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UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND

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

I. OVERVIEW

A. Introduction

1. This report covers the centralized review of the 2004 greenhouse gas (GHG) inventory submission of the United Kingdom of Great Britain and Northern Ireland (UK), coordinated by the United Nations Framework Convention on Climate Change (UNFCCC) secretariat, in accordance with decision 19/CP.8 of the Conference of the Parties. The review took place from 18 to 22 October 2004 in Bonn, Germany, and was conducted by the following team of nominated experts from the roster of experts: Generalist – Mr. William Irving (United States) and Mr. Matthew Dudley (Australia), Energy – Mr. Pavel Fott (Czech Republic), Mr. Hongwei Yang (China), and Mr Takeshi Enoki (Japan), Industrial Processes – Mr. Jos Olivier (Netherlands) and Ms. Virginia Sena (Uruguay), Agriculture – Mr. Damdin Dagvadorj (Mongolia) and Ms. Anna Romanovskaya (Russian Federation), Land-use Change and Forestry (LUCF) – Mr. Rizaldi Boer (Indonesia) and Mr. Xiaoquan Zhang (China), Waste – Mr. Yunus Arikan (Turkey) and Ms. Elisabeth Scheele (United States). Mr. William Irving was the lead reviewer. Due to unforeseen circumstances, Mr. Rizaldi Boer, who was invited as the second lead reviewer, was not able to attend the review in Bonn, but contributed from Indonesia. The review was coordinated by Ms. Astrid Olsson (UNFCCC secretariat).

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

B. Inventory submission and other sources of information

3. In its 2004 submission, the UK has submitted a complete set of common reporting format (CRF) tables for the years 1990–2002 and a national inventory report (NIR). Where needed the expert review team (ERT) also used previous years' submissions, additional information provided during the review and other information. The full list of materials used during the review is provided in annex 1 to this report.

C. Emission profiles and trends

4. In the year 2002, the most important GHG in the UK was carbon dioxide (CO_2), contributing 86.4 per cent to total[2] national GHG emissions expressed in CO_2 equivalent, followed by methane (CH_4) – 6.9 per cent – and nitrous oxide (N_2O) – 6.5 per cent. Perfluorocarbons (PFCs), hydrofluorocarbons (HFCs) and sulphur hexafluoride (SF_6) taken together contributed 2.0 per cent of the overall GHG

[1] In the symbol for this document, 2004 refers to the year in which the inventory was submitted, and not to the year of publication.
[2] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding LUCF, unless otherwise specified.

emissions in the country. The Energy sector accounted for 86.8 per cent of total GHG emissions, followed by Agriculture (7.4 per cent), Industrial Processes (4.1 per cent) and Waste (1.8 per cent). Total GHG emissions from LUCF amounted to 0.3 Gg CO_2 equivalent and decreased by 78.7 per cent from 1990 to 2002.

D. Key sources

5. The UK reports a level and trend key source analysis using the tier 2 method. The UK key source analysis produced markedly different results from the UNFCCC secretariat's[3] tier 1 analysis. The UK identified 16 key source categories, and the secretariat identified 19. The differences are primarily due to the incorporation of uncertainty estimates in the analysis by the UK, which emphasized smaller sources of N_2O emission sources with highly uncertain emission factors (EFs), and de-emphasized larger sources with lower uncertainties. In addition, the UK included LUCF categories in its key source analysis and the secretariat did not.

6. The UK key source analysis is consistent 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), but the documentation of the methodology and results should be improved. The UNFCCC reporting guidelines require the inclusion of IPCC good practice guidance tables 7.A1–7.A3, but the UK has only included summary table 7.A3.

E. Main findings

7. The national inventory submitted by the United Kingdom is in conformity with the UNFCCC reporting guidelines. The methodologies used are described for each source category individually under the respective sector. The methodologies for estimating emissions are consistent with the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC Guidelines) and the IPCC good practice guidance. The UK inventory is particularly strong in the methodological implementation of cross-cutting activities such as uncertainty assessment, quality assurance/quality control (QA/QC), and key source analysis.

8. The ERT noted some minor questions of transparency and consistency, which are described in the sections on Industrial Processes and Waste below. In addition, while recalculations are adequately reported in the CRF, the corresponding explanations in the NIR should be strengthened.

9. The ERT also noted that the UK provided timely and thorough responses to questions raised during the review. It was evident from these responses that the UK plans to address many of the questions raised by the ERT, either as part of work already underway, or specifically as a result of the inventory review.

F. Cross-cutting topics

Completeness

10. The national inventory submitted by the United Kingdom is comprehensive and complete. All major source/sink categories and direct and indirect GHGs are reported, with the exception of N_2O emissions from domestic waste-water treatment. Disaggregation of emissions for some subsectors of manufacturing industries and construction is not reported.

