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NEW ZEALAND

REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY SUBMITTED IN THE YEAR 2004[1]

I. OVERVIEW

A. Introduction

1. This report covers the centralized review of the 2004 greenhouse gas (GHG) inventory submission of New Zealand, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8 of the Conference of the Parties. The review took place from 11 to 15 October 2004 in Bonn, Germany, and was conducted by the following team of nominated experts from the roster of experts: Generalists – Ms. Riitta Pipatti (Finland) and Mr. Pavel Shermanau (Belarus), Energy – Ms. Branca Americano (Brazil), Mr. Dario Gomez (Argentina) and Mr. Mamadou Diarra (Niger), Industrial Processes – Mr. Menouer Boughedaoui (Algeria) and Mr. Alexander Nakhutin (Russian Federation), Agriculture – Mr. Viktor Novikov (Tajikistan) and Mr. Haruo Tsuruta (Japan), Land-use Change and Forestry (LUCF) – Mr. Nagmeldin Goubti Elhassan (Sudan) and Mr. Risto Sievänen (Finland), Waste – Ms. Tatiana Tugui (Moldova) and Mr. Gao Qingxian (China). Mr. Dario Gomez and Ms. Riitta Pipatti were the lead reviewers. The review was coordinated by Ms. Astrid Olsson (UNFCCC secretariat).

2. In accordance with the "UNFCCC guidelines for the technical review of greenhouse gas inventories from Annex I Parties", (hereinafter referred to as UNFCCC review guidelines), a draft version of this report was communicated to the Government of New Zealand, which provided comments that were considered and incorporated, as appropriate, in this final version of the report.

B. Inventory submission and other sources of information

3. In its 2004 submission, New Zealand has submitted a complete set of common reporting format (CRF) tables for the years 1990–2002 and a national inventory report (NIR). The full list of materials used during the review is provided in annex 1 to this report.

C. Emission profiles and trends

4. In the year 2002, the most important GHG in New Zealand was carbon dioxide (CO_2), contributing 45.1 per cent to total[2] national GHG emissions expressed in CO_2 equivalent, followed by methane (CH_4) – 36.7 per cent – and nitrous oxide (N_2O) – 17.6 per cent. Perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) taken together contributed 0.6 per cent of the overall GHG emissions in the country. The Agriculture sector accounted for 49.2 per cent of total GHG emissions, followed by

[1] In the symbol for this document, 2004 refers to the year in which the inventory was submitted, and not to the year of publication.

[2] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding LUCF, unless otherwise specified.

Energy (42.8 per cent), Industrial Processes (4.7 per cent) and Waste (3.2 per cent). Total GHG emissions amounted to 74,882 Gg CO_2 equivalent and increased by 21.7 per cent from 1990 to 2002.

D. Key sources

5. New Zealand reports a key source tier 1 analysis, both level and trend assessment, as part of its 2004 submission. The key source analysis performed by the Party and the secretariat[3] produced similar results. New Zealand has divided the category Fugitive Emissions from Oil and Gas Operations into "Fugitive Emissions from Oil and Gas Operations" and "Fugitive Emissions from Geothermal Operations", and presents a more disaggregated category, "Other Consumption of Halocarbons and SF_6". The expert review team (ERT) recommends New Zealand to use the tier 2 key source analyses, taking into account qualitative estimates of key sources and the uncertainty analyses included in the NIR.

E. Main findings

6. The NIR covers the fundamental reporting requirements and includes information on key sources, methods, data sources, uncertainty estimates, quality assurance/quality control (QA/QC) procedures, and verification activities.

7. The NIR is well structured but could be improved in certain sections by the addition of more information on activity data (AD) and methodologies used, particularly where country-specific emission factors (EFs) are used or where significant information is referenced in background documentation (see the relevant individual sector sections below). For example, there is a lack of information in the 2004 submission about nitrogen contents in agricultural soils and manure management, the composition of wastes, some country-specific EFs in the Agriculture sector, and the fluctuation of implied EFs in the Industrial Processes sector.

F. Cross-cutting issues

Completeness

8. All major source/sink categories and direct and indirect GHGs are reported in the inventory. The NIR generally adheres to the UNFCCC reporting guidelines with regard to completeness. Although New Zealand reports actual emissions from source category 2.F Consumption of Halocarbons and SF_6, the inventory does not provide estimates of potential emissions from HFCs and PFCs from this source. Carbon emissions and removals from abandonment of managed land and changes in soil carbon are currently not included (due to a lack of AD). However, New Zealand reports in the NIR that it plans to include these sinks/sources in future inventories.

