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Report of the individual review of the greenhouse gas inventory of Ireland 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 the Netherlands, coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8. The review took place from 10 to 15 October 2005 in Bonn, Germany, and was conducted by the following team of nominated experts from the roster of experts: Generalists – Mr. Ignacio Sánchez García (Spain) and Mr. Audun Rosland (Norway); Energy – Mr. Scott McKibbon (Canada), Mr. Hristo Vassilev (Bulgaria) and Mr. Hongwei Yang (China); Industrial Processes – Mr. Menouer Boughedaoui (Algeria) and Mr. Manfred Ritter (Austria); Agriculture – Mr. Sergio González (Chile) and Ms. Lilian Portillo (Paraguay); Land Use, Land-use Change and Forestry (LULUCF) – Mr. Charalampos Petsikos (Greece) and Ms. María José Sanz Sánchez (Spain); Waste – Mr. Seungdo Kim (Republic of Korea) and Ms. Tatiana Tugui (Republic of Moldova). Mr. Sergio González and Mr. Audun Rosland were the lead reviewers. The review was coordinated by Mr. Sergey Kononov and Ms. Astrid Olsson (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 Ireland for comment prior to its publication.

B. Inventory submission and other sources of information

3. In its 2005 submission, Ireland submitted a complete set of common reporting format (CRF) tables for the years 1990–2003 and a national inventory report (NIR). Ireland has not provided the tables of the CRF for LULUCF as required by decision 13/CP.9. Where needed, the expert review team (ERT) also used previous years' submissions, additional information provided during the review and other information (see the annex to this report).

C. Emission profiles and trends

4. In 2003, the most important GHG in Ireland was carbon dioxide (CO_2), contributing 65.8 per cent to total[1] national GHG emissions expressed in CO_2 equivalent, followed by methane (CH_4), 18.9 per cent, and nitrous oxide (N_2O), 14.4 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) taken together contributed 0.9 per cent of the overall GHG emissions in the country. The Energy sector accounted for 64.6 per cent of total national GHG emissions, followed by Agriculture (27.8 per cent), Industrial Processes (4.4 per cent) and Waste (3.0 per cent). Total GHG emissions amounted to 67,554 Gg CO_2 equivalent in 2003; they increased by 31.5 per cent from 1990 to 2001, mainly due to growth in CO_2 emissions from energy use, but declined after 2001, mainly as a consequence of reduced economic growth and the closure of some major industrial plants. In 2003 total emissions were 25.6 per cent higher than in 1990. The trends for the different gases and sectors appear to be reasonable and well explained in the NIR.

[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. Ireland has not provided the tables of the CRF for LULUCF as required by decision 13/CP.9 using the land use categories of the Intergovernmental Panel on Climate Change *Good Practice Guidance for Land Use, Land-use Change and Forestry*. Instead it has used the CRF tables for Land-use Change and Forestry as contained in the CRF adopted by decision 18/CP.8, which are based on the categories of the IPCC *Revised 1996 Guidelines for National Greenhouse Gas Inventories*.

D. Key categories

5. Ireland 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. However, Ireland's key category analysis was based on a more disaggregated categorization of sources than the analysis prepared by the secretariat. This approach can result in too high a focus on relatively small sources. Ireland is therefore encouraged to assess the level of disaggregation in order to enhance the usefulness of its key category analysis for prioritizing improvements to the methodology. Ireland is also encouraged to implement a tier 2 key category analysis including LULUCF categories.

6. Some of the key categories identified by Ireland are estimated on the basis of tier 1 methodologies, for example, Energy Industries and Transport – CO_2, and Enteric Fermentation – CH_4. The ERT encourages Ireland to consider a more extensive use of higher-tier methods for key categories. During the review Ireland informed the ERT that it is trying to make such improvements for the most important categories for inclusion in the 2006 submission.

E. Main findings

7. Ireland's GHG inventory is both transparent and comprehensive, and the NIR includes information that makes the review of most methodologies and assumptions possible. However, the structure of the NIR is not fully consistent with the structure outlined in the "Guidelines for the Preparation of National Communications by Parties Included in Annex I to the Convention, Part I: UNFCCC Reporting Guidelines on Annual Inventories" (hereinafter referred to as the revised UNFCCC reporting guidelines). Some emission categories are not included in the inventory and some key categories are estimated on the basis of tier 1 methodologies. Data for the LULUCF sector, required by decision 13/CP.9, have not been estimated and reported. The ERT welcomes Ireland's plans to establish a formal quality assurance and quality control (QA/QC) plan, and a tier 2 key category analysis.