11. The UK has provided inventory data for the years 1990–2002. The CRF is complete and table 9 provides explanations for cells where notation keys have been used. Minor gaps, where they exist, reflect

[3] The secretariat had identified, for each individual Party, those source categories which are key sources in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the IPCC good practice guidance. Key sources according to the tier 1 trend assessment were also identified for those Parties providing a full CRF for the year 1990. Where the Party has performed a key source analysis, the key sources presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key source assessment conducted by the secretariat.

the limits of disaggregating available activity data (AD) to smaller subcategories. Notation keys are used throughout the tables.

Transparency

12. The NIR is sufficiently transparent in most cases to allow for a full assessment of underlying assumptions and the rationale for choices of data, methods and other inventory parameters. The NIR describes in detail the methods, AD and EFs used in the Energy (particularly for stationary and mobile combustion), Agriculture and LUCF sectors. Methods and data are provided in the Industrial Processes sector, but the ERT noted that the transparency of reporting in this sector could be improved by, for example, providing information on the application of EFs over time. The Waste sector could also be documented more thoroughly by including selected information on oxidation rates, methane recovery and protein consumption.

Recalculations and time-series consistency

13. The UK has carried out a significant number of minor recalculations to the estimates provided in its 2003 submission, which are documented in CRF tables 8(a) and (b) for the years 1990–2001. Major recalculations include actual and potential emissions of fluorinated gases, CO_2 from waste incineration and N_2O from waste-water handling. The total effect of the recalculations for the base year (as reported in the CRF tables) is a decrease by 0.21 per cent in the estimates for CO_2 equivalent emissions excluding LUCF (0.16 per cent including LUCF).

14. A cross-check between the NIR and CRF tables 8(a) and 8(b) identified the following issues that should be addressed in the UK's future submissions in order to improve the documentation of recalculations:

(a) The annex to the NIR identifies a change in the method of deriving AD for Road Transportation that has resulted in a recalculation of the data on vehicle-km travelled between 1993 and 2001, but this is not reflected either in the main NIR or in table 8(b).

(b) There is no discussion of individual recalculations and their impact on the time series.

Uncertainties

15. The NIR provides a general discussion of overall inventory uncertainty in the first chapter and detailed quantitative results for both tier 1 and tier 2 in the annex, using the IPCC good practice guidance tables. The overall level uncertainty of the inventory, using the tier 2 method, is estimated as 15 per cent in 2002. The tier 2 results are presented by gas only, although the uncertainties for AD and EF inputs are provided for individual sources. The UK indicated that it intends to provide tier 2 source category results in the next inventory submission.

16. To improve the discussion of the uncertainty analysis, the UK should provide quantitative results and qualitative discussion of the sources of uncertainty in individual source categories in the sectoral chapters of the NIR (chapters 3–8).

Verification and quality assurance/quality control approaches

17. The UK's GHG inventory includes a detailed description of the QA/QC plan and its implementation. The QA/QC system allows for standardization of QA/QC checks among the different contributors at disparate institutions. The UK is phasing in tier 2 QA/QC checks for key source categories and expects them to be implemented fully in future inventories.

18. As an additional verification step, the UK compares bottom-up AD-based estimates for non-CO_2 GHGs with top-down modelled estimates developed from atmospheric measurements. The ERT encourages the UK to provide additional discussion of possible explanations for the differences in estimates from the two approaches.

Follow-up to previous reviews

19. The UK has made improvements to cross-cutting areas, such as providing uncertainty estimates at the source category level (tier 1), expanding the documentation of methods, trends and data for key sources, and organizing the NIR by sector instead of by pollutant.

20. The UK has not followed up on some specific recommendations from the 2003 report regarding improving documentation in the Waste sector.

G. Areas for further improvement

Identified by the Party

21. In the NIR and in subsequent correspondence with the ERT the UK identified two areas for improvement:

(a) Estimation of tier 2 uncertainties at the source category level, which should be completed in 2005 and the results presented in the 2005 NIR;

(b) A separate key source analysis for LUCF categories, consistent with the IPCC good practice guidance for Land Use, Land-use Change and Forestry (LULUCF).

Identified by the ERT

22. The ERT identifies the following cross-cutting issues for improvement. The UK should:

(a) Improve the documentation of recalculations to ensure that all recalculations are described/justified, and in this regard correct some inconsistencies between the NIR and table 8(b);

(b) Improve the documentation of the key source analysis;

(c) Include more analysis/discussion of the factors influencing the uncertainty of individual source categories;

(d) Include in the NIR a description of how AD and emissions data reported by companies are verified.

