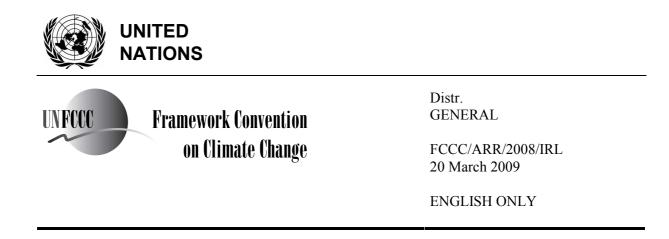# Report of the individual review of the greenhouse gas inventories of Ireland submitted in 2007 and 2008

Note by the secretariat

The report of the individual review of the greenhouse gas inventories of Ireland submitted in 2007 and 2008 was published on 24 March 2009. For purposes of rule 10, paragraph 2, of the rules of procedure of the Compliance Committee (annex to decision 4/CMP.2, as amended by decision 4/CMP.4), the report is considered received by the secretariat on the same date. This report, FCCC/ARR/2008/IRL, contained in the annex to this note, is being forwarded to the Compliance Committee in accordance with section VI, paragraph 3, of the annex to decision 27/CMP.1.

UNITED NATIONS

UNFCCC **Framework Convention on Climate Change**

Report of the individual review of the greenhouse gas inventories of Ireland submitted in 2007 and 2008[*]

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[*] In the symbol for this document, 2008 refers to the year in which the inventory was submitted, and not to the year of publication.

CONTENTS

<u>Annex</u>

I. Overview

A. Introduction

1.   This report covers the centralized review of the 2007 and 2008 greenhouse gas (GHG) inventory submissions of Ireland, coordinated by the UNFCCC secretariat in accordance with decision 22/CMP.1. In accordance with the conclusions of the Subsidiary Body for Implementation at its twenty-seventh session,[1] the focus of the review is on the most recent (2008) submission. The review took place from 15 to 20 September 2008 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Justin Goodwin (United Kingdom of Great Britain and Northern Ireland) and Mr. Jan Pretel (Czech Republic); energy – Mr. Javier Gonzalez (Spain), Mr. Simon Wear (New Zealand) and Mr. Scott McKibbon (Canada); industrial processes – Mr. Stanford Mwakasonda (South Africa) and Mr. Eilev Gjerald (Norway); agriculture – Mr. Tom Wirth (United States of America) and Mr. Jorge Alvarez (Peru); land use, land-use change and forestry (LULUCF) – Ms. Thelma Krug (Brazil) and Mr. Chris Cameron (New Zealand); waste – Mr. Mark Hunstone (Australia) and Mr. Qingxian Gao (China). Mr. Goodwin and Mr. Mwakasonda were the lead reviewers. The review was coordinated by Ms. Astrid Olsson and Mr. Vitor Gois Ferreira (UNFCCC secretariat).

2.   In accordance with the "Guidelines for review under Article 8 of the Kyoto Protocol" (decision 22/CMP.1), a draft version of this report was communicated to the Government of Ireland, which provided comments that were considered and incorporated, as appropriate, into this final version of the report.

B. Inventory submission and other sources of information

3.   The 2008 annual inventory was submitted on 11 April 2008; it contains a complete set of common reporting format (CRF) tables for the period 1990–2006 and a national inventory report (NIR). This is in line with decision 15/CMP.1. The Party indicated that the 2008 submission is also its voluntary submission under the Kyoto Protocol.[2] In its 2007 submission, Ireland included a complete set of CRF tables for the period 1990–2005 and an NIR. When necessary the expert review team (ERT) also used the 2006 submission, 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.

C. Emission profiles and trends

4.   In 2006 (as reported in the 2008 annual inventory submission), the main GHG in Ireland was carbon dioxide (CO_2), accounting for 67.08 per cent of total GHG emissions[3] expressed in CO_2 eq; methane (CH_4) accounted for 19.0 per cent and nitrous oxide (N_2O) for 12.1 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) (hereinafter referred to as F-gases) together accounted for 1.0 per cent of total GHG emissions. The energy sector accounted for 66.1 per cent of the total GHG emissions, agriculture for 26.4 per cent, industrial processes for 4.7 per cent, waste for 2.6 per cent, and solvent and other product use for 0.1 per cent. Total GHG emissions amounted to 69,762.35 Gg CO_2 eq and increased by 25.3 per cent between the base year[4] and 2006. In 2005 (as reported in the 2007 inventory submission), total GHG emissions amounted to 69,945.48 Gg CO_2 eq. The shares of gases and sectors in 2006 (2008 annual inventory submission) were similar to those of 2005 (2007 inventory submission). Trends for different gases and sectors are reasonable.

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[1] FCCC/SBI/2007/34, paragraph 104.

[2] Parties may start reporting information under Article 7, paragraph 1, of the Kyoto Protocol from the year following the submission of the initial report, on a voluntary basis (decision 15/CMP.1).

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

[4] Base year refers to the base year under the Kyoto Protocol, which is 1990 for CO_2, CH_4 and N_2O, and 1995 for HFCs, PFCs and SF_6. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

5.   Tables 1 and 2 show GHG emissions by gas and by sector, respectively.

D. Key categories

6.   Ireland has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2008 submission. The key category analyses performed by the Party (28 key categories) and by the secretariat[5] (17 key categories) produced similar results. There are a few differences in the results of these analyses, which can be explained by the different levels of aggregation used by the Party for the energy and agriculture sectors. Ireland has included the LULUCF sector in its key category analysis, which was performed in accordance 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) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). The ERT recommends that Ireland carry out a tier 2 key category analysis as a basis for further improvement of the inventory.