F. Cross-cutting topics

1. Completeness

8. Ireland's inventory is complete for all years with regard to geographical coverage and is generally complete in terms of coverage of sources and gases. However, Ireland has not submitted LULUCF reporting tables according to the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance for Land Use, Land-use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF) following decision 13/CP.9, but has used the reporting format for Land-use Change and Forestry (LUCF), as contained in decision 18/CP.8.

9. Some sources are not included in the inventory, the most important being Asphalt Roofing – CO_2; Road Paving with Asphalt – CO_2; Other Production (Food and Drink) – CO_2, CH_4 and N_2O; Solvent and Other Product Use – N_2O; Forest and Grassland Conversion – CO_2; Abandonment of Managed Lands – CO_2; Emissions and Removals from Soil – CO_2 (except for emissions from lime application); Agriculture Soils – CH_4; and Wastewater Handling – N_2O. Ireland believes that many of these categories

[2] The secretariat identified, for each Party, those source categories that 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 that provided a full set of CRF tables for the year 1990. Where the Party 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.

are minor, with the probable exception of the LULUCF categories. The ERT encourages Ireland to investigate the possibility of estimating emissions for all these source categories. According to the NIR, major national research is ongoing in Ireland in order to establish an LULUCF inventory and work is now underway to produce models, methods and data that can be applied to account for carbon stock changes in all relevant carbon pools and to report these changes according to the IPCC source/sink classification.

10. Ireland has included actual emissions from the consumption of HFCs, PFCs and SF_6 only for the years 1995–2003. The ERT encourages Ireland to include a full time series for these gases if possible.

2. Transparency

11. The NIR includes information on key categories, methods, data sources, uncertainty estimates, QA/QC procedures and planned improvements. However, the structure of the NIR is not fully consistent with the structure outlined in the revised UNFCCC reporting guidelines. The ERT recommends that full use be made of the structure set out in the revised UNFCCC reporting guidelines in future, in order to facilitate more efficient use and review of the information in the NIR.

12. There are some inconsistencies as between the NIR and the CRF with regard to descriptions of methodology. For example, for CH_4 and N_2O from Road Transportation, the CRF refers to the use of an IPCC tier 1 method together with emission factors (EFs) from CORINAIR, whereas the NIR indicates the use of a tier 3 method together with EFs from a model (COPERT III). Furthermore, for CH_4 and CO_2 from oil and natural gas, the NIR refers to the use of country-specific methods and EFs, whereas the CRF indicates the use of tier 1 and country-specific EFs. Similar inconsistencies can be found for the categories Petroleum Coke, Civil Aviation, Cement Production, Lime Production, the Agriculture sector, and Wastewater Handling (Human Sewage). The ERT recommends Ireland to describe the methodologies consistently in the NIR and the CRF in its future submissions.

13. There are also some inconsistencies with regard to the use of the notation keys in the CRF compared to the notation keys in table 1.1 of the NIR. For instance, in NIR table 1.1 emissions from the Energy Sector category Other are described as “not occurring” (“NO”), while in CRF table 7 emissions from the subcategories of Other are described as “not estimated” (“NE”). Similarly, inconsistencies can be found for categories Mineral Products, Chemical Industry, Agricultural Soils, Field Burning of Agricultural Residues, Changes in Forest and Other Woody Biomass Stocks, Waste-water Handling and Waste Incineration. Furthermore, no notation keys are used in the CRF tables for the reference approach or the stored carbon worksheets.

14. “0” is broadly used throughout the CRF tables, while it should be used only if it the estimate is an actual zero. Otherwise a number, even if very small, or “not estimated” (“NE”) or “not occurring” (“NO”), should be reported, depending on the situation. Ireland is recommended to improve its use of the notation keys in both the NIR and the CRF.

15. Furthermore, the numbers for CH_4 in table 2.1(a) of the NIR for 1990 up to 2001 are not equal to those numbers given in the corresponding CRF Table 10s5. Ireland should correct these discrepancies in the next submission.