II. ENERGY

A. Sector overview

23. In 2002, the Energy sector accounted for 86.8 per cent of the UK's total emissions excluding LUCF. The sector was responsible for 98.0 per cent of total national CO_2 emissions (excluding LUCF), 34.9 per cent of CH_4 emissions and 21.8 per cent of N_2O emissions. Fuel combustion contributed 83.5 per cent of total national GHG emissions: of this Energy Industries accounted for 31.2 per cent, Manufacturing Industries for 13.4 per cent, Transport for 20.1 per cent and Other Sectors for 18.3 per cent. Fugitive emissions contributed 3.3 per cent of total national GHG emissions. Emissions from the Energy sector decreased by 8.9 per cent between 1990 and 2002.

24. For the Energy sector all IPCC sources and sinks are addressed, and all years and gases are covered. The UK has used tier 2 methodologies and country-specific EFs (tier 2/3 for Transport). The level of disaggregation is consistent with the IPCC Guidelines. Emissions estimates for the indirect GHGs and sulphur dioxide (SO_2) are reported in the CRF. All the CRF tables including the sectoral background data tables have been provided for the years 1990–2002.

25. The reporting of the Energy sector is consistent with the UNFCCC reporting guidelines. All the methodologies used for the calculation of the direct and indirect GHGs have been documented properly in most cases. Initial calculations are conducted in the UK's National Atmospheric Emissions Inventory (NAEI) nomenclature, reflecting the national energy statistics given in the *Digest of UK Energy Statistics*.

Detailed information showing how the national NAEI codes correspond with the IPCC sources is given in the NIR (appendix A3). In many cases the NIR provides sufficient additional information to complement the CRF tables. In some cases, however, the explanations and documentation of methods used might be clearer and more transparent (see paragraphs 27, 33, and 34 below).

26. Specific examples of QA/QC for Energy are not given in the Energy chapter in the NIR, but relevant procedures are presented in the general chapter for all sectors. Recalculations have been carried out only for the year 2001, and are reported in the Energy chapter. These recalculations were mostly motivated by small corrections in the energy statistics and are documented satisfactorily.

27. The ERT gave emphasis to the review of carbon emission factors (CEFs) because of the dominant role of CO_2 in the UK's inventory. In chapter 3 (Energy), the NIR states that the CEFs of all fuels are constant for the whole time period. The CEF values are presented in annex 3: for solid fuels they are related to the unit of mass, while for gaseous fuels (physically gaseous, that is, including those derived from coal and oil) they are related to the gross energy unit. The ERT encourages the UK to demonstrate transparently in the NIR whether the CEFs are really constant over the whole period (the majority of the values are rather old).

28. This documentation would make it possible to compare country-specific CEFs with the IPCC default values or with values from the IPCC Emission Factors Database (EFDB). The UK informed the ERT that the CEFs are now under review and will be updated.

B. Reference and sectoral approaches

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

29. The differences between the reference and sectoral approaches vary from 2 per cent to 5 per cent between 1990 and 2002; these differences are not excessive. In 2002 the approaches differed by 3.2 per cent. When the relevant fossil fuel contribution from energy is added, the difference is only 2.4 per cent. Explanations of the differences are included both in the CRF documentation box and in the NIR (annex A4). A comparison of apparent consumption values in the reference approach estimated by the UK and by the International Energy Agency (IEA) shows close agreement.

International bunker fuels

30. The NIR provides a detailed description of the calculation of CO_2, N_2O and CH_4 emissions from aviation. Fuel consumption values for the different modes of transport – national landing/take off (LTO) cycle, international LTO, national cruise and international cruise – are obtained in order to estimate domestic and international aviation separately. The ERT noted that the UK should consider the consistency of its reporting on fuel used for aviation (mainly a split between domestic and bunker fuels) to UNFCCC and IEA: for example, the AD for jet kerosene in 2002 were found to be 19.1 per cent higher in the CRF than the figure reported to IEA (difference 71.8 PJ); on the other hand, for civil aviation the AD for 2002 in the CRF are 109.2 PJ lower than the figure given to IEA.

Feedstocks and non-energy use of fuels

31. Emissions from feedstocks are largely reported under Industrial Processes (e.g., natural gas used for ammonia production). In Iron and Steel Production, the greater part of CO_2 emissions for energy supply is reported in the Energy sector under category 1.A.2. Emissions from the use of coke in blast furnaces are split between 1.A.2 Energy and 2.C.1 Industrial Processes according to a complicated approach: emissions from pig iron carbon oxidation are counted under 2.C.1. Also blast furnace losses are covered under 2.C.1. On the other hand, emissions from blast furnace combustion used for energy production are reported under 1.A.2.a.