E. Main findings

7.   The inventory is complete in terms of years, sectors, gases and geographical coverage. Ireland has provided CRF tables for the entire time series. The inventory is generally in line with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. However, the ERT questioned whether the maximum methane producing capacity parameter was applied correctly for both dairy and non-dairy cattle and encourages Ireland to check that its application is consistent with the IPCC good practice guidance. The structure of the NIR and the transparency of the methodology descriptions have improved compared with previous submissions.

8.   The overall completeness and quality of the inventory have been considerably improved since the 2006 inventory submission (e.g. improvements in overall inventory compilation for agriculture, particularly with respect to CH_4 emissions from enteric fermentation and manure management for cattle, and N_2O emissions from agricultural soils, and the use of a new forest inventory for emissions/sinks estimates in the LULUCF sector). The ERT identified some areas for improvement relating to the transparency of the inventory, such as the need for more detailed descriptions of methodology used, and implementation of comprehensive quality assurance/quality control (QA/QC) procedures.

9.   The NIR provides information on the methodologies used, activity data (AD) and emission factors (EFs) needed to assess the inventory. By supplying the additional information requested by the ERT during the review Ireland has demonstrated sufficient capacity to comply with 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 UNFCCC reporting guidelines) and the IPCC good practice guidance. The ERT recommends that Ireland include the additional information provided to the ERT during the review in its next NIR.

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[5] The secretariat identified, for each Party, the 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 for Land Use, Land-Use Change and Forestry*. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year. 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.

Table 1. Greenhouse gas emissions by gas, 1990–2006

Greenhouse gas emissions	Gg CO$_2$ eq								Change base year–2006 (%)
	Base year[a]	1990	1995	2000	2003	2004	2005	2006	
CO$_2$	32 545.20	32 545.20	35 447.90	44 846.84	45 125.65	45 991.76	47 722.66	47 319.68	45.4
CH$_4$	13 466.77	13 466.77	13 799.26	13 539.47	13 942.35	13 355.63	13 261.81	13 286.68	−1.3
N$_2$O	9 477.40	9 477.40	9 917.36	10 050.52	8 880.74	8 717.62	8 661.24	8 432.62	−11.0
HFCs	44.85	0.69	44.85	230.22	349.98	386.44	435.06	506.45	1 029.3
PFCs	75.38	0.09	75.38	305.41	228.79	182.43	168.34	148.32	96.8
SF$_6$	82.83	35.40	82.83	55.96	118.69	67.09	95.96	68.60	−17.2

[a] Base year refers to the base year under the Kyoto Protocol, which is 1990 for CO$_2$, CH$_4$ and N$_2$O, and 1995 for HFCs, PFCs and SF$_6$. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

Table 2. Greenhouse gas emissions by sector, 1990–2006

Sectors	Gg CO$_2$ eq								Change base year–2006 (%)
	Base year[a]	1990	1995	2000	2003	2004	2005	2006	
Energy	31 590.77	31 590.77	34 612.23	43 479.30	44 672.55	44 826.36	46 561.00	46 141.47	46.1
Industrial processes	3 330.95	3 164.08	3 060.67	4 185.50	3 039.29	3 142.50	3 250.97	3 261.94	−2.1
Solvent and other product use	81.15	81.15	86.05	80.29	76.28	76.09	77.89	80.01	−1.4
Agriculture	19 228.56	19 228.56	19 920.06	19 639.90	19 063.18	18 863.94	18 681.68	18 447.52	−4.1
LULUCF	NA	188.63	293.38	152.26	−284.54	−201.74	−421.80	−489.00	NA
Waste	1 461.00	1 461.00	1 688.56	1 643.43	1 794.90	1 792.08	1 773.52	1 831.42	25.4
Other	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total (with LULUCF)	NA	55 714.19	59 660.96	69 180.68	68 361.66	68 499.23	69 923.26	69 273.35	NA
Total (without LULUCF)	55 692.42	55 525.56	59 367.58	69 028.42	68 646.20	68 700.97	70 345.06	69 762.35	25.3

Abbreviations: LULUCF = land use, land-use change and forestry, NA = not applicable.

[a] Base year refers to the base year under the Kyoto Protocol, which is 1990 for CO$_2$, CH$_4$ and N$_2$O, and 1995 for HFCs, PFCs and SF$_6$. The base year emissions do not include any possible emissions from deforestation; however, if applicable, these are taken into account when the assigned amount is calculated.

F. Cross-cutting topics

1. Completeness

10.   The inventory is complete in terms of years, sectors, gases and geographical coverage. Ireland has provided CRF tables for the entire time series. The CRF tables are broadly complete, except for table 8(b), explanatory information on recalculations. Emissions of CO_2 from soda ash production were reported for 2005 and 2006 only. The ERT welcomes Ireland's intention to report the full time series in its 2009 submission. In addition, the ERT notes that waste incineration may become a source of emissions in Ireland in the future, and encourages Ireland to include this category in relevant future submissions.

