient information on the methodologies and emission factors is provided in the NIR to allow replication of the inventory or to assist the review. Significant improvements are required to the documentation of the methodologies, emission factors and additional data (e.g. livestock characterization) used to estimate emissions from all agriculture subsectors.

B. Key sources

1. Enteric fermentation – CH₄

60. The IPCC tier 2 methodology is used to estimate emissions from cattle and sheep. Although average daily feed intake and methane conversion rates are provided in table 4.A, livestock characterization data for the tier 2 analysis are neither reported in the NIR nor in the CRF tables. For transparency it is recommended that this information be included in the NIR and in the additional information boxes to the sectoral background tables of the CRF.

61. The IPCC default emission factors have been used for all other species. The IEFs calculated in the CRF, while close to the IPCC defaults, are not exactly the same. The values should be checked to determine whether this is due to a problem with reporting in the CRF tables or with the actual emission estimation process. In its response to the draft review report Spain explained that a 0.8 scaling factor has been applied to the IPCC default emission factors for juvenile (as compared with adult ones) animals.

62. Emissions from buffalo, camels and llamas should be reported as NO in table 4 of the CRF, consistent with reporting in table 4.A.

2. Manure management – CH₄ and N₂O

63. Improved documentation of the assumptions used to estimate emissions is required as it is unclear what livestock characterization has been used to estimate the country-specific volatile solids or whether the characterization is consistent with that used for enteric fermentation estimates. In its response to the draft review report Spain explained that for swine, the volatile solids (VS) parameter adopted was of 0.5 kg/head and year, which corresponds to the IPCC default value for developed countries (table B-2). For cattle, the VS parameter was derived from equation 15 of IPCC Guidelines, in accordance with the gross energy calculation used for enteric fermentation emissions estimation (tier 2).

64. The NIR indicates that the IPCC default nitrogen excretion rates for “Middle East and Mediterranean” regions are used. However, the rates reported in table 4.B(b) match the defaults only for dairy cattle, horses, mules and asses. In response to the draft S&A report 2002 Spain indicated that for the other animals a scaling factor has been applied to the IPCC defaults (assumed to represent adult excretion rates) for juvenile animals. The reference for the scaling factors (table 4.14 of IPCC good practice guidance) was provided in the response of Spain to the review report. Documentation of these scaling factors is required in the next NIR to ensure transparency. There is an inconsistency in the total nitrogen excreted for non-dairy cattle and sheep calculated by multiplying population by the reported excretion rates with that reported by animal waste management system (AWMS) in table 4.B(b). In its comments to the draft review report, Spain pointed out that there was an error in the excretion ratio shown in the CRF table, but the figure of total N excreted was correct.

65. Emissions from anaerobic lagoons are currently reported as zero. If this treatment does not occur in Spain, this source category should be reported as NO in the CRF.

3. Agricultural soils – direct N₂O emissions

66. Assuming that the activity data are reported in the correct units, the N₂O emissions from N fixing crops and crops residues appear to have been calculated incorrectly. It would appear that the kg dry biomass has been multiplied by the IPCC kg N₂O-N/kg N emission factor. The kg dry biomass must be converted into kg N before the IPCC default emission factor is applied. In response to the review report Spain explained that the correct activity data (kg N/yr) had been used but that the text describing the units had not been modified. The ERT recommends the units descriptions be corrected in the next submission.

C. Non-key sources

1. Rice cultivation

67. There is an inconsistency in the reporting of rice activity data in table 4.C. The units for reporting the area of cultivation have changed in 2000, resulting in a significant increase in the IEF from 1.2 g/m² to 12 g/m². As the country-specific emission factor was not documented, it was not possible to say for which years the data are incorrectly reported. In its response to the draft review report, Spain explained that a value of 12 g/m² was used according to the reference for Spain (Seville) as appears in table 4-9 of Revised IPCC Guidelines (Reference Manual) and that the value of 1.2 g/m² was an arithmetical input error.

2. Field burning of agricultural residues

68. Two values for the fraction of biomass burnt are reported in the CRF. In its response to the draft review report Spain explained that the values for the fraction of biomass burned are 0.012 or 0.024 depending on the species burnt. The ERT recommends that in the CRF a weighted average should be reported and the specific situations should be included in the documentation box or in the NIR.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

69. The LUCF sector represents a net sink offsetting 7.6 per cent of Spain's total GHG emissions. From 1990 to 2000, CO₂ removals in the LUCF sector remained at the same level of 29,252 Gg.

70. The LUCF inventory is prepared by the Directorate-General for Nature Conservation of the Spanish Ministry of Environment. The Second National Forest Inventory of Spain (1986–1995) is the major sectoral data source. In the LUCF sector, Spain uses a national method which is generally consistent with the IPCC Guidelines. The NIR does not include calculation sheets for all years within the submission period, nor information on emission and expansion factors used, and neither does it describe the methodology and parameters used. Additional information on the methodology used and 1990 data on forest stocks and logging has been provided at the request of the ERT.

