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REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY OF NEW ZEALAND SUBMITTED IN THE YEAR 2000[1]

(Centralized review)

A. GENERAL OVERVIEW

1. Introduction

1. The Conference of the Parties (COP), at its fifth session, by its decision 6/CP.5, requested the secretariat to conduct, during the trial period, individual reviews of greenhouse gas (GHG) inventories for a limited number of Parties included in Annex I to the Convention (Annex I Parties) on a voluntary basis, according to the UNFCCC guidelines for the technical review of GHG inventories from Parties included in Annex I to the Convention.[2] In doing so, the secretariat was requested to coordinate the technical reviews and to use different approaches for individual reviews, including desk reviews, centralized reviews and in-country reviews.

2. In response to the mandate by the COP, the secretariat coordinated a centralized review of six national GHG inventories (Australia, Canada, Hungary, Japan, the Netherlands and New Zealand) submitted in 2000, which took place from 7 to 11 May 2001. The review was carried out by a team of nominated experts from the roster of experts working at the headquarters of the UNFCCC secretariat in Bonn. The members of the team were: Mr. Ayite-Lo Ajavon (Togo), Mr. Wiley Barbour (United States of America), Mr. Pascal Boeckx (Belgium), Mr. Jose Gonzalez Migues (Brazil), Mr. Tomas Hernandez-Tejeda (Mexico), Mr. Klaus Radunsky (Austria), Mr. Yiannis Sarafidis (Greece), Ms. Sirintornthep Towprayoon (Thailand) and Mr. Hristo Vassilev (Bulgaria). The review was coordinated by Mr. Stylianos Pesmajoglou (UNFCCC secretariat). Mr. Wiley Barbour and Mr. Jose Gonzalez Migues were lead-authors of this report and also served as sector experts.

3. The main overall objective of the centralized review of the GHG inventories was to ensure that the COP had adequate information on the GHG inventories. The review should further assess the progress of the Parties towards fulfilling the requirements outlined in the UNFCCC reporting guidelines on annual inventories (FCCC/CP/1999/7). In this context, the

[1] In the symbol of this document, 2000 refers to the year the inventory was submitted and not to the year of publication. The number (3) indicates that, for New Zealand, this is a centralized review.

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

review team checked the responses of the Parties to questions raised in previous stages of the review process and the consistency of the inventory submission with the UNFCCC reporting guidelines and the *Revised 1996 Intergovernmental Panel on Climate Change Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC guidelines), and identified possible areas for improvement in the inventories of the six Annex I Parties. Each inventory expert reviewed the information submitted for specific IPCC sectors and each IPCC sector was covered by two experts.

4. The review team has also assessed, to a certain degree, whether the reporting fulfils the requirements included in the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance), although the IPCC good practice guidance had not been published at the time the inventory was submitted and could not, therefore, have been used in the compilation of the inventory.

5. The UNFCCC secretariat provided the review team with all necessary technical guidance, information and data, such as national inventory data reported according to the common reporting format (CRF) submitted in the year 2000, national inventory report (NIR) for the year 2000, the synthesis and assessment report (S&A report) of GHG inventories prepared by the secretariat, and comments from the Parties on the S&A report.

2. Overall findings

6. New Zealand's NIR conforms to current IPCC inventory standards and appears largely consistent with the principles recently developed in the IPCC good practice guidance.

3. Completeness

7. New Zealand's NIR and CRF tables appear to be complete, with minor exceptions noted below.

4. Transparency

8. The NIR for New Zealand is very well documented and referenced. Methods and emission factors (EFs) are generally described and models are often discussed in detail. In some cases worksheets are only provided for 1998. The NIR notes that calculation tables for 1990 to 1997 were included in New Zealand's greenhouse gas inventory reports in 1998 and 1999, and provides some further information regarding these calculation tables.

5. Data sources used for centralized review

5.1 National greenhouse gas emission inventory report

9. The NIR was submitted in April 2000 and is available in electronic format (doc file). The NIR provides information on divergences from IPCC methodology, estimation of emissions, changes since the last inventory and uncertainties in the calculations.

10. The New Zealand NIR for 1998 was updated with inventory information provided in 1999, and with minor recalculations for 1990 to 1997. Most of the calculation worksheets or

database information were provided. Several peer reviewed references are included to explain country-specific values, activity data, methodologies and assumptions used to compile the national GHG inventory. Information on assumptions and conventions were consistent with UNFCCC guidelines and IPCC guidelines. Most of the information needed or used for the recalculations was provided in the NIR.

5.2 Common reporting format (CRF)

11. New Zealand submitted CRF inventory data tables for all years from 1990 to 1998.

12. New Zealand submitted all summary and sectoral tables even when some data were not available (NA) or not estimated (NE). The GHG submission to the secretariat includes all the relevant sectoral background information recommended by the UNFCCC guidelines for the CRF.

13. There is also frequent use of the documentation boxes in the CRF.

14. There are some differences between activity data and emissions from industrial processes reported in the CRF tables and in the worksheets incorporated in the NIR.