2. Transparency

11.   The NIR, together with the information provided during the review, provides much of the information necessary to assess the inventory. This greatly improved the understanding of the major underlying assumptions and rationale behind the choices of data and methods and of other inventory parameters. The energy and agriculture sectors are transparent, and transparency in the LULUCF sector has improved substantially, but in the industrial processes and waste sectors the methodologies used, the historical trend analysis, and AD are not sufficiently documented; the ERT suggests this be improved in the next NIR. Further options to enhance transparency identified by the ERT are described in detail in the sector chapters below.

3. Recalculations and time-series consistency

12.   The ERT noted that for both the 2007 and the 2008 submissions main recalculations are identified and quantified in the NIR and the CRF tables. Principal recalculations have been made for all categories in the energy sector, for mineral products and consumption of halocarbons and SF_6, for solid waste disposal on land and wastewater handling, and for several categories in the agriculture and LULUCF sectors. The impact of these recalculations was an increase in total GHG emissions by 0.27 per cent in 1990 and by 0.57 per cent in 2005. Recalculations, which are well documented in the NIR and the CRF tables, resulted in real improvement of the inventory.

4. Uncertainties

13.   Ireland provides an uncertainty analysis using the same methodology as in previous years, which fully follows the IPCC good practice guidance. This method estimates uncertainties for the entire inventory in a particular year and the uncertainty in the trend over time by combining the uncertainties in AD and EFs for each category. The tier 1 uncertainty analysis for 2006 gives an overall uncertainty of 6.1 per cent in total emissions and a trend uncertainty of 3.6 per cent for the period 1990 to 2006. The application of improved tier 2 methods for estimating emissions from enteric fermentation and manure management for cattle has reduced the level of uncertainty to some extent. The uncertainty analysis for the 2006 submission shows lower figures than similar analyses for previous years. Ireland uses the uncertainty analysis for prioritizing the improvement of its inventory. The ERT encourages Ireland to continue to improve its uncertainty analysis with a tier 2 approach and to provide more detailed descriptions of the approaches and underlying assumptions used for the uncertainty estimates.

5. Verification and quality assurance/quality control approaches

14.   Ireland provided information on its QA/QC procedures in line with the UNFCCC reporting guidelines and the IPCC good practice guidance. The inventory agency in Ireland commissioned a project with United Kingdom consultants to establish formal QA/QC procedures in the emission inventory. The project developed a QA/QC system, including a documented QA/QC plan and procedures, together with a QA/QC manual which provides a general overview of the QA/QC system and

guidance on the application of the plan and procedures. The ERT recommends that Ireland include in its next NIR descriptions of the QC for individual categories where specific methods are used.

6. Follow-up to previous reviews

15.   Ireland has made substantial improvements to its inventory following previous reviews. These improvements include moving to tier 2 methods for some important agricultural categories (e.g. enteric fermentation and manure management for cattle) and first steps in developing a more comprehensive LULUCF inventory based on development of a new and extensive national forest inventory. Improvements relate also to corrections in estimates of F-gases and plant-level data for a number of energy and industrial process categories. The ERT recognized that there have been considerable improvements to the national QA/QC system in the agriculture sector, which covers more than one quarter of total GHG emissions. However, the ERT noted that Ireland has not followed up on some of the recommendations from previous reviews, such as following the recommended structure of the NIR for the industrial processes sector, reporting increases and decreases of carbon stocks in living biomass separately, fully explaining emissions trends, and providing more information on the national registry as required in the report of the review of Ireland's initial report.[6]

G. Areas for further improvement

1. Identified by the Party

16.   The 2008 NIR identifies several areas for improvement. Ireland indicated that it is working on:

(a)   Further consolidation of the national system;

(b)   Further application of formal QA/QC procedures that have been put into operation as an integral part of the national system;

(c)   An extension of peer review and expert review of the inventory data;

(d)   An outline of the annual requirements of a continuous improvement programme for the inventory.

2. Identified by the expert review team

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

(a)   Provision of more detailed descriptions of the approaches and underlying assumptions used for the uncertainty estimates;

(b)   Improved descriptions of methodologies that differ from those provided/recommended by the IPCC;

(c)   Provision of more detailed explanations of emission trends and changes in trends in all sectors;

(d)   Provision of technical references to country-specific EFs and AD.

18.   Recommended improvements relating to specific source/sink categories are presented in the relevant sector chapters of this report.

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[6] FCCC/IRR/2007/IRL.

II. Energy

A. Sector overview

19.   The energy sector is the main sector in the GHG inventory of Ireland. In 2006, emissions from the energy sector amounted to 46,141.47 Gg CO_2 eq, or 66.1 per cent of total GHG emissions. Emissions from the sector increased by 46.1 per cent between 1990 and 2006. The main driver behind the rise in emissions is the fuel combustion associated with transport and energy industries. Over this period emissions of CO_2 from transport categories, which are largely accounted for by road transportation, increased by 165.4 per cent, and emissions of CO_2 from energy industries increased by 33.3 per cent.

20.   Within the energy sector in 2006, 33.4 per cent of the emissions were from energy industries, 29.7 per cent were from transport, 23.7 per cent were from other sectors and 12.8 per cent were from manufacturing industries and construction. The remaining 0.4 per cent were fugitive emissions relating to the oil and natural gas industries.