Transparency

9. Further integration and documentation of the methodological steps, especially in regard to the development of country-specific EFs and methods, would improve the overall transparency of the inventory. This could be done by including additional information from the publications referenced in the NIR (e.g., for agricultural soils, solid waste disposal on land, and changes in forest and other woody biomass stocks).

[3] The 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 providing a full CRF for the year 1990. Where the Party has performed a key source analysis, the key sources presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key source assessment conducted by the secretariat.

Recalculations and time-series consistency

10. New Zealand provides recalculated estimates and explanatory information for the years 1990–2001 in the CRF and in the NIR. The effect of the recalculations for the base year (1990) (as reported in the CRF tables) was a decrease in the estimates for CO_2 equivalent emissions of 0.18 per cent excluding LUCF and 0.77 per cent including LUCF.

Uncertainties

11. The NIR states that an Intergovernmental Panel on Climate Change (IPCC) tier 1 uncertainty analysis has been performed, and the results of this analysis are presented at a summary level. Qualitative uncertainty estimates are provided in CRF table 7. The estimated uncertainty in the annual total emissions is high (20.1 per cent for the year 2002) which is linked to the high share of agricultural emissions (especially CH_4 from enteric fermentation and N_2O from agricultural soils) in New Zealand's inventory. The uncertainty in these categories reflects the inherent variability of emission factors from agricultural sources. The uncertainty in the trend in emissions from 1990 to 2002 is much smaller, ±4.6 per cent.

Verification and quality assurance/quality control approaches

12. Information on the QA/QC procedures in place is well presented. The NIR contains a description of New Zealand's QA/QC plan and information on its implementation. It also provides two tables (checklists) of results of QC checks, a checklist of recent reviews undertaken as part of the QA of the New Zealand inventory, and a schedule for the future implementation of QA/QC procedures.

Follow-up to previous reviews

13. The review of the 2003 submission identified the lack of a complete time series of CRF tables. New Zealand has provided CRF tables for all years 1990–2002 in its 2004 submission.

G. Areas for further improvement

Identified by the Party

14. The NIR identifies several areas for improvement. New Zealand plans to report data on categories that are currently incomplete and presents information about the development of QA/QC procedures.

Identified by the ERT

15. It is recommended that New Zealand improve the transparency of its methodological descriptions of country-specific methods and EFs.

II. ENERGY

A. Sector overview

16. In 2002 the Energy sector was the second-largest contributor of New Zealand's GHG emissions, accounting for 42.8 per cent of total emissions. It is the fastest-growing sector and its emissions in 2002 were 35.0 per cent above the 1990 level. The sources contributing most to this increase were CO_2 emissions from road transportation, public electricity and heat production, and chemicals. The sector includes seven key source categories, namely six sources for CO_2 (coal, oil and gas fuels from stationary combustion; road transportation and aircraft from mobile combustion; and fugitive emissions from oil and gas operations) and CH_4 emissions from coal mining and handling (identified as a key source only by the trend assessment).

17. The NIR and the CRF contain emissions estimates for direct and indirect GHGs from the sources in the Energy sector. Emissions from fuel combustion in category 1.A.2 Manufacturing Industries and Construction are only disaggregated for a few subcategories because of lack of detailed energy use statistics for all source subcategories. Tier 1 methods have been used for all sources. Most EFs used to estimate emissions for the Energy sector are presented in the NIR. New Zealand indicates in the NIR that some EFs for gaseous fuels are withheld for confidentiality reasons.

18. In 2003, New Zealand commissioned a review of 168 EFs used to estimate emissions from the Energy sector (Hale & Twomey, 2003). For direct GHGs, the reviewers gave priority to those 28 EFs used to estimate emissions from key sources. The results of the review were assessed by an independent review panel of New Zealand energy experts (Clarkson et al., 2004) which agreed to adopt most of the 168 recommendations. The 2002 inventory incorporates the EFs recommended by the review and agreed by the review panel. For CO_2, country-specific EFs have been used, while for non-CO_2 gases New Zealand has reverted to the IPCC default EFs in those cases where there was a significant difference between the country-specific and the IPCC default EFs and a defensible explanation for the difference could not be obtained. The values and sources of EFs for the main fuels used are indicated in the NIR. The ERT commends New Zealand on its effort in updating the EFs following previous recommendations from New Zealand's inventory QA procedures (Clarkson, 2001, 2002) and encourages New Zealand to follow the recommendations by Hale & Twomey (2003) to review and update its EFs in future submissions. The ERT also recommends that New Zealand include the complete set of EFs used in its future submissions.