3. Recalculations and time-series consistency

16. The ERT noted that recalculations for the years 1990–2002 have been undertaken to take into account changes in the methodology and activity data (AD) used for calculating N_2O emissions from agricultural soils, and in the AD used for calculating CH_4 from solid waste disposal on land and for calculating N_2O from waste-water handling. The most important change is due to the recalculation of N_2O from agricultural soils with regard to both 1990 and 2002. In addition, CO_2 from changes in forest

and other woody biomass stocks have been recalculated due to the use of a revised biomass expansion factor (BEF) and carbon content factor for all species, leading to estimates for this source category in the years 1990–1998 and 2000 in the 2005 submission that are more than 75 per cent higher than in the previous (2004) submission.

17. The rationale for these recalculations is provided in the NIR, and the information in the NIR and the CRF is in general consistent. However, the recalculation of CH_4 emissions from solid waste disposal on land for 1990–2001 should be described not only in the CRF but in the NIR as well. Nevertheless, in the ERT's judgement the recalculations are sufficiently justified, and have resulted in improvements of the inventory. Ireland plans to perform additional recalculations in its next submission in order to further improve the inventory.

18. The effect of the recalculations on the estimates of total GHG emissions without LULUCF is increases in 1990 and 2002 by 1.0 per cent and 0.7 per cent, respectively. The increase in the estimates of total GHG emissions from 1990 to 2002 has been adjusted downwards by 0.4 per cent, from 29.4 per cent in the 2004 submission to 29.0 per cent in this year's submission.

4. Uncertainties

19. Ireland has provided quantitative uncertainty estimates using the tier 1 level and trend assessments as set out in the IPCC *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance). The uncertainty assessment is well described and documented in the NIR, and includes a description and discussion of how Ireland has used the uncertainty assessment in its inventory. The ERT encourages Ireland to use the uncertainty assessment to implement a tier 2 key category analysis in its next submission.

20. Qualitative uncertainty estimates are also provided in table 7 of the CRF. The ERT identified some minor inconsistencies between the uncertainty estimates in the NIR and those shown in CRF table 7. For instance, the quality of the estimates of N_2O emissions from agricultural soils is characterized as medium (M) in CRF table 7, whereas in the NIR the uncertainty level for these emissions is estimated to be over 100 per cent.

5. Verification and quality assurance/quality control approaches

21. Ireland has not yet implemented a formal QA/QC plan. However, it has put in place a number of activities that may be regarded as fundamental elements of QA/QC procedures and a good basis for developing a formal QA/QC plan. These elements are to some extent described in the introductory chapter of the NIR. The sectoral part of the NIR, however, does not include descriptions of sectoral verification and QA/QC procedures. Ireland is recommended to include more complete descriptions of its verification and QA/QC procedures in its future submissions, including sectoral verification and QA/QC procedures. The ERT was informed that Ireland plans to establish formal QA/QC procedures when implementing its national inventory system under the Kyoto Protocol.

6. Follow-up to previous reviews

22. Compared to its 2004 submission, Ireland has improved the methodology used for some categories, such as for direct N_2O emissions from agricultural soils and CO_2 from Changes in Forest and Other Woody Biomass Stocks.

G. Areas for further improvement

1. Identified by the Party

23. The NIR identifies several areas for improvement. The most important is the development of a QA/QC system for the national inventory, including the specification of institutional responsibilities, a QA/QC plan, and reporting, documentation and archiving procedures. Ireland plans to improve the completeness of the inventory and to use higher-tier methodologies for most important source categories. It also plans to implement the IPCC good practice guidance for LULUCF and submit LULUCF reporting tables in accordance with decision 13/CP.9.

2. Identified by the ERT

24. The ERT identifies the following cross-cutting issues for improvement:

(a) Use of tier 2 methods for key category analysis;

(b) More extensive use of higher-tier methods for key categories, depending on available resources and AD;

(c) Full use of the NIR structure set out in the revised UNFCCC reporting guidelines.

25. Recommended improvements relating to specific source/sink categories are presented in the relevant sectoral sections of this report.

II. Energy

A. Sector overview

26. In 2003, the Energy sector was the main source of GHG emissions in Ireland, accounting for 64.6 per cent of total national emissions expressed in CO_2 equivalent. CO_2 represented 96.1 per cent of the total Energy sector emissions, while CH_4 and N_2O accounted for 0.4 and 3.5 per cent, respectively. Emissions from fuel combustion represented 99.7 per cent of total GHG emissions from the sector and emissions from transport accounted for 27.2 per cent.

27. Energy emissions grew between 1990 and 2003 by 40.7 per cent, with CO_2, CH_4 and N_2O changing by 41.0, –40.6 and 58.4 per cent, respectively. Total national GHG emissions increased by 25.6 per cent over the same period. The increase in emissions from the Energy sector accounted for 93.1 per cent of the overall increase in national GHG emissions.