5.3 Synthesis and assessment report (S&A Report)

15. New Zealand provided comments to the Synthesis and Assessment Report and the review team was able to take those comments into account.

16. The main concern regarding the S&A report was over the relatively high values for key sources and low values for non-key sources. New Zealand responded by providing an explanation of the differences observed in relation to IPCC values. It also expected to take action on rectifying such gaps in the future.

B. ENERGY SECTOR

1. General overview

1.1 Completeness

17. The NIR for New Zealand is largely complete.

1.2 Transparency

18. Most of the calculation worksheets and database information were provided.

2. Reference approach

19. For the reference approach, the quantities of coking coal exported in 1997 and 1998 were high compared to the sum of the amount produced; imports and stock changes resulted in negative apparent consumption for coking coal. In its response, New Zealand stated that the two sources of information for the solid fuel sector (Statistics New Zealand and the coal producers "Crown Minerals"), use a different breakdown for ranking coal products and, as a result, coking coal is currently reported under the "other bituminous" category. It is also stated that this

situation is predominantly linked to the fact that there are strict confidentiality agreements within the industry.

20. CO_2 emissions from fuel combustion were calculated using both reference and sectoral approaches. There is a difference of -0.02 % between the estimates.

21. The S&A report indicated specific differences between the data used in the reference approach and the International Energy Agency (IEA) energy balances. New Zealand's response to the S&A report addressed these differences and stated that "IEA reports the net energy rather than gross (which is what we report in the CRF)". Since all fuel consumption data for the reference approach are to be reported based on net calorific value (NCV), this response is unclear and this issue merits further consideration.

3. Feedstocks

22. Information on feedstocks is reported in the CRF. The gas quantities used for the production of methanol, synthetic petrol, ammonia and urea are confidential. Thus, the fraction of carbon stored is not reported and, as a result, the respective implied emission factors (IEFs) cannot be calculated. The procedure followed is described in the NIR.

23. The IEF calculated for bitumen is 19 tC/TJ (the IPCC default value is 22 t C/TJ).

4. Specific findings

4.1 Fugitive emissions from oil and gas

24. *Emission trends*: Fugitive methane emissions from this category represent 0.9 per cent of reported GHG emissions. Although the S&A report did not list this category as a key source for New Zealand based on level analysis (in fact, the S&A report does not list this as a key source in table 3, but it is listed as a key source in the detailed tables), methane emissions increased by approximately 22 per cent over the period, so this review attempted to review this category based on the trend. Natural gas leaks from transmission/distribution contributed most of the emissions.

25. *Methodology*: The NIR contains a discussion of the methodology used and calculation sheets are provided for 1998. Oil refining emissions of methane are estimated, but no IEFs could be calculated owing to a lack of activity data in the CRF tables. Actual values for oil throughput in refining are provided in the calculation sheets. Gas leaks are estimated as approximately 1.75 per cent of total throughput in distribution, which appears to be in agreement with reported values for other Parties.

26. *Completeness*: Methane emissions are not estimated for several categories including oil exploration, oil production and oil distribution. According to the IEA, New Zealand extracts oil and gas, so these estimates appear to be missing. CO_2 estimates are not provided (listed as not occurring (NO) for all oil subcategories). Methane and CO_2 emissions are estimated for natural gas transmission/distribution, but not for gas production/processing.

27. *Emission factors*: IEFs could not be calculated for all subcategories owing to confidentiality concerns over gas, and a lack of reporting of activity data for oil. Actual CH_4 EFs

are provided in the calculation sheets for oil transport and refining and gas transmission/ distribution. These values are consistent throughout the trend and are within IPCC default ranges.

28. *Activity data*: Confidentiality concerns prohibit full reporting of gas throughput but New Zealand did provide information on gas distribution in the CRF and calculation sheets. No data is provided in the "additional information" table.

29. *Uncertainty*: Is discussed in the NIR, and in general IPCC default values are reported with some additional discussion of specific relevant analysis from various country-specific sources.

4.2 Fugitive emission from solid fuels

30. *Emission trends*: Methane emissions from coal mining and handling is a key source category for New Zealand, representing 0.7 per cent of total emissions. Emissions of methane from mining activities increased by 109 per cent over the period. Total CH_4 emissions from coal mining and handling increased from 11.8 Gg in 1990 to 24.7 Gg in 1998. Surface mining emissions stayed relatively constant, while underground mining emissions increased by 12.6 Gg.

31. *Methodology*: The IPCC tier 1 approach was used for surface mines and country-specific factors were used for underground mines, which differentiate on the basis of bituminous and sub-bituminous mines.

32. *Emission factors*: The fugitive EF for bituminous coal mines (35.3 t CH_4/kt coal) appears to be high relative to other countries. The IEFs for underground mining activities varied from 16-25 kg/t. These are the highest reported values for all reporting Parties and are significantly higher than the default maximum values suggested by the IPCC. Underground post-mining and surface mining EFs are based on the mid-points of the IPCC default EF ranges.

