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Report of the individual review of the greenhouse gas inventory of New Zealand submitted in 2005*

* In the symbol for this document, 2005 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

I. Overview

A. Introduction

1. This report covers the centralized review of the 2005 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. The review took place from 17 to 22 October 2005 in Bonn, Germany, and was conducted by the following team of nominated experts from the roster of experts: Generalists – Mr. Art Jaques (Canada) and Ms. Inga Konstantinaviciute (Lithuania); Energy – Mr. Matej Gasperic (Slovenia), Ms. Sophia Mylona (Norway) and Ms. Roberta Quadrelli (International Energy Agency (IEA)); Industrial Processes – Ms. Marisol Bacong (Philippines), Mr. Domenico Gaudioso (Italy) and Ms. Birna Hallsdottir (Iceland); Agriculture – Mr. Steen Gyldenkaerne (Denmark) and Mr. Vlad Trusca (Romania); Land Use, Land-use Change and Forestry (LULUCF) – Mr. Aquiles Neuenschwander Alvarado (Chile) and Mr. Nijavalli H. Ravindranath (India); Waste – Mr. Eduardo Calvo (Peru) and Ms. Sirintornthep Towprayoon (Thailand). Ms. Sirintornthep Towprayoon and Mr. Art Jaques were the lead reviewers. The review was coordinated by Mr. Matthew Dudley (UNFCCC secretariat).

2. In accordance with the "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention", 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 2005 submission, New Zealand submitted a complete set of common reporting format (CRF) tables for the years 1990–2003 and a national inventory report (NIR). Where needed, the expert review team (ERT) also used previous years' submissions, additional information provided during the review, and other information. The full list of materials used during the review is provided in the annex to this report.

4. In 2003, the most important GHG in New Zealand was carbon dioxide (CO_2), contributing 46.1 per cent to total[1] national GHG emissions expressed in CO_2 equivalent, followed by methane (CH_4), 35.4 per cent, and nitrous oxide (N_2O), 17.9 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) taken together contributed 0.7 per cent of the overall GHG emissions in the country. The Agriculture sector accounted for 49.4 per cent of the total GHG emissions, followed by the Energy (42.9 per cent), Industrial Processes (5.3 per cent), Waste (2.3 per cent), and Solvent and Other Product Use (0.1 per cent) sectors. Total GHG emissions amounted to 75,345.29 Gg CO_2 equivalent and had increased by 22.5 per cent from 1990 to 2003. Total GHG emissions including LULUCF amounted to 52,479.58 Gg CO_2 equivalent and increased by 30.7 per cent over the same period. Over the period 1990–2003, CO_2 emissions increased by 37.1 per cent, CH_4 by 5.4 per cent, and N_2O by 29.8 per cent. PFCs emissions decreased by 83.5 per cent and SF_6 increased by 0.4 per cent. Emissions of HFCs increased significantly, from 0 Gg in 1990 to 403.96 Gg in 2003. Increases in CH_4 emissions, primarily from fugitives, and coal mining, were mostly offset by declining emissions from waste-water handling.

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

C. Key categories

5. New Zealand has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2005 submission. The key category analyses performed by the Party and the secretariat[2] produced similar results. In order to better reflect national circumstances, fugitive emissions from geothermal energy have been separated from the category Fugitive Emissions from Oil and Gas.

D. Main findings

6. New Zealand's inventory submission, in general, adheres to the UNFCCC "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the revised UNFCCC reporting guidelines). A full set of CRF tables for the years 1990–2003 is provided.

7. It was clear to the ERT that New Zealand is focusing on improvements to categories as time and resources permit. The NIR is well laid out and follows the structure of the revised UNFCCC reporting guidelines, with a few exceptions. The ERT noted that the NIR could be improved with additional explanations on data and choices of methodologies, in particular where country-specific data are used. Additional findings from the individual sectors are addressed in the relevant sector sections of this report below.

E. Cross-cutting topics

1. Completeness

8. Overall, the New Zealand inventory is complete. It covers all years for the whole of New Zealand and for the six mandatory greenhouse gases. The inventory also includes an NIR, a complete set of CRF tables, and estimates of emissions for all major sources. In addition, the inventory contains time series estimates from 1990–2003 of the indirect greenhouse gases (nitrogen oxide (NOx), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs), and sulphur dioxide (SO_2)). The NIR identifies known sources that are missing and in most cases provides detailed explanations. As a result of gaps being identified in the previous (2004) submission, New Zealand has in this year's submission provided potential emissions from HFCs and PFCs from the consumption of halocarbons, as well as emissions of SF_6 for all years (1990–2003) and emissions of CO and NOx from aluminium production. New Zealand has provided the new LULUCF reporting tables as required by decision 13/CP.9, for all years 1990–2003. Emissions and removals from the LULUCF categories Forest Land Remaining Forest Land for planted forests and Grassland Converted to Forest Land have been included for all years 1990–2003. The NIR notes that data for the other LULUCF categories are not available for the period 1990–1996 and states that this will be corrected with the implementation of the New Zealand Carbon Accounting System (NZCAS).