32. Emissions from solid fuel transformation (the carbonization process itself: coke and smokeless fuel production) are reported as fugitive emissions. CO_2 emissions from fluidized bed cracking in refineries (catalyst regeneration by burning of carbonaceous deposits) are considered in 1.A.1.b because the heat generated is used for energy production.

C. Key sources

Stationary combustion: solid, oil, gas – CO_2

33. Owing to the use of country-specific emission factors, implied emission factors (IEFs) for some subcategories have been identified as outliers (e.g., for solid fuels in 1.A.1.a (87.0 t/TJ) and for gas in 1.A.1.c (64.8 t/TJ)). The ERT encourages the UK to analyse and provide explanations for such cases to demonstrate that they reflect country-specific conditions. In response to questions raised during the review by the ERT, the UK informed the ERT that it intends to examine this issue.

Mobile combustion: road transportation – CO_2, N_2O

34. The ERT did not find any problems with the advanced methodological approach for road transportation. In accordance with the IPCC good practice guidance, different AD are used for emissions of different gases from mobile sources: CO_2 emission are estimated from the fuel consumption statistics, and non-CO_2 emission estimates are based on the COPERT model concept using detailed transport statistical data. N_2O emissions from road traffic show an increasing trend because of the increasing share of vehicles equipped with catalysts. Despite the fact that the transport discussion in the NIR (annex 3) is very detailed, there is no documentation of the increasing number of vehicles equipped with catalysts, and no documentation of other relevant activity parameters (e.g., mileage travelled).

D. Non-key sources

Fugitive emissions – CO_2, CH_4, N_2O

35. The UK did not identify fugitive emissions from oil and gas and from coal mining as key sources, but these sources were identified by the secretariat. Nevertheless, the majority of EFs concerning fugitive emissions are country-specific, as recommended for key sources.

36. The UK reports fugitive emissions of all the main GHGs and precursors. The methodologies used are in line with the IPCC Guidelines. In some categories, such as Coal Mining and Handling, the EFs fluctuate throughout the whole time series. However, in cases where an advanced bottom-up approach is applied which reflects actual mining conditions in detail, such fluctuations (11–15 kg/t) are reasonable.

37. The UK reports emissions from solid fuel transformation processes as fugitive (1.B.1.b). As the IPCC Guidelines do not provide a methodology for CO_2 emission from this source, emissions are estimated using the US Environmental Protection Agency (EPA) default EFs. The Party should demonstrate in the NIR that the resulting CO_2 emissions are not double counted in sector 1.A.1.c Manufacture of Solid Fuels.

38. In some less important categories the reporting is not fully consistent. For example, for the years 1990–1994 emissions of CH_4 from venting are reported as included elsewhere ("IE"), because the relevant data are not separately available, but since 1995 these emissions are reported correctly in the right cell.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

39. In 2002, emissions from the Industrial Processes sector accounted for 4.1 per cent of the total CO_2 equivalent emissions of the UK (without LUCF). CO_2 represented 39.7 per cent of emissions from the sector in 2002 (mostly from cement production) and N_2O 11.9 per cent, with nitric acid production being responsible for 78.4 per cent of N_2O emissions. Actual emissions of fluorinated gases (F-gases) accounted for 48.2 per cent of sectoral emissions. Over the period 1990–2002, emissions from the sector decreased by 55.2 per cent. This was due mainly to a decrease of 15.4 per cent in HFC and PFC emissions; a decrease of 27.8 per cent in CO_2 emissions due to a reduction in emissions from cement production and from lime production and use; and a decrease of 89.5 per cent in N_2O emissions, mainly

from a reduction in emissions from adipic acid and nitric acid production. Both actual and potential emissions for F-gases are reported, but not by individual gas, for reasons of confidentiality. CO_2 emissions in 2002 from solvent and other product use are reported in the CRF (table 3.A-D, documentation box) but not included in the total, and no trend information is provided for this sector.

40. For the Industrial Processes sector, the UK identified only two key source categories: N_2O from nitric acid production and HFC emissions from consumption and production of ozone depleting substance (ODS) substitutes. The secretariat's analysis did not identify N_2O from nitric acid as a key source, but did identify three additional key sources: CO_2 emissions from cement production, N_2O from adipic acid production, and CO_2 from iron and steel production.

41. The emissions estimates from the sector are complete except for a few minor sources (CO_2 from asphalt roofing and paving, CH_4 from ammonia production, CH_4 from iron and steel, ferroalloys and aluminium production, and N_2O from anaesthesia). The UK explains that these sources are excluded either because of a lack of methodology or because they are believed to be negligible.