4.3 Stationary combustion – CO_2 emissions

33. *Emission trends*: Emissions from stationary combustion (liquid, solid and gaseous fuels) are key sources for New Zealand, representing approximately 20 per cent of all reported gross emissions (without land-use change and forestry (LUCF)). New Zealand reports CO_2 emissions from stationary combustion increasing from 11.9 Mt in 1990 to 13.8 Mt in 1998 (a 16 per cent increase):

(a) CO_2 emissions from the stationary combustion of liquid fuels represents 3 per cent of all reported emissions in 1998 (without LUCF), a 1.5 per cent decrease compared with 1990;

(b) CO_2 emissions from the stationary combustion of solid fuels represents 4 per cent of all reported emissions in 1998 (without LUCF), a 9 per cent decrease compared with 1990.

34. CO_2 emissions from the stationary combustion of gaseous fuels represents 11 per cent of all reported emissions in 1998 (without LUCF), a 34 per cent increase compared with 1990.

35. *Methodology*: Estimation of emissions is based on the IPCC tier 1 method. The calculation steps are presented in the NIR.

36. *Emission factors*: The EFs used for CO_2 emissions estimation in both reference and sectoral approaches are country-specific in most cases. The values are reported in the NIR and further references provided.

(a) The EFs used for bitumen and refinery stocks in the reference approach are the IPCC default values;

(b) CO_2 emissions from burning wood were calculated using the IPCC default factor;

(c) The CO_2 IEF from liquid fuels in petroleum refining for 1998 has a higher value (74.82 t/TJ) compared with the IEF for other energy sector activities (range: 60.70 – 69.40 t/TJ). This IEF is consistently reported as higher than 73 t/TJ for the years 1990 to 1998. The largest EF mentioned in the NIR is 72.9 t/TJ for "other liquids". The response provided by New Zealand indicates that the fuels included under "other liquids" are fuel oil (EF: 72.5) and asphalt (EF: 75.2) and they contribute different proportions every year. The IEFs calculated for the years 1990 to 1998 are within this range;

(d) The low IEFs for CO_2 emissions from gaseous fuels in the manufacturing and construction sector, in comparison to other countries and other sectors in New Zealand, are attributed to the exclusion of carbon stored in final products;

(e) The CO_2 IEF from solid fuels calculated in 1998 for the manufacturing and construction sector had a lower value (90.43 t/TJ) compared to the IEF for the years 1990 to 1997 and compared to the IEF for other energy sector activities (91.2 t/TJ, also mentioned in the NIR). It is stated in the response provided to the S&A report that this variation comes from the fact that reported steel emissions result from direct emissions measurements. It is unclear if these measurements are also available prior to 1998.

37. *Activity data*: Activity data for the energy sector were compiled by the Ministry of Economic Development (formerly Ministry of Commerce). The NIR mentions that some information concerning natural gas use is confidential in New Zealand and, in order to ensure that it remains so, some EFs for gas also had to be withheld. Specifically:

(a) A breakdown of energy consumption data in the manufacturing and construction sector according to the reporting tables is not possible owing to a lack of consistent data;

(b) Data concerning gas use by large industrial consumers in New Zealand is confidential;

(c) The activity data for CO_2 estimation exclude energy containing carbon that is later stored in manufactured products. No subsequent downward adjustment in carbon emissions is required.

38. *Completeness*: Not all subsectors are covered owing to a lack of activity data on the manufacturing and construction sector.

39. *Uncertainty*: General results of the uncertainty analysis carried out are presented in the report (uncertainty per gas).

40. *Recalculations*: New Zealand provided recalculated estimates (tables 8(a)) and explanatory information (tables 8(b)) for these recalculations for the years 1990 to 1997.

However, the information in table 8(b) does not refer to the stationary combustion sector. This information is available in the NIR.

4.4 Mobile combustion – CO_2 emissions

41. *Emission trends*: Emissions from mobile combustion (road transportation and civil aviation) are key sources for New Zealand, representing 15 per cent of all reported gross emissions (without LUCF). New Zealand reports CO_2 emissions from stationary combustion increasing from 8.3 Mt in 1990 to 11.1 Mt in 1998 (a 34 per cent increase):

(a) CO_2 emissions from mobile combustion – road transportation represent 14 per cent of all reported emissions in 1998 (without LUCF), a 36 per cent increase compared with 1990;

(b) CO_2 emissions from mobile combustion – civil aviation represent 1 per cent of all reported emissions in 1998 (without LUCF), an 8 per cent increase compared with 1990.

42. *Methodology*: Estimation of emissions is based on the IPCC tier 1 method. The calculation steps are presented in the NIR.

43. *Emission factors*: The EFs used for CO_2 emissions are a combination of country-specific and default values.

44. *Activity data*: Estimation is based on energy consumption data. Transport sector activity is not currently reported. This is related to the format in which the statistics service survey is carried out (New Zealand's response to the S&A report). Additionally, the completeness table in the CRF (table 9) reports: "A breakdown by mode, or by fuel type is possible, but not both simultaneously".