19. Emissions estimates have been recalculated for all years as a result of the Energy sector EF review. For the period 1990–1999, the recalculations result in decreases in the figures for the aggregated emissions of CO_2, CH_4 and N_2O of between 0.4 per cent (1990) and 1.9 per cent (1996). For recent years, the recalculations result in increases of 2.0 per cent (2000) and 1.1 per cent (2001). The recalculations had a small effect on CO_2 emissions. Non-CO_2 emissions are significantly affected by the new EFs: the recalculations result in decreases between 2.5 and 21.0 per cent for CH_4 and between 16.2 and 23.7 per cent for N_2O.

B. Reference and sectoral approaches

Comparison of the reference approach with the sectoral approach and international statistics

20. In 2002, the CO_2 emissions estimated by the sectoral approach were 2.94 per cent less than those estimated by the reference approach. New Zealand indicates in the NIR that the difference is mainly related to differences in AD that are of the same order of magnitude as statistical differences in the national energy balance. The ERT recommends that New Zealand include the corresponding national energy balance in its future NIRs to improve transparency.

International bunker fuels

21. Data on fuel consumption by international transportation are obtained from the databases of the Ministry of Economic Development and data on fuel consumption from domestic transport are obtained from Statistics New Zealand, based on a survey of deliveries of petroleum fuels. To improve transparency, it is recommended that New Zealand indicate whether this information is in accordance with the distinction between domestic and international transportation suggested by the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance).

Feedstocks and non-energy use of fuels

22. The non-energy use of bitumen and the use of natural gas as feedstock for methanol and urea production are taken into account in the reference approach. The IPCC default value is used for the

fraction of carbon stored in bitumen, while for confidentiality reasons only the total amount of carbon stored for the overall production of methanol and urea is reported. In the sectoral approach, the carbon sequestered in final products is estimated on the basis of the chemical composition and the amount produced. The Industrial Processes chapter of the NIR includes the scheme followed for this estimation for methanol and ammonia/urea.

C. Key sources

Energy industries – CO_2

23. The series of CO_2 implied emission factors (IEFs) for manufacturing of solid fuels and other energy industries for gaseous fuels show large variations in the period 1990–2002, and the values are not consistent with the CO_2 EFs for natural gas, which are the only EFs for gaseous fuels reported in the NIR. For the period 1990–1996 the CO_2 IEFs are the lowest among reporting countries and 40–47 per cent lower than New Zealand's EFs for natural gas, while for the period 1997–2002 the values are higher than those for local natural gas. It is recommended that the values of these EFs be included in future NIRs if they are different from those of natural gas or that New Zealand specify whether these are the EFs that are not reported for confidentiality reasons. New Zealand informed the ERT that:

(a) The low IEFs between 1990 and 1996 are related to the sequestration of carbon in the production of synthetic petrol. The production ceased in 1997;

(b) The high IEFs reflect the fact that the gas used in this subcategory comes from a gas field (Kapuni) with a high CO_2 content;

(c) The gas from the Kapuni gas field is treated before sending it to the distribution network and therefore the EF for end users is lower than that for manufacturing of solid fuels and other energy industries;

(d) The sequestration of carbon in synthetic petrol made up for the difference between EFs before 1997; and

(e) New Zealand also added that additional information on this subject will be included in the next NIR to clarify the apparent inconsistency and increase transparency.

24. The 1990–2002 values of the CO_2 IEF for gaseous fuels for petroleum refining are the highest of reporting Parties, except for the years 1996 and 2002. In its response to previous review stages and in the NIR, New Zealand indicates that a weighted-average CO_2 EF is estimated based on the fuels used. To improve transparency, the ERT recommends that New Zealand include the range of the carbon content of the fuels used in this category.