2. Transparency

9. In general the inventory is transparent. In line with the revised UNFCCC reporting guidelines, the NIR contains a general description of institutional arrangements, quality assurance/quality control (QA/QC) procedures, uncertainty assessments, estimation methods, key category analyses, references to

[2] The secretariat identified, for each individual Party, those source categories which are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Key categories 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 category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

key category estimation methods, a summary of trends in emissions by gas, recalculations, and explanations of the minor differences between the reference and sectoral approaches. In addition, a quantitative tier 1 assessment of uncertainties is provided, along with a description of tier 1 and tier 2 QC checks relating to completeness.

3. Recalculations and time-series consistency

10. The ERT noted that New Zealand reports recalculated estimates and provides explanatory information for the years 1990–2002. The rationale for these recalculations is provided in some detail in the NIR and overall they appear to be well justified. The overall impact on the trends from the recalculations is negligible. The total effect of the recalculations for the base year (1990) is a decrease of 0.03 per cent in the estimates of CO_2 equivalent emissions (excluding LULUCF), and for 2002 a decrease of 2.21 per cent. SF_6 emissions from the Industrial Processes sector in 2002 were 2.59 per cent higher in the 2004 submission than in the 2005 submission. However, SF_6 emissions from the Industrial Processes sector in 1990 are calculated to be the same in the 2005 submission as in that for 2004, whereas table 8(a) of the CRF reports an increase of 4.03 per cent between the submissions. It should be noted that New Zealand has made use of the CRF Reporter software, which calculated the effect of the recalculations incorrectly due to a bug. The changes reported here reflect the correct values.

11. In general the time series are consistent. The calculation of Cement Production – CO_2 (a key category) uses a tier 1 methodology for the period 1990–1996 and a tier 2 methodology for the period 1997–2003. The ERT recommends that a consistent tier 2 methodology be applied for the entire time-series, in line with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance).

4. Uncertainties

12. The NIR states that an 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 for 1990 and 2003. Overall, the uncertainty for New Zealand's inventory (emissions and removals) is estimated to be +/–16.9 per cent, while the trend uncertainty is estimated to be +/–4.9 per cent. Some uncertainty values appear to be low, particularly in the Waste sector. Without additional information, the ERT was not able to assess these values.

5. Verification and quality assurance/quality control approaches

13. A QA/QC plan was developed in 2004. The NIR contains information on procedures implemented and on future improvements to the QA/QC system. Tier 1 QC checks for key categories and a selection of non-key categories have been completed on the 2003 data. A review of New Zealand's QA/QC programme was undertaken in late 2004 and the NIR indicates that the Party is working to implement the recommendations from that review as time and resources permit.

6. Follow-up to previous reviews

14. In response to comments made in the 2004 centralized review report, the NIR contains more explanatory information to aid transparency. In addition, New Zealand indicated in its 2004 NIR that it was planning to report on additional categories and provide more information on its QA/QC programme, both of which have been done, thereby improving the NIR.

F. Areas for further improvement

1. Identified by the Party

15. The NIR identifies several areas for improvement. New Zealand will undertake additional tier 2 checks of key categories, as resources permit, and will investigate the application or development of an inventory information system in order to improve the inventory preparation processes.

2. Identified by the ERT

16. New Zealand should provide additional explanations on data used and choice of methodologies, in particular where country-specific data are used.

II. Energy

A. Sector overview

17. In 2003, the Energy sector in New Zealand represented 42.9 per cent of total national GHG emissions (without LULUCF). This makes it the second largest contributor to the national GHG total after Agriculture. Its relatively low contribution to the total reflects the fact that national electricity needs are met primarily by hydroelectric power generation. Emissions from the Energy sector increased by 37.0 per cent between 1990 and 2003, primarily because of increases in the categories Road Transportation and Electricity and Heat Production. The 4.7 per cent increase observed between 2002 and 2003 is attributed by the Party to drier weather conditions, resulting in a greater reliance on thermal electricity production. The largest source in the Energy sector is Road Transportation, which in 2003 accounted for 16.1 per cent of total national GHG emissions. The key category analysis performed by the secretariat revealed that the Energy sector includes seven key source categories (among which Fugitive Emissions: Coal Mining and Handling – CH_4 is not identified as a key category in the Party's analysis).