45. *Uncertainty*: General results of the uncertainty analysis carried out are presented in the report by gas.

46. *Recalculations*: New Zealand provided recalculated estimates (tables 8(a)) and explanatory information (tables 8(b)) for these recalculations for the years 1990 to 1997. However, the information in tables 8(b) does not refer to the transport sector. This information is available in the NIR.

5. Bunker fuels

47. International fuel consumption for navigation and aviation are reported in the CRF. There is no explanation of the estimation in the documentation box, but the data sources are reported in the NIR

48. The calculated allocation of fuel consumption between domestic and international transport (100 per cent in international transport) in the additional information table on worksheet table1.C has been carried out because the respective sectoral overview table in the CRF is not detailed (major fuel types and the sector as a whole are reported). Energy consumption data are provided in the file "Energy98.xls" where all calculations are presented.

49. Using the above-mentioned data, the respective share of domestic transport is as follows: 34 per cent for domestic aviation and 14 per cent for domestic navigation.

6. Weather-related adjustments

50. It is presumed that there are no weather-related adjustments of emissions since they are not mentioned in the NIR.

7. Questions and issues from previous review stages

51. New Zealand provided a detailed response to the issues raised in the draft S&A report.

8. Questions and issues from Parties' response to draft centralized review report

52. New Zealand provided detailed technical comments on the draft review report, which were helpful to the review team and were taken into account.

C. INDUSTRIAL PROCESSES

1. General overview

1.1 Completeness

53. Most key sources were reported. The emissions from limestone and dolomite use were not available (activity data were not estimated); for consumption of halocarbons and SF_6, potential emissions were calculated for the following reasons: "actual emissions of HFCs and C_3F_8 were not estimated due to insufficient information on the actual usage of the imported chemicals" and "actual emissions for SF_6 for 1990 to 1993 were not estimated as no data were available".

1.2 Transparency

54. New Zealand has a relatively small number of plants emitting GHGs from non-energy related industrial processes that allow the use of country- or plant-specific (PS) information. The New Zealand NIR provides some information on HFCs and PFCs and the formula used for calculating actual emissions from other uses of SF_6.

1.3 Recalculations

55. No recalculation was made for industrial processes for the years 1990 to1997. The NIR mentioned that in the inventory 2000, data for 1997 for solvent and other product use had been updated and new data reported for 1998. However, the update data refers to NMVOC emissions and therefore it is not possible to report under table 8 of the CRF. (The S&A report states: "in view of the small share of emissions from this sector, no information was provided in the recalculation table").

1.4 Methodologies

56. Tier 1 and country-specific EF for the whole sector; tier 1a (country-specific for SF_6) for new gases and country-specific /IPCC tier 1 for PFCs/SF_6 methods and plant-specific for EF.

1.5 Uncertainties

57. A quality assessment of the uncertainty of the estimates was given in table 7 (sheets 1 and 2) (high for CO_2 and potential emissions of HFCs, PFCs and SF_6, and low for CH_4 and NO for N_2O).

1.6 Cross-cutting issues with the energy sector

58. Iron and steel industry: New Zealand reported as emission from industrial processes, part of the metallurgical coal carbon content released as CO_2.

2. Mineral sector

59. The emissions from limestone and dolomite use were not applicable (activity data were not estimated). CO_2 emissions were reported as 0 Gg for soda ash production and use. Activity data were not applicable for soda ash production and use.

60. The CO_2 IEF from lime production is below the IPCC range.

61. Emissions from limestone and dolomite use were reported as not applicable (NA) whereas they were described as NE in the report (FCCC/WEB/2001/1).

62. Soda ash production and consumption was reported as NA.

3. Chemical sector

63. For ammonia production, CO_2 emissions were estimated as 163.41 Gg and activity data for ammonia/urea were reported as 163.21 kt (table 2(I) (Sheet 1 of 2), but the IEF was reported as 0. The IEF should be about 1 and therefore lower than the IPCC default value (1.5 tCO_2/tNH_3). However, in the background table, CO_2 emissions were reported as NO. N_2O emissions for nitric acid and adipic acid production were reported as 0 Gg, but the activity data for nitric and adipic acid production were not available.

64. The same occurs in the case of CO_2 emissions for carbide production. CO_2 emissions for non-key subsectors were estimated as 174.75 Gg, but sources were not specified and no explanation was given in CRF table 2(I) (Sheet 1 of 2). The NIR reported these emissions as "hydrogen". Table 2(I).A-G reported 27.35 kt as the activity data for hydrogen. No further explanation is given.

65. Activity data are not estimated for carbon black, ethylene, dichlorethylene and styrene, but the following explanation is given: "NE has been entered into the table for carbon black, styrene, although no data is available to the Ministry of Environment at this time on whether or not New Zealand produces these compounds".