71. Spain reports on category 5.A Changes in forest and other woody biomass stocks (CRF tables 5 and 5.A) and emissions of nitrogen oxide (NO_x) from managed forests under category 5.E Other (CRF table 5). The rest of the categories are not covered due to a lack of relevant data. This is indicated using notation keys in the relevant sectoral background data tables and providing explanation in table 9 of the CRF.

72. Spain reports recalculated estimates for the period 1990 to 1999. Apparently, the recalculations are specified by updating forestry data based on results of the Second Forest National Inventory, but the NIR does not provide clear evidence of this. In its response to the draft review report Spain explained that in 2002 only background data table 5.A was new.

73. Spain undertakes efforts to report on categories 5.B to 5.D. As indicated in the NIR, these categories are among the priority matters for future work. It is expected that the ongoing IPCC work relating to the sector will further clarify and facilitate this process. The ERT encourages Spain to make efforts to report currently lacking categories.

B. Sink and source categories

1. Changes in forest and other woody biomass stocks

74. CO₂ emissions and removals are calculated as the difference between carbon uptake in forest biomass and losses from logging and forest fires. Removals in biomass of young and adult trees and emissions from cutting and fires are calculated separately on an annual basis. Forest fire emissions are estimated under CORINAR SNAP 97¹⁹. The NIR does not provide clear evidence as to why net removals for this category remained stable from 1990 to 2000, but according to additional clarification provided by Spain, net removals for this category are kept stable until Third National Forest Inventory data become available allowing recalculation of changes in forest biomass growth and cuts.

75. Spain uses country-specific factors higher than the IPCC defaults to account for carbon removals in biomass and losses due to harvesting. These are reported in CRF table 5.A according to additional clarification provided by Spain. The factors are based mainly on expert judgment, and efforts are undertaken to publish their values in referred editions. The ERT encourages Spain to facilitate ongoing work on justifying emission factors used, in line with general IPCC requirements.

2. Other sink and source categories

76. Under category 5.E Other, Spain reports on emissions of NO_x from managed forests. From 1990 to 2000, the emissions decreased by 6 per cent. However, it is unclear from the NIR and CRF what is the actual source of emissions. In its response to the draft review report, Spain explained that NO_x emissions

¹⁹ SNAP: Selected Nomenclature for Air Pollution.

from forest soils were estimated according to EMEP/CORINAIR methodology (chapter 11.01.17). Spain plans to reconsider the emissions from this source category in the next inventory submission.

VI. WASTE

A. Sector overview

77. The sectoral contribution to total GHG emissions increased from 3.3 per cent in 1990 to 3.9 per cent in the year 2000. Emissions increased steadily from 9,401 Gg CO₂ equivalent in 1990 to 14,581 Gg CO₂ equivalent in 2000 (55.1 per cent increase). The increase is mainly in CH₄ emissions from solid waste disposal and CH₄ and N₂O from wastewater handling. According to the explanation submitted by the Party, the high growth in emissions is due mainly to the fact that the absolute amount of municipal solid waste (MSW) deposited in landfill sites has greatly increased from the year 1990 to the year 2000.

78. A combination of default, IPCC tier 2 and CORINAIR methodologies and country-specific, default and CORINAIR emission factors has been used. Although there is an improvement, the information submitted in the NIR is still not sufficient to allow the criteria used in the selection of some emission factors and activity data to be adequately understood.

79. The inventory for this sector is nearly complete and the estimates obtained are comparable with those of other Parties and seem consistent. The analysis of key sources made by the Party and that made by the secretariat correspond closely. Recalculations made in the sector are clearly documented and explanations are provided both in table 8(b) of the CRF and in the NIR.

B. Key sources

1. Solid waste disposal on land – CH₄

80. Explanations of the rationale for several of the parameters used for the tier 2 method applied were neither provided in the NIR nor in the documentation box and additional information box to table 6.A of the CRF (e.g. time lag). The fraction of waste disposal is less than 1 (0.67). In its comments to the review report Spain explained that the fraction of 0.67 was calculated as the ratio of total municipal solid waste generated to municipal solid waste disposed in landfill sites. The remaining 33 per cent of municipal solid waste is managed with other treatment systems (incineration, compost production, etc.).

81. The criteria for selecting the value 0.1 for the CH₄ generation rate constant (k) and the CH₄ oxidation factor of 0.05 were not explained in the NIR. In its response to the draft review report Spain explained that the values were selected as mean values from the range provided in IPCC good practice guidance. However, the IPCC good practice guidance recommends the use of the oxidation factor of 0.1 for well-managed landfills in industrialized countries and not the mean of the range. The explanation for the choice of the CH₄ generation rate ignores that IPCC Guidelines suggest 0.05 as a default value if no data on types of waste are available. The ERT recommends the Party to provide further justification for the values chosen in the next NIR.

2. Wastewater handling – CH₄²⁰ and N₂O²¹

82. Industrial wastewater is covered at an aggregated level, except for food and beverage and chemical industries, for which activity data were available. In the information submitted it is not clearly documented whether the activity data were obtained from national statistics or from a survey of relevant industries. In its response to the draft review report, Spain explained that data was gathered by a survey in food and beverages industry and chemical industry in 1994 or 1996 respectively. For other point sources, surveys are conducted regularly.

