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REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY OF FRANCE SUBMITTED IN THE YEAR 2001[1]

(Desk 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, hereinafter referred to as the review guidelines,[2] for a trial period covering the 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 on a voluntary basis. In so doing, 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 desk review of five national GHG inventories (Bulgaria, France, Iceland, Latvia and Switzerland) submitted in 2001, which took place from 19 November 2001 to 15 April 2002. The review was carried out by a team of nominated experts from the roster of experts. The members of the team were: Mr. Jose Ramon Villarin (Philippines), Mr. Arthur Rypinski (United States of America), Professor Anthony Adegbulugbe (Nigeria), Mr. Domenico Gaudioso (Italy), Ms. Nadzeya Zaleuskaya (Belarus), Dr. Lorna Brown (United Kingdom), Ms. Punsalmaa Batima (Mongolia), Mr. Rizaldi Boer (Indonesia), Mr. Josef Mindas (Slovakia) and Mr. Charles Jubb (Australia). The review was coordinated by Ms. Astrid Olsson (UNFCCC secretariat). Professor Anthony Adegbulugbe and Mr. Charles Jubb were the lead authors of this report.

3. The principle objective of the review of GHG inventories was to ensure that the Conference of the Parties had adequate information on the inventories. The review should also further assess the progress of Parties toward fulfilling the requirement outlined in the UNFCCC reporting guidelines on annual inventories (FCCC/CP/1999/7).[3] In this context, the review team checked the responses of Parties to questions raised in the previous stages of the review process and the consistency of the inventory submission with the UNFCCC reporting guidelines and the Revised 1996 IPCC Guidelines (hereinafter referred to as the IPCC Guidelines), and identified possible areas of improvement in the inventories of the five Annex I Parties. Each inventory

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

[2] Document FCCC/CP/1999/7, in particular the UNFCCC review guidelines (pages 109 to 114), and decision 6/CP.5 (pages 121 to 122).

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

expert reviewed the information submitted for specific IPCC sectors and each sector was reviewed by two experts, with the exception of the general review and the waste sector.

4. The review team also considered and commented upon the extent to which 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).[4]

5. In accordance with the UNFCCC review guidelines, a draft version of this report was communicated to the Government of France, which provided comments that were considered and incorporated, as appropriate, in this final version of the report. In its response to the draft review, the Party stated that the review report is globally relevant and reflects quite well the actual situation of France's greenhouse gas inventory for 2001. The Party further commented that more recent inventories (2002 and 2003) include many of the changes recommended in the draft review report.

B. Inventory submission and other sources of information

6. The expert review team (ERT) was provided with common reporting format (CRF) tables for all years from 1990 to 1999 and the national inventory report (NIR) for the 2001 submission. The status report 2001 and the draft synthesis and assessment (S&A) report 2001, together with the Party's responses to the draft S&A report 2001, were also made available to the ERT. In addition, the secretariat's preliminary key source analysis[5] (level and trend) was provided. This facilitated comparisons with the key source analysis prepared by the Party and presented in the NIR.

7. Other sources of information used during the review include: the preliminary guidance for experts participating in the individual review of GHG inventories, the UNFCCC reporting guidelines and the review guidelines (FCCC/CP/1999/7).

C. Emission profiles, trends and key sources

8. The main GHG emitted in France is carbon dioxide (CO_2). During the period 1990 to 1999, CO_2 emissions have increased as a proportion of total emissions (without CO_2 from land-use change and forestry (LUCF)) from 69.7% to 73.3%. Nitrous oxide (N_2O) emissions have declined in proportion over the same period. These emissions comprised 17.1% of total emissions in 1990 compared with 14.3% in 1999 (decreasing by 17.0% from 1990 to 1999). Methane (CH_4) emissions increased from 11.8% to 12.6% of total emissions from 1990 to 1994 and 1995, and then fell during the period 1995 to 1999 to 10.8% of total emissions (declining by 8.6% from 1990 to 1999).

9. HFC emissions have more than doubled since 1990, increasing from 0.4% to 0.9% of total emissions. HFC emissions fell from 0.4% to 0.1% from 1990 to 1993 as a result of declining emissions of HFC-23, a by-product emission from the production of HCFC-22.

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

[5] The UNFCCC secretariat had identified, for each individual Party, those source categories which 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 which provide 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.

Despite a continuing decline in emissions of HFC-23, HFC emissions increased each year from 1993 to 1999. This trend is consistent with the expected trend in HFC emissions as HFCs replace ozone-depleting substances (ODS) in Annex I countries.

10. The Party has provided detailed analysis and discussion of the trends for all GHGs both direct and indirect.

11. France's emission trends are summarized by GHG and by sector in tables 1 and 2.

Table 1. GHG emissions by gas, 1990–1999 (Gg CO_2 equivalent)

GHGs	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)									
CO_2 emissions (without LUCF)	385,490	409,099	401,010	379,660	375,710	381,996	395,858	389,579	410,684	404,695
CH_4	65,288	66,466	66,752	67,399	67,461	68,574	67,611	62,312	61,722	59,652
N_2O	94,838	94,683	91,277	87,112	88,878	90,598	91,392	92,449	84,398	78,721
HFCs	2,253	1,514	1,061	804	818	1,302	2,186	3,095	3,752	4,815
PFCs	3,195	2,469	2,147	1,650	1,390	1,350	1,410	1,471	1,661	1,915
SF_6	2,195	2,216	2,238	2,262	2,288	2,314	2,387	2,444	2,405	2,411
Total (with net CO_2 emissions/removals)	493,642	519,959	503,240	473,023	469,050	480,983	493,649	483,260	496,598	483,214
Total (without CO_2 from LUCF)	553,259	576,447	564,486	538,888	536,545	546,134	560,846	551,350	564,622	552,209

12. The energy sector is the largest source of emissions contributing 72.0% of total CO_2 equivalent emissions (excluding LUCF) in 1999 compared with 67.6% in 1990. The agriculture sector contributes 15.7% of total emissions, the industrial processes sector 6.8%, the waste sector 3.8% and the solvent and other product use sector 0.4%. With the exception of the energy sector, all sectors have declined as a proportion of total emissions since 1990. The largest fall has been in the industrial processes sector which has decreased in significance from 10.3% of total emissions in 1990 to 6.8% in 1999.

Table 2. GHG emissions by sector, 1990–1999 (Gg CO_2 equivalent)

GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)									
Energy	374,243	400,762	393,991	373,522	367,871	374,005	388,879	381,658	402,731	397,507
Industrial processes	56,725	53,536	49,421	45,167	47,132	49,016	48,245	49,654	42,522	37,483
Solvent and other product use	2,448	2,369	2,336	2,221	2,226	2,244	2,226	2,234	2,261	2,230
Agriculture	90,403	89,037	86,659	85,024	85,476	86,118	86,934	87,252	86,888	86,493
LUCF	–52,020	–48,849	–53,550	–58,171	–59,845	–57,488	–59,508	–60,396	–60,330	–61,301
Waste	21,843	23,105	24,382	25,260	26,190	27,088	26,872	22,858	22,527	20,802
Other	0	0	0	0	0	0	0	0	0	0

13. Emissions from the energy sectors have increased by 6.3% from 1990 to 1999, industrial processes sector emissions have decreased by 33.9%, solvent and other product use emissions have declined by 8.9%, agriculture sector emissions have fallen by 4.3%, the net sink from LUCF has grown by 17.8%, and waste sector emissions have decreased by 4.8%.

14. The key-source level analysis prepared by the UNFCCC secretariat shows CO_2 from mobile combustion – road vehicles (23.8%), CO_2 stationary combustion – oil (18.4%), CO_2 stationary combustion – gas (13.0%), and CO_2 stationary combustion – coal (8.1%) as the most significant key sources. The first three of these sources each contribute more than 10% of total

emissions. Of the 23 key sources identified by the key source level analysis, ten are in the energy sector, seven in the industrial processes sector, and six in the agriculture sector.

15. The key source trend analysis indicates that CO_2 stationary combustion – gas (22.4%), CO_2 from mobile combustion – road vehicles (20.5%), N_2O from adipic acid production (14.0%), and CO_2 stationary combustion – coal (9.4%) are the major contributors to the growth trend in emissions.

Table 3. Key sources France: Level and trend assessment (UNFCCC secretariat)[(a)]

Key source	Gas	Level assessment %	Cumulative total %	Contribution towards trend %
Mobile combustion – road vehicles	CO_2	23.8	24	20.5
Stationary combustion – oil	CO_2	18.4	42	1.4
Stationary combustion – gas	CO_2	13.0	55	22.4
Stationary combustion – coal	CO_2	8.1	63	9.4
Enteric fermentation in domestic livestock	CH_4	5.1	68	2.0
Direct N_2O from agricultural soils	N_2O	5.1	73	1.1
Stationary combustion – other fuels	CO_2	4.8	78	5.0
Indirect N_2O from N used in agriculture	N_2O	3.3	81	
Solid waste disposal sites	CH_4	3.0	84	1.4
Cement production	CO_2	1.5	86	2.5
Mobile combustion – aircraft	CO_2	1.1	87	1.7
Animal production	N_2O	1.1	88	
Adipic acid production	N_2O	0.8	89	14.0
ODS substitutes	all HFCs and PFCs	0.8	90	
Fugitive emissions: oil and gas operations	CO_2	0.7	90	
Nitric acid production	N_2O	0.7	91	4.1
Manure management	CH_4	0.7	92	
Mobile combustion – road vehicles	N_2O	0.6	92	2.1
Manure management	N_2O	0.6	93	
Ammonia production	CO_2	0.5	94	
Iron and steel	CO_2	0.5	94	1.3
Non-CO_2 stationary combustion – biomass	CH_4	0.5	94	
Other (chemical industry)	N_2O	0.5	95	0.6
Fugitive emissions: coal mining and handling	CH_4			1.3
PFCs from aluminium production	CF_4+C_2F_6			1.2
Semiconductor manufacturing	all HFCs and PFCs, SF_6			0.5
Fugitive emissions (production of halocarbons and SF_6)	all HFCs and PFCs, SF_6			0.5
HFC-23 from HCFC production	HFC-23			1.7

[(a)] See footnote 5 to this report.

16. In the NIR, France has presented a key-source analysis which classifies key sources for each of the direct GHGs of the major source categories in terms of total contribution to CO_2 equivalent emissions.