18. Overall, emissions from the Energy sector for the period 1990–2003 are reported and documented in a complete and transparent manner, both in the NIR and in the CRF tables. Some exceptions concern: missing disaggregation of activity data (AD) in Manufacturing Industries and Construction (the subsector is also affected by some data being confidential); missing estimates of AD for use of energy by the military; and a lack of discussion in the NIR on the Railways subsector. The ERT recommends that New Zealand address the missing elements and, if possible, provide a more thorough description of the issues involving confidentiality. To improve the overall transparency of the inventory, the ERT reiterates the recommendation of the previous (2004) review that the Party should provide a complete national energy balance in the NIR.

19. The methodology applied in the estimation of emissions for all sources of the Energy sector is tier 1. The EFs used are either IPCC default or country-specific and their validity was reviewed extensively in 2003 by Hale and Twomey Ltd. To improve transparency, the ERT recommends that the Party describe clearly the reasons why several tier 2 EFs for non-CO_2 gases are considered more appropriate than tier 1 EFs.

20. Recalculations are provided for several sources in the Energy sector (CRF table 8) along with a discussion in the NIR. The Party mainly reports that the changes in EFs are due to recommendations by Hale and Twomey (2003) and that the changes in AD are due to previous misreporting of liquid fuels. The latter recalculation affects especially the Transport sector for 2002, when CO_2 emissions as now reported are 4.8 per cent lower than in the 2004 submission.

B. Reference and sectoral approaches

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

21. Reference and sectoral approach estimates of CO_2 emissions from fuel combustion are provided for all years. For 2003, the difference in CO_2 emissions is less than 0.4 per cent. However, for all categories of fuels the differences in energy consumption are larger (10 per cent for liquid fuels, 23 per cent for solid fuels, 24 per cent for gaseous fuels). The ERT recommends that the Party provide further documentation on this issue. For example, stock changes for several solid fuels are reported as "not estimated" ("NE") in the CRF tables. The Party is encouraged to verify that the large quantities of coal used in the steel industry (and reported under the Industrial Processes sector) are not reported in the apparent consumption of the reference approach.

2. International bunker fuels

22. Data on fuel consumption in international transportation are obtained from the databases of the Ministry of Economic Development (MED) on the basis of information from oil companies, while fuel consumption for national transportation is obtained from Statistics New Zealand. As recommended by the 2004 review report, New Zealand is requested to indicate whether the allocation of fuel consumption to domestic and international transportation is in accordance with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines).

3. Feedstocks and non-energy use of fuels

23. The ERT recommends that the Party use consistent notation keys in table 1.A(b), where only bitumen and natural gas are reported as feedstock/non energy use, and table 1.A(d), where it is stated that lubricants, other oil and petroleum coke are aggregated under bitumen. It is also recommended that the Party verify that in general AD in the sectoral approach only include the quantities used for energy purposes: for example, there are inconsistencies between the AD and CO_2 emissions for gaseous fuels in Energy Industries for the period 1990–1994, which indicates that non-energy use of fuel is likely to have been included in the AD.

C. Key categories

1. Stationary combustion: Gas – CO_2 and CH_4

24. According to the NIR, the Kapuni field produces gas with a particularly high CO_2 content, and the largest fraction of this gas is used both as a feedstock and as a fuel in the production of methanol. Given that there are still some issues related to confidentiality, and hence full disclosure, transparency would be improved by including a discussion on the gas from Methanol-LTS (low temperature separator), in operation between 1990 and 1994, which had a CO_2 emission factor (EF) reported to be comparable to that of gas from the Kapuni field (84 t CO_2/TJ).

2. Mobile combustion: Road transportation – CO_2, CH_4 and N_2O

25. With regard to road transportation, the Party has developed a tier 2 methodology (using the Ministry of Transport Vehicle Fleet Model) to complement the information reported in the CRF, which follows a default tier 1 methodology. The ERT commends this effort and encourages further steps in the direction of the full implementation of the model.

26. For CH_4 and N_2O, the Party is recommended to improve transparency in the documentation by explaining all the assumptions used and by clarifying the relationship of the vehicle fleet model data with the emissions reported in the national inventory. The Party is further encouraged to develop country-specific EFs based on available data on car fleet composition, so that, for example, catalyst cars

be taken into account. For many Parties, this is a key category, especially after the introduction of catalyst technology into the car fleet.

3. Fugitive emissions: Oil and gas – CO_2

27. Fugitive emissions of CO_2 from oil and gas operations are reported only for Transport/ Transmission and Refining/Storage. As oil and gas production do take place in New Zealand, it is recommended that the Party make efforts to estimate all associated emissions and provide more transparent documentation of this key category.