Road transportation – CO_2

25. Diesel consumption in 2002 was 12.7 per cent higher than the 2001 value. In its response to previous review stages, New Zealand related this situation to problems with the data on oil consumption collected from the petroleum companies and indicated that these figures were revised. The ERT encourages New Zealand in its undertaking to implement a tier 2 method to estimate CO_2 emissions from road transportation to support the figures produced from the tier 1 methodology, particularly considering the future availability of the detailed transport model that is being developed by the Ministry of Transport.

D. Non-key sources

Road transportation – N_2O

26. In 2003, New Zealand adopted default IPCC values for US vehicles as updated in the IPCC good practice guidance. These values, which were applied to all type of vehicles, replaced the single EF that had been used previously for both gasoline and diesel. To improve transparency it is recommended that New Zealand explain in future submissions why these values for uncontrolled vehicles are representative of the average fleet of the country.

27. The estimated N_2O emissions from road transportation relative to the corresponding CO_2 emissions are low compared to those of other Annex I Parties. The ratio [N_2O emission (Gg)x310/CO_2 emissions (Gg)]x100 for New Zealand is the fourth-lowest among reporting Parties. It is considerably lower than the values of those countries that were taken as references in the review of EFs by Hale & Twomey (2003). The ERT encourages New Zealand to fully exploit the detailed transport model that is being developed by the Ministry of Transport to implement a higher tier approach. The ERT also recommends that EFs be reviewed and updated as required to reflect fleet changes. New Zealand indicated that although the IPCC value is considered low, it was used in preference to EFs of other countries as these countries have had different vehicle emission standards. The Party also added that its first vehicle emission testing program will start in 2006.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

28. In 2002 CO_2 equivalent emissions from the Industrial Processes sector in New Zealand amounted to 3,535 Gg, or about 4.7 per cent of total national GHG emissions, and had increased by 20.5 per cent between 1990 and 2002. N_2O emissions from solvent and other product use were 48.4 Gg, which represented 0.1 per cent of total national emissions, and had increased by 16.4 per cent between 1990 and 2002. Emissions from the Metal Production category are dominant, accounting for 61.8 per cent of total emissions in the sector.

B. Key sources

Cement production – CO_2

29. The 2002 value of the CO_2 IEF (0.46 t/t) is among the lowest of reporting Parties and is lower than the IPCC default. In response to previous review stages New Zealand explained that the value is in line with information provided by industry. It also stated that the methods used to calculate CO_2 emissions are likely to be assessed in the near future, with a focus on clinker production. The ERT encourages the Party's intention to review its method of estimating CO_2 emissions from cement production. New Zealand informed the ERT that in the next NIR, the text on CO_2 emission estimates from cement production will be revised to avoid misinterpretations and increase transparency. The Party also indicated that:

(a) Emissions from cement production are already calculated based on clinker production;

(b) Since at least 1997, both major cement producers in New Zealand have used an emission factor of 0.54 CO_2 (t)/ clinker produced (t); and

(c) The IEF estimated in the CRF tables refers to cement production, which implies that this IEF is dependent on the particular blends of cement used and not that emissions are underestimated.

Iron and steel production – CO_2

30. The CO_2 IEF for steel production fluctuates between 1.83 and 2.09 t/t over the period 1990–2002 and these values are among the highest of reporting Parties. New Zealand has used a tier 1 method to estimate CO_2 emissions with a country-specific EF which is not described in the NIR. The ERT recommends New Zealand to provide more information about the methodology used.

Consumption of halocarbons and SF_6

31. New Zealand reports potential emissions of HFCs and PFCs as "not estimated" ("NE") or "not occurring" ("NO"). For 1998 notation keys are not used for PFCs. The ERT recommends New Zealand to estimate and report the potential emissions in order to improve the completeness and transparency of the inventory.

C. Non-key sources

Ammonia production – CO_2

32. CO_2 emissions are estimated using the tier 1a method based on gas consumption in the plant. Emissions are reported in the Energy sector under 1.A.2 Fuel Combustion. The ERT recommends reporting emissions from ammonia production in the Industrial Processes sector in accordance with the IPCC good practice guidance. New Zealand noted the ERT´s recommendation and indicated that ammonia production in New Zealand is used as a precursor to urea production, and that urea production will be reported in the Industrial Processes sector in future submissions.

Soda ash production and use – CO_2

33. AD and CO_2 emissions are reported as "NE". The ERT recommends New Zealand to estimate these emissions and to report them in future inventories. New Zealand stated that an explanation on the negligible quantities of soda ash that are produced in the country will be included in future NIR.