28. General QA/QC activities have not yet been developed or implemented formally. Some QC activities for the Energy sector exist in the form of comparison of independent calculations using CollectER and IPCC software. There are no explicit references to QA/QC or uncertainty in the discussion of the Energy sector methodologies, although the NIR contains IPCC tier 1 uncertainty estimates for 2003.

29. The methodological descriptions for the Energy sector given in the NIR are limited but they are in general transparent with clear tables (specifically appendices B and C addressing the national energy balance and calculation sheets). Quite frequently the notation keys in the CRF are not used appropriately, consistently or completely and this reduces the overall transparency.

30. The Party identifies and acknowledges shortcomings of the inventory. The NIR discusses proposed improvements, including general improvements to the national energy balance by increasing the frequency of fuel-use surveys and better resolution of fuel use in, for example, the subsector Manufacturing Industries and Construction.

B. Reference and sectoral approaches

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

31. Comparison of the reference and the sectoral approaches in 2003 yielded differences of only 0.6 and 0.1 per cent for energy consumption and CO_2 emissions, respectively (the reference approach giving higher values than the sectoral approach). The differences are observed mainly with respect to emissions from solid fuels. This is in contrast to the conclusions of previous review reports which indicated that the difference was mainly attributed to emissions from gaseous fuels. Similarly, small differences were noted with respect to comparison with international data.

32. In order to increase transparency and completeness, the Party is encouraged to seek the appropriate AD and develop estimates for imported quantities of lubricants, bitumen and asphalt because only a portion of the carbon associated with them is stored.

33. The methods to develop estimates are different for base year (1990) and the most recent year. The Party is encouraged to align the methods across the time series in order to minimize the impact on the trends that arises from changes to methods.

2. International bunker fuels

34. In the CRF tables, CO_2 emissions are reported for Aviation and Marine Bunker Fuels but zeros are provided for CH_4 and N_2O emissions from marine bunker fuels. Correct use of the notation keys would clarify if these are truly zero values. The methods, EFs and AD used are clearly defined. Although the NIR reports "NE" for emissions of non-CO_2 gases from aviation bunker fuels, values are presented in the CRF. The fuel use values correlate well with data from the International Energy Agency (IEA) except for aviation fuel in 1992, 1996 and 2000.

3. Feedstocks and non-energy use of fuels

35. The CRF reports no consumption of feedstocks for 2003 while the national energy balance included in the NIR for 2003 contains data for natural gas consumption (Table B.1(b)). The Party further notes that historically a substantial amount of natural gas feedstock was used in ammonia production. The company concerned closed down in 2002 and there is therefore no feedstock use of natural gas in 2003. Also, the consumption of naphtha and natural gas as feedstocks is not provided in CRF table 1.A (d) for some years between 1990 and 2002.

C. Key categories

1. Mobile Combustion – Road Vehicles: liquid – N_2O

36. The inter-annual changes of the N_2O implied emission factors (IEFs) for both gasoline and diesel oil appear to be inconsistent. Significant step changes are observed for the two fuels between 1999 and 2000. The N_2O IEF for gasoline increases between 1990 and 1999, decreases between 1999 and 2000 and thereafter increases again. For diesel oil the N_2O IEF is quite stable for the years 1990 to 1999. Between 1999 and 2000 there is a larger increase in the IEF followed by a slower increase for the years after. Also, the overall trend is not smooth as would be expected when older vehicles are replaced by new ones. The ERT suggests that the Party investigate the inputs to its transport model and explain the changes in the N_2O IEFs for gasoline and diesel oil.

2. Other Sectors: all fuels – CO_2

37. CO_2 emissions from Commercial/Institutional increased by 13.6 per cent between 1993 and 1994. This change is not explained in the NIR. The AD for some sub-sector fuel types are unchanged

for sequential years, for example, the same amount of solid fuel is reported for 1992 and 1993, as well as 1999, 2000 and 2001 in the sub-sector Commercial/Institutional. Furthermore, for 1993, the use of "Other" fuel is reported for the Residential sub-sector, but the fuel is not specified. This is the only year the fuel is reported. The ERT encourages the Party to review fuel use in each sub-sector across the time series and to report in the CRF documentation boxes and the appropriate section in the NIR what fuels are represented by "Other".