Table 4. France's key source analysis in terms of CO_2 equivalent (from the NIR)

Key source	Gas	Level assessment %	Cumulative total %
Mobile combustion – transport (1.A.3)	CO_2-e[(a)]	26.1	26.1
Stationary combustion – other sectors (1.A.4)	CO_2-e	19.6	45.7
Stationary combustion – manufacturing industries and construction. (1.A.2)	CO_2-e	14.3	60.0
Stationary combustion – energy industries (1.A.1)	CO_2-e	11.4	71.4
Agricultural soils (4.D)	CO_2-e	9.5	80.9
Enteric fermentation – (4.A)	CO_2-e	5.1	86.0
Solid waste disposal on land (6.A)	CO_2-e	3.0	89.0
Chemical industry (2.B)	CO_2-e	2.5	91.5
Mineral products (2.A)	CO_2-e	1.9	93.4
Other sources	CO_2-e	6.6	100.0

(a): CO_2-e: CO_2 equivalent

17. The Party's overall key source level assessment is far more aggregated than the assessment by the secretariat. It does not facilitate the identification of key sources by gas and by subsector. To that extent the analysis does not conform to the IPCC good practice guidance and it is suggested that the approach implemented by the secretariat (see table 3) be adopted in future inventory reports.

D. General assessment of the inventory

1. Institutional arrangements

18. The country's institutional arrangements are more easily explained and examined during in-country reviews.

2. Completeness

19. France's inventory is comprehensive, covering all major source and sink categories. The direct greenhouse gases, CO_2, CH_4 and N_2O, are reported, as are disaggregated actual emissions of HFCs (hydrofluorocarbons), PFCs (perfluorocarbons) and SF_6 (sulphur hexafluoride). Potential emissions are not reported and the Party commented in its response to the draft S&A report 2001 that it had not been possible to estimate potential emissions because import and export data by product are very difficult to obtain. Indirect GHGs, carbon monoxide (CO), nitrogen oxides (NO_X), non-CH_4 volatile organic compounds (NMVOCs) and sulphur dioxide (SO_2) are also included.

20. The CRF is substantially complete with the exception of several sectoral background tables (1991 to 1997), namely, tables 1.A(b), 1.A(d) and 5.A-D. These are mentioned in the draft S&A report 2001 and the Party responded that the inventory is detailed for the years 1990, 1998 and 1999, and that its interpretation of the requirements is that detailed reporting for the current year only, 1999, is obligatory. It further stated that in some cases France's methodology is completely different from the IPCC methodology and that some of the tables are inappropriate.

21. CRF table 9 lists some of the source categories which are not estimated, and subsectors which are included elsewhere (IE) are explained in this table. Regarding the IE entries in table 9, it would be useful if the unavailability of disaggregated manufacturing industries and construction categories (CRF table 1.A(a)s2) were noted in the documentation box of sheet 4 of the same table. Furthermore, with the exception of the additional information box of table 6.A,

6.C notation keys have not been used in the CRF. Consequently, it is not known whether the empty cells should contain NA (not applicable), NE (not estimated), IE or C (confidential), and it cannot be determined whether table 9 includes all the information it should. It would be of assistance if the Party ensured that notation key entries were included in future CRF submissions.

3. Transparency

22. The complete CRF tables for 1990 to 1999 together with the NIR provide an acceptable level of transparency, although this could be improved in future submissions. Specifically, the use of notation keys in all CRF tables would improve transparency, as would the inclusion in the NIR of more explanation of methodologies. Additionally, clear statements in the NIR on data sources and frequency of updating, together with emission factor sources and frequency of updating, would be of assistance. The inclusion in the NIR of a list of references is recommended.

4. Recalculations and changes in relation to previous years

23. Recalculations are made for the majority of sectors in the 2001 submission. The CRF for 1999 include recalculation tables from 1990 to 1998. The NIR provides explanations for all recalculations that expand on the explanations summarized in CRF table 8(b). Minor changes (of less than 1%) are observed in the dominant GHG which is CO_2. Substantial changes are noted in CH_4 and N_2O.

5. Uncertainties

24. The NIR comments on uncertainties and the need to undertake more comprehensive uncertainty analysis and report this in future submissions. In response to the draft S&A report 2001, the Party stated that work had been done on quantitative assessment of uncertainties but that this was not sufficiently complete to be included in the 2001 submission. A qualitative assessment of uncertainties is provided in CRF table 7.

6. Verification and quality assurance/quality control (QA/QC) approaches

25. The NIR refers to issues relating to uncertainty and validation. Specifically, reference is made to comparisons between estimates for energy from a simplified reference approach and sectoral approach. Work on issues relating to uncertainty and validation is stated as being undertaken in accordance with the requirements of the IPCC good practice guidance. In response to a comment in the draft S&A report 2001, the Party stated that this section of the NIR is less developed than other sections and it is expected that this information will be provided in more detail in 2003.

7. Areas for further improvement

Issues identified by the Party

26. Both the draft S&A report 2001 and the review have commented on the absence of quantitative uncertainty analysis consistent with the IPCC good practice guidance. The Party has responded that work has been done on quantitative uncertainty analysis. It is expected that this will be included in future submissions.

27. The matter of QC procedures and documentation was raised in the draft S&A report 2001 and has been raised in this review. The Party has commented that these procedures will be elaborated and that this is expected to be achieved in 2003.

Issues identified by the ERT

28. In future inventories it is recommended that the Party ensure that:

(a) *Reporting:* All cells in the CRF contain data or a notation key. This is considered important for both completeness and transparency;

(b) *Methodologies:* The NIR provides a more detailed outline of the methodologies employed;

(c) *Activity data and emission factors:* The NIR provides information on sources of activity data and frequency of collection, and sources of emission factors and frequency of review;

(d) *Uncertainty:* When quantitative uncertainty analysis is implemented and reported, explicit documentation of the assumptions be provided.

In its response to the draft review report, the Party commented that many changes had been made in more recent inventories (2002 and 2003), including changes consistent with a large number of the recommendations made in the draft review report. By way of clarification of the time required to implement changes, the Party stated that the reporting deadlines faced by the Party as a member of the European Community requires that the inventory be prepared three months earlier than the UNFCCC deadline. This means that there can be a delay of one or two years between changes being identified by the Party or the ERT, and the implementation of those changes.

8. Consistency with the UNFCCC reporting guidelines and the IPCC Guidelines

29. France's GHG inventory for the period 1990 to 1999 has been compiled according to the UNFCCC reporting guidelines. The NIR and CRF are substantially consistent with the IPCC Guidelines and the UNFCCC reporting guidelines for estimating and reporting emissions, although some background information has been omitted from the CRF tables for 1991 to 1997 (based on the Party's interpretation of the requirements for submissions). The NIR is an important and useful source of information on the Party's inventory. Implementation of the IPCC good practice guidance includes a key source level assessment. The Party is yet fully to implement and report a quantitative uncertainty assessment.

9. Conclusion

30. France's submission, comprising the CRF for all years from 1990 to 1999 and an NIR, provides an acceptable level of information on the GHG inventory and GHG emission trends. In addition, where the draft S&A report 2001 has identified issues, the Party has responded and has suggested future improvements to the inventory.

II. ENERGY SECTOR

A. Sector overview

31. Energy-related GHG emissions are 397,507 Gg CO_2 equivalent in 1999, accounting for 97% of CO_2 emissions and about 77% of total GHG emissions (excluding LUCF).

32. French energy-related emissions are unusual by comparison with other Annex I countries in several respects, arising from national circumstances:

(a) Because France has an extensive nuclear power programme, emissions from the electric power sector are unusually low, both per kilowatt-hour of electricity generated, and also as a share of total energy-related and national emissions. French average emissions per kilowatt-hour are, for example, a fifth of German emissions per kilowatt-hour;

(b) France has a large integrated steel industry which includes production and international trade in coke. Consequently, other fuels (probably coke, blast furnace gas, coke oven gas, gas works gas and patent fuels) account for an unusually large share of emissions;

(c) Since fossil fuel combustion is a relatively small and marginal source of power generation, electric power sector emissions are volatile. Fossil power generation must compensate for normal variations in hydroelectric output, weather-related changes in consumption, and economic fluctuations. Autoproducers account for an unusually large share (about a third) of electric power sector CO_2 emissions;

(d) Emissions include those from several overseas departments (territories) with relatively small emissions.

33. Energy-related CO_2 emissions have been rising at an annual rate of about 0.7% per year, reaching 107% of 1990 levels in 1999. Much of the growth in energy emissions comes from the transport sector; emissions have been rising at an annual rate of 1.6%, and are now 117% of 1990 levels. Most of the volatility in emissions is generated by the volatility in the electric power sector, with emissions fluctuating from 80% to 118% of 1990 levels.

1. Completeness

34. There are many cells which contain neither data nor notation keys. Three tables in the energy sector CRF have not been filled in. Tables 1.A(b) and 1.A(c), covering the comparison between the reference approach and the sectoral approach, are blank. The documentation box indicates “the information is not available at this time”. These tables have been completed for two previous years (1990 and 1998) suggesting that it may be possible to revise the inventory as data become available.

35. In addition, table 1.A(d), covering carbon sequestration from non-fuel use of minor petroleum products, is also blank. The table has been filled in for 1998.

36. The discussion of uncertainty in the inventory is very general, and linked to the difference between the reference approach and the sectoral approach, which, as noted above, is calculated only for years prior to 1999.

37. The discussion of inventory validation is brief.

2. Transparency

38. In addition to the CRF, the Party has submitted an NIR, which includes an annex on emission calculation methods.[6] This material has been helpful in understanding the construction of the French inventory, although more detail on some issues specific to calculating emissions would be of assistance.

39. In particular, it would have been helpful if there had been more detailed discussion of how emissions from the iron and steel industry had been treated. Information on the composition

[6] Centre Interprofessionel Technique d’Etudes de la Pollution Atmosphérique (CITEPA), *Inventaire des Emissions de Gaz à Effet de Serre en France au Cours de la Période 1990–1999*, Decembre 2000.

of other fuels (which account for about 7% of 1999 energy-related carbon dioxide emissions) would also have been helpful.

3. Methodologies, emission factors and activity data

40. The French inventory has been prepared using a sectoral approach. In general, it appears that energy-related CO_2 emissions have been calculated by a hybrid tier 2/tier 1 approach, in which emissions from large point sources are measured directly, emissions from road transport calculated by reference to the output of a detailed transport model, and emissions for other sectors by the usual method of multiplying estimated activity data by an emission factor specific to each fossil fuel. While national emission factors have been used, these are within the expected range for fossil fuels. However, emission factors for the most important liquid fuels are several per cent higher than the default IPCC emission factors. This choice presumably reflects the national characteristics of petroleum products actually consumed in France.