Solvent and other product use – CO_2, N_2O

34. New Zealand reports N_2O emissions from the use of anaesthesia and non-methane volatile organic compound (NMVOC) emissions from all source categories. CO_2 emissions and all other N_2O emissions are reported as "NE". The ERT recommends New Zealand to estimate these emissions and to report them in future inventories. New Zealand informed the ERT that these emissions are considered to be negligible in the country.

IV. AGRICULTURE

A. Sector overview

35. In 2002, emissions from the Agriculture sector amounted to 36,857 Gg CO_2 equivalent, or 49.2 per cent of total national emissions (without LUCF). CH_4 emissions from enteric fermentation, manure management, prescribed burning of savannas (a new source included in the 2002 inventory) and field burning of agricultural residues represented 87.9 per cent of total CH_4 emission. N_2O emissions from manure management, agricultural soils, prescribed burning of savannas and field burning of agricultural residues represented 96.6 per cent of total N_2O emissions.

36. New Zealand reports emission trends from 1990 to 2002. Total emissions from the Agriculture sector increased by 15.5 per cent from the base year (1990) to 2002, mostly due to the increases in CH_4 emissions from enteric fermentation (by 10.4 per cent) and in N_2O emissions from agricultural soils (by 27.6 per cent).

37. New Zealand identified five key sources based on level and trend assessment: CH_4 from enteric fermentation and manure management, and N_2O from agricultural soils (direct, indirect, and from animal production). CH_4 emissions from enteric fermentation represent 31.5 per cent of total CO_2 equivalent emissions in the level assessment, and this is the largest key source in New Zealand.

38. The QA/QC procedures and uncertainty for each source category are described in the NIR, and an example of the individual source category checklist (4.A CH_4 from Enteric Fermentation) is shown in annex 6 to illustrate QC procedures implemented in the preparation of the 2002 inventory. According to the Monte Carlo analysis, the uncertainty of the EF for N_2O from manure management systems (EF_3) has the greatest influence on total uncertainty because it accounted for 88 per cent of total N_2O emissions in 2001.

39. Recalculations have been made in the Agriculture sector because the data on provisional livestock populations for the previous year (2001) have been updated with the actual population, and emissions from a new source – prescribed burning of savannas – have been included since the 2003 submission. These recalculations have resulted in a slight increase in the estimates of emissions from the sector in the 2004 submission – by 0.01 and 1.97 per cent in the base year (1990) and 2001, respectively – compared to the 2003 submission.

40. Source-specific planned improvements have been made, being supported by an agricultural sector inventory research programme administered by the Ministry of Agriculture and Forestry, and assisted by two expert groups as follows:

(a) A national inter-institutional ruminant methane expert group was formed to identify the key strategic directions for research into the methane inventory and mitigation in order to maximize the benefit of the existing programmes and to develop a collaborative approach to improving the certainty of methane emissions.

(b) The work of N_2Onet, a collaborative research programme, will continue in order to better quantify N_2O EFs for New Zealand's pastoral agriculture.

B. Key sources

Enteric fermentation – CH_4

41. New Zealand reports in the NIR the time series of CH_4 EFs from 1990 to 2002. The ERT recommends that New Zealand include an explanation of the possible reason for the gradual increase in the EFs for dairy cattle and beef cattle. New Zealand indicated that an explicit explanation for increasing EFs has been included in previous NIRs, was omitted from the 2004 NIR and will be included in future NIRs. The country also added that:

(a) The reason for this increase is implicit in the NIR from the production time-series shown in the agriculture sector worksheets and Annex 3a;

(b) Increases in animal weight and animal performance (milk yield) require increased feed intake by the animal to meet energy demands;

(c) Increased feed intake produces increased emissions per animal; and

(d) Given worldwide increases in animal productivity, an increase in the EF should be expected.