21.   The Party is encouraged to enhance its discussion on trends by referring to trends in underlying or associated AD which validate the change in emissions. Examples could include changes in vehicle numbers and human populations, tonne-kilometres shipped by mode, gross domestic product by sector, references to heating or cooling degree days, and changes in residential/commercial square metres – all of which could help validate the fuel consumption figures.

22.   Between the 2007 and 2008 submissions, the Party's incorporation of COPERT IV to replace COPERT III as its on-road transportation model resulted in a more consistent time-series estimate. A minor omission of peat units in the 2006 reference approach has been addressed in the 2007 submission.

B. Reference and sectoral approaches

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

23.   In 2005 (as reported in the 2007 submission), there is a difference between the reference approach and the sectoral approach of 2.63 and –0.62 per cent in energy consumption and CO_2 emissions, respectively, whereas in 2006 (as reported in the 2008 submission), the difference is reduced to –0.45 and –0.32 per cent in energy consumption and CO_2 emissions, respectively; these small differences indicate a good reconciliation at an aggregated level and a reasonable improvement between successive submissions. Liquid fuels tend to dominate this gap in 2005 whereas solid fuels dominate the gap in 2006. For both submissions, the Party clearly identifies the causes in its NIR.

24.   However, there appear to be multiple disparities with data reported by the International Energy Agency (IEA); these could be reconciled by enhanced cooperation between statistical agencies and national reporting bodies. The Party indicates that work is ongoing to address the differences and the ERT recognizes and encourages this process.

2. International bunker fuels

25.   The national energy balance sheets report fuel sold for marine bunkers and international aviation as specific line items and the emissions are calculated directly, whereas civil aviation emissions are estimated using a bottom-up, landing and take-off (LTO) method and IPCC plane-specific EFs. The ERT encourages the Party to include general indications of the trends in the LTO method that support the trends in these emissions in its next annual submission.

3. Feedstocks and non-energy use of fuels

26.   A large amount of natural gas feedstock was traditionally used in ammonia production in Ireland but since the closure of the single ammonia production company in 2002 there has been no feedstock use

of natural gas. Ireland does provide a brief statement about lubricants, naphtha and bitumen. Previous ERTs have requested enhanced descriptions for the handling of feedstocks, but the text has remained vague and brief in the previous three NIR submissions. The ERT reiterates previous recommendations that the Party invest in bringing clarity to the methodology used for feedstocks.

C. Key categories

Stationary combustion: solid, liquid, gas – CO_2

27. Generally, the Party's estimates are robust for public electricity and heat production for solid and liquid fuels, with abundant use of facility-specific fuel consumption data or available national energy statistics. Almost all issues flagged during the review were related to fluctuating CO_2 implied emission factors (IEFs) and were resolved through iterative communications between the ERT and the Party. A remaining issue, also identified as fluctuating CO_2 IEFs for liquid fuels, was understood through provision of fuel-specific quantities for the time series. These fuel-specific data illustrated a minor reporting artefact of combining the facility-specific emissions and fuel consumption data with data from national energy statistics. This combination resulted in unreasonably high and stable IEFs. The ERT strongly encourages the Party to include this fuel-specific information annually with a clear description of the internal reporting mechanism to ensure that the fuel consumption patterns and associated CO_2 intensity are understood.

28. There is a fluctuating IEF associated with public electricity and heat production for gaseous fuels between 1992 and 1997; values range between 58.69 and 54.16 t/TJ. Ireland is encouraged to provide a discussion of the drivers for this in its subsequent submissions.

29. CO_2 emissions from the residential sector, solid fuels, accounted for between 7 and 10 per cent of total GHG emissions, depending on the inventory year. The CO_2 IEF fluctuates throughout the time series (98.84–100.93 t/TJ). The ERT encourages the Party to include fuel-specific information in its next annual submission, with a brief description of the drivers for these shifts, to ensure that the fuel-consumption patterns and associated CO_2 intensity are understood.

D. Non-key categories

Oil and natural gas: gas – CO_2

30. CO_2 emissions from venting and flaring are reported for 1999 and 2001. Ireland indicates, in response to previous 2008 review stages, that data for CH_4 (not CO_2) losses come directly from the platforms at sea, from either production or exploration. The ERT encourages the Party to revisit this issue, to provide the values reported for other years for CO_2, if available, and to include a description of this data flow in its subsequent submissions.

III. Industrial processes and solvent and other product use

A. Sector overview

31. In 2006, emissions from the industrial processes sector amounted to 3,261.94 Gg CO_2 eq, or 4.7 per cent of total GHG emissions. Emissions from the industrial processes sector decreased by 2.1 per cent from the base year to 2006 and increased by 0.3 per cent from 2005 to 2006. The relatively stable emissions in this sector hide the fact that there have been structural changes in the Irish economy since 1990. Emissions from cement production increased by 165.6 per cent from 1990 to 2006 but this increase has been counterbalanced by the termination of the production of ammonia and nitric acid in 2002.

32. Within the industrial processes sector, 77.8 per cent of GHG emissions were from mineral products and the remaining 22.2 per cent were from consumption of halocarbons and SF_6.

33.   The NIR does not follow the recommended detailed structure of the UNFCCC reporting guidelines for sectoral chapters. The NIR would be more transparent if the recommended detailed structure was used and the ERT encourages Ireland to use this reporting structure.