41. The International Energy Agency (IEA) publishes a detailed breakdown of French energy consumption by fuel and sector.[7] However, the national energy data sources cited in the inventory, and those that this reviewer have been able to examine via the Internet, are far less detailed than those presented by either the IEA or the UNFCCC CRF.[8]

42. According to the discussion in the inventory, emissions from single large facilities engaged in electric power generation, district heating, oil refineries and iron and steel manufacturing are derived from surveys undertaken by diverse bodies and compiled by the inventory group. Emissions from smaller sources are inferred by deducting emissions from the individually reported large point sources (*grandes installations de combustion*) and particular known sources and processes from total industrial sector emissions, presumably derived from national energy statistics.[9] Thus, as in other countries, national total energy-related CO_2 emissions are determined largely by national energy statistics, while the division between sectors is determined by CORINAIR.

43. In the French context, there are difficulties in classifying emissions. While most electric power generation can be attributed to nuclear and hydroelectric power, France has significant amounts of autogeneration and district heating. These units can be logically classified as either manufacturing or energy industry in the CRF classification scheme. When deducting large point source fuel consumption or emissions from data derived from national energy statistics, the national authorities must be careful to make their deduction from the same category of energy consumption in which the large point source was originally placed. The national authorities must then map the combined data into the CRF classification scheme.

44. A somewhat similar problem occurs with respect to iron and steel production. France has significant iron and steel production. Metallurgical coal is mined or imported, and shipped to coke ovens which produce coal tars, coke and coke oven gas. Coke itself is exported and imported, and has fluctuating stocks. Most coke presumably finds its way into steel mills, along with limestone for use as a reductant and as steam coal for fuel use. Steel mills produce blast

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7 IEA, *Energy Balances of OECD Countries 1998–1999* (Paris, OECD, 2001), and IEA energy database 2001.

8 Cf. Direction Général de L'Energie et des Matières Premières, *Bilan Energétique Provisoire de la France en 1999*, (Ministère de L'Economie des Finances et de L'Industrie, Paris, 29 March 2000). Available via the Internet at: http://www.industrie.gouv.fr/energie/statisti/se_stats.htm. There may be published sources of French national energy statistics not found by this reviewer, or it may be that more detailed data are available but not published. These data as published are also weather-adjusted (*corrigée du climat*).

9 Ibid., annex 3, p. 11.

furnace gas, which will mostly be oxidized on site, but is also used (in France) to generate electricity. In the CRF, these emissions may be distributed across the categories electricity, other energy, manufacturing, or industrial processes emissions.

45. These two factors have played a significant role in the attempt to reconcile the French inventory to published French energy data. The inventory reports significant energy consumption from other fuels which appear to be defined as coke, coke oven gas and blast furnace gas. While there is a close correspondence between total French energy-related CO_2 emissions and total emissions calculated by the IEA, the reported consumption of specific fuels (in terajoules) and the distribution of fuel consumption and emissions across sectors do not correspond well with data reported in the inventory.

46. Energy consumption in the transport, residential, commercial and agricultural sectors is drawn largely from national energy statistics.

4. Recalculation

47. Together with a CRF for 1999, the Party has also submitted revised CRFs covering the period 1990–1998. The NIR attributes the recalculations, as they affect energy-related emissions, to a revision of national energy statistics for the period 1996–1998, and recalibration of transport estimates from several causes. According to the report, all revisions are small.

48. It is not clear whether or not the latest IEA energy statistics incorporate the 1996–1998 revisions in French national energy statistics. This adds an element of indeterminacy to comparisons (such as this review notes below) between the French inventory and IEA data.

5. Uncertainty estimates

49. Qualitative assessment of uncertainties is provided in CRF table 7. The NIR discusses the uncertainty of emissions and verification of its results in general terms.

50. The discussion of uncertainty is linked largely to the difference between the reference approach and the sectoral approach which, as noted above, was done only for years prior to 1999. Quantitative uncertainty analysis in accordance with the IPCC good practice guidance is yet to be provided.

6. Consistency with the UNFCCC reporting guidelines and the IPCC Guidelines

51. Energy-related emissions in the French inventory are generally in conformity with the IPCC Guidelines and the UNFCCC reporting guidelines. Tables 1.A(b), 1.A(c) and 1.A(d), covering the comparison between the reference approach and the national approach, and the non-fuel usage of fossil fuels, are not filled in in the 1999 submission. These forms are filled in in the 1998 CRF.

B. Reference and sectoral approach

1. Comparison between reference and sectoral approaches

52. The Party does not report on the reference approach in 1999. With regard to previous years, a reference approach is reported for 1990 and 1998.

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

53. Essentially all the carbon in non-fuel use of fossil fuels is assumed to be sequestered.[10] In several cases (ammonia manufacture, aluminium smelting) CO_2 process emissions of fossil fuel origin are correctly reported in the industrial processes sector and, consequently, sequestration of the equivalent non-fuel usage in the energy sector is necessary to prevent double counting. Similarly, emissions of hydrocarbon solvents are accounted for in the solvents sector of the inventory.

54. There are two minor areas where emissions may not have been reported:

(a) Lubricants: According to the IEA, 1999 consumption of lubricants in France is about 35,000 TJ. It is likely that a large portion of lubricant usage was oxidized, either directly, through combustion in two-stroke engines or defective internal combustion engines, or indirectly, through "recycling" of waste oil into boiler fuel or through oxidation reactions of lubricants released into the environment from air or surface emissions. Assuming, consistent with the IPCC Guidelines, that about half of lubricant consumption is oxidized, this would imply annual emissions of about 1.3 Mt CO_2;

(b) Carbon black: According to the inventory (table 2(I).A-Gs1), some 264,000 metric tons of carbon black has been produced in 1999. Carbon black is manufactured by combusting fossil fuel under oxygen-deficient conditions, and harvesting accumulated carbon-rich black "soot" from the exhaust stream. Only 35-65% of the carbon in the fuel is harvested; the balance is emitted as CO or CO_2.[11] Assuming that the fuel input for carbon black manufacture is correctly accounted for as a feedstock use of the fuel, there should be 0.5–2 tons of CO_2 emitted for each ton of carbon black produced. Under the IPCC Guidelines, this could be reported as a process emission or as a non-sequestering non-fuel use of the fossil fuel.

3. International bunker fuels

55. The inventory reports consumption of both aviation and marine bunker fuels. Marine bunker fuel consumption corresponds reasonably with IEA data. Reported 1999 total jet fuel and aviation gasoline consumption differs by only 1.5% in the two sources. However, the IEA attributes 79% of aviation consumption to international aviation bunkers, while the inventory attributes 69% of aviation consumption to international aviation bunkers. Consequently, the IEA estimate of international aviation bunkers is 31,000 TJ greater than that in the inventory, while the IEA estimate of domestic aviation consumption is 26,000 TJ smaller than that in the inventory.[12]

56. The inventory also applied a 4.8% higher national emission factor (74.9 vs. 71.5 tCO_2/TJ) for jet fuel than the IPCC default used by the IEA. This higher emission factor reduces the gap in international aviation bunker emission estimates between the two sources, and slightly increases the corresponding gap in domestic aviation emissions.

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10 Table 1.A(d) in the CRF is blank in the 1999 report. In the 1998 report, however, all non-fuel use was reported sequestered. The large volume of liquid fuels used for feedstocks (nearly 400,000 TJ in 1999, according to the IEA) would have been very noticeable in the manufacturing sector estimates had they been included in combustion in 1999.

11 See chapter entitled "Carbon Black" in the U.S. Environmental Protection Agency's AP-42 Handbook, available on-line at: http://www.epa.gov/ttn/chief/ap42/ch06/final/c06s01.pdf.

12 The draft S&A report 2001 noted the differences in both domestic and international aviation consumption.

57. Previous year estimates of total aviation fuel consumption and the domestic/international division differ more than the 1999 estimates.

C. Key sources

58. The UNFCCC secretariat's analysis of key sources indicates that the top four sources of emissions (out of a total of eleven key sources for the energy sector) are attributable to emissions of energy-related CO_2, accounting for 63% in 1999. These four key sources are:

(a) Carbon dioxide mobile combustion – road vehicles (24%);

(b) Carbon dioxide stationary combustion – oil (18.4%);

(c) Carbon dioxide stationary combustion – gas (13.0%);

(d) Carbon dioxide stationary combustion – coal (8.1%).

59. This review will combine coverage of stationary source emissions into a single grouping, followed by consideration of transport emissions.

1. Stationary combustion: coal, oil and gas – CO_2

Trends

60. The CRF divides stationary combustion into three broad categories: energy industries, manufacturing, and other sectors. The apparent volatility of French emissions is largely a function of fluctuations in emissions in the electric power sector.

61. The natural volatility of French stationary combustion emissions limits the usefulness of inter-year comparison of emissions. Nonetheless, reported 1999 emissions do not appear exceptional by comparison with previous years.

62. At the highest level of aggregation, the emissions from the French inventory and the IEA database correspond closely. (Reported energy consumption, measured in terajoules, does not correspond so closely.) However, the division across sectors suggests the possibility of differing classification schemes in the two sources.

Completeness

63. Coverage of emissions from this source appears to be complete. It would have been helpful if manufacturing industries emissions had been distributed across industries in CRF table 1.A(a), particularly in the difficult to reconcile iron and steel sector. More detail on the composition of other fuels in manufacturing industries and energy industries would also have been helpful.

Methodologies

64. According to the NIR, energy consumption from large point sources is surveyed individually, and emissions are inferred by applying CO_2 emission factors to these sources. Emissions from smaller sources are inferred by differences between national energy consumption data and the sum of emissions from point sources, multiplied by a set of national emission factors. This approach is consistent with the IPCC good practice guidance.

Activity data

65. The activity data for stationary combustion are a hybrid of CORINAIR data and national energy statistics. An effort to reconcile this hybrid data with French energy data published by the IEA has produced many points of agreement and some differences.

66. While the national total for fossil energy consumption is very similar to the IEA figure, the distribution is different. Compared with the IEA presentation, the inventory has too little natural gas, and too much other fuels. Coke ovens and blast furnaces, which would normally fall into the other energy category of the CRF, appear to have been rolled into the manufacturing category. Public electricity and heat is deemed to include both of the IEA categories, electric utility production and autogeneration.