Manure management – CH_4

42. The EFs for dairy cattle (0.889 kg CH_4/head/year) and non-dairy cattle (0.909 kg CH_4/head/year) were obtained using a country-specific methodology. These EFs are much lower than the IPCC default

values (which are 32 and 6 kg CH_4/head/year, respectively). New Zealand indicated that the IPCC defaults are not applicable to New Zealand conditions, e.g. in New Zealand dairy cows and beef animals are treated similarly yet the IPCC emission factor varies by a factor of 5. Although the NIR does not include an explanation for the estimated maximum CH_4 potential and EFs in table 6.3.1, references to research for the New Zealand values are provided in the NIR (Joblin and Waghorn, 1994) and copies of the referenced papers were provided to the ERT during the review. However, the ERT noted the emission rate from sheep faeces cited in the study should not be applied to cattle faeces, because they are different in quality. The ERT encourages New Zealand to further develop country-specific EFs for CH_4 emission from manure management, especially for dairy and non-dairy cattle. To improve transparency, the ERT recommends that New Zealand describe how the estimated maximum CH_4 potential and EFs for dairy and non-dairy cattle are derived.

43. It is not clear in the NIR or the CRF if any allocation of animal waste management systems (AWMS) was considered in the country-specific methodology for estimating CH_4 emissions. No data regarding the allocation of AWMS (per cent) were provided in the table for additional information in table 4.B(a) of the CRF, although those data are inevitably used at least for the estimate of N_2O emissions from manure management. The ERT recommends that New Zealand describe any information on AWMS in the country-specific methodology, and fill in the data of AWMS in the table for additional information in table 4.B(a).

Agricultural soils – N_2O

44. The IEF for animal production (EF_3 = 0.01 kg N_2O-N/kg nitrogen (N)) is country-specific and is shown in CRF table 4.D and on page 78 of the NIR. This value is half the IPCC default value; however, the NIR reports on page 75 that the IPCC default value for EF_3 was used. New Zealand is requested to explain this inconsistency, to describe why this country-specific value of 0.01 kg N_2O-N/kg N is appropriate, and to explain the country-specific methodology by which it is derived. The ERT acknowledges that although the NIR does not include an explanation on the methodology to derive the country-specific EF_3, references to research for the New Zealand values are provided in the NIR (Kelliher et al., 2003) and a copy of the referenced paper was provided to the ERT during the review. New Zealand, informed the ERT that:

(a) The reference to EF_3 being the IPCC default value (page 75) is located in the manure management category "6.3 Manure Management (CRF 4.B)" and not in the "Agricultural soils" category;

(b) The EF_3 values for all AWMS apart from pasture range and paddock ($EF3_{PRP}$) are the IPCC default;

(c) The corresponding text will be edited in future NIRs to remove this source of confusion; and

(d) More of the scientific methodology used to derive country-specific EFs will be included in future NIRs.

45. The value of $Frac_{LEACH}$ in CRF table 4.D (0.07) is much lower than the IPCC default value (0.3). The NIR reports that this value is estimated by an analysis developed by a nutrient budget model called OVERSEER®. New Zealand indicated that the country-specific value reflects national circumstances as it was developed using four New Zealand multi-year animal grazing field trials. A reference to the supporting documentation (Thomas et al., 2004) is provided in the NIR and a copy of the referenced paper was provided to the ERT during the review. To improve transparency, the ERT recommends that New Zealand describe in the NIR how this analysis is derived and how this country-specific value reflects national circumstances.

46. The IPCC default value of 0.0125 kg N_2O-N/kg N is used for the EF for chemical fertilizers, while this source category is one of the key sources, and the amount of fertilizers used increases year by year. New Zealand is encouraged to explore the possibility of developing country-specific factors. New Zealand noted that research on this subject is in progress but results have been thus far variable.

C. Non-key sources

Manure management – N_2O

47. The estimated N excretion for dairy cattle and non-diary cattle is 113.9 kg N/head/yr and 71.9 kg N/head/yr, respectively, using the country-specific model. This is much higher than the IPCC default value (80 kg N/head/yr and 60 kg N/head/yr, respectively, for Oceania). New Zealand included in the NIR a brief explanation of how the country-specific Nex values are generated (NIR page 74) and informed the ERT that differences with the IPCC default values are due to the feed intake of the New Zealand herd and N content of the country's pastures. The ERT requests New Zealand to include additional information in future NIRs to clarify the process and EFs.

48. For dairy cattle, New Zealand has used country-specific data for allocation to AWMS, and the only information provided in the NIR is that 89 per cent of manure is allocated to pasture, range and paddock (Haynes and Williams (1993)). The ERT recommends that New Zealand describe the reason why country-specific data are used only for dairy cattle. New Zealand informed the ERT that country-specific data are used only for dairy cattle because the IPCC defaults for other species are correct for New Zealand. The Party also indicated that it is estimated that 11 percent of waste from dairy animals is deposited in dairy sheds and that all other species comprise less than 5 percent of this non-key category.