D. Non-key categories

Fugitive emissions: Oil and Gas Operations: gas – CH_4

38. AD for gas distribution and related emissions are reported for the period 1994–2003. However, no distribution emissions are reported for the years 1991–1993, during which consumption occurred (emissions from distribution are reported as "NE"). The Party is encouraged to review this situation and attempt to complete the time series using the best available information/knowledge and to express its findings using values and the appropriate notation keys, accompanied by explanations, in both the CRF and the NIR.

39. AD for gas production and processing are reported for all years. The NIR describes the AD and methods clearly. The NIR describes emissions from venting and flaring as being included under the Production and Processing categories, although inconsistent use of the notation keys hampers transparency here. The estimation method is described as being based on emission values reported from the production platforms, which correlate well with the production volumes, yet the IEFs fluctuate considerably in the years after 1997. The Party is encouraged to investigate this and to improve its reporting through consistent use of the notation keys, and completeness in the tables and the NIR text.

III. Industrial Processes and Solvent and Other Product Use

A. Sector overview

40. In 2003, Ireland's Industrial Processes sector accounted for GHG emissions amounting to 2,972 Gg expressed in CO_2 equivalent which represents 4.4 per cent of total national GHG emissions. As the ammonia and nitric acid plants have been closed in 2003, the major sources remaining are cement and lime production subcategories with the consumption of halocarbons and SF_6.

41. Emissions for the following categories are reported as "NE" in 2003: Asphalt Roofing – CO_2; Road Paving with Asphalt – CO_2; Other Production (Food and Drink) – CO_2, CH_4 and N_2O; and Solvent and Other Product Use – N_2O. Actual emissions from consumption of HFCs, PFCs and SF_6 are only given for the years 1995–2003. The ERT encourages Ireland to investigate the possibility of estimating emissions for these sources.

42. All the CH_4 and N_2O EFs used in the CRF are based on the 1990 version of CORINAIR. Ireland recognizes the need to review these factors as they differ significantly from the IPCC default values. The ERT encourages Ireland to update EFs to be in line with the IPCC good practice guidance.

B. Key categories

1. Cement Production – CO_2

43. The methodology used is based on clinker production and a weighted average EF of 0.54 g CO_2 per tonne of clinker derived from the four cement plants in operation in 2003. For all years prior to 2003, the CRF uses a default EF of 0.5 g CO_2 per tonne of clinker. The EF of 2003 is based on data disclosed by operators in the context of the European Union (EU) Emissions Trading Scheme (ETS). The ERT

encourages Ireland to ensure consistency in the time series by investigating the possibility of applying the same methodology for the whole time series.

2. Semiconductor Manufacture – PFC, SF_6

44. The emissions estimates are based on plant-specific reporting by the two major companies in Ireland and follow-up correspondence. The NIR does not specify how the follow-up correspondence influences the overall estimate made. Moreover, the 2005 NIR states that emissions abatement is not taken into account, even though there is some abatement equipment installed. The estimates are therefore seen by Ireland as conservative. The ERT encourages Ireland to detail the methodology used to estimate emissions for this sector and to take the abatement technology into account in its calculations of emissions.

45. Emissions are reported for the years 1995–2003; "NE" is reported from 1990 to 1993, and for 1994 there are no entries in the CRF. The ERT recommends the Party to review its use of the notation keys for the whole time series and to investigate the possibility of estimating emissions between 1990 and 1994.

C. Non-key categories

1. Lime Production – CO_2

46. Ireland uses statistical data on lime production and the CORINAIR default value of 0.75 tonnes of CO_2 per tonne of lime. This is in the range of the IPCC default values for high-calcium lime. The 2005 NIR states that revisions are foreseen as lime producers will provide estimates under the ETS. The ERT encourages Ireland to further assess time-series consistency by documenting the methodological differences between the data collection process used for the statistical data on lime production and that used for the ETS data that come from the plant operators.

2. Iron and Steel Production – CO_2

47. CO_2 emissions for this source are reported as "NE", "NO" or "0.00" in the period 1990–2003. The NIR indicates that there was steel production for which emissions have not been estimated prior to 2001. The ERT encourages Ireland to include a description of the time-series consistency in the NIR and recommends estimating the emissions prior to 2001. If this is not possible Ireland should revise the use of the notation keys in the CRF.

3. Consumption of Halocarbons and SF_6 – HFCs, PFCs, SF_6

48. There are high inter-annual changes in the ratio of actual to potential emissions for the subsector Refrigeration and Air Conditioning Equipment. During the review, Ireland explained that these variations are due to the use of AFEAS (Alternative Fluorocarbon Environmental Assessment Study) data. The ERT encourages Ireland to present in its NIR the actual-to-potential ratios along with a description of the factors that influence variations in these ratios.

