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THE UNITED KINGDOM OF GREAT BRITAIN AND NORTHERN IRELAND

REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY SUBMITTED IN THE YEAR 2003[1]

(Centralized review)

I. OVERVIEW

A. Introduction

1. In accordance with decision 19/CP.8 of the Conference of the Parties, the United Nations Framework Convention on Climate Change (UNFCCC) secretariat coordinated a centralized review of the 2003 greenhouse gas (GHG) inventory submission of the United Kingdom of Great Britain and Northern Ireland (UK). The review took place from 15 to 19 September 2003, in Bonn, Germany, and was conducted by the following team of nominated experts from the roster of