66. The following inconsistency is reported in CRF table 2(I) (Sheet 1 of 2) under B. "Chemical industry": there are two emissions reported in 1. "Ammonia production" (163.41 Gg) and 5. "Other" (174.75 Gg), but the total is only 174.75 Gg (the emission for ammonia production is missing). The NIR only reported 175 Gg under "hydrogen", and CH_4

emissions of 0.1142 Gg for ammonia production. Nevertheless, in the background table 2.(I).A-G, although activity data of 163.21 kt are reported, the CO_2 emissions are described as NO. The IPCC default value of 1.5 kg CO_2/ kg of NH_3 for CO_2 emissions from ammonia production.

4. Metal sector

67. CO_2 from iron and steel production is a key sector for New Zealand. The activity data were reported for steel production. All relevant emissions from this sector were estimated.

68. For aluminium production, the activity data increased by 20 per cent between 1990 and 1998, but the 1998 EF decreased to 10 per cent of the EF for 1990. The result is a decrease of CF_4 emissions to 10.4 per cent of the 1990 value. This is one of the largest reductions in CF_4 emissions, but there is no reference to whether abatement measures were put in place and no explanation of any abatement measures that were actually undertaken.

69. CO_2 emissions from aluminium production constitute a key source for New Zealand.

Emissions from ferroalloys production were reported as NA. Emissions from SF_6 used in aluminium foundries were not reported. Emissions from SF_6 used in magnesium foundries were estimated.

5. Production and consumption of HFCs and SF_6

70. The production of halocarbons and SF_6, as well as of HCFC-22, was reported as NA, but the emissions were reported as 0 Gg.

71. The consumption of halocarbons and SF_6 is estimated as potential and is explained in the NIR as follows “emission estimates for the consumption of HFCs and PFCs are potential rather than actual. They are based on import data and detailed information as to their use is not available. It is known, however, that most of the HFC use in New Zealand is in refrigeration and air-conditioning equipment. Both actual and potential emissions of SF_6 are included. Actual emissions resulting from magnesium production are reported, and actual emissions from other uses of SF_6 are calculated using the formula (Montgomery Watson, 1998(b))”.

72. Actual emissions of HFCs were reported as NE.

6. Key sources

73. CO_2 emissions from the iron and steel industry (level assessment of 2 per cent).

74. CO_2 emissions from aluminium production (level assessment of 1 per cent).

7. Questions and issues from previous stages

75. The S&A report includes a table that presents minor differences in estimates for CO_2 and CH_4 from industrial sources:

CO_2 (Gg)		CH_4 (Gg)	
CRF	NIR	CRF	NIR
2,739.90	2,729	0.11	0.12

76. The differences are explained by small inconsistencies between reported emissions in each of the two formats (CRF and NIR) for CO_2 emissions from cement production and CH_4 emissions from other chemical processes as follows:

CO_2 emissions	**CRF**	**NIR**
Cement Production	478.72	468
CH_4 emissions	**CRF**	**NIR**
Orica Adhesives and resins (Formaldehyde)	0.00	0.01

77. The S&A report stated "2.C.1 Iron and Steel production: The CO_2 IEF varied from year to year within a range of 1.8064 t/t to 2.0714 t/t for the period 1990 to 1998. In addition, 2.C.3. Aluminium production: the CO_2 IEF for 1997 and 1998 was lower compared to the values reported for the period 1990 to 1996. For these two cases, the NIR provided a reference for the source of production and emissions data". New Zealand, in its answer, states that: "This variation within the IEF in Iron and Steel is linked to the variation in the reporting of the coal sources and the variation linked to reporting the coking coal in New Zealand. This IEF varied due to the fact that steel emissions are direct measurements". No comment was provided on aluminium production. However, the NIR states: "Emissions of two PFCs from the production of aluminium, CF_4 and C_2F_6, are supplied by the Comalco New Zealand. These are estimates of actual emissions".

78. As noted above, the activity data for aluminium production increased by 20 per cent between 1990 and 1998, but the 1998 EF for CF_4 decreased to 10 per cent of the initial EF for 1990. The result is a decrease in CF_4 emissions to 10.4 per cent of the 1990 value. This is one of the largest reductions in CF_4 emissions. There should be an explanation of whether or not abatement measures were implemented.

79. In relation to 2.F "Consumption of halocarbons and SF_6", the S&A report stated that: "Data were not provided in the CRF as only potential emissions for HFCs and PFCs were reported". New Zealand replied that: "Consumption of SF_6 was actual emissions of SF_6 in the CRF". There was a misunderstanding in the answer since the statement does not refer to SF, but only to HFCs and PFCs. However, the NIR contains an explanation as mentioned in section 5 above.

D. AGRICULTURE

1. General overview

80. A slight decrease in GHG emissions in the agriculture sector was observed over the period 1990 to 1998. For N_2O from agriculture there is a slight increase in the emission trend between 1990 and 1998. For CH_4, the trend is a decreasing one. There is consistency between the animal statistics in the different tables.

1.1 Completeness

81. The documentation on activity data, EFs, assumptions and tables in the agriculture sector and all the different subcategories attained a high level of completeness.