34.   The Party is encouraged to include in the NIR the information provided during the review in response to questions from the ERT regarding mineral products and the QC that has been performed.

35.   Even though the production of ammonia and nitric acid ceased in 2002, the NIR should still include a description of the methodology, AD, EF and uncertainty. The ERT strongly recommends that Ireland include this information in its next NIR.

36.   The main differences between the 2007 and 2008 submissions for industrial processes are related to the changes in the method and data used for the individual categories of HFCs, PFCs and SF_6. CO_2 emissions from soda ash production and use are partly included in the latest inventory and CO_2 emissions from the use of clay and shale as raw materials in the manufacture of bricks and ceramics, which were previously reported in limestone and dolomite uses, are now reported in the category other (mineral products).

B. Key categories

Cement production – CO_2

37.   The CO_2 IEF is fairly stable between 1990 and 2002 and decreases thereafter. The 2006 value (0.53 t/t) is 2.8 per cent lower than the 1990 value (0.55 t/t). Ireland has explained that the change after 1999 is due to two new cement plants opening after 1999, which almost doubled the national clinker production (using different sources of limestone as a raw material), and that EFs after 1999 are derived from the plant-by-plant data received within the framework of the European Union emissions trading scheme. The ERT noted that the information submitted by the Party to the ERT is not sufficient to confirm that the time series is consistent. Ireland is encouraged to include further information in its next NIR to justify the change in the CO_2 IEF after 2002.

C. Non-key categories

1. Lime production – CO_2

38.   The trend in the CO_2 IEF is unstable. The 2006 value (0.78 t/t) is 6.9 per cent lower than the 1990 value (0.84 t/t). There are fluctuations in the IEF; these were questioned during the review but the Party did not provide any explanations. The ERT encourages Ireland to explain and justify the time series consistency and the fluctuations in the CO_2 IEF for lime production.

2. Soda ash production and use – CO_2

39. CO_2 emissions from soda ash production and use were reported for 2005 and 2006 only. Ireland has informed the ERT that it is currently working on preparing estimates for a complete time series, to be reported in the 2009 submission.

3. Consumption of halocarbons and SF_6

40.   Ireland has investigated the applicability of the AD and underlying assumptions in the F-gas inventory. Errors that were found in the transcription of data from the Excel spreadsheet to the CRF tables have been corrected, and all calculations of F-gas emissions are now performed in one calculation workbook. The results of the recalculations have reduced the estimate of the emissions of F-gases by 0.3 per cent in 2005.

IV. Agriculture

A. Sector overview

41.   In 2006, emissions from the agriculture sector amounted to 18,447.52 Gg CO_2 eq, or 26.4 per cent of total GHG emissions. Emissions from the sector decreased by 4.1 per cent between 1990 and 2006. The main driver for the reduction in emissions is the reduced number of dairy cattle and the reduced usage of mineral fertilizer.

42.   Within the sector, 49.6 per cent (9,151.16 Gg CO_2 eq) of the emissions were from enteric fermentation, 36.1 per cent (6,663.71 Gg CO_2 eq) were from agricultural soil and 14.3 per cent (2,632.63 Gg CO_2 eq) were from manure management.

43.   There is a large difference (11.1 per cent) between information presented in the CRF tables and information from the Food and Agriculture Organization of the United Nations (FAO) for cattle population. During the review the Party provided information on the method used by the Central Statistics Office to collect data for cattle population; this method was considered appropriate by the ERT. The Party also indicated that the source of FAO statistics for cattle population is not clear. The ERT recommends that Ireland try to identify why the two data sets are different, and provide information on this to the secretariat and FAO.

44.   A comparison of the 2007 and 2008 submissions shows some improvements relating to the use of more country-specific data to obtain country-specific EFs. The ERT welcomes the additional information provided on uncertainties, category-specific recalculations and category-specific planned improvements throughout the agriculture chapter.

B. Key categories

1. Enteric fermentation – CH_4

45.   The 2008 submission contains some additional description of the methodology used to estimate emissions from enteric fermentation in cattle, with associated improvements in transparency, together with some revisions to the country-specific data from feeding practices and milk yield, which are the input used by Ireland to determine the country-specific enteric EFs. The ERT welcomes the improvements made, which permitted the use of more country-specific data and thus provided greater accuracy in the emission estimates.

46.   The Party uses the same average body weight of dairy cattle (535 kg) to estimate emissions from enteric fermentation for the whole time series. However, milk yield increases by 20.9 per cent between 1990 and 2006 (11.48 to 13.88 kg/day), so the value for average weight is inconsistent with the milk yield. During the review Ireland expressed the view that there is no clear relationship between average milk yield and dairy-cow weight. The ERT recommends a review of this information and the provision of more consistent specific information in the next submission.

2. Manure management – CH_4 and N_2O

47.   Ireland uses the dairy cattle default value of the CH_4-producing potential (Bo=0.24 m^3 CH_4/kg volatile solids (VS)) to estimate CH_4 emissions from manure management for dairy and non-dairy cattle, whereas the correct default value for non-dairy cattle is 0.17 m^3 CH_4/kg/VS. The ERT recommends that Ireland use the correct default value for the next submission, and conduct some research to obtain country-specific values for dairy and non-dairy cattle in the future.