²⁰ Defined as a key source in the UNFCCC's key source analysis only.

²¹ Defined as a key source in Spain's key source analysis only.

83. Information or references on country-specific emission factors used are not provided. The change in the value of the parameter Bo (maximum CH₄ producing capacity) according to the IPCC good practice guidance and the update of activity data motivated the recalculation of emission estimates in this source category. Recalculated estimates and explanatory information were provided in the CRF. The ERT recommends the Party to clarify the characteristics of the activity data used as well as to provide more information on the emission factors applied.

3. Waste incineration²²

84. Waste incineration includes emissions from hospital waste and cremation. For incineration of corpses, no activity data or emission factors are provided. In its response to the draft review report, Spain explained that an emission factor of 39 kg CO₂/corpse and 0.08 g CH₄/ corpse incinerated was used. For incineration of hospital waste, no explanation on assumptions was presented. The ERT recommends the Party to provide more information on the characteristics of the activity data and emission factors used in these source categories.

C. Non-key sources

1. Solid waste disposal on land – CO₂

85. Emissions from burning the fossil fraction of municipal solid waste at unmanaged landfill sites are reported under the subcategory 6.A.3 Other. No information about methods and emission factors used in the estimation of emissions from this source is provided. These CO₂ emissions should be reported under category 6.A.2 if combustion is used as a management practice at solid waste disposal sites. The ERT recommends the Party to provide relevant details as well as to document methods and emission factors used.

2. Emissions from human sewage – N₂O

86. Emissions from this source category are included for the first time in the current submission of Spain's inventory. The data for protein consumption are not documented or referenced. In its response to the draft review report, Spain provided the data source²³, which should also be included in future NIRs.

3. Other

87. Emissions from domestic and commercial wastewater sludge spreading are reported in this category. No information for the characteristics of the spreading or the methodology, activity data and emission factors used in the estimation of emissions are provided in the NIR. In order to improve transparency it is recommended that this information be included in both the NIR and the CRF.

²² Defined as a key source in Spain's key source analysis only.

²³ Reference for the protein consumption is: "La Alimentación en España" (The Food Diet in Spain), published by the Ministry of Agriculture, Fishing and Food.

Annex 1:**MATERIALS USED DURING THE REVIEW****A. Support materials on the CD ROM and the web page for the review**

2000, 2001 and 2002 *Inventory submissions of Spain*. 2002 submissions including CRF for years 1990-2000 and an NIR [unpublished].

UNFCCC secretariat. *2000 Status reports for Spain* [available at <http://unfccc.int/program/mis/ghg/statrep00/esp00.pdf>].

UNFCCC secretariat. *2001 Status report for Spain* [available at <http://unfccc.int/program/mis/ghg/statrep01/esp01.pdf>].

UNFCCC secretariat. *2002 Status report for Spain* [available at <http://unfccc.int/program/mis/ghg/statrep02/esp02.pdf>].

UNFCCC secretariat. *Synthesis and assessment report of the greenhouse gas inventories submitted in 2000*. FCCC/WEB/SAI/2000 [available at <http://unfccc.int/program/mis/ghg/sai2000.pdf>].

UNFCCC secretariat. *Synthesis and assessment report of the greenhouse gas inventories submitted in 2001*. FCCC/WEB/SAI/2001 [available at <http://unfccc.int/program/mis/ghg/sai2001.pdf>].

UNFCCC secretariat. *Draft synthesis and assessment report of the greenhouse gas inventories submitted in 2002* (Part I and Part II – the section on Spain [unpublished]).

Spain's comments on the Draft synthesis and assessment report of the greenhouse gas inventories submitted in 2002 [unpublished].

Energy balances for years 1990 to 2000 provided with Spain's response to the draft S&A report [unpublished].

UNFCCC secretariat. *Key source analysis for the year 2000*. [unpublished].

UNFCCC secretariat. *Handbook for review of national GHG inventories*. Draft 2002, [unpublished].

UNFCCC secretariat. *UNFCCC guidelines on reporting and review*. FCCC/CP/1999/7, [available at <http://www.unfccc.int/resource/docs/cop5/07.pdf>].

UNFCCC secretariat. Database search tool – *Locator* [unpublished].

IPCC. *IPCC good practice guidance and uncertainty management in national greenhouse gas inventories*. 2000. [available at <http://www.ipcc-nggip.iges.or.jp/public/gp/gpgaum.htm>].

IPCC/OECD/IEA. *Revised 1996 IPCC Guidelines for national greenhouse gas inventory, volumes 1–3*, 1997, [available at: <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>].

B. Additional materials provided by the Party

Responses to questions during the review were received from the working team in charge of emission inventories (Ministerio de Medio Ambiente, Madrid, Spain) including additional material on the methodology and assumptions used in the estimation of carbon removals in the LUCF sector and in the estimation of emissions from forest fires. Additional tables with detailed activity data for the LUCF sector and the calculation sheets for forest fire emissions were also provided.