67. Note that this reorganization will not produce subtotals and totals comparable to the actual totals shown in IEA publications. International aviation bunkers, non-fuel use and feedstock use, municipal waste and biomass fuels have all been excluded. The organization of IEA fuels into the UNFCCC taxonomy of liquid/solid/gaseous/other has followed a best guess as to the organization of the inventory. The treatment of energy transformation has followed a best guess as to how coke oven and blast furnace emissions are organized in the inventory.

68. Other points specific to individual sectors are discussed below.

Energy industries

69. In 1999, energy-related CO_2 emissions from energy industries are 61.4 Mt CO_2, while the IEA estimated sectoral emissions at 61.5 Mt CO_2. This sectoral agreement is striking because a similar balancing of the energy portion of the accounts (shown in terajoules) has proved difficult.

Electric power generation

70. The level of reported emissions from the electric power sector coincide for 1999, but differ for earlier years.

71. A comparison of reported energy consumption (in terajoules) in the IEA statistics with that in the inventory raises several disparities.

72. The IEA statistics consistently report less solid fuel burnt in the sector than the amount reported in the inventory. The gap is volatile, ranging from 50,000 TJ in 1992–1993, to zero in 1995.

73. While IEA statistics (and emissions) report significant volumes of blast furnace gas and coke oven gas burnt in the electricity production sector, the inventory indicates only tiny amounts of other fuels. Possibly the inventory counts blast furnace gas and coke oven gas as solid fuels. This would reduce the gap between the inventory and IEA estimates of solid fuel consumption in the sector. However, blast furnace gas and coke oven gas appear to be tracked as other fuels in manufacturing (based on the large quantity of reported energy consumed) and it would be odd if they were treated differently in electricity. Another possibility is that consumption of these fuels to make electricity has been allocated to the other energy subsector, rather than to the electricity subsector;

74. The IEA statistics also consistently report about 30,000 TJ less liquid fuels burnt in the sector than reported by the inventory. It is not clear why this occurs.

75. Biomass fuel consumption, measured in terajoules, while low in both cases, is reportedly about 10 times higher in the IEA data than in the French inventory. Although biomass does not affect CO_2 emissions, this suggests that the emission inventory and the IEA energy statistics are based on independent data sets.

76. Fuel consumption and emissions in the electric power sector ought to be relatively easy to track. It is surprising that such large variations in both level and trend can occur, and an explanation would be helpful.

Petroleum refining

77. It appears that the inventory and the IEA energy data are derived from different, though generally similar, sources. The petroleum refining sector in the IEA data shows petroleum products as the sole fuel source, while the inventory indicates that small amounts of solid and gaseous fuels were burnt.[13] Reported petroleum consumption for refining and CO_2 emissions from refining are very similar in both sources for the entire 1990–1999 period.

Other energy industries

78. This grouping includes energy consumption relating to oil, gas and coal production (a minor factor in France), manufacture of gasworks gas, and, most significantly, manufacture of coke, consumer solid fuels and, by IEA convention, blast furnace operations. The reporting of this sector in the inventory is difficult to explain in the context of IEA energy data. Of energy consumption of 44,400 terajoules, and CO_2 emissions of 4.6 Mt, 38,000 TJ and 4.0 Mt CO_2 respectively are accounted for by other fuels. The consumption of other fuels is far too small to be accounted for by coke ovens and blast furnaces, and far too large to be accounted for by the reported energy consumption of any other subsector.

79. It is possible that other energy industries is being used as a kind of balancing item showing the net carbon consumption of the coke oven and blast furnace sector. However, the manufacturing sector emissions and energy consumption in the inventory cannot be explained unless coke, coke oven and blast furnace gas energy consumption and emissions are included in manufacturing, since manufacturing has over 400,000 TJ of energy consumption of other fuels.

Manufacturing

80. The inventory shows manufacturing industries and construction to account for about 79 Mt CO_2 emissions in 1999. The equivalent number from the IEA is 77 Mt. In contrast to the energy sector, the inventory has higher manufacturing emissions than estimated by the IEA.

81. It is possible that some of the gross differences between IEA data and the inventory in this sector arise from the treatment of transformation losses and statistical differences between apparent consumption (production + imports + stock change – exports) and reported consumption. Since the CRF does not explicitly allow for statistical differences or transformation losses, inventory compilers must decide whether inconsistencies represent combustion or not and, if they decide that these inconsistencies represent consumption, attribute

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[13] We have considered the hypothesis that petroleum coke is treated as a solid fuel and that refinery gas and/or ethane are defined as gaseous fuels in the French inventory, but the values shown are not consistent with that hypothesis The draft S&A report 2001 indicates that the emission factor for gaseous fuels in the refinery sector is unusually high (59.3 tCO_2/TJ). This implies that the 'gaseous fuel' reported in the inventory includes a component other than CH_4, which might be refinery gas. However the IEA reports 1999 refinery gas consumption of 108,000 TJ, about forty times higher than the reported consumption of gaseous fuels in the refinery sector.

them to some sector or other. Adding emissions from IEA transformation losses into manufacturing reduces, but does not eliminate, the differences between the two series.

82. Another possible explanation for the discrepancy is that the inventory accounts for some fossil fuel emissions from the iron and steel sector as process emissions while the IEA treats the same emissions as energy emissions. The French report iron and steel process emissions of 2.7 Mt CO_2 in 1999. If process emissions are added to manufacturing emissions, the 1999 gap between the two sources is almost closed. The time profile of the two sets of the emissions remains different.

83. By comparison with the IEA statistics, emissions from the manufacturing sector are too low, while emissions from the energy sector are too high. This would suggest that some discrete emission sources may be differently classified in the two data sets. However, the hypothesized "mis-classified source(s)" consume(s) about 50,000 TJ of coal annually, and is located within the public electricity or autogenerator subsectors in the IEA data.

84. Other fuels account for more than a third of the reported energy consumption of the French manufacturing sector, but only 28% of emissions. The implied emission factor (IEF) (49.44 gCO_2/TJ) is lower than for any possible hydrocarbon fuel, except coke oven gas. The high consumption of other fuels does not correspond well with reported energy consumption in the IEA energy statistics. The hypothesis producing the best correspondence between inventory energy data and IEA energy data is to sum reported energy transformation and manufacturing consumption of coke, coke oven gas, and blast furnace gas. This approach would double count because blast furnace gas is produced largely from the same coke that was already reported consumed, while coke and coke oven gas are products of prior consumption of metallurgical coal.

85. Hence, reported energy consumption of blast furnace gas (in terajoules) might be double counted within the manufacturing sector. The very low IEF suggests that some correction might have been applied to the emission data to remove the possible double counting. If so, the same correction ought to be applied to the energy data.

Other sectors

86. Other sectors include residential, commercial, agricultural and other-other sectors. Reported emissions from this sector are about 102 Mt CO_2 in 1999. Reported emissions and energy consumption from the IEA data correspond well with the inventory data.

Emission factors

87. The emission factors appear reasonable. The IEFs calculated in the inventory are consistent with reported emission factors, with the exception of that for other fuels.

88. The draft S&A report 2001 noted that the aggregate solid fuels emission factor for manufacture of solid fuels and energy has an unusually high implicit emission coefficient (105.9 tCO2/TJ). The S&A report did not mention the even higher figure for manufacturing solid fuels (114.85 tCO2/TJ). These numbers are puzzling, because they are higher than any coal-oriented coefficient listed in the inventory. The emission factor might indicate that solid fuels include mostly *coke de lignite* (108 t CO_2/TJ) or smaller amounts of blast furnace gas (266 t CO_2/TJ). But if blast furnace gas and coke are included in solid fuels, then it is not clear what fuels are included in the category other fuels.

2. Transport emissions – CO_2

Trends

89. Transport sector emissions are growing at an annual rate of 1.6%. Emissions reported for 1999 are consistent with previous years' reports.

Completeness

90. Reported emissions appear to be complete, with the possible exception of emissions from lubricants. The inventory does not appear to report any transport sector emissions associated with the combustion of lubricants (although it is possible that such consumption is included within liquid fuels).

Methodology

91. Actual emissions are based on detailed computations of vehicle behaviour, which are then calibrated against national transport fuel consumption, so that model results and transport fuel consumption correspond closely, but detailed information is available for estimation of emissions of other gases, particularly urban air pollutants. CO_2 emissions are then calculated using national emission factors, which appear to be reasonable.

92. This could be described as a tier 2 approach (based on the transport calculations), or as a tier 1 approach since the total is determined by national fuel use.

Activity data

93. Transport emissions and energy consumption as reported in the inventory generally correspond well with IEA data. Reported emissions are fractionally higher than IEA emissions. This is, in part, because the inventory attributes a larger share of jet fuel consumption to domestic use than do the IEA data. However, the inventory also reports small amounts of natural gas and other fuels consumed in other transport. The IEA data report zero consumption of natural gas in the transport sector, and zero consumption of fuel by natural gas pipelines, which is inherently unlikely. If there was (unreported) natural gas consumption by pipelines, it would probably appear as part of the statistical discrepancy in the IEA data.

94. The draft S&A report 2001 notes the absence of an explicit entry for aviation gasoline in the 1999 inventory. According to the IEA, aviation gasoline accounts for only 2.1% of domestic aviation fuel consumption. Hence, the scope for an error affecting national totals from the incorrect treatment of this source is small.

Emission factors

95. The gasoline emission factor is 5.3% higher than the IPCC default, and the jet fuel coefficient is 4.8% higher than the default. This may be accounted for by a particular national circumstance; for example, high-octane unleaded gasoline fortified with aromatics.

3. Energy combustion – CH_4

96. Energy-related emissions of CH_4 amount to 3,237 Gg CO_2 equivalent, or less than 1% of sectoral CO_2 emissions. Emissions are concentrated in other sectors, particularly biomass combustion in the residential sector. This seems reasonable.

4. Energy combustion – N_2O

97. Energy combustion emissions of N_2O amount to 6,108 Gg CO_2 equivalent, or just under 2% of sectoral CO_2 emissions. About half the emissions are from road transport, presumably caused by catalytic converter-equipped motor vehicles.

5. Fugitive emissions from coal mining – CH_4

98. Emissions from coal mining of 111 Gg of CH_4 are reported, equivalent to 2,658 Gg CO_2 equivalent, or less than 1% of sectoral CO_2 emissions.

6. Fugitive emissions from oil and gas production – CO_2, CH_4

99. The inventory reports CO_2 emissions of 4,000 Gg and CH_4 emissions of 4,563 Gg CO_2 equivalent from oil and gas production, or less than 3% of sector emissions. The CO_2 emissions are attributable largely to natural gas flaring.