1.2 Transparency

82. New Zealand's NIR provided a clear discussion of methodological issues and references on background data.

1.3 National self-verification

83. There was no indication as to whether a national self-verification process had taken place.

1.4 Methodology

84. The national GHG inventory submitted to the UNFCCC by New Zealand was based on the UNFCCC guidelines and IPCC methodology according to decision 3/CP5.

85. Emissions from the agriculture sector were estimated using the IPCC guidelines, but New Zealand recognized that there were divergences in respect of the IPCC methodology. Documentation in the agriculture sector describes how the emissions were estimated and how they have changed since the last inventory, as well as uncertainties in the calculations.

86. Estimates of GHG emissions have been reported according to the UNFCCC guidelines using the CRF adopted by the COP.

1.5 Activity data and emission factor

87. Activity data from national statistics were used. In the agriculture sector, the EFs used were IPCC default EF values and national-/regional-specific EF values. National or regional-specific (Oceania region) EFs and parameters have been used where available.

1.6 Good practice

88. The data reported in the agriculture sector on key sources show a level of detail that accords with the level of disaggregation recommended by the IPCC good practice guidance, in particular:

(a) CH_4 from manure management;

(b) Direct N_2O emissions from agricultural soils;

(c) Indirect N_2O emissions from nitrogen used in agriculture.

2. Specific findings

Enteric fermentation (table 4.A)

89. IPCC tier 1 methodology was used. Country-specific EFs have been used in some cases. Swine and poultry EFs require further examination; values differ from defaults.

Methane emissions from manure management (table 4.B(a))

90. IPCC tier 1 methodology was used.

Nitrous oxide emissions from manure management (table 4.B(b))

91. IPCC tier 1 methodology was used. The IEF for cattle seems very low, but the values are referenced in the NIR.

Rice cultivation (table 4.C)

92. Emissions from rice cultivation were reported as non occurring (NO).

Agricultural soils (table 4.D)

93. *Direct soils emission*: The IEF for FBN and FCR is low, probably because the wrong N input data from the NIR were copied into the CRF. $FRAC_{graz}$ is not calculated and therefore not used in the calculation of FAW. This should be done.

94. *Animal production*: The IEF is low, but referenced in the NIR.

95. *Indirect emissions*: $FRAC_{leach}$ is lower than the IPCC default, but is referenced in the NIR.

Savannah burning (table 4.E)

96. Emissions from savannah burning were reported as non occurring (NO).

Agricultural residue burning (table 4.F)

97. Incomplete (no IEF given), but explained in the NIR. N_2O (low figure) is not reported in CRF. $FRAC_{burn}$ has been adapted to calculate FCR.

3. Quality assessment/quality control (QA/QC)

98. No discussion of QA/QC is provided in the NIR.

4. Uncertainty

99. A semi-quantitative to descriptive system is used.

E. LAND USE CHANGE AND FORESTRY (LUCF)

1. General overview

100. The documentation on activity data, EFs, assumptions and tables attained a high level of completeness.

101. The NIR provided a discussion of methodological issues and indicated planned improvements.

2. Findings

2.1 Changes in forest and other woody biomass stocks (table 5.A)

102. *Completeness*: Data have been provided on CO_2 removals for subsector 5.A.3 "Changes in forest and other woody biomass stocks – temperate forests" for all years since 1990. They show that changes in forest and other woody biomass stocks may have compensated for approximately 28.9 per cent of the total GHG emissions in 1998. It is reasonable for New Zealand that categories 5.A.1 "Tropical forests", 5.A.3. "Boreal forests" and 5.A.4 "Grasslands/ tundra" are not applicable. Harvested wood has been included elsewhere.

103. *Consistency*: The information provided indicates that the LUCF data are internally consistent over the period since 1990 and the same methods have been used for calculations throughout this period. It is also acknowledged that information related to subsectors 5.A, 5.B, 5.C and 5.D have been provided in a consistent manner. Data show no unreasonable fluctuations or robust trend.

104. *Recalculations*: The NIR describes various improvements/changes in methodology that have not produced any major effects on data, although this finding has not been described in quantitative terms. Recalculations were made for CO_2.

105. *Transparency*: Has been achieved by providing calculation tables as appendix 5 to the NIR, which follow closely the sectoral background data addressed in table 5.A of the CRF. From this it is obvious that the carbon uptake is mainly due to plantation forest with the predominant species Pinus radiata.

106. *Comparability*: *H*as been addressed by providing data on relevant subsectors based on methodology which is described in some detail in the NIR. However, it was not possible to compare the country-specific model with other methodologies during the expert review.

107. It was noticed that the model used for forests describes the whole ecosystem including soil. However, the IPCC guidelines address soil in a separate subsector (5.D) and reporting is organized accordingly. It is a complex task to assess comparability for such different approaches.

108. It is noted that not only is the term "natural forest" used, e.g., in the relevant section of the NIR, but also that in the worksheets the term "native forest" appears without any further explanation. Only the term "natural forest" is used in the IPCC guidelines. Some clarification seems to be necessary to help verification and comparability.