42. Recalculations have been made for the complete time series for emissions of F-gases (HFCs, PFCs and SF_6) from production and consumption of these gases, as well as from aluminium production. Recalculations are reported in the CRF and mentioned in the NIR. Details are provided in a separate document to show that they have led to an improvement in the emissions estimates, but the ERT recommends that this information also be summarised in the NIR itself.

43. To improve confidence in the inventory estimates based on data reported by individual companies (either through the Pollution Inventory or directly to AEA Technology (AEAT), the ERT recommends that the UK include in the NIR results from its planned efforts to document verification procedures for plant-level activity and emissions data, particularly for sources where emissions are decreasing over time.

44. To improve the transparency of its reporting of emissions of F-gases, the ERT recommends that the UK should keep the confidentiality of reporting individual HFCs and PFCs to a minimum wherever possible, for example, emissions from the consumption of HFCs and PFCs. The ERT also encourages the UK to provide information on the procedures used to ensure that the data reported by industry on emissions of F-gases are correct.

B. Key sources

Nitric acid production – N_2O

45. For this source, the IEF decreased by 30 per cent in 1995, increased by 50 per cent in 1999, remained constant from 1999 to 2001, and dropped (to 0.005 t/t) in 2002. The ERT recommends that the UK provide an explanation in the NIR of these marked IEF changes, as it did during the review, and give detailed information on the abatement technologies used at plant level (e.g., number of sites with abatement technologies fitted, the period for which they have been operating, and abatement percentages).

46. There are inconsistent statements in the NIR regarding the procedure used to estimate N_2O emissions from nitric acid. First, it is stated that from 1990 to 1994 emissions were calculated using a mixture of site-specific EFs and default EFs (with no abatement technology in place). Later, however, the NIR states that for all years emissions were estimated using plant-specific EFs. The ERT recommends that the UK reconcile this inconsistency.

Production of halocarbons and SF_6 – HFCs

47. By-product HFC-23 emissions from HCFC-22 production and fugitive emissions of HFCs from HFC manufacturing are reported in an aggregate manner under Other Production for reasons of confidentiality, and both are therefore reported as "IE". On the basis of information provided in the NIR, the ERT was therefore not able to assess the methodology the UK has applied to estimate emissions. Since these emissions decreased by 80 per cent from 1990 to 2002, and HFC emissions from halocarbon manufacturing were estimated using a model to predict them, based on data reported by the manufacturers, the ERT recommends that the UK include information in the NIR (in addition to

supplementary documents) on which data manufacturers do report (production data, emissions, efficiency of abatement technology installed) and the model used.

48. The NIR states that HFC emissions from halocarbon manufacturing have been recalculated due to updated information on the effect of the introduction of efficient pollution abatement equipment (a thermal oxidiser) at the main UK manufacturing plant over 1998-1999. However, these changes are not mentioned under the section of the NIR on source-specific recalculations, even though they are included in the appropriate CRF tables.

C. Non-key sources

Adipic acid production – N_2O

49. The IEF prior to 1994 is lower than the IPCC default, although N_2O emissions from one nitric acid production plant were included until that year. The IEFs from 1994 to 1997 are higher than the default, while the NIR states that the default EF is used. A very large decrease which occurred between 1998 and 1999 is explained by the N_2O abatement system that was retrofitted to the plant, but the ERT found no explanation of the fluctuations in the IEF from 2000 to 2002. The ERT encourages the Party to include more detailed information on the assumptions made and on the efficiency of the abatement technology used for the whole period.

Iron and steel production – CO_2

50. The UK uses a carbon balance approach, which is explained in the NIR and reflected in the CRF, including negative components, for example, for parts reported as fuel combustion. The ERT commends the UK for the transparency of its reporting but recommends it also to provide total basic oxygen furnace (BOF) steel production in the CRF and to relate this to the NIR in order to show that the time series of total CO_2 from fuel combustion and the remainder from coke consumption is consistent.

Lime production – CO_2

51. Emissions are estimated on the basis of the assumption that all lime is quicklime. Lime production from dolomite is not estimated, since the Party "believes dolomite calcination is a small proportion of the total", instead of using the default fraction of 15 per cent presented in the IPCC good practice guidance. The ERT recommends that the UK provide documentation for this assumption and provide the data which lead it to conclude that dolomite calcination is a small proportion of the total.

Ammonia production – CO_2

52. The ERT recommends that the UK provide a more transparent description of the information provided in sections 4.10.2 and 4.10.3 of the NIR, on data sources and type of data used for calculating CO_2 emissions.

Aluminium production – CO_2 and PFCs

53. The ERT recommends that the UK include in the NIR the value of and the basis for the selection of the EF for CO_2. Regarding PFC emissions, the ERT encourages the UK to describe in the NIR the type of aluminium processes in use (Side Worked Prebaked (SWPB), Vertical Stud Søderberg (VSS), Centre Worked Prebaked (CWPB), Horizontal Stud Søderberg (HSS), Point Feed Prebaked (PFPB)), the share of each in total national production, and the PFC EFs per type, and to explain the large inter-annual variations of the IEFs.