III. Industrial Processes and Solvent and Other Product Use

A. Sector overview

28. In 2003, total GHG emissions from the Industrial Processes sector in New Zealand amounted to 4,014.19 Gg CO_2 equivalent, or 5.3 per cent of total national emissions. The major source of emissions in 2003 was Metal Production, contributing 58.3 per cent of total Industrial Processes emissions. Mineral Products industry, Chemical Industry, and Consumption of Halocarbons and SF_6 contributed 15.9 per cent, 15.3 per cent and 10.5 per cent, respectively. Among the six GHGs, CO_2 emissions account for the largest share, at 86.4 per cent. The Party reports "0" N_2O emissions in 2003. Emissions from the Industrial Processes sector in 2003 had increased by 25.0 per cent from the 1990 level. Annual emissions have fluctuated since 1990, with low peaks in 1994 and 1997. From 2000 onwards, emissions show an increasing trend. The change in CO_2 emissions between the base year (1990) and 2003 is the greatest. The corresponding change in Mineral Production (+42.5 per cent) was higher than that for Chemical Industry (34.2 per cent) and metal production (26.4 per cent).

29. All source categories for the Industrial Processes sector are reported, either with data or with the appropriate notations keys.

30. Recalculations have been performed for CO_2, CH_4, HFCs and SF_6. CO_2 emissions in Chemical Industry have been recalculated because of the reallocation of urea production emissions to the Industrial Processes sector, and in Metal Industry they have been recalculated because of changes in methodology and data corrections in Iron and Steel Production. CH_4 emissions have been recalculated in Chemical Industry because of both the availability of methanol production data for the entire time series (1990–2003) and the reallocation of urea production in the Industrial Processes sector. SF_6 emissions have been recalculated due to the correction of SF_6 emissions for the years 1990–1998. The data have been corrected by interpolating values for 1998 and 1999 using the average SF_6 values for the periods 1994–1997 and 2000–2003.

31. The uncertainties associated with CO_2 emissions reported by New Zealand are lower than those associated with non-CO_2 emissions. The CO_2 emissions supplied by the companies are considered to be accurate to ±5 per cent. The uncertainty is applicable in all subcategories. Uncertainties in non-CO_2 EFs are higher than the uncertainties in the AD provided by the companies engaged in mineral, metal and chemical production. Uncertainties in the calculation of HFCs and PFCs are higher for the AD collected on aerosol imports (±50 per cent), foam production (±50 per cent), factory-charged refrigeration/air conditioning units (±60 per cent) and medical use (50 per cent).

32. CO_2 emissions from mineral, metal, and chemical production and data on consumption of halocarbons and SF_6 have undergone tier 1 QC checks. Activity data for non-CO_2 were cross-referenced between companies and industry associations. The Ministry for the Environment commissioned QA reviews of individual sectors and categories. A peer review on synthetic greenhouse gases (substitutes for ozone depleting substances (ODS)) was undertaken in August 2004.

B. Key categories

1. Cement production – CO_2

33. Cement Production – CO_2 is a key category on both level and trend assessment. Emissions from 1997 onwards have been calculated using the tier 2 method. Clinker production data were collected from the two operating plants. Emissions from non-recycled cement kiln dust have been obtained only for one plant. For the other plant, the ERT recommends that the Party use the default correction factor. From 1990 to 1996, emissions have been estimated using the tier 1 method based on cement production. New Zealand notes in the NIR that it will attempt to obtain data on clinker use in order to develop estimates using the same methodology, consistent with the IPCC good practice guidance, for the entire time series. The ERT encourages the Party to obtain these data and provide a consistent time series of estimates.

2. Iron and steel production

34. Iron and Steel Production – CO_2 is a key category on both level and trend assessment. New Zealand uses a tier 2 approach based on tracking carbon from the production process, but emissions from pig iron and steel production are not reported separately, as all of the pig iron is transformed into steel by the steel plant. Furthermore, due to a lack of industry data, carbon content in iron and in scrap input is not reported. For the years 1990–1999, emissions from an electric arc furnace are calculated using a tier 1 approach by multiplying steel production by an EF which is based on the average implied emission factor (IEF) for the plant for the years 2000–2004 (around 0.1 t CO_2/t steel).

35. Since this is a key category, the Party should make an effort to apply the tier 2 approach consistently throughout the time series. The Party is encouraged to collect the corresponding AD from the two steel producers, such as reducing agents, carbon (C) stored and electrodes, and provide in the NIR the assumptions used and an account of how the emissions were derived.

3. Aluminium production – CO_2

36. Aluminium Production – CO_2 is a key category on the level assessment. Data on production and CO_2 emissions are supplied by New Zealand's sole aluminium smelter. The carbon content of consumed anodes is multiplied by 3.812 to convert C to CO_2 (as compared with 3.666 if the standard atomic weights ratio of 44/12 is used). The NIR states that this number is specific to Comalco smelters to take into account some other process losses. Given the fact that the IEF (in t CO_2 per t aluminium) is within the range of the IPCC default EFs, the ERT is satisfied with the emission estimates provided.