48.   The typical average body weights for swine (200 kg) and poultry (2 kg) used by Ireland are the highest reported among all Parties. The ERT recommends that Ireland conduct some research to obtain adequate country-specific information relating to these values for the next submission.

V. Land use, land-use change and forestry

A. Sector overview

49.   In 2006, the LULUCF sector in Ireland was a net sink of 489.00 Gg CO_2 eq, corresponding to 0.7 per cent of total GHG emissions. The sector changed from being a net source during the period 1990–1997, to being a net sink in 1998 and 1999, to being a net source again in 2000 and 2001, and to being a net sink again thereafter. This sink effect was largely driven by the category forest land remaining forest land, which had a net removal of 859,57 Gg CO_2 in 2006. The cropland and grassland categories were net sources, at 73.25 and 303.76 Gg CO_2, respectively. Conversion of grassland to cropland and application of agricultural lime were the main sources in these land-use categories. Ireland indicates that the complex dynamics of land-use changes between categories, and the relative contributions from biomass and soils, led to fluctuating estimates of sectoral emissions and removals over the period 1990–2006.

50.   The most relevant emission sources are soils in land converted to forest land and CO_2 emissions from agricultural lime application on grassland and cropland. Forest land remaining forest land accounts for the largest sink. All the other categories are comparatively less important in terms of emissions and removals, although cropland becomes increasingly relevant at the end of the time series. Although the area of forests increased by 64 per cent between 1990 and 2006, the total area of forest land is still less than 10 per cent of the total national area, a figure considered to be low compared to other Parties included in Annex I to the Convention.

51.   Ireland has used tier 2 and tier 3 methods for estimating net emissions in forest land. For all the other categories, tier 1 methods have been applied. These emission estimates are largely derived from the national forest inventory, data from Coillte (the State forest company) and various other sources, and use of the Irish carbon reporting system (CARBWARE) model.

B. Key categories

1. Forest land remaining forest land – CO_2

52.   Ireland reports increases (gains) and decreases (losses) jointly when estimating the net changes in carbon stock in living biomass. Data are provided only for gains, whereas the losses are indicated by the notation key included elsewhere ("IE") in CRF table 5.A. However, Ireland does provide detailed data in annex E, including area for afforestation, reforestation and felling activities, harvest volume and carbon stock, and carbon stock for young and mature forests. Ireland adopts a conservative approach to cleared/unclassified forest areas (less than seven years old), assuming zero biomass. The ERT recommends that Ireland seek to estimate the changes in carbon stock in these forested areas, to ensure that the forest land estimates are not underestimated, in accordance with the IPCC good practice guidance for LULUCF. The ERT reiterates the recommendation from the previous review that Ireland report estimates for carbon gains and losses separately in order to increase the transparency of the inventory.

53.   Changes in carbon stock in the litter carbon pool in mature forest land have been estimated using the default values provided in the IPCC good practice guidance for LULUCF (table 3.2.1) for net annual accumulation of litter carbon over the length of the transition period (50 years), of 0.3 and 0.5 t C per ha per year for broadleaf deciduous (31 per cent) and needleleaf evergreen (69 per cent) trees, respectively. For young crops, Ireland used the default values of 0.8 and 1.3 t C per ha per year for the net annual accumulation of litter carbon based on a 20-year default, for broadleaf deciduous (7 per cent) and needleleaf evergreen (93 per cent) trees, respectively. Ireland mentions that higher values than the default IPCC values have been reported, but they have not been used because not enough country-specific data are available. The ERT recommends that Ireland seek to develop country-specific data to ensure that the inventory follows the general principle of good practice, as far as is feasible. The ERT

noted with appreciation that Ireland has, in its 2008 NIR, followed the recommendations from the previous review regarding the use of IPCC default values for mature and young forests. Because forest land remaining forest land is a key category, the ERT recommends that Ireland strive to report using a higher tier approach than tier 1 and IPCC default values.

2. Grassland remaining grassland – CO_2

54.   Changes in the soil organic carbon pool in grassland have been estimated using the IPCC tier 1 method and default values for the stock change factors for land use, management regime and input of organic matter. The ERT noted that Ireland, in table 7.6 of the NIR, may have inadvertently swapped the default value for stock change factor for management regime with the stock change factor for organic matter input for improved grassland. Ireland identifies subcategories of grassland in its territory (unimproved pasture, improved pasture, rough grazing), but does not differentiate between the management systems applied to them (these may include seeding of productive species, soil tillage, irrigation and fertilization). The ERT recommends that Ireland provide more disaggregated estimates for this category (e.g. different land-use categories and management systems).

C. Non-key categories

1. Cropland remaining cropland – CO_2

55.   Changes in the soil carbon pool in cropland have been estimated using the IPCC tier 1 method and default values for the stock change factors for land use, management regime and input of organic matter. The default values for the carbon stock change factors accounting for management systems and for organic matter input have been appropriately selected, but a single value for each factor is used for the entire country. The ERT recommends that Ireland provide more disaggregated estimates for this category, defining different cropland subcategories to reflect different cropland systems (e.g. perennial crops, annual crops, set-aside land) and management practices (e.g. crop rotations, soil tillage, crop residue management, irrigation and fertilization).