109. *Methodology*: For estimation, a country-specific methodology has been used which is based upon models implemented by the New Zealand Forest Research Institute. The models are the CARBON/DRYMAT model (which calculates carbon per hectare by component and age class in the planted estate) and the FOLPI model (which calculates carbon stocks in each modelled year). The database used originates from the National Exotic Forest Description (NEFD) survey, which provides estimates of the land area and merchantable stemwood in the estate by crop type and age class and associated yield tables for each crop type. Literature has been provided which includes more details. However, only the CARBON/DRYMAT model has been described in internationally referenced literature.

110. *Emission and conversion factors*: The following information has been taken from appendix 5, sheet 2 of the NIR:

- Biomass conversion ratio (pinus radiata plantations)	0.455 t dm/m^3
- Biomass conversion ratio (native forests)	0.50 t dm/m^3
- Biomass expansion ratio	2.04 t dm/m^3

111. The following information is implicitly included in appendix 5, sheet 2 of the NIR report (sheet carbon uptake):

- Annual average biomass uptake (pinus radiata plantations)	7.00 t C/ha to 5.28 t C/ha

112. The above factors compare well with those in the literature.

113. Activity data on harvesting have been provided in terms of merch.m^3 in appendix 5, sheet 1, of the NIR (about 15 Million m^3 per year) and on carbon uptake for total forest area (1.7 Million ha in 1998) and area of new forest planting (51,200 ha in 1998), both as yearly values and three-year average data.

114. The data seem to be reasonable and compare well with other international data (United Nations Food and Agriculture Organization (FAO) statistics).

115. *Uncertainty*: According to information provided in the NIR (which has been based on sensitivity analysis) precision of the carbon sequestration estimates could be in the order of ±25 per cent, the main contribution originating from carbon allocation. No uncertainty estimates are currently available for emissions from unsustainable harvesting of natural forests.

2.2 Forest and grassland conversion (table 5.B)

116. *Completeness*: Data have been provided for category 5.B.2 "Forest and grassland conversion - temperate forests" for emissions of CH_4, N_2O, NO_X and CO, as well as category 5.B.5 "Other", specified as "Temperate shrublands", for the above pollutants and CO_2 emissions. Again, it is reasonable for New Zealand that categories 5.B.1 "Tropical forests", 5.B.3 "Boreal forests" and 5.B.4 "Grasslands/tundra" are not applicable. The emissions from section 5.B account for about 1.1 per cent of total GHG emissions in 1998.

117. It is noted that no conversion from grassland into e.g., cultivated land/streets/houses due to urban development has been included in the estimate. It is recommended that such data be added.

118. *Consistency*: The information provided indicates that the LUCF data are internally consistent over the period since 1990 and the same methods have been used for calculations throughout this period. It is also acknowledged that information related to subsectors 5.A, 5.B, 5.C and 5.D has been provided in a consistent manner. Data show no unreasonable fluctuations without any robust trend.

119. *Recalculations*: The NIR describes various improvements/changes in methodology that have not produced any major effects on data, although this finding has not been described in quantitative terms. Recalculations were made for CO_2.

120. *Transparency*: Has been achieved by providing calculation tables as appendix 5 of the NIR which follow closely the sectoral background data addressed in table 5.B of the CRF.

121. *Comparability*: See discussion under 5.A above.

122. *Methodology*: According to summary table 3, the IPCC default method has been used. It has been assumed for calculation purposes that 25 per cent of scrub biomass is burnt on site and that the remainder is left to decay. The worksheets have been provided in appendix 5 of the NIR.

123. *Emission and conversion factors*: The following information has been taken from appendix 5, sheet 2 of the NIR:

- quantity of biomass burned 136 t dm/ha
- fraction of oxidized biomass 90%
- biomass conversion ratio 0.5 t C/t dm

124. According to footnote 18 (see page 5.24 of the Reference Manual of the IPCC guidelines), the fraction which oxidizes during burning seems to be on the low side.

125. *Activity data*: Activity data on scrubland cleared for new planting of forests (about 10,000 ha per year), scrubland area burned in wildfires (3,000 ha per year) and forests burned in wildfires (about 700 ha per year) have also been provided in appendix 5, sheet 1 of the NIR. The data seem to be reasonable and compare well with other international data (United Nations Food and Agriculture Organization (FAO) statistics).

126. *Uncertainty*: No uncertainty estimates are currently available for emissions from sectors 5.B.

2.3 Abandonment of managed lands (table 5.C)

127. *Completeness*: Owing to a lack of data, no data have been provided for this sector. This applies to categories 5.C.2 “Temperate forests” and 5.C.5 “Other”, specified as “Temperate shrublands”. Again, it is reasonable for New Zealand that categories 5.C.1 “Tropical forests”, 5.C.3 “Boreal forests” and 5.C.4 “Grasslands/tundra” are not applicable. According to the NIR, a substantial research project has been undertaken to remedy the data gaps. More information is expected to be available by next year.

128. *Consistency*: It is also acknowledged that information relating to subsector 5.C has been provided in a consistent manner.

129. *Transparency*: The lack of information makes it impossible to comment on transparency in respect of this sector. However, information has been provided on future plans on remedying the data gaps.

130. *Comparability*: Owing to a lack of information, it was not possible to check for comparability of data/methodologies for these categories.

131. *Methodology*: Owing to a lack of data and information relating to methodologies in section 5.C, methodological issues for this sector could not be reviewed.

132. *Emission and conversion factors*: Owing to a lack of information relating to section 5.C, emission and conversion factors for this sector could not be reviewed.

133. *Activity data*: Owing to a lack of information relating to section 5.C, activity data for this sector could not be reviewed.

2.4 CO_2 emissions and removals from soil (table 5.D)

134. *Completeness*: Owing to a lack of data, no information has been provided for this sector. According to the NIR, a substantial research project has been undertaken to remedy the data gaps. More information is expected to be available in the future.

135. *Consistency*: It is also acknowledged that information relating to subsector 5.D has been provided in a consistent manner.

136. *Transparency*: Owing to a lack of information, it is impossible to comment on transparency with respect to this sector. However, information has been provided on future plans for the future and on remedying the data gaps.

137. *Comparability*: Owing to a lack of information it was not possible to check for comparability of data/methodologies for these categories.

138. *Methodology*: Owing to a lack of data and information relating to methodologies in section 5.D, methodological issues for this sector could not be reviewed.

139. *Emission and conversion factors, activity data and uncertainty*: Owing to a lack of information relating to section 5.D, emission and conversion factors, activity data and uncertainty related to sector 5.D could not be reviewed.

140. No information was provided on any additional categories in the LUCF sector.

3. Reporting

141. The NIR contains plenty of information that is very relevant to the review process and helps to elucidate the underlying calculations. However, more information could be provided on the basis/background of the national emission and conversion factors used as it was not possible to include in the review the cited literature that might include additional information.

142. It is noted with interest that New Zealand is working on a remote-sensing based land cover database (LCDB) to significantly improve the accuracy of mapped land use and cover. If repeated, it will also provide information on land conversion and abandonment. LCDB 2 will use enhanced sensors to increase the number of major classes and improve thematic depth for

forest classes. The provisional time frame envisages national imagery being acquired over the summer of 2001/02.

143. It is also noted that the NIR does not mention QA/QC, archiving and internal verification. However, it provides very relevant information on inventory improvement.

4. Feed back on in-depth review (IDR)

144. The summary report does not provide any specific information on feedback on the IDR in sector 5. However, the latest IDR did not include any recommendations on further improvements in this sector.

5. Areas for improvement

145. New Zealand is encouraged to compare its methodologies with the current IPCC methods for selected categories by means of a special study.

146. It is appreciated that New Zealand is already working on remedying the data gaps and reducing uncertainty, e.g., by using remote sensing.

147. It would help verification if larger areas (e.g., larger than 100 ha) of land-use change were identified with the help of a map.

F. WASTE

1. General overview

148. The information provided in the NIR and the CRF, as well as the worksheets, are shown to be at a level that facilitates review. Solid waste disposal on land is a key source category accounting for 3 per cent of total GHG emissions and 8 per cent of total methane emissions.

1.1 Completeness

Key source: Waste disposal on land

149. The CRF and worksheets are complete.

Non-key source: Wastewater handling

150. The activity data in table 6.B from the CRF were incomplete, however, the figure could be found in the additional work sheet provided.

Non-key source: Waste incineration

151. Combustion-related CO_2 from waste is considered negligible due to the small amount of waste incineration that takes place as described in table 9 in the CRF.

1.2 Methodology

Key source: Waste disposal on land

152. A country-specific methodology utilizing IPCC default values was used. It is noted that the waste generation rate – 2.46 kg/capita/day (additional information in table 6.A in the CRF) – is high: twice as much as in IPCC 1996 table 6-1.

Non-key source: Wastewater handling

153. Country-specific data are used. N_2O from human sewage is also reported.

Non-key source: Waste incineration

154. Not reported.

1.3 Emission factor

Key source: Waste disposal on land

155. The IEF is at the applicable limit.

Non-key source: Wastewater handling

156. The IEF for both domestic and industrial wastewater handling is at a reasonable figure.

1.4 Activity data

157. The activity data from the additional worksheet are complete. However, a figure is missing in the CRF.

1.5 Recalculation

158. Recalculation was done between 1990 and 1996 using more accuracy data, namely, DOC and total MSW landfill, and more sources were included in the analysis of industrial wastewater. Therefore, the recalculation impact on the increases in key source emissions from –0.75 to 19.61 per cent and non-key sources from 45.75 to 55.16 per cent.

1.6 Uncertainties

159. The uncertainty for key sources was reported at ± 35 per cent, while the uncertainty for wastewater handling varied from –30 % to 40 %. The uncertainty for N_2O is high.

1.7 Trends

160. The overall trend in CH_4 from the waste sector has been reduced due to a reduction in emissions from key sources. However, the emissions of both CH_4 and N_2O from non-key sources have increased slightly.

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