D. Issues relating to previous reviews

100. Points raised in the draft S&A report 2001 have been noted in the context of the earlier discussion. A large number of issues were noted in the draft S&A report 2001 and a detailed response was provided by the Party.

E. Areas for further improvement

101. In the energy sector, the following improvements would be of assistance:

(a) Given the importance of the iron and steel industry, a general discussion of the accounting treatment of fuel consumption and emissions in the iron and steel industry would be helpful, particularly the treatment of derivative fuels such as blast furnace gas, coke oven gas and coke. This discussion should include, *inter alia*, how such emissions are distributed among the various relevant categories in the CRF;

(b) Completion of tables 1.A(b), 1.A(c), and 1.A(d) in the 1999 CRF would be helpful. Table 1.A(d) might help explain the distribution of emissions between the industrial processes and energy sectors of the CRF;

(c) Revision and publication of revised historical energy statistics and historical emission inventories consistent with the revised statistics will help build confidence in the accuracy and consistency of reported emission trends. This is particularly important since the Party’s emissions are somewhat more volatile than those of other Annex I countries.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

102. Emissions from industrial processes represent around 8% of total GHG emissions in 1999.

103. An analysis of key sources is included by the Party in its NIR, on the basis of their contribution to the emissions of different gases. Within this sector, the two categories 2.B Industrial processes – chemical industry and 2.A Industrial processes – metal production are the most significant for total GHG emissions.

104. Total GHG emissions from the sector have decreased by 32.9% from 1990 to 1999.

1. Completeness

105. For the industrial processes and solvent use sector, all relevant tables for 1999 include the required data entries, although in most cases notation keys have been omitted. In table 2(II).F Consumption of halocarbons and SF_6, information is provided for actual emissions but not for potential emissions. The Party has stated that data for potential emissions are very difficult to obtain.

106. The completeness of the reported data for industrial processes (CRF table 7) has been assessed by the Party as including all sources for all relevant GHGs. Potential emissions of HFCs, PFCs and SF_6 are indicated as NO.

107. Table 9 (completeness) has been completed. The Party notes that emissions of SF_6 from various minor applications were neglected.

108. Table 10 on emission trends provides data for CO_2, CH_4 and N_2O as well as for HFCs, PFCs and SF_6 emissions.

2. Transparency

109. Use of notation keys could improve the transparency of the submission. The NIR includes useful information on trends and recalculations, together with brief explanations for the reasons for changes from previous submissions.

3. Uncertainties

110. Quantitative uncertainty analysis has not been reported. Qualitative assessments of uncertainties have been provided. The quality of the estimate of CO_2 emissions from industrial processes is reported as high, and of CH_4 and N_2O as medium.

111. For solvents the quality of the estimate of CO_2 emission is reported as high and N_2O as low. For NMVOC emissions from solvents and other product use no quality assessment is provided.

4. Time series consistency

112. There are no identified inconsistencies in the emission series for the period of reporting.

5. Recalculations

113. For industrial processes and solvents, recalculated estimates (table 8(a)) for 1990 to 1998, and explanatory information for these recalculations (table 8(b)) are reported.

114. The explanatory information for recalculations notes the following:

(a) The changed N_2O emission estimation in the chemical industry is described as updating of emission data. The reference to a direct input applied for 1998 is unclear and requires further explanation;

(b) CH_4 emissions from metal production, previously taken into account, are excluded from the CRF for 1999;

(c) For the solvent use sector, a previous conversion of NMVOCs into CO_2 is stated as the reason for recalculations;

(d) In the consumption of halocarbons subsector, updating of activity data was the rationale.

115. In the industrial processes sector the recalculations resulted in a less than 1% change in CO_2 emissions, about a 3% change (increase) in CH_4 emissions between years, and a 3.17% increase in N_2O emissions for 1998 with previous years unchanged.

116. Recalculations for the solvent and other product use sector result in a fall in CO_2 emissions of 15–16% compared to previous estimations.

117. Recalculations for HFCs, PFCs and SF_6 result in substantial changes for HFCs, especially in 1996 (–10.32% difference) and in 1998 (+11.23% difference), and an average 2% difference for PFCs and SF_6.

6. Consistency with the UNFCCC reporting guidelines and the IPCC Guidelines

118. The Party has submitted CRF tables for all years and an NIR. The submission is substantially consistent with the IPCC Guidelines and the UNFCCC reporting guidelines, although notation keys have not been used.

B. Key sources

1. Cement production – CO_2

119. CO_2 from cement production contributes 1.5% to the total GHG inventory in 1999 and 2.5% to the overall trend. The Party reports use of the CORINAIR method and a country-specific emission factor.

120. CO_2 emissions have decreased relative to the base year by 23.3%. Emissions have varied from year to year. There was significant growth in emissions from 1997 to 1998 (7.1%), and a rapid decrease in emissions from 1990 to 1993; from 1994 onwards, emissions have been relatively stable.

121. Activity data from the CRF are 15% lower than United Nations figures (1998). In the CRF it is not clear whether the activity data refer to clinker or cement production; the Party has, however, stated in its response to the draft S&A report 2001 that the information presented refers to clinker.

2. Adipic acid production – N_2O

122. N_2O from adipic acid production contributes 0.8% to total GHG emissions in 1999 and 14.0% to the overall trend. The Party reports use of the CORINAIR method and a country-specific or plant-specific emission factor.

123. The Party's IEF of 0.07 is much lower than the IPCC default values (0.264–0.3).

124. N_2O emissions have decreased by 74.5% in comparison to the base year. Emissions have varied from year to year. A significant reduction in emissions occurred in 1998 and 1999 (by 47% from 1997–1998 and by 53% from 1998–1999) when a substantially different emission factor was used. The IEF has decreased in comparison to the base year by 76.1% (from 0.31 to 0.07). Reduction of the IEF accounts for two thirds of the reduction in emissions; according to the Party's response to the draft S& A report 2001, the reason for this is the installation of abatement devices in 1997.

3. ODS substitutes

125. ODS substitutes contribute 0.8% to the total GHG inventory in 1999. The Party reports use of a country-specific or tier 2 method and country-specific emission factor. Only actual (but not potential) HFCs, PFCs and SF_6 emissions are reported because, as advised by the Party in response to the draft S&A report 2001, data for estimating potential emissions are very difficult to obtain.

126. In the NIR the Party assessed the trends in HFCs, PFCs and SF_6 emissions in relation to emissions in 1990. HFCs emissions expressed as CO_2 equivalent were reported to have increased by 109%. PFC emissions decreased by 41% and SF_6 emissions increased by 10%.

4. Nitric acid production – N_2O

127. N_2O emissions from nitric acid production contribute 0.7% to total GHG emissions in 1999 and 4.1% to the overall trend. The Party reports use of the CORINAIR method and country-specific or a plant-specific emission factor.

128. There has been a significant reduction in emissions from this source between 1990 and 1999 (–49.5%), which is due partly to a drop in nitric acid production and partly to the significantly lower emission factor adopted since 1994.

5. Ammonia production – CO_2

129. CO_2 emissions from ammonia production contribute 0.5% to total GHG emissions in 1999. The Party reports use of the CORINAIR method and a country-specific emission factor.

130. CO_2 emissions have decreased in comparison to the base year by 14.4%. Emissions have varied from year to year. A significant reduction in emissions occurred in 1992 (22% compared to the previous year).

131. Activity data from the CRF are 17% lower than the United Nations figures (1998).

132. In its response to the draft S&A report 2001, the Party advised that the emission figures for 1990, 1991 and 1992 will be revised in the next submission.

6. Iron and steel production – CO_2

133. CO_2 emissions from iron and steel production contribute 0.5% to total GHG emissions in 1999 and 1.3% to the overall trend. The Party reports use of the CORINAIR method and a country-specific emission factor.

134. The emission trend from 1990 to 1999 is volatile, fluctuating from year to year. CO_2 emissions have decreased in comparison to the base year by 32.1%. A significant increase in emissions was in 1994 (34.6% higher than in 1993), later followed by a big decline in 1996 (30.7% lower than 1995).

7. Other (chemical industry) – N_2O

135. N_2O emissions from other (chemical industry) contribute 0.5% to total GHG emissions in 1999 and 0.6% to the overall trend. A significant quantity of N_2O emissions arises from the production of these chemicals, but there is no indication as to which chemicals are grouped under this source category. In its comments to the draft S&A report 2001 the Party stated that N_2O emissions originate from the production of glyoxal (ethanedial) and glyoxylic acid.

8. Aluminium production – PFCs, CO_2

136. PFCs emissions from aluminium production contribute 1.2% to total GHG emissions in 1999. The methods and emission factors used are not identified in the CRF. Emissions of CF_4 have decreased by 49.2% in comparison to the base year. The decreasing trend continues until 1996, after which emissions tend to increase. The most noticeable changes are the following: 28.8% decrease from 1990 to 1991, 31.6% decrease from 1992 to 1993, 30.1% increase from 1997 to 1998, and 29.8% increase from 1998 to 1999.

137. CO_2 emissions have increased in comparison to the base year by 33.7%. Emissions have varied from year to year. There was a significant reduction in emissions in 1991 (15.4% lower than 1990), when the emission factor was changed from 1.7 to 1.6. Another decrease was in 1994 (9.9% lower than 1993). A noticeable increase in emissions was reported in 1992 (46% higher than 1991).

138. The IEF for CO_2 is stable throughout the period; the IEFs for CF_4 and C_2F_6 decline from 1990 to 1995–1996 by about 75%, and then increase by about 50% from 1996 to 1999.

9. PFCs, HFCs, SF_6 from semiconductor manufacturing

139. PFCs, HFCs, SF_6 from semiconductor manufacturing contribute 0.5% to the overall trend.

10. Fugitive emissions (production of halocarbons and SF_6)

140. Fugitive emissions (production of halocarbons and SF_6) contribute 0.5% to the overall trend. Activity data (halocarbons and SF_6 production) are not provided in the CRF, most likely for confidentiality reasons.

11. HFC-23 from HCFC production

141. HFC-23 from HCFC production contributes 1.7% to the overall trend. Activity data (HCFC-22 production) are not provided in the CRF, most likely for confidentiality reasons.

C. Non-key sources

1. Lime production

142. The IEF (0.44t/t) is lower than those of other Parties and lower than the IPCC default (0.79 t/t). However, it is indicated in the CRF that the reported figure is for limestone consumed.

2. Solvent and other product use

143. The Party reports use of the CORINAIR method and a country-specific emission factor.

144. The IEF for CO_2 emissions for paint application appears high. Emissions of CO_2 from paint application and degreasing and dry cleaning and of N_2O from anaesthesia also appear to be high.