2. Biomass burning – CH_4 and N_2O

56.   Ireland reports GHG emissions from biomass burning for the first time in its 2008 submission. Although the forest area affected by wildfires is small compared to the total forest land, it is important to report these emissions to ensure transparency and completeness. Ireland presents several assumptions to estimate emissions from forest fires. The ERT recommends that Ireland check the validity of the assumptions either from field checking or through use of satellite imagery.

VI. Information on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol

57.   Ireland reported the Kyoto Protocol LULUCF tables voluntarily with its 2007 inventory submission. It reported on all activities under Article 3, paragraph 3, for the period from 1990 to reporting year 2008 in the report "KP LULUCF tables April 2007"[7] and reported in the Kyoto Protocol LULUCF tables for the year 2008. Ireland acknowledged that some of the data were preliminary estimates and based on assumptions that will be improved as more precise data and information become available and when the input data to the Irish carbon reporting system (CARBWARE) become available. The Party reports on all pools and on non-CO_2 emissions from wildfires and nitrogen fertilization on afforested/reforested areas. Ireland is also advancing ways to validate the model results through the use of experimental data, and in the assessment of errors (uncertainties). Ireland is also creating a QA/QC system (software and data interface).

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[7] Black K. 2007. *KP LULUCF Tables April 2007. The Irish National Carbon Reporting Manual. Supplementary to KP Tables v1.01. Carbware*. Dublin: COFORD and Bray: FERS.

58.   CARBWARE has evolved from meeting the reporting needs under the Convention to include activities under Article 3, paragraph 3, of the Kyoto Protocol. The system has evolved from a tier 2 to a tier 3 method which uses forest inventory data, yield models and national research information. This is in accordance with the IPCC good practice guidance for LULUCF. Ireland has described various auxiliary data to generate the AD necessary to report under Article 3, paragraph 3, which the ERT deems appropriate.

VII. Waste

A. Sector overview

59.   In 2006, emissions from the waste sector amounted to 1,831.42 Gg CO_2 eq, or 2.6 per cent of total GHG emissions, compared with the base year contribution (2.6 per cent). Since 1990, emissions from the waste sector have increased by 25.4 per cent. Most of the emissions are from solid waste disposal on land, which accounted for 91.2 per cent of the total emissions in 2006; GHG emissions from wastewater handling accounted for the remaining 8.8 per cent.

60.   GHG emissions from waste incineration are reported as not estimated ("NE") in the 2008 submission. Ireland mentions in the NIR that incineration of municipal waste may become an additional source of emissions in the coming years following the granting of waste licences for two incinerators by the Irish Environmental Protection Agency. The ERT recommends that the Party report GHG emissions from waste incineration in the next submission after the waste incinerators begin functioning.

61.   The ERT had difficulty determining from the NIR the exact modifications that Ireland had made to the IPCC tier 2 methodology for solid waste disposal on land. The ERT encourages Ireland to clearly explain the difference between its approach and that of the IPCC tier 2 methodology in its next annual submission.

62.   The CH_4 emissions reported in the 2008 submission are different to those in the 2007 submission for a number of years. The NIR briefly explains the reasons behind the differences between the 2007 and 2008 submissions (e.g. recalculations in emissions from solid waste disposal on land and reduction of the landfill of sewage sludge). The ERT recommends that Ireland provide further analysis of this difference in the next submission.

B. Key categories

Solid waste disposal on land – CH_4

63.   A modified form of the IPCC tier 2 first order decay method was used. The ERT recommends that Ireland provide more information about this modified approach in the next submission, such as the theory of modification and formulation of the modified form. AD on waste in Ireland are from the National Waste Database. In 2006 the total emissions from solid waste disposed on land were 79.50 Gg CH_4 after recovery and flaring and the average amount of waste going to solid waste disposal sites was about 1.46 million tonnes annually in Ireland. About 77.1 per cent of the CH_4 was emitted from managed waste disposal on land and the other 22.9 per cent was from shallow unmanaged waste disposal sites. Compared with the base year, CH_4 emissions from solid waste disposal on land increased by 25.4 per cent due to the increasing number of managed sites in Ireland.

C. Non-key categories

1. Wastewater handling – CH_4

64.   The tier 1 method was used to estimate emissions from wastewater and sludge with a country-specific EF (the fraction of biochemical oxygen demand (BOD) that readily settles and the fraction of BOD in sludge that degrades anaerobically), national statistical data of Ireland as AD, and IPCC default

values. The emissions from wastewater sludge in Ireland amounted to 1.2 Gg CH_4 in 2006. Compared with the base year, CH_4 emissions from wastewater handling increased by 64.7 per cent, but the reason for this increase was not provided in the NIR. The ERT recommends that Ireland provide more information in the NIR about the methodology, trend analysis of AD and calculated results.

2. Wastewater handling – N_2O

65.   The tier 1 methodology was used to estimate emissions from human sewage with the IPCC default EF and the FAO estimate of protein intake. However, the method applied and the variables used were not clearly described in the NIR. The ERT recommends that Ireland provide a clearer presentation of the method used, trend analysis about AD and calculation results in its next submission.

66.   In 2006, emissions from human sewage were 0.44 Gg N_2O in Ireland, accounting for an increase of 20.8 per cent since 1990 due to the changes in the body weight and average protein intake of the population.