4. Aluminium production – PFCs

37. Aluminium Production – PFCs is identified as a key category on the trend assessment. Emissions are estimated using the tier 2 slope method. Data on the anode effect frequency and duration are logged by the sole producer. These data are then combined with the default coefficients for centre worked prebaked anode and the amount of metal produced to provide an estimate of tetrafluoromethane (CF_4) and hexafluoroethane (C_2F_6) emissions. The general downward trend for total PFCs – from 515.60 Gg CO_2 equivalent in 1990 to 80.70 Gg CO_2 equivalent in 2003 – is explained in the NIR. Total emissions of PFCs (plus CF_4 and C_2F_6) decreased by 65 per cent between 1993 and 1994. The ERT recommends that New Zealand provide additional information on the derivation of the emission estimates to improve transparency.

5. Ammonia/urea production

38. CO_2 emissions from ammonia and urea production are identified as a key category with respect to qualitative criteria, due to the large increase in the use of nitrogenous fertilizer in agriculture.

Emissions from ammonia production are reported under urea production, since all ammonia production is used for urea production. Emissions are estimated on the basis of the amount of gas supplied to the plant. The sole operating plant provides AD. CO_2 emissions are calculated from the carbon content of the gas, based on the assumption that all carbon in the gas is eventually released. Emissions from ammonia/urea production have been reallocated from the Energy sector to the Industrial Processes sector based on a recommendation from the previous (2004) centralized review. In accordance with the Revised 1996 IPCC Guidelines it is now assumed that the carbon in urea is eventually released after it is applied to the land. The ERT recommends that New Zealand report these emissions under Ammonia Production, since the emissions originate from that production. Although the CO_2 can be used to produce urea, the carbon will be stored only for a short time.

6. Consumption of halocarbons and SF_6

39. Emissions of HFCs and PFCs from the use of substitutes of ODS are a key category on both level and trend assessment. A number of end-uses have been considered (stationary refrigeration and air conditioning, mobile air conditioning, foam blowing, fire extinguishers, aerosol/metered dose inhalers, and electrical equipment). The submission is complete, since it includes all major end-uses and substances. For HFCs and PFCs, the Party has used the IPCC tier 2 approach, which takes account of the time lag between consumption and emissions of the chemicals. Potential emissions for HFCs and PFCs have been calculated using the tier 1a method both because disaggregated data for the years 1999–2001 for refrigeration are lacking and because potential emissions from refrigeration could not be calculated. As a result, the total potential emissions for consumption of halocarbons for those years are underestimated. Actual emissions of SF_6 from electrical switchgears have been calculated using the tier 3 methodology for the majority of emissions, on the basis of information provided by one firm, and a tier 2 approach for the rest of the industry. Potential emissions of SF_6 are also included in the 2003 inventory.

40. The use of disaggregated data from trade statistics, if they are available, makes it possible to fill in the gaps in end-uses and check the estimates based on consumption data. In order to improve the quality of reporting, HFC emissions from refrigeration and air conditioning equipment, for substances other than those reported, should be reported as not occurring ("NO") rather than as not applicable ("NA"). Emissions from mobile air conditioning are reported as included elsewhere ("IE"); emissions from this source category are reported in 1.B.2.c Venting. The ERT notes that this was caused by an error in translation between the CRF Reporter software and the CRF Excel spreadsheets produced from the software.

IV. Agriculture

A. Sector overview

41. In 2003, emissions from the Agriculture sector in New Zealand amounted to 37,203.2 Gg equivalent, or about 50 per cent of total national GHG emissions (excluding LULUCF). The Agriculture sector is the most important source of emissions in the country. During the period 1990–2003, emissions from the sector increased by 15.6 per cent, mainly due to increases in CH_4 emissions from enteric fermentation and N_2O emissions from agricultural soils. The submission is complete in terms of gases, sources and years covered; all the additional information tables and documentation boxes in the CRF are filled in; and the notation keys are used in all the CRF tables over the entire time series. The Party has included estimates for Enteric Fermentation – CH_4, Manure Management – CH_4 and N_2O, Agricultural Soils – N_2O, Prescribed Burning of Savannas – CH_4 and N_2O, and Field Burning of Agricultural Residues – CH_4 and N_2O, as recommended by the Revised 1996 IPCC Guidelines. Since rice cultivation does not occur in New Zealand, the notation key "NO" has been used. Buffalo, camels, llamas, mules and asses populations are reported in the CRF tables as "NE" and the CRF documentation box explains

that, on the basis of the last agriculture census, they make up less than 0.05 per cent of the total livestock in New Zealand.