IV. Agriculture

A. Sector overview

49. In 2003, the Agriculture sector was responsible for emissions amounting to 18,747 Gg CO_2 equivalent, or 27.8 per cent of total national emissions, while in 1990 it represented 34.1 per cent. In 2003, the sector emitted 83.5 per cent of national emissions of CH_4 and 83.2 per cent of national emissions of N_2O. From 1990 to 1999, emissions increased by 11.6 per cent, but in 2003 they were only 2.1 per cent higher than the 1990 level.

50. The submission is complete in terms of gases, sources and years covered. A complete series of CRF tables for the Agriculture sector has been submitted. The ERT noted, however, that table 4.B(a) has been filled in with "0" for animal species which do not occur in the country; that table 4.C contains a mixture of "NO" and "0" for the AD and emissions for the years 1993 to 1996 and 2000; that table 4.E has been filled with "NA" instead of "NO" which is the right notation key to be used for a not occurring category; and that table 4.F was partially filled with "NO" for the AD for the years 1994 to 1997 and 2000.

51. The results of Ireland's key category analysis are comparable with the secretariat's analysis, with a difference in the importance of CH_4 emissions from manure management. Uncertainties have been estimated applying a tier 1 method based on expert judgement. Some internal QC activities are in place.

52. Ireland stated during the review that there is a need for future research on enteric fermentation from cattle and N_2O emissions from soils. The ERT recognizes the improvements made and encourages Ireland to further improve its data collection system to allow for the adoption of higher-tier methods for key categories – a process which is already under way – and to include more detailed information on the country-specific methodologies used in the NIR.

B. Key categories

1. Enteric Fermentation – CH_4

53. Ireland has estimated CH_4 emissions using a tier 1 method and default EFs (for cool conditions in Western Europe), except for non-dairy cattle, for which a country-specific EF, based on expert judgement, has been derived; no supporting information is provided. Ireland stated during the review that the available data were not sufficient to allow it to implement a tier 2 method.

2. Manure Management – CH_4

54. Ireland has applied a tier 1 method and country-specific EFs which is in line with the IPCC good practice guidance as a lack of AD was reported. No estimates have been produced for sheep (reported to be kept out of doors) or for goats, horses, mules and asses (no available AD). Ireland assumes that CH_4 is not produced from sheep manure excreted on to wet soils in its cool maritime climate; during the review process, Ireland stated that documentation to support this assumption will be provided. The IEFs for swine and poultry are 80 and 25 per cent, respectively, higher than the IPCC defaults. The ERT encourages Ireland to provide the supporting information for the country-specific EFs.

55. Although the values for methane producing capacity (B_o), volatile solids (VS) and methane correction factor are reported to be taken from the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the value of the methane correction factor for swine manure in anaerobic lagoon is only a fraction of 0.11 of the IPCC default value. During the review, Ireland stated that this value will be re-checked for the 2006 submission.

56. Some inconsistencies were found in the CRF tables, probably reflecting typing mistakes: for 1992, anomalous values for CH_4-producing potential for dairy cattle, non-dairy cattle and swine, and for the VS daily excretion from dairy and non-dairy cattle, values which seem to have been reported in different units. The ERT encourages Ireland to correct these inconsistencies in its next inventory submission.

3. Manure Management – N_2O

57. Ireland has applied a tier 1 method and default EFs for the animal waste management systems and nitrogen (N) excretion rates, with the exception of cattle, for which country-specific values have

been developed; they are partially explained in the NIR. The IEF values for cattle, sheep, swine and poultry reported for the years 1991, 1993–1996 and 2000 are anomalous, being a fraction of 0.001 of those for the other years.

4. Direct N_2O Emissions from Agricultural Soils – N_2O

58. Ireland has estimated direct N_2O emissions using a mixture of country-specific and tier 1b methods and default EFs. Some country-specific parameters have been developed. The ERT recommends Ireland to improve the information provided in the NIR to make it possible to understand the underlying calculation process. Some inconsistencies were found in the IEFs: for N-fixing crops and crop residues, different values are reported for the period 1990–2001 and 2002–2003.