D. Results from previous reviews

145. Points raised in the draft S&A report 2001 have been noted in the context of the earlier discussion. Many points were raised in the draft S&A report 2001 and a detailed response was provided by the Party.

E. Areas for further improvement

1. Issues identified by the Party

146. The Party has stated that a specific report dealing with uncertainty and validation issues is being prepared, and will be ready in 2003.

2. Issues identified by the ERT

147. It is suggested that the Party should focus on gradual implementation of the IPCC good practice guidance, starting from key sources assessment and detailed uncertainty analysis. In addition, all cells in the CRF should to contain data or a notation key.

148. Estimation of potential emissions of fluorinated compounds would also allow comparison with actual emissions.

IV. AGRICULTURE

A. Sector overview

149. Agriculture represents 54% of France's CH_4 emissions and 69% of its N_2O emissions. CH_4 and N_2O emissions from agriculture have decreased by 5.9% and 3.4%, respectively, over the period 1990–1999.

150. Key sources for CH_4 are enteric fermentation and manure management (noted in the NIR), representing 47% and 6% of national emissions of CH_4, respectively, and 5.1% and 0.7% of total GHG emissions, respectively.

151. Key sources for N_2O are direct emissions from agricultural soils, animal production (pasture, range and paddock (PRP)), indirect emissions and manure management. Of these, direct emissions from soils and manure management are noted as key sources in France's NIR. Direct soil emissions contribute 5.1% of total GHGs. Pasture, range and paddock (PRP), indirect emissions and animal waste management systems (AWMS) contribute 1.1%, 3.3% and 0.6% of total GHG emissions, respectively.

1. Completeness

152. France has provided CRFs for the years 1990 to 1999, reporting emissions from all agricultural sources (except savanna and residue burning which are considered, according to the response to the draft S&A report 2001, as not occurring), and an NIR has also been submitted. Gaps in the CRF are not always correctly annotated, with the appropriate notation keys (tables 4.A, 4.B(a), 4.C, 4.D).

2. Transparency

153. There are no inconsistencies between the NIR and the CRF tables. Tables are provided specifying the correspondence between CORINAIR and IPCC classes. The sources of activity data and emission factor calculations are not presented in sufficient detail.

3. Methodology

154. France uses a CORINAIR method with country-specific emission factors for CH_4 emissions from enteric fermentation, a country-specific/tier 2 methodology for CH_4 from manure management and a tier 2 methodology for N_2O. All are specified accurately in table summary 3. Neither details of the methodology nor rigorous documentation of IEFs are given in the NIR.

155. In the NIR, France states that emission factors result from assumptions relating to the 12 categories of animals considered. The IEFs differ greatly in some cases from the default IPCC emission factors.

156. The Party points out that natural sources can also contribute to air pollution, but these sources are not quantified, and are not reported within the IPCC framework.

4. Activity data

157. There is insufficient information on the source of activity data, how figures are collected (such as through surveys) and what level of disaggregation they represent.

158. Single year activity data are used.

159. There are some discrepancies in livestock numbers between CRF values and United Nations Food and Agricultural Organization (FAO) statistics. The sheep number in the CRF is 0.7% smaller than the FAO estimate. For swine there is a 106% difference between the number reported in the CRF (7,107,000) and the FAO (14,682,000). In France's response to the draft S&A report 2001, it is suggested that the reason for this is that the CRF takes account only of pigs over 50 kg in weight.

5. Emission factors

160. Country-specific emission factors are used (see discussion on key sources below).

6. Uncertainties

161. In table 7, France categorizes the quality of the estimate of CH_4 from enteric fermentation and manure management as M (medium), and the estimate of N_2O emissions from soils as L (low). The NIR states that work is in progress to quantify and reduce uncertainties.

7. Recalculations

162. The report states that there are no changes in the agricultural sector since the last version of the inventory, except for statistics that have become available. In the CRF, however, a number of changes are noted. For nitrate leaching and runoff (agricultural soils), the emission factor has been divided by 20 due to improved knowledge (table 8(b), CRF 1999). It is not clear to what this relates, since the IEF in table 4.D (0.026) is very close to the IPCC default (0.025). A discussion of this is not included in the NIR. Also, the CRF states that activity data have been multiplied by approximately two due to new statistics (for all years). It is not clear to which of the soil activity figures this refers, from where the new statistics came or why they are considered preferable to those previously used. All years have been recalculated.

163. It is stated in table 8(b) of the CRF that rice cultivation is now excluded from the CRF (no reason given) whereas it was included for the years before 1999. Despite this, rice cultivation is in fact included in the estimate for 1999.

8. Verification and QA/QC approaches

164. There is no information specific to agriculture, but a general discussion is provided in the NIR. Elements are subjected to expert opinion. In its response to the draft S&A report 2001, France states that this area will be developed.

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

165. The use of a CORINAIR approach, as adopted by France for CH_4, is approved under the IPCC Guidelines, and the IPCC classes corresponding to CORINAIR are given in the NIR. An assessment of key sources is provided. France appears to have followed the IPCC good practice guidance by estimating the key sources in the agricultural sector using a tier 2 type of approach. However, the UNFCCC reporting guidelines require that rigorous documentation be provided and this requirement has not been met. The NIR provides some information, but it would not be sufficient to allow a third party to repeat the calculations.

166. Also there is no quantitative assessment of uncertainty, although progress is being made to allow this to be provided.

B. Key sources

1. Enteric fermentation – CH_4

Trends

167. Emissions of CH_4 from enteric fermentation have decreased by 7% since 1990. For dairy cattle, these emissions have decreased by 13.6% from 1990–1999, and by 0.4% from 1998–1999.

168. For non-dairy cattle, there has been a 0.9% reduction in emissions from enteric fermentation since 1990, including a 0.6% increase since 1998. For swine there has been a 16% increase since 1990, including a 0.4% reduction since 1998. For all livestock classes, there has been no change in the IEF during the period 1990–1999.

Completeness

169. Gaps in table 4.A should include the notation keys NE or NO.

Methodology

170. Methods for the estimates of CH_4 emissions from enteric fermentation are given as CORINAIR/country-specific.

Activity data

171. There were some discrepancies between livestock numbers reported in the CRF and those of the FAO (see above).

172. Although livestock numbers for poultry are given in table 4.B(a and b), a number is not given in table 4.A, and CH_4 emissions for enteric fermentation from poultry is given as zero. No CH_4 emissions from enteric fermentation for poultry are reported in any years, and for 1990, 1997, 1998 and 1999, no poultry numbers are entered in table 4.A. (in its comment on the draft S&A report 2001, France stated that this source was negligible).

Emission factors

173. The country-specific IEF for CH_4 emissions from enteric fermentation in dairy cattle (82 kg CH_4/hd/yr) is low compared to the default for Western Europe (100 CH_4/hd/yr) and is at the lower end of the range given by the reporting Parties. France states that in the calculation of this emission factor, heifers were included within the dairy cattle category, producing a decreased average compared to dairy cows only. Heifers will be allocated to other cattle in the next

inventory in order to avoid ambiguity. The non-dairy emission factor is slightly higher than the default, and the value for sheep and swine is lower than the IPCC default (–25% and –33%, respectively). The value for swine is the lowest of all reporting Parties and that for sheep is amongst the lowest. In its response to the draft S&A report 2001, France states that these values are from La Mission Interministérielle de L'Effet de Serre (MIES)and are close to the IPCC values. Adoption of the IPCC values is being considered.

2. Manure management – CH_4

Trends

174. CH_4 emissions from manure management have increased by 3% in the period 1990–1999, despite an overall reduction in CH_4 emissions from agriculture of 5.9%. There has been a reduction in livestock numbers in cattle and sheep during this period, and the IEF for manure management for dairy cattle has decreased.

Completeness

175. Data are given on population size and IEFs. No additional information is given.

Methodology

176. The method is specified as country-specific/tier 2.

Activity data

177. See comments on livestock numbers above (paragraph 172).

Emission factors

178. The IEF for dairy cattle (5.85 kg CH_4/hd/yr) is 87% lower than the IPCC default for temperate Western Europe (44 kg CH_4/hd/yr) and at the lower end of the range given by the reporting Parties. These are based on data from MIES and are based on the IPCC equations with parameters specific to France (response to the draft S&A report 2001). The IEF for non-dairy cattle (3.48 kg CH_4/hd/yr) is 82.6% lower than the IPCC default (20 kg CH_4/hd/yr) and below the average for the reporting Parties. The IEF for swine is 23.8% lower than the IPCC default and slightly below the average for all Parties. The IEF for manure management with sheep is equal to the IPCC default (the Party reported use of country-specific emission factors).

3. Agricultural soils – N_2O

Trends

179. Emissions of N_2O from agricultural soils have decreased by 3.3% compared to the figure for 1990, and there is a decrease of 0.7% in 1999 relative to 1998.

Completeness

180. No values for the fractions (such as $Frac_{GRAZ}$, $Frac_{GASM}$) are supplied. The Party has commented that these fractions require additional calculations that have not been carried out.

Methodology

181. The method is given as tier 2.

Activity data

182. There is no area given as the area of cultivated organic soils (cell blank). France states (in its response to the draft S&A report 2001) that histosols are not included in the inventory.

Emission factors

183. It is not clearly documented how emission factors are calculated. There is a reference in table 4.D to a specific document describing the methodology used to estimate N_2O emissions.

184. The IEF for N_2O emissions from N applied as fertilizer is low (0.0113) compared to the IPCC default (0.0125). IEFs from applied animal waste (0.0096) and fixed N (0.008) are among the lowest values given by reporting Parties. France states that the IEFs for residue and fixed N are the IPCC default values.

4. Animal production (PRP) – N_2O

Completeness

185. This part of table 4.D is complete, but information on the proportion of animals in each animal waste management system (and therefore PRP), omitted from table 4.B(a), would aid transparency for this source.

Methodology

186. There is no specific information on methodology for this source.

Activity data

187. There is a large discrepancy (63.5%) between the calculations of N excretion in PRP in tables 4.B(b) and 4.D. (In its response to the draft S&A report 2001, France states that PRP is not represented in 4.D, and there also seems to be a transcription error in this table.)

188. Data on the allocation of animals to PRP are not given in table 4.B(a).

Emission factors

189. The emission factor is the same as the IPCC default. It is not stated whether the default has been adopted or whether country-specific information has been used to derive this value.