42. The information presented in the CRF tables and the NIR is consistent. In addition, the CRF tables show consistency over time as the same methodologies, EFs and sources of AD have been used over the entire time series. Three-year average AD are used for all livestock population characterization in accordance with the Revised 1996 IPCC Guidelines. The Party uses enhanced livestock characterisation according to the IPCC good practice guidance in calculating the emissions. The ERT suggests that New Zealand report additional information on livestock characterization in the NIR.

43. The methodologies used are consistent with the Revised 1996 IPCC Guidelines and the IPCC good practice guidance, but more detailed information is needed in the NIR to facilitate the understanding of some methodological approaches (e.g. regarding manure management and crop residues in agricultural soils). The AD used are based on census or survey information taken from the national statistics office of New Zealand and presented in detail in annex 8 of the NIR.

44. The Party has performed a key category analysis, which is entirely consistent for the Agriculture sector with the one performed by the secretariat. Uncertainty estimates, time-series consistency, QA/QC and verification, recalculations, and planned improvement activities are presented in the introductory chapter of the NIR and for all the sources in the Agriculture sector using the required structure for the NIR. A list of general references is included at the end of the NIR together with a list of references for the Agriculture sector. No information on sectoral archiving procedures is presented. The Party is encouraged to improve the transparency of the NIR by providing more comprehensive information on the methodologies and EFs used in the calculation of emissions estimates.

45. It is acknowledged that New Zealand will continue its work on estimating the CH_4 and N_2O emissions and EFs within the framework of N_ZONET.

46. Recalculations have been done for the base year (1990) for the Agriculture sector. This has resulted in increases in the estimates of CH_4 emissions from the sector in 1990 by 0.73 per cent, and in N_2O emissions by 1.23 per cent.

B. Key categories

1. Enteric fermentation – CH_4

47. New Zealand has estimated CH_4 from enteric fermentation according to a country-specific model based on Australian feeding standards. The model aggregates the total dry matter intake for two groups of cattle: dairy cattle and beef cattle. Dairy cattle are defined as all dairy cows which have calved and all heifer calves. The same methodology is used for beef cattle, where all bull calves from milking cows are included. In 2003 the average IEF for CH_4 is estimated to be 79.1 kg CH_4/animal/yr for the group "dairy cattle". The same IEF is applied for beef cattle. For purposes of transparency and comparability, the Party is recommended to report additional details of enhanced livestock characterization and report the IEF for all subgroups in the NIR.

2. Manure management – CH_4

48. There are several inconsistencies in the Party's existing calculation method for Manure Management. The Party has stated, in response to questions from the ERT on this topic, that a new tier 2 methodology for Manure Management will be implemented for the 2006 submission.

3. Agricultural soils – direct N_2O emissions

49. The amount of fertilizer consumed in New Zealand has increased fivefold since 1990, while the area of annual crops has remained about the same. In responding to questions posed by the ERT on the possibility that this increased fertilization may have increased the nitrogen (N) content in the grass and led to a higher N intake by grazing animals, New Zealand stated that there are two main drivers for the availability of N in the soil. The first being an increase in mineral N from the addition of fertiliser and the second, the reduction in available N through the suppression of clover growth once N fertiliser is applied. Expert opinion in New Zealand is that the assumption used in the inventory, that N content in grass has stayed relatively constant over the period 1990–2003, is a reasonable one.

50. The excretion rate from animals in the OVERSEER N budget model should be explained in terms of kg N per subcategory of animals in the NIR in order to improve the transparency of the inventory. The Party is asked to give further details on input data because the N content in the feed may be either overestimated or underestimated: for example, the nitrogen excretion rate (Nex) /head/yr given for dairy cattle in 2003 is 116 kg per dairy cow, although 40 per cent of these are heifers and small calves. This is a much higher value than the default IPCC values for dairy cows with similar milk production. However, the data seem to be appropriate for cattle grazing all year round due to the high N content in the grass compared to optimized stall feeding. For comparison with other countries, New Zealand is recommended to provide detailed information in the NIR on feed consumption and Nex for all relevant animal subgroups.

51. New Zealand uses a tier 1 approach with default values, (apart from $Frac_{BURN}$ for the production of non-N fixing crops) to estimate the amount of crop residues returned to soil. In the NIR the Party writes that "crop residues removed from the field as crop" is accounting for 45 per cent. It appears to the ERT that the methodology used by the Party might not take into account that crop residues (straw etc.) are removed from the field. In order to improve transparency, the ERT encourages New Zealand to provide additional explanatory information in future NIRs.