5. Indirect N_2O Emissions from Agricultural Soils – N_2O

59. Ireland reports the use of a tier 1 method and a mixture of country-specific and default AD and EFs to estimate indirect N_2O emissions from agricultural soils. The value for $Frac_{LEACH}$ is reported as a default value but it differs from the IPCC default value; the ERT recommends Ireland to check the value used.

6. Animal Production – N_2O

60. For N_2O emissions from animal production, Ireland reports the use of a tier 1 method, with country-specific AD and default EFs. Ireland uses a country-specific value of 0.63 for $Frac_{GRAZ}$. The methodological approach is in line with the IPCC good practice guidance.

V. Land Use, Land-use Change and Forestry

A. Sector overview

61. Ireland has not provided the LULUCF reporting tables as required by decision 13/CP.9 and following the land-use categories of the IPCC good practice guidance for LULUCF. Instead, Ireland continued to report according to the tables for LUCF as contained in the CRF adopted by decision 18/CP.8, which are based on the categories of the Revised 1996 IPCC Guidelines. The remainder of this section is based on Ireland's reporting of the LUCF sector.

62. In 2003, the LUCF sector accounted for net removals of 982 Gg CO_2, corresponding to 1.5 per cent of total national GHG emissions (without LUCF).

63. For the LULUCF sector Ireland notes that, due to the high level of uncertainty in annual estimates, until the results of major national research in this area become available, it has not included categories other than Forest Land. A six-year research and development programme begun by the National Council for Forest Research and Development (COFORD) in 2001 includes several projects that will provide a better understanding of carbon sequestration in forests and other ecosystems, and scientific support for further development of the methods for quantifying carbon removals. In the case of peatlands, a research programme to carry out measurements is ongoing.

64. Ireland states in the NIR that a major improvement, based on an existing model from COFORD, is in preparation and that the LULUCF reporting tables required by decision 13/CP.9 will be provided in the next submission. The ERT encourages the country to provide the new CRFs for the next submission while taking into account the problems highlighted in the review.

B. Sink and source categories

1. Changes in Forest and Other Woody Biomass Stocks – CO_2

65. Ireland uses a country-specific method (tier 2) to determine forest areas and stocks of stemwood over bark; it is based on extrapolation from forest areas inventoried in 1995, growth and yield models, and management statistics for public forests only, except for data on planting, which are available for both public and private forests. On the basis of these data sources and assumptions, Ireland estimates carbon stocks for each inventory year and determines changes by the difference from the previous year's stocks.

66. Ireland has modified table 5.A to provide stock data, introducing two columns for "implied emission factors/implied carbon uptake". The NIR clearly identifies conversion or expansion factors, and explains their use in the estimation procedures. However, it seems that what is termed "conversion factor biomass volume to dry matter, t dm/m^3" in CRF table 5.A is actually a dry density, while the column "Expansion factor stemwood volume to total tree biomass", for which no units are specified, may be the expansion factor from merchantable to total volume (tree biomass in m^3).

67. The same BEF is used for all species (1.64). In appendix G of the NIR the BEF is stated to be 1.3, which is in line with the default value recommended by the IPCC good practice guidance for LULUCF, but 1.64 (still within the range of IPCC values) is used since 1.3 is considered too low. The relatively high expansion factor is the same for all species; it could be further refined at least by species type and (if possible) by age class as well, since the NIR states that a time series of forest strata by area and age was prepared for 1990–2003 and recent BEF databases are available for Europe (the Cost E21 database).

68. Removals are reported from plantations only, and it is not clear if all forests are considered plantations or if only plantations are included and other forests excluded. In table 5.A, the "conversion factor from biomass volume to dry matter" of biomass removed (harvested) is lower than the mean of the one used for calculating standing biomass, and no explanation is given for the difference. It is possible that the low conversion factor is due to the allocation of felled trees to the age strata. Fuelwood estimates are included in commercial harvest, but no explanation is provided as to why the fuelwood consumed cannot be reported separately.

2. Forest and Grassland Conversion and Abandonment of Managed Lands

69. The notation keys are not used consistently. Of all the subcategories under Cropland, only Mixed Broadleaf/Coniferous is indicated as "NE"; for all others Ireland reports "0" instead of using the notation keys. Appendix G to the NIR mentions "afforested and reforested areas", but no conversion is reported.

3. CO_2 Emissions and Removals from Soils

70. Only CO_2 emissions from liming are estimated. The NIR indicates that major research is under way to develop the missing estimates. The ERT encourages Ireland to continue its work to develop the missing estimates.