IV. AGRICULTURE

A. Sector overview

54. In 2002, the Agriculture sector accounted for 7.4 per cent per cent of total national GHG emissions, reaching 46,763 Gg CO_2 equivalent. Over the period 1990–2002 emissions from the sector decreased by 12.9 per cent. CH_4 and N_2O contributed 40.6 and 59.4 per cent, respectively, to the total

emissions from the sector. The tier 2 key source analysis of the Party identified CH_4 from enteric fermentation, N_2O from agricultural soils and N_2O from manure management as key sources, which is consistent with the results of the secretariat's key source analysis.

55. Agricultural soils and enteric fermentation are the major source categories in the Agriculture sector, contributing 56.5 per cent and 36.2 per cent, respectively. Rice cultivation and prescribed burning of savannas were reported as "not occurring" ("NO") and field burning of crop residues has been prohibited in the UK since 1993. From 1990 to 2002, GHG emissions from enteric fermentation and agricultural soils decreased by 11.5 and 13.0 per cent, respectively, because of a reduction in the animal populations and in rates of nitrogen (N) fertilization. The ERT encourages the UK to provide more explanatory information on the drivers behind the AD trends during the period 1990–2002.

56. The UK reports complete estimates of all gases and sources from the Agriculture sector as recommended by the IPCC Guidelines, and provides transparent descriptions of the methodologies used. It reports additional subcategories of animals (deer) and emissions from N fixation from improved grasslands. The UK provided the ERT with timely and comprehensive answers to questions on agriculture raised during the review. The ERT recommends that the UK include this additional information in its next submission to facilitate review.

B. Key sources

Enteric fermentation – CH_4

57. The UK uses a tier 2 method for cattle, but not for sheep. The ERT encourages the UK in its intention to implement a tier 2 method for sheep in future. As noted in the 2003 review report, the IEF for sheep is among lowest of reporting Parties, at about 50 per cent of the default value. In response to a question from the ERT, the UK noted that the EF for lambs is assumed to be 40 per cent of that for adult sheep on the basis of a study by Sneath et al., 1997. The ERT encourages the UK to provide more explanatory information on the EF for lambs in the NIR and to consider the possibility of peer-reviewed publication of the research paper it references. The UK may also wish to report AD on populations of subcategories of cattle and sheep in the country in order to clarify the weighted EFs it uses for these animals.

Manure management – N_2O

58. The UK uses the tier 1 method for this source category, along with country-specific data. It adjusts values on N excretion with 20 per cent of ammonia (NH_3) and nitrogen oxide (NO_x) volatilization before estimating N_2O emissions from animal waste management systems (AWMS). However, the default EF for N_2O in accordance with its unit (kg N-N_2O/kg of N excreted in AWMS) should be applied to the total N excretion in the AWMS. The ERT recommends that the UK investigate this question and recalculate the N_2O emissions.

59. The values for N excretion of dairy cows vary from year to year, increasing in 2001 and decreasing in 2002. The UK assumes that animal body mass increases at 1 per cent per year. For 2002, however, the assumption was that animal weights were no longer increasing, as there was a move to keeping smaller breeds. The ERT encourages the UK to provide clear explanations of these assumptions in the NIR.

Agricultural soils – N_2O

60. The UK uses the IPCC methodology, incorporating some UK-specific parameters for N fixation on grasslands and amount of N applied with organic fertilizers. The IEF for cultivation of histosols varies from 0.5 to 500 across the time series. Only in 2002 was the IPCC good practice guidance default value (8 kgN-N_2O/ ha) used appropriately. The ERT encourages the UK to correct the values for the area of histosols and to recalculate emissions using the IPCC good practice guidance default EF for the period 1990–2001.

61. The UK's estimates of indirect N_2O emissions from soils include a correction to avoid double counting of N_2O emitted from synthetic fertilizers. However, this could lead to underestimation, because $Frac_{GASF}$ and $Frac_{LEACH}$ have units of kg N/kg of synthetic fertilizer nitrogen applied (IPCC Guidelines, Vol. 2, table 4-17). The ERT recommends that the UK investigate this question closely and perform recalculations for the whole time series for indirect N_2O emissions.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

62. The LUCF sector in the UK shows net emissions since 1990. The emissions include CH_4 and N_2O from forest and grassland conversion, as well as CO_2 emissions from four categories (5.A, 5.B, 5.D and 5.E). However, net emissions decreased from 9,077 to 1,930 Gg over the period 1990–2002, representing 1.2 per cent of total national GHG emissions in 1990 and 0.3 per cent in 2002. Since 1990, net CO_2 emissions from the LUCF sector have decreased by 79.0 per cent. Of this decrease, 82.5 per cent resulted from a decrease in CO_2 emissions from soils, and 16 per cent from an increase in CO_2 removals from forest and other woody biomass.