5. Indirect emissions – N_2O

Trends

190. N in leaching and runoff is the second highest of the reporting countries. N_2O emissions from indirect sources have decreased by 0.3% in the period 1990–1999. This source accounts for 3.3% of total national GHG emissions.

Completeness

191. A value is not given for N deposition in table 4.D. It is noted in the documentation box that this is "because of a risk of double counting". This is also noted in the NIR. France has sought clarification on the inclusion of secondary pollutants.

Methodology

192. Information is not given on the calculation of N leached.

Activity data

193. Activity data relevant to this source are covered in the sections above.

Emission factors

194. The IEF for emissions from leached N is 0.026, very similar to the IPCC default value of 0.025. A value is not given for $Frac_{LEACH}$.

6. Animal waste management systems (AWMS) – N_2O

Completeness

195. Table 4.B(b) is fully completed.

Methodology

196. The method of estimation is given as tier 2.

Activity data

197. Population size data agree with other tables (but see comments above on FAO/CRF comparison).

Emission factors

198. The IEF for liquid systems within AWMS is 70% of the IPCC default value, and is low compared to other reporting Parties. The IEF for solid storage and dry lot is 40% lower than the IPCC value, and the value for other is 38% of the IPCC default and among the lower values given by the reporting Parties. N in anaerobic lagoons is reported to be zero.

199. All N excretion values are as the IPCC default values.

200. Total N excretion, calculated by multiplication of N excretion by population size, is not equivalent to the sum of N excretion in all AWMS (table 4.B(b)) for non dairy cattle (966 kg N/yr by former method, 956 by latter), sheep (203 compared to 669 kg N/yr) pigs (142 compared to 673 kg N/yr), poultry (197 compared to 669 kg N/yr) or other (43 compared to 672 kg N/yr). There is not sufficient information on calculation methods to allow explanation of these differences, but the Party has stated that there is a transcription error in this table.

C. Non-key sources

201. Information on water regimes for rice cultivation is given for irrigated, continuously flooded only, with other parts of table 4.C left blank.

D. Results from previous reviews

202. The draft S&A report 2001 noted the discrepancy between FAO statistics and the CRF (as mentioned above). The low enteric CH_4 IEF values for dairy cattle, sheep and swine and the low manure management CH_4 IEF for dairy cattle were also noted. The low values for liquid systems and other AWMS was noted, and the inconsistency between the sum of N excretion from sheep and non-diary cattle over all AWMS compared to the product of animal number and N excretion

rate was pointed out. The lack of information on histosols was raised, and the low IEFs for animal waste applied to soils, N fixing crops and crop residues was noted. The difference in N excretion on PRP in table 4.D compared to 4.B(b) was also recorded.

203. Where the Party has responded to these points, comments are included in the relevant sections above.

E. Areas for further improvement

1. Issues identified by the Party

204. France intends to adopt IPCC CH_4 emission factors for sheep and swine. The Party has suggested no other improvements.

2. Issues identified by the ERT

205. France appears to be adopting a sufficiently detailed methodology to provide a good estimate of emissions. Insufficient information is provided on exact methodologies used to allow suggestions to be made for further improvements. More detailed documentation should be provided on sources of activity data and emission factors. For example, it is not clear how $Frac_{Leach}$ and emission factors are arrived at or why the IEFs for CH_4 from manure are so different from the IPCC defaults. A greater degree of detail would aid transparency and facilitate a more useful assessment of methodology and estimates in the CRF.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

206. LUCF is an important sector in France. The capacity of this sector to offset emissions of other sectors has increased steadily at a rate of 2.2% per year over the period 1990 to 1999. In 1990, this sector offset about 9.4% of carbon emissions from other sectors (equivalent to about 52,020 Gg CO_2 equivalent), while in 1999 it offset about 11.1% (equivalent to about 61,301 Gg CO_2 equivalent). The CO_2 removal capacity is mainly from temperate commercial forests (92.7%) followed by growing trees in tropical forest (7.2%) and abandonment of managed lands (0.1%).

1. Completeness

207. In the 2001 submission, the Party provides all GHG estimates from all categories (5.A up to 5.E) following the CRF. However, sectoral background data are provided only for 5.A and 5.B and limited to the years 1990, 1998 and 1999. The notation keys used are 0 (emission and removal of gases estimated to be less than 0.5). The Party also reports GHGs other than CO_2, which include CH_4, N_2O, NO_X, NMVOC and CO. Trend analysis of all GHGs is also provided.

2. Transparency

208. In the NIR, the Party has partly described information used in developing the GHG inventory, such as methodology, activity data and emission factors. As methodology and emission factors used in the GHG inventory are all country-specific (not IPCC default), all relevant information regarding these aspects should be provided, such as references regarding the methodology or whether emission factors are based on expert judgement, research or surveys).

3. Recalculations

209. The Party has provided the recalculation tables (table 8(a)) as well as the explanatory information (table 8(b)) in the inventory submission 2001. There are slight changes in estimates between the previous (2000) submission and the current (2001) submission, that is, for CH_4 and N_2O. The changes are due to rounding of the values of the emission estimates.

4. Uncertainties

210. The calculation of the uncertainty is not fully described for this sector. However, the Party has provided a qualitative assessment of uncertainties in the CRF (table 7). It is considered that the quality of the estimates is low.

5. Verification and QA/QC approaches

211. In the 2001 NIR, it is indicated that the Party will improve the quality of the inventory following the availability of updated statistics and improvements in knowledge and methodology. However, procedures for quality control are not described and no documentation has been submitted.

6. Consistency with the UNFCCC reporting guidelines and the IPCC Guidelines

212. The GHG inventory of France in the CRF and NIR is consistent with the IPCC Guidelines and the UNFCCC reporting guidelines. In tables 5.C and 5.D there are no notation keys, however. For full consistency with the UNFCCC reporting guidelines, these should be provided where there are no data.

B. Sources and sink categories

1. Changes in forest and other woody biomass stock

213. Under category 5.A, the Party indicates that CO_2 removal occurs mainly in temperate plantation forest, that is, about 78%. The average annual growth rate of this forest is 6.67 t dm/ha/yr (equivalent to 2.6 tC/ha/yr). The second highest CO_2 removal occurs in temperate commercial forests, that is, evergreen and deciduous (19%). The average annual growth rates of these forests are very high (over 7 million ton dm/ha/yr). This might be a typographical error, since the implied carbon uptake factors of these two forests are only 0.28 and 0.30 t C/ha/yr respectively. If it is assumed that the carbon fraction in the biomass of these two forests is 0.5, the average annual growth rate of these forests should be about 0.56 and 0.60 t dm/ha/yr. The use of the overestimated annual growth rates might not affect the carbon removal estimates since the calculation has been made using the implied carbon uptake factors. This value is lower than the productivity of land regenerating naturally as secondary forest (0.75 tB/ha/yr; Ravindranath et. al 1997) and IPCC defaults for natural regeneration temperate forest. Tropical forest also contributes about 3% to total carbon removal in the country.

214. Based on the above findings, temperate plantation forests and temperate commercial forests make a significant contribution to the total carbon removals of the country. These forests can therefore be categorized as key sinks. Improving the certainty of activity data such as forest area as well as the average annual growth rate is very important.

215. The removal estimates presented in table 5 are not consistent with the removal estimates presented in table 5.A. In 1999, for example, the carbon removal of tropical forest presented in table 5 is about 5,446 Gg CO_2, while in table 5.A it is about 1,525 Gg C or 5,594 Gg CO_2.

Similarly for temperate forest, in table 5 the carbon removal estimate is 149,481 Gg CO_2 while in table 5.A it is about 177,247 Gg CO_2. These differences require explanation.

2. Forest and grassland conversion

216. Based on sectoral background data (table 5.B) for 1990, 1998 and 1999, the rates of forest conversion have been the same in all years, namely 800 ha/yr for tropical forests, and 80,100 ha for temperate mixed broadleaf/coniferous forests. Thus the emission estimates should also be the same. In the report, the GHG emissions for 5.B are not the same across the years. These differences are due only to the difference in biomass removed during conversion of temperate mixed broadleaf/coniferous forests. In 1990, the biomass removed from these forests is about 76 tB/ha while in 1998 and in 1999 it is about 81 tB/ha. There is no explanation or justification as to why different values have been applied for the different years. Furthermore, fractions of biomass burnt on-site and off-site during the conversion of temperate mixed broadleaf/coniferous forests are 0.2 and 0.8 respectively, while those of tropical forests are 0.5 and 0.5 respectively. Again, there is no explanation as to why different values have been applied for different forest types.

217. Inconsistency is also found when data for forest area reported in table 5.A are compared with the data reported in table 5.B. In table 5.A, the area of tropical forest in 1990, 1998 and 1999 is the same, that is, 366,100 ha. In table 5.B, it is reported that this forest has been converted into other uses at a rate of 800 ha/yr. If this is the case, the area of tropical forest should decrease according the rate of conversion. If it is argued that the decrease was compensated by the regeneration of tropical forest from abandonment of managed lands, then there is a problem of double counting since module 5.A has already calculated the carbon removal.

3. Abandonment of managed lands

218. The Party reports that CO_2 removal in abandonment of managed lands is the same for each year in the period 1990 to 1999, that is, 48 Gg. The sink category is tropical forest. Explanation for the difference between tropical forest in subsectors 5.A and 5.C is not given, such as average annual growth rate of the forest.

4. Emissions and removals from soils – CO_2

219. The Party reports CO_2 emissions and removals from soils. However, there are no activity data and emission factors provided in the table of sectoral background data (table 5.D).

5. Others

220. The Party provides estimates of non-CO_2 emissions from the category other (5.E). It is reported that the GHGs emitted are CH_4, N_2O and NMVOC. The rates of emission are almost constant for all gases in the period 1990 to 1999. Rates of emission for CH_4 are between 89 and 90 Gg, for N_2O between 17.7 and 17.9 Gg, and for NMVOC between 400 and 450 Gg. Information on the sources of emissions is not provided and it is not clear whether they derived from forest fires or other sources.

C. <u>Other sources</u>

221. The Party has used a country-specific approach (methods and emission factors) for estimating CO_2 emissions and removals from 5.A, 5.B, 5.C and 5.D and non-CO_2 emissions from

5.B, as indicated in CRF table 3. For 5.E, however, the Party does not provide this information. There is no information as to whether the Party has used a default or a country-specific approach.

D. Results from previous reviews

222. The draft S&A report 2001 commented that for LUCF:

(a) France is the only country to report an average annual growth rate for tropical forests (others), of value 8.34 t dm/ha;

(b) Emissions and removals are reported in table 5.E, but no activity data and emission factors are reported for this category.