VI. Waste

A. Sector overview

71. In 2003, the Waste sector contributed 3.0 per cent to total national GHG emissions in Ireland. In the category Solid Waste, CH_4 emissions from managed and unmanaged waste disposal sites and N_2O emissions from human sewage are reported. Emissions from waste-water handling are assumed to be

negligible and not estimated. Ireland has not estimated emissions from waste incineration, mainly because incineration is used only by a small number of chemical and pharmaceutical companies, whose data are often confidential. The ERT recommends Ireland to make an effort to obtain these data and calculate emissions from waste incineration in its next submission in the interests of completeness.

72. Ireland has used a modified form of the IPCC tier 2 method, which is consistent with the IPCC good practice guidance, for estimating CH_4 emissions from solid waste disposal on land and country-specific methodologies for CH_4 and N_2O emissions from waste-water handling.

73. The NIR provides some general information on the methodologies used and the sources covered. However, for the NIR of future submissions Ireland should include precise descriptions of the methodologies and AD used, explanations of unusual trends in emissions, and reasons for recalculations.

B. Key categories

1. Solid Waste Disposal on Land – CH_4

74. CH_4 emissions from solid waste disposal on land accounted for 2.9 per cent of Ireland's total GHG emissions in 2003 and had increased by 56.4 per cent since 1990. CH_4 emissions have been estimated for managed and unmanaged disposal sites separately. It is assumed that, in 2002, 65 per cent of municipal solid waste (MSW) went to well-managed landfills and 35 per cent to shallow unmanaged landfills.

75. The AD from table 6.A, Additional Information are not consistent with the same parameter from the NIR. In the CRF the waste generation rate remains constant at 1 kg/cap/day during the period of 1990–2000, but then it changes from 1.5 kg/cap/day in 2001 to 1.87 kg/cap/day in 2003. However, the NIR states that generation rates are assumed to remain constant at 1 kg/cap/day prior to 1995. The ERT encourages Ireland to explain which numbers are used.

76. Ireland reports in CRF table 6.A an average of the total amount of waste over a 20-year period contributing to emissions in 2003 rather than the MSW deposited in 2003. The ERT encourages the Party to follow the revised UNFCCC reporting guidelines for completing the CRF tables, in order to enable reviewers to understand better and replicate the calculations provided.

77. Some mistakes have occurred in CRF table 6.A. The table indicates a value of 1 for the fraction of degradable organic content (DOC) in MSW. During the review the Party provided a new value for DOC as 0.14. The ERT recommends Ireland to provide more information in the NIR in the interests of greater transparency. Also, the value for the CH_4 fraction in landfill gas should be corrected to 0.5 instead of 50.00 (CRF table 6.A for 2003).

78. The per capita CH_4 emissions (23.02 kg/capita) shown for 2003 are among the highest of reporting Parties (1.34–35.68 kg/capita). The Party explained that the amount of MSW going to landfills had increased in recent years. The ERT recommends that the Party provide an explanation for that increase in the NIR.

2. Waste-water Handling – CH_4 and N_2O

79. Emissions from waste-water handling are not estimated because they are assumed to be negligible; the notation key "NE" is used. Ireland is currently trying to find AD that would enable it to estimate N_2O emissions from industrial and commercial waste water. The Party is encouraged to obtain data for these emission sources for inclusion in its future submission.

80. N_2O emissions from human sludge have been recalculated for the 2005 submission based on AD on protein consumption/person/year from the Food and Agriculture Organization of the United Nations

(FAO). This has led to an increase of 90 per cent in estimated N_2O emissions from this source between 1990 and 2003. In the ERT's judgement the recalculations are sufficiently justified, and have resulted in improvements of the inventory.

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>.

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

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. FCCC/SBSTA/2004/8. Available at <http://unfccc.int/resource/docs/2004/sbsta/08.pdf>.

UNFCCC. Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention. FCCC/CP/2002/8. Available at <http://unfccc.int/resource/docs/cop8/08.pdf>.

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

UNFCCC secretariat. Synthesis and assessment report of the greenhouse gas inventories submitted in 2005. FCCC/WEB/SAI/2005. Available at <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/sa_2005_part_i_final.pdf>.

UNFCCC secretariat. Report of the individual review of the greenhouse gas inventory of Ireland submitted in the year 2004. FCCC/WEB/IRI/2004/IRL. Available at <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/2004_irr_desk_review__ireland.pdf>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Michael McGettigan (Office of Environmental Assessment, Environmental Protection Agency).

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