52. New Zealand indicates in the NIR that farming practices in the country "include extensive use of all year round grazing systems and a reliance on nitrogen fixation by legumes rather than nitrogen fertilizer". The amount of N_2O emissions from N fixation is only related to peas and lentils, and no information is given in the NIR on how N fixed by crops has been calculated for clover and other legumes in grassland. New Zealand is encouraged to develop an emissions estimation method which would include N fixed for the different types of grassland occurring in New Zealand.

4. Agricultural soils – indirect N_2O emissions

53. For manures, indirect emissions of N_2O resulting from ammonia and NOx emissions are estimated using the default IPCC value for $Frac_{GASM}$ (0.20). Several studies in Europe show that an appropriate EF for animal manure excreted on grassland is approximately 0.07. New Zealand has indicated to the ERT that there are not enough country-specific data to enable the use of any factor other than the IPCC default. The ERT notes that this is in line with IPCC good practice guidance. As a key category, the Party is encouraged, as resources permit, to examine this in more detail.

54. For mineral fertilizers, indirect emissions from ammonia and NOx emissions, New Zealand uses a default value for $Frac_{GASF}$ of 0.10. The Party has informed the ERT that there are not enough country-specific data for this factor to be changed. Because this is a key category, New Zealand is encouraged, as resources permit, to examine this further.

55. The $Frac_{LEACH}$ value shown in CRF table 4.Ds2 (0.07) is much lower than the IPCC default value of 0.3. The 2004 review report recommended that the Party provide more information in the NIR on how

this country-specific factor has been developed, in order to improve transparency. This information has now been provided satisfactorily in the 2005 NIR.

C. Non-key categories

Manure management – N_2O

56. In previous review reports, New Zealand was asked to provide further information in the NIR on its low N_2O emission rate from manure deposited on soil (EF_{3PRP} = 0.01) and on how the emissions had been estimated. This has been satisfactorily explained in the 2005 NIR, although the ERT noted that the referenced IPCC default value for EF_{3PRP} is not correct. It is referenced as 0.002 and should be 0.02.

V. Land Use, Land-use Change and Forestry

A. Sector overview

57. In its 2003 inventory, New Zealand has applied the IPCC *Good Practice Guidance for Land Use, Land-use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) and reported emissions and removals in all the relevant CRF tables. New Zealand's LULUCF sector in 2003 was a net sink of 22,865.71 Gg CO_2 equivalent, which represented the removal of approximately 30 per cent of all GHG emissions. Net removals in 2003 were 7 per cent above those in 1990. The net removals over the time series 1990–2003 shows inter-annual variations of between about 6 per cent and 17 per cent, which New Zealand attributes to annual variations in the extent of new plantations and wood harvest rates.

58. All the land-use categories and GHG emissions and most removals from living biomass and soil organic carbon pools are reported. Forest Land and Cropland are net sinks, Forest Land being the most important category by far. All the other land-use categories are emission sources. All the relevant CRF tables are provided.

59. The 2005 NIR provides detailed information on country-specific EFs and methodologies used in the inventory for the year 2003. In addition, the annex to the NIR contains tables that include data on yearly afforestation, forest fires and grassland burning. Calculated emissions and removals from harvesting are included in the NIR to improve transparency. Although the 2005 NIR states (in section 7.1.2.2) that living biomass pool includes aboveground and belowground biomass, it is recommended that the titles of tables 7.1.3.2 and 7.1.3.3 (on country-specific factors) specify this.

60. According to the 2005 NIR, tables 1.5.2(b) and A1.1, the LULUCF sector is included in the analysis in determining key categories. Forest Land Remaining Forest Land, Conversion to Forest Land, Conversion to Grassland, Cropland Remaining Cropland, Conversion to Settlement and Conversion to Cropland are considered the most important. The key category analysis is not reported in CRF table 7.

61. Since New Zealand has adopted all the land-use categories according to the IPCC good practice guidance for LULUCF, recalculations are reported for the time series 1997–2003, while the period 1990–1996 is expected to be recalculated in future submissions once a more consistent set of data for the entire time series has been prepared.

62. Only the Forest Land calculations have been reviewed by third parties. An independent consultant compared the estimates of planted forest emissions and removals in the years 2003 and 2002 to check consistency.

63. Attempts have been made to quantify the uncertainties in CO_2 removals for planted forests, cropland, wetland, settlement and other lands, using country-specific factors and default factors taken from the IPCC good practice guidance for LULUCF. The uncertainty calculations are provided in the

NIR, table A7.1, following the IPCC tier 1 method, for CO_2 in Forest Land and other land-use categories and for CH_4 and N_2O across the LULUCF sector. The NIR states that the category Forest Land introduces an uncertainty of about 2.2 per cent into the trend in the national total from 1990 to 2003, having the second largest impact on the trend after CO_2 emissions from the Energy sector.