VIII. Other issues

1. Changes to the national system

67.   The Party has not reported on any changes to its national system in the 2008 submission. In response to questions raised by the ERT during the review the Party confirmed that no changes to the national system have taken place. In addition, Ireland confirmed that any changes to its national system will be documented in future NIRs.

2. Changes to the national registry

68.   The Party has not reported on any changes to its national registry in the 2008 submission. In response to questions raised by the ERT during the review the Party confirmed that no changes to the national registry have taken place. Ireland also stated that it plans to relocate the national registry before the end of 2008 and that this will be documented in the 2009 submission. The ERT requested additional details of the national registry as recommended by the previous review, including additional information on the national registry's current system, the security hardware and infrastructure, the security software and governance, the registry parameters and capacity, and additional documentation on the technical and administrative procedures for the operation of the national registry (e.g. management procedures of the files and documents, the users, the accounts, the transactions, the recorded emissions and the system), as well as the results of an audit of the administrative procedures that underlie the registry system which was undertaken by external contractors in February 2007. Ireland provided this information after the review and satisfied the ERT that the national registry is in order. The ERT encourages Ireland to include this information in its next annual submission and to report any future changes to the national registry in its annual submissions.

3. Commitment period reserve

69.   Ireland has not reported its commitment period reserve in the 2008 submission. In response to questions raised by the ERT during the review Ireland reported that its commitment period reserve has not changed since the initial report review (282,765,845 t CO_2 eq). The ERT agrees with this figure. The ERT recommends that the Party include information on its commitment period reserve in its next annual submission.

IX. Conclusions and recommendations

70.   Ireland has submitted a complete set of CRF tables for the years 1990–2006, except for table 8(b) (explanatory information on recalculations), and an NIR, which are complete in terms of geographical coverage, years, sectors, categories and gases.

71.   Ireland's institutional arrangements are fully functional and designed to use the best expertise and resources available to develop, prepare and compile the inventory. The ERT noted that Ireland intends to further consolidate the national system, further apply the formal QA/QC procedures that have been put into operation as an integral part of the national system; extend peer review and expert review of the inventory data; and outline the annual requirements for a continuous improvement programme for the inventory.

72.   The ERT noted that Ireland submitted an inventory report that is generally in line with the UNFCCC reporting guidelines, the Revised 1996 IPCC Guidelines, the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. However, there are some areas which need further improvements such as:

(a)   Correcting some specific estimates, including the use of the correct assumptions relating to the derivation of AD for emissions for dairy and non-dairy cattle;

(b)   Improving estimates for key categories, including forest land remaining forest land, using a higher tier approach than tier 1 and IPCC default values, ensuring that the forest land estimates are not underestimated, and reviewing the relationship between the body weight and the milk yield of dairy cows;

(c)   Providing more detailed descriptions of the approaches and underlying assumptions used for the uncertainty estimates.

73.   The ERT encourages Ireland to provide more detailed descriptions on methods, AD, EFs and methodologies used in its next NIR, by:

(a)   Providing more detailed explanations of emission trends and changes in trends in all sectors;

(b)   Improving descriptions of methodologies that differ from those provided/recommended by the IPCC (including the provision of technical references to country-specific EFs and AD), such as: a modified form of the IPCC tier 2 first order decay method; methods for estimating CH_4 and N_2O emissions from wastewater handling; fluctuations in the CO_2 IEF for lime production and in CO_2 IEFs for liquid fuels; the methodology used for feedstocks; and the fuel consumption trends;

(c)   Following up on recommendations in this review report and previous review reports that are still pending.

X. Questions of implementation

74.   No questions of implementation were identified by the ERT during the review.

<u>Annex</u>

Documents and information used during the review

A. Reference documents

Intergovernmental Panel on Climate Change. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gp/english/>.

Intergovernmental Panel on Climate Change. *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Available at <http://www.ipcc-nggip.iges.or.jp/public/gpglulucf/gpglulucf.htm>.

"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/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

"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>.

"Guidelines for national systems under Article 5, paragraph 1, of the Kyoto Protocol". Decision 19/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=14>.

"Guidelines for the preparation of the information required under Article 7 of the Kyoto Protocol". Decision 15/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a02.pdf#page=54>.

"Guidelines for review under Article 8 of the Kyoto Protocol". Decision 22/CMP.1. Available at <http://unfccc.int/resource/docs/2005/cmp1/eng/08a03.pdf#page=51>.

Status report for Ireland 2007. Available at <http://unfccc.int/resource/docs/2007/asr/irl.pdf>.

Status report for Ireland 2008. Available at <http://unfccc.int/resource/docs/2008/asr/irl.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2007. Available at <http://unfccc.int/resource/webdocs/sai/2007.pdf>.

Synthesis and assessment report on the greenhouse gas inventories submitted in 2008. Available at <http://unfccc.int/resource/webdocs/sai/2008.pdf>.

FCCC/ARR/2006/IRL. Report of the individual review of the greenhouse gas inventory of Ireland submitted in 2006. Available at <http://unfccc.int/resource/docs/2007/arr/irl.pdf>.

FCCC/IRR/2007/IRL: Report of the review of the initial report of Ireland. Available at <http://unfccc.int/resource/docs/2007/irr/irl.pdf>.

B. Additional information provided by the Party

Responses to questions during the review were received from Mr. Paul Duffy (Irish Environmental Protection Agency), including additional material on the methodology and assumptions used.

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