63. The latest submission has been greatly improved since the last review, in particular through the inclusion of a new source category, Forest and Grassland Conversion, and detailed descriptions of methodologies, AD, EFs and QA/QC, which have ensured the transparency of the submission.

64. The UK has provided emissions and removals data for categories 5.A, 5.B, 5.D and 5.E for all individual years in the period 1990–2002. Category 5.C is reported as "NO" as it is considered to be negligible in the UK.

65. Inventory data are mostly reported only in CRF table 5. Sectoral background data tables 5.A and 5.D have not been used because the UK uses country-specific methods and/or models rather than the IPCC default methods in these categories.

66. The inventory data reported are transparent. Methodologies, AD and EFs have been used consistently throughout the 1990–2002 inventory and are well documented and referenced in annex 3.7 of the NIR. The new source category included in the inventory has been accounted for all years.

67. Category 5.D Emissions from Soils – Cultivation of Mineral and Liming of Agricultural Soils – has been recalculated but information has not been reflected or explained in CRF table 8(a) and 8(b).

68. There are some inconsistencies in the reporting formats between the NIR and the CRF, although the net emissions reported for the LUCF sector are not affected by the use of the different formats. For example, removals from forest soils and litter are reported in category 5.A in the NIR, and in category 5.D in the CRF. Emissions from soils due to upland and lowland drainage are reported in category 5.E in the NIR and in category 5.D in the CRF.

69. The combined uncertainty of AD and EFs is 30–60 per cent depending on source category.

B. Sink and source categories

Changes in forest and other woody biomass stocks – CO_2

70. The UK has used a country-specific methodology for calculating CO_2 emissions/removals in category 5.A. A carbon accounting model (C-Flow) is used for the calculation of the net change in pools of carbon in standing trees, litter, soil and products from harvested material for coniferous and broadleaf forest. This model includes all important pools and processes in forest ecosystems. Useful explanatory data regarding the land use and forestry activities are reported in the NIR and are based on the national inventory system.

Forest and grassland conversion

71. Previously it was assumed that this category is negligible in UK. The UK has used the IPCC Guidelines to estimate emissions of CO_2, CH_4 and N_2O from on-site burning throughout the period 1990–2002. A description of AD and EFs is provided with the NIR. Estimates of emissions of CO_2, CH_4 and N_2O from off-site burning and decay are not reported.

Emissions and removals from soils – CO_2

72. This category includes CO_2 emissions/removals from the cultivation of mineral and organic soils, liming of agricultural soils, forest soils, and others (set-aside land, and upland and lowland drainage).

73. A country-specific method has been used in estimating CO_2 emissions/removal from the cultivation of mineral soils, set-aside, and upland and lowland drainage. The country-specific methods, AD and EFs are well analysed, justified and documented in the NIR.

74. CO_2 emissions from liming of agricultural soils have been estimated using the IPCC default method. AD and EFs are provided in the NIR and the CRF tables. CO_2 emissions from liming of soils are a relatively small component of CO_2 emissions/removals from soils.

75. The CRF reports all the above sources/sinks in 5.D, as the IPCC Guidelines require, while the NIR reports some of the sub-sources in 5.A and 5.E. This structure introduces difficulties when it comes to summarizing the total emissions/removals from soils for the whole area of the country. The ERT would have preferred a consistent grouping between the CRF and the NIR in order to facilitate comparison, for instance, between Parties.

Others – CO_2

76. This category includes CO_2 emissions from peat extraction and changes in crop biomass.

C. Areas for improvement

77. Emissions from off-site burning and decay as well as on-site burning in the source category Forest and Grassland Conversion should be completely accounted and reported.

VI. WASTE

A. Sector overview

78. Between 1990 and 2002, total GHG emissions from the Waste sector in UK decreased by 57.5 per cent. The contribution of the sector to total national emissions decreased from 3.6 per cent to 1.8 per cent over the same period. In 2002, CH_4 from managed disposal of solid waste on land constituted 77.8 per cent of CH_4 emissions from the Waste sector. The decrease in GHG emissions was due to a 54.3 per cent reduction in CO_2 emissions from waste incineration, and a 62.9 per cent reduction in CH_4 emissions from managed waste disposal on land.

79. On the basis of a tier 2 key source analysis, the UK identified CH_4 from solid waste disposal on land and N_2O from waste-water handling as key sources, whereas the secretariat's tier 1 analysis identified only CH_4 from solid waste disposal on land.