223. The Party did not comment on these issues in its response to the draft S&A report 2001 and they remain to be addressed by the Party.

E. Areas for further improvement

1. Issues identified by the Party

224. The Party has suggested no areas for improvement.

2. Issues identified by the ERT

225. Plans for the further improvement of reporting of GHGs emissions and removals for the LUCF sector are not fully described in the NIR 2001. In future NIR and inventory submissions, it would assist if the Party described efforts that are going to be implemented to enhance the quality of the inventory. All relevant information such as justification and clarification of the use of certain assumptions would be helpful in improving the transparency of the inventory. In future inventory submissions, sectoral background data should be provided for all categories. Quality of annual growth rate estimates for temperate plantation forest should be improved, since the contribution of this forest to total CO_2 removals is very significant, that is, 78%, and furthermore the contribution of the LUCF sector to a reduction in the country's total GHG emissions is also significant. With LUCF, the country has reduced its GHG emission to up to 2.1% below the figure for 1990 emissions, while without LUCF, the figure is only 0.19% below that for 1990 emissions. If the quality of carbon removal estimate for this forest is low, then the significant GHG emission reduction achieved by the country by the inclusion of LUCF will not be meaningful.

VI. WASTE

A. Sector overview

226. Emissions from the waste sector contribute 3.8% of total emissions (excluding LUCF) in 1999 compared with 3.9% in 1990. CH_4 emissions, the major GHG from this sector, decline by 6.9% from 1990 to 1999 and by 9.0% from 1998 to 1999. The waste sector has one key source, CH_4 from solid waste disposal on land, which represents 3.0% of total emissions, compared with 3.3% in 1990.

1. Completeness

227. All CRF tables specific to the waste sector contain data. Where data entries are not provided, with the exception of waste composition in the additional information table of table 6.A,C, notation keys have not been used. In some cases, it is clear that the appropriate notation key is NA. In other instances, it is not obvious whether the notation key should be NA, NE or IE.

For example, there are no entries for CH_4 recovered from industrial wastewater, and domestic and commercial wastewater (table 6.B). It is suggested that the Party endeavour to ensure that notation keys are used for future inventories. No information for the waste sector is provided in table 9 Completeness. Based on table 6 all sources and gases are included.

228. Table 6.B includes estimates of N_2O emissions from wastewater handling. Estimates are entered for both industrial wastewater, and domestic and commercial wastewater. Both estimates are identical (1.07 Gg for each source).

2. Transparency

229. The CRF tables, read in conjunction with the Party's NIR, provide a reasonable level of transparency in respect of inventory compilation and changes in the inventory from previous submissions. Methodologies used for estimating emissions from the waste sector are described briefly for most sources. In the documentation box, comments are provided on aspects of the methodologies and this assists in understanding the inventory.

230. A relevant point regarding transparency is that the Party reports emissions from sludge spreading and biogas production under 6.D Other. Emissions from sewage sludge are generally included in 6.B Wastewater handling. It is not clear whether the biogas production is associated with or derived from sludge spreading, or whether it relates to dedicated processes for biogas production such as the use of anaerobic digesters, a waste management option. If the latter, it should be included in managed waste disposal on land. Summary 3 has not been completed for this sub-source. The Party's NIR does not assist understanding of the analysis of these emissions. More explanation is needed in order to understand fully the estimation of these emissions.

231. The Party's NIR is concise. It is suggested that more detailed information on waste sector methodologies would make the inventory more transparent.

3. Uncertainties

232. Qualitative assessments of uncertainties in the estimates are reported in table 7. No quantitative analysis for the waste sector has been presented.

4. Recalculations

233. The Party provides information on recalculations in table 8(a) for all years from 1990 to 1998. Explanations for recalculations are noted in table 8(b). The NIR discusses the reasons for recalculations.

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

234. Estimation of emissions from the key source is consistent with the tier 2 methodology for solid waste disposal sites (SWDS). It is a country-specific time-dependent methodology. Other sources are noted as CORINAIR methods with country-specific emission factors.

235. The reporting of emissions from this source in the CRF and in the NIR is consistent with the IPCC Guidelines and the UNFCCC reporting guidelines, but noting the matters referred to under completeness above.

B. Key sources

1. CH_4 emissions from 6.A Solid waste disposal on land

236. CH_4 emissions from solid waste disposal on land have fallen by 8.2% from 1990 to 1999 and by 9.4% from 1998 to 1999. Emissions have increased each year during the period from 1990 to 1995, growing by 26.6%. From 1995 to 1999, this trend has reversed, with emissions declining by 27.5%. The change since 1995 is substantially attributable to an increase in CH_4 recovery (NIR, p.14) as a result of a ministerial order making it compulsory for operating landfills to install CH_4 recovery and flaring systems by 1999. The CRFs for earlier years, submitted as part of the 2001 submission, do not include data on CH_4 recovered, nor is there any trend data available from other sources.

2. Methodology

237. CRF table summary 3 shows the methodology as country-specific tier 2 (tier 2 as defined in the IPCC good practice guidance). Brief comments on the methodology are provided in the documentation box of table 6.A,C. Additional brief comments are included in the NIR with particular reference to changes in the method for estimating emissions from household waste from a zero order model to a first-order decay model. That is, the method has been changed from the IPCC default model to the first-order decay model. Complete recalculations are reported.

3. Activity data

238. Activity data are not described in the NIR. The source of data is assumed to be l'ADEME but the frequency of collection is not stated. The acronym l'ADEME is not defined in the NIR.

4. Emission factors

239. The CRF (table summary 3) notes the emission factor as country-specific tier 2. The documentation box and additional information box of table 6.A,C include information on the FOD model parameters. Specifically, values for CH_4 generation rate constants, half-lives of wastes and the proportion of wastes assumed for each generation rate constant and half-life are noted. The models do not incorporate a unique emission factor. Rather, the emission factors are implied based on the DOC (degradable organic carbon) and DOC_f (fraction of DOC dissimilated) of wastes disposed of in each year and the resultant CH_4 potential of the waste. Emission factors are implied from the model results and total waste relevant to each calculation. A value for DOC is included in the additional information table; however, there is no information on CH_4 potential in either the CRF or the NIR.

C. Non-key sources

240. CH_4 and N_2O from 6.B Wastewater handling, CH_4 and N_2O from 6.C Waste incineration and CH_4 from 6.D Other are non-key sources. The CRF notes that a specific method based on national expert data is used to calculate emissions from wastewater handling. Table summary 3 notes that the methodology is CORINAIR (C) and that the emission factor is country-specific for both CH_4 and N_2O. Identical emissions of N_2O from industrial wastewater, and domestic and commercial wastewater have already been commented on and might disclose an error or double counting given that there is no separate estimate of CH_4 emissions from industrial wastewater. With regard to activity data, the frequency of collection is unknown. Further, it is not clear whether the national expert data refer to both activity data and emission factors, or to one of

these variables only. The NIR does not assist in making the methodology, activity data and emission factors more explicit.

241. The draft S&A report 2001 commented that CH_4 emissions from industrial wastewater had not been calculated, and that N_2O emissions from human sewage were NE (not estimated). The Party responded that CH_4 emissions from industrial wastewater are considered negligible; however, this assumption will be revised when improved data on the importance of agricultural food processing and fermentation industries are obtained. With regard to N_2O emissions from human sewage, the Party affirmed that is was "NE". Clarification of the origin of the N_2O emissions reported would be of assistance.

242. The methodologies for CH_4 and N_2O from 6.C Waste incineration are referenced in CRF table summary 3 as CORINAIR and country-specific. The NIR does not assist in making the methodology, activity data and emission factors more explicit.

243. For CH_4 from 6.D Other, the methodologies, activity data sources and emission factors are neither outlined in the NIR nor summarized in the CRF. It is suggested that the Party provide more information on this source, and consider whether the allocation is appropriate.

D. Results from previous reviews

244. The draft S&A report 2001 commented that for solid waste disposal on land:

(a) CH_4 recovery and CH_4 conversion factor were not reported for 1991 to 1997;

(b) DOC was not reported for managed waste disposal sites;

(c) Annual municipal solid waste (MSW) disposed of at SWDS appeared to be the second highest of the reporting Parties;

(d) The CH_4 IEF for unmanaged shallow waste disposal sites appears to be the highest of the reporting Parties. The value for 1999 was, however, not reported.

245. The Party has provided a comprehensive response to the comments in the draft S&A report 2001. In respect of CH_4 recovery and CH_4 conversion factor for 1991 to 1997, the Party has stated that the CRF tables were on a CD-ROM and not in the report. As a result, some data relevant to the background tables are not automatically exported from the database and integrated into earlier CRFs.

246. In response to the comment that DOC was not reported for managed waste disposal sites, the Party notes, correctly, that DOC is reported for these sites. DOC is not reported for non-compacted unmanaged waste disposal sites. The Party further noted that DOC was not relevant because of the use of an FOD method. Values for DOC and DOC_f are implicit in the CH_4 potential used in FOD models; however, neither DOC nor DOC_f are unique to aggregate waste disposed of where there are different waste types with different degradation time profiles as used by the Party. To this extent, a value for DOC is not relevant and could be misleading.

247. With regard to annual MSW disposed of, the Party responded that the quantities are obtained from a survey by l'ADEME.

248. In response to the comment in the draft S&A report 2001 on the CH_4 IEF for unmanaged shallow waste disposal sites, the Party commented that the difficulty is the same as for DOC; namely, that a single value is not relevant because emissions are attributable to waste deposited

in years prior to 1999. There was no waste disposed of in 1999. This highlights the issue of the relevance of IEFs and other information when time-dependent decay methods are used.

E. Areas for further improvement

1. Issues identified by the Party

249. The Party responded to most of the points raised in the draft S&A report 2001. The main suggestion is to improve data on wastewater from the agricultural food processing and fermentation industries.

2. Issues identified by the ERT

250. In future inventories it is recommended that the Party ensure that:

(a) All cells in the CRF tables contain a notation key or data;

(b) Additional explanation is provided on N_2O from industrial wastewater and domestic and commercial wastewater, noting that reported emissions are the same for both sources;

(c) CH_4 recovery from wastewater handling is reported;

(d) Additional information is provided on the source of activity data and the frequency of collection of data and updating of emission factors;

(e) Clarification is provided on the emission sources included under 6.D Other. Consideration should be given as to whether they are correctly allocated or whether they should be included in wastewater handling.

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