64. The ERT commends New Zealand for the very complete 2005 NIR, which has made possible a comprehensive analysis of the GHG inventory for 2003, and for the consistency of the time series. This has been achieved by adopting all the relevant CRF tables according to the IPCC good practice guidance for LULUCF.

B. Sink and source categories

1. Representation of land-use categories

65. New Zealand has used an analysis of two existing country-wide cover maps obtained from satellite imagery for the years 1997 and 2002, according to approach 3 in the IPCC good practice guidance for LULUCF. In NIR table 7.1.1 a land-use interpolation matrix between 1997 and 2002 is provided and the land-use areas for 2003 are extrapolated.

2. Forest land

66. Emissions and removals from the Forest land-use category are key categories in New Zealand's 2003 inventory. Although New Zealand has not adopted a national definition of forest, from the NIR it can be assumed that it corresponds to areas over 1 hectare with 30 per cent canopy cover and stands of 5 metres in height or more. The IPCC good practice guidance for LULUCF tier 1 approach and country-specific EFs have been used for calculating emissions and removals in the Forest land-use category.

3. Cropland

67. This land-use category is a key category for New Zealand. Tier 1 and default EFs have been applied, and only changes in living biomass and soil C stocks are provided, since the IPCC good practice guidance for LULUCF does not provide a default method for reporting dead biomass pool. In Grassland Converted to Cropland, the ERT noted that only an increase in C stock is reported. Although a decrease could be the most common situation, this is not reported.

4. Grassland

68. A tier 1 method has been applied and only changes in living biomass and soil C stocks are provided, since the IPCC good practice guidance for LULUCF allows Parties not to report dead biomass pool. Table 7.1.3.2 in the 2005 NIR assumes that grassland with woody vegetation has a living biomass of 63 t C per hectare, which seems to be a high value compared with the peak aboveground living biomass given in table 3.4.2 of the IPCC good practice guidance for LULUCF.

5. Suggestions for improvements in future submission

69. New Zealand could consider updating table 7.1.1 of the 2005 NIR, which contains a land-use matrix for the years 1997–2002, so as to complete the time series since 1990, and complete the recalculation for all land-use categories. Since New Zealand has identified some land-use categories and subcategories as key categories, it is recommended that the Party develop and use country-specific emission and removals factors instead of default factors, in line with the IPCC good practice guidance for LULUCF. New Zealand could consider double-checking the use of "NE", "IE" and "0" for most of the CRF tables.

VI. Waste

A. Sector overview

70. In 2003, the Waste sector contributed 2.3 per cent of total national emissions. Emissions from waste in 2003 were 29.2 per cent below the 1990 level. The CRF includes Managed Solid Waste Disposal on Land – CH_4 as a key category, while considering Wastewater Handling – CH_4 and N_2O as non-key categories.

71. The methodologies used in the Waste sector are both IPCC tier 1 and tier 2, with country-specific AD and EFs for solid waste disposal. Emissions from managed waste disposal on land over the period 1990–2002 have been recalculated. The tier 1 and tier 2 approaches are used for verification and QA/QC.

B. Key categories

Solid waste disposal on land – CH_4

72. Ninety per cent of waste disposal sites are managed sites; others are uncategorized. Emissions of CH_4 from solid waste disposal on land represented 81.2 per cent of total emissions from the Waste sector in 2003. 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, but that an investigation will be undertaken and the results reported in the next submission of the NIR.

73. The IPCC tier 1 and tier 2 methods have been used to calculate emissions from solid waste. The NIR reports that a new landfill review and audit and solid waste analysis protocol have been used to recalculate emissions. To improve transparency, the ERT recommends that New Zealand include more information about the reports used to estimate CH_4 in its next submission of the NIR.

74. For 2003, gross annual CH_4 generation has been verified using tier 1 and tier 2 methods, and the tier 1 QC process has been employed.

C. Non-key categories

1. Waste-water handling – CH_4 and N_2O

75. There are no recalculations reported for Wastewater Handling.

2. Waste incineration – CO_2, CH_4 and N_2O

76. Because the amount of emissions from waste incineration is considered to be negligible, the notation key "NE" is used in this source category. However, 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 in 16 small incinerators. The ERT recommends that New Zealand include capacity data on incinerators in its next submission of the NIR in order to provide a basis for demonstrating that they are in fact negligible.

Annex

Documents and information used during the review

A. Reference documents

IPCC. Good practice guidance and uncertainty management in national greenhouse gas inventories, 2000. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

IPCC. Good practice guidance for land use, land-use change and forestry, 2003. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

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UNFCCC secretariat. Status report for New Zealand. 2005. Available at <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/2005_status_report_new_zealand.pdf>.

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B. Additional information provided by the Party

Responses to questions during the review were received from Ms. Sonia Petrie (Ministry for Environment) including additional material on the methodology and assumptions used.

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