80. The NIR contains improved information on the proportion of cellulose and hemi-cellulose of solid waste, the data sources of the model for solid waste disposal, the estimation of oxidation factors, and the EFS for sludge methane. However, the ERT noted that questions of transparency still exist, as identified in the following paragraphs. (This issue was also highlighted during the 2000 in-country review.)

B. Key sources

Solid waste disposal on land – CH_4

81. The UK uses the first order decay (FOD) model, which is consistent with the choice of tier in the IPCC good practice guidance. During the review, the UK provided additional information to explain that for the two years 2002–2003 municipal solid waste (MSW) amounted to 1.35 kg/cap/day. Of this, 12 per cent was recycled, 4 per cent composted, 9 per cent incinerated and 75 per cent landfilled. As recommended in the 2003 and 2000 review reports, the ERT encourages the UK to provide more background information in table 6.A and to include in the NIR relevant explanations of the overall fractions of the different management practices used.

82. The ERT recommends that the NIR include an explanation on how methane recovery increased from 11 per cent in 1990 to 63 per cent in 2002. Moreover, methane recovery is reported as 69 per cent (45 per cent and 24 per cent) in the NIR but 63 per cent in the CRF. The ERT therefore encourages the UK to present a more detailed summary of the data related to methane recovery in its next submission, particularly the assumptions and emission parameters used.

83. The oxidation rate is indicated as 67.5 per cent in the NIR and as 90 per cent in the CRF. The material supplied by the UK during the review clarified that the oxidation rate is 65 per cent overall but up to 90 per cent for at least one subclass of landfills (four classes are presented in the model). The ERT encourages the UK to present more detailed information on its estimation of oxidation rate in the next submissions.

Waste-water handling – N_2O

84. N_2O emissions are not included in domestic and commercial waste-water treatment. The ERT recommends that this fact be mentioned as appropriate in table 9.

C. Non-key sources

Waste-water handling – CH_4

85. The UK uses a country-specific methodology. Although the NIR states that the model complies with the IPCC good practice guidance as a national model, and provides a reference to the methodology in a separate document, validation and the basic information (assumptions and EFs) of this model have still not been provided, despite the recommendations of the 2000 in-country review and the 2003 centralized review report.

86. The CRF contains no AD for waste-water handling as additional information in table 6.B. The NIR does not explain the exclusion of emissions from private industrial waste-water treatment, although the need for an explanation was noted in 2003 review report. In the CRF, industrial waste water is noted as not estimated ("NE") but the NIR notes that it is included in the domestic estimate. This should be clarified.

87. The notation key "IE" used in table 6.B for CH_4 emissions from domestic and commercial waste water should be explained in table 9.

Waste incineration – CO_2

88. The notation key "IE" used in table 6.C should be explained in table 9.

89. The NIR reports that since 1996 all MSW incineration is used for energy and heat production, and emissions of incinerated MSW wastes are therefore included in the Energy sector, which is line with the IPCC Guidelines. However, CO_2 emissions of biogenic sources should be calculated in the Waste sector, without including them in the overall emissions.

ANNEX 1: MATERIALS USED DURING THE REVIEW

A. Support materials used during the review

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

UNFCCC secretariat (2004). "Report of the individual review of the greenhouse gas inventory of the UK, submitted in the year 2003 (Centralized review)". FCCC/WEB/IRI(3)/2003/GBR (available on the secretariat web site <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/national_inventories_submissions/application/pdf/ukrep03.pdf>).

UNFCCC secretariat. "2004 Status report for the UK" (available on the secretariat web site <http://unfccc.int/files/national_reports/annex_i_ghg_inventories/inventory_review_reports/application/pdf/gbr04.pdf>).

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

UNFCCC secretariat. Review findings for the UK (unpublished).

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

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

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

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

UNFCCC secretariat. Database search tool – *Locator* (unpublished).

IPCC. *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000* (available on the following web site: <http://www.ipcc-nggip.iges.or.jp/public/gp/english>).

IPCC/OECD/IEA. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, volumes 1–3, 1997* (available on the following web site: <http://www.ipcc-ggip.iges.or.jp/public/gl/invs1.htm>).

B. Additional materials

Responses to questions during the review were received from Mr. John D. Watterson (AEA Technology) including additional material on the methodology and assumptions used.

AEAT (2004). Emissions and Projections of HFCs, PFCs and SF6 for the UK and Constituent Countries. AEA Technology, Culham. report no. AEAT/ED50090/R02, June 2004.

"Methane Emissions from Landfill Sites in UK-Final Report", LQM Report No: 443/1, January 2003, Land Quality Management Ltd, for DEFRA.

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