49. In AWMS, 97 per cent of poultry manure is allocated to Other. New Zealand is encouraged to assess how poultry manure is treated and to estimate the N_2O EF for each treatment in its future submissions. New Zealand indicated that poultry accounts for 0.81 per cent of emissions in this minor non–key source category and thus, consistent with focussing on key categories, the Party does not anticipate that resources will be used to estimate a country-specific EF for poultry.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

50. In 2002 New Zealand's LUCF sector was a net sink, offsetting 24,076 Gg of CO_2 equivalent, or 32.2 per cent of total national GHG emissions (the same proportion as in the year 2001). As previous reviews have observed, the emissions of New Zealand are characterized by inter-annual variation. New Zealand has attributed this variation mainly to socio-economic reasons.

51. Country-specific methods that also utilize the IPCC default values have been used. The NIR provides information on national data and a description of the country-specific methods and the EFs used, and contains worksheets which are consistent with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Information on a carbon monitoring system being developed and relevant research programmes is provided in annex 3 to the NIR. This research aims to generate data that will improve the completeness and quality of the GHG estimates in future submissions.

52. Recalculated estimates for the whole time series have been provided and explanatory information is given in CRF table 8(b). The recalculations have been done because new information has become available on the proportions of area by National Exotic Forest Description regime. The resulting differences in the emissions estimates for the whole LUCF category (net) in the years 1990–2001 compared to the estimates in the 2003 submission are for most years less than 2 per cent, and the largest is 4.3 per cent.

B. Sink and source categories

Other categories

53. New Zealand has not estimated CO_2 emissions in source category 5.C. Emissions and removals are reported as "NO" and "NE". Only CO_2 emissions due to liming of agricultural soils are reported in CRF table 5.D and the source category Other is reported as "NE". Country-specific AD and the IPCC default method have been used and are described in the submission. The ERT suggested that New Zealand use default values to give an estimate for the carbon fluxes in the subcategories which are reported as "NE". In response to this suggestion, during the review, New Zealand informed the ERT that this will be reconsidered in future submissions.

VI. WASTE

A. Sector overview

54. In 2002 the Waste sector contributed 3.2 per cent of total national emissions. Emissions from waste in 2002 were 17.7 per cent below the 1990 level. The CRF includes CH_4 emissions from managed solid waste disposal on land as a key source, and CH_4 emissions from waste-water handling systems and N_2O emissions from waste-water handling systems as non-key sources.

55. The methodologies used in the Waste sector are both IPCC tier 1 and tier 2 methods with country-specific AD and EFs for solid waste disposal. Emissions from managed waste disposal on land from 1990 to 2001 have been recalculated on the basis of improved population data. The tier 1 and tier 2 approaches are used for verification and QA/QC.

B. Key sources

Solid waste disposal on land – CH_4

56. Ninety per cent of waste disposal sites are managed sites; others are uncategorized. Emissions of CH_4 from solid waste disposal on land account for 86.3 per cent of total emissions from the Waste sector. Emissions from unmanaged solid waste disposal sites are not estimated. The ERT recommends that New Zealand make efforts to estimate these emissions. New Zealand informed the ERT that data on the uncategorized waste disposal sites are unavailable, and that an investigation will be undertaken and the results will be reported in future submissions.

57. The IPCC tier 1 and tier 2 methods have been used to calculate emissions from solid waste. The NIR reports that the improved population data from 1990 to 2001 have been used to recalculate emissions. However, it is not clear if the municipal solid waste (MSW) generation rate has also been recalculated since the MSW generation rate for year 2002 is based on 1995 data. New Zealand indicated that the MSW generation rate was not recalculated in the 2001 inventory, and that it will be updated for the 2002 inventory.

58. The methane recovery rate has been estimated based on information on settlements with populations over 20,000 in New Zealand. To improve transparency, the ERT recommends that New Zealand include more information about the methods used to estimate recovered CH_4 in its future submissions.

59. Emissions from solid waste disposed on land for the years 1990–2001 have been recalculated on the basis of improved population data. The uncertainty is not estimated in the current inventory (the previous estimate was ±35 per cent). Gross annual methane generation is verified using tier 1 and tier 2 methods in the inventory for the year 2002. The tier 1 QC process has been employed in the submission for the year 2002.

C. Non-key sources

Waste-water handling – CH_4 and N_2O

60. The figures for CH_4 emissions from waste water in table 6 are not consistent with those reported in table 6.B. It is recommend that this information be reconciled. There are no recalculations in the estimates for 2002, although the improved population data could be used to recalculate the N_2O from human sewage in New Zealand's next submission.

Waste incineration – CO_2, CH_4 and N_2O

61. Because the amount of emissions from waste incineration was considered to be negligible, the notation key "NE" is used in this source category. The ERT encourages New Zealand to make efforts to estimate and report these emissions. New Zealand reminded the ERT that the rationale for considering these emissions as negligible is that, according to the Party, the only incineration that occurs is for small specific waste streams.

ANNEX 1: MATERIALS USED DURING THE REVIEW

A. Support materials used during the review

2003 and 2004 Inventory submissions of New Zealand. 2004 submission including a set of CRF tables for 1990–2002 and an NIR.

UNFCCC secretariat (2004). "Report of the individual review of the greenhouse gas inventory of New Zealand submitted in the year 2003 (Centralized review)". FCCC/WEB/IRI(3)/2003/ (available on the secretariat web site <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/pdf/nzlrep03.pdf>).

UNFCCC secretariat. "2004 Status report for New Zealand " (available on the secretariat web site <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/nzl04.pdf>).

UNFCCC secretariat. "Synthesis and assessment report of the greenhouse gas inventories submitted in 2004. Part I": FCCC/WEB/SAI/2004 (available on the secretariat web site <http://unfccc.int/resource/webdocs/sai/2004.pdf>) and Part II – the section on *New Zealand* (unpublished).

UNFCCC secretariat. Review findings for New Zealand (unpublished).

New Zealand's comments on the draft "Synthesis and assessment report of the greenhouse gas inventories submitted in 2004" (unpublished).

UNFCCC secretariat. "Handbook for review of national GHG inventories". Draft 2004 (unpublished).

UNFCCC secretariat. "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories", "Part II: UNFCCC reporting guidelines on national communications" and "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention." FCCC/CP/1999/7 (available on the secretariat web site <http://www.unfccc.int/resource/docs/cop5/07.pdf>).

UNFCCC secretariat. "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC Reporting guidelines on annual inventories" and "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention." FCCC/CP/2002/8 (available on the secretariat web site <http://unfccc.int/resource/docs/cop8/08.pdf>).

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B. Additional materials

Responses to questions during the review were received from Mr. Len Brown (New Zealand Climate Change Office) including additional material on the methodology and assumptions used.

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Clark, H. (2004). Enteric methane emissions from New Zealand ruminants 1990 and 2002 calculated using an IPCC Tier 2 approach, AgResearch Ltd, 19 pp., May.

Clarkson, T., B. Lloyd, R. SriRamaratnam and L. Brown (2004). Changes in energy sector emission factors resulting from peer review of the Hale and Twomey review of energy sector EFs: Report of the peer review panel, New Zealand, 27 January.

Hale & Twomey Ltd (2003). Review of energy sector greenhouse gas emission factors. Report to Energy Modelling and Statistics Unit, Ministry of Economic Development, New Zealand.

Haynes, R.J. and P.H. Williams (1993). Nutrient cycling and soil fertility in the grazed pasture ecosystem, *Advances in Agronomy*, 49: 119–198.

Joblin, K.N. and G.C. Waghorn (1994). Estimates of methane production from animal waste deposited in New Zealand pastures. AgResearch Grasslands, New Zealand.

Kelliher, F.M., S.F. Ledgrand, H. Clark, A.S. Walcroft, M. Buchan and R.R. Sherlock (2003). Revised nitrous oxide emissions from New Zealand agriculture soils: 1990–2001. Report prepared for the Ministry of Agriculture and Forestry of New Zealand, 63 pp.

SCS Wetherill Environmental (2002). National greenhouse gas inventory from the Waste sector 1990–2020. A report for the Ministry for the Environment, Wellington, New Zealand.

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Ulyatt, M.J., K. Betteridge, J. Knapp and R.L. Baldwin (1991). Methane production by New Zealand ruminants. Global change: Impacts on agriculture and forestry, *Proc. of the Royal Society of New Zealand*, 89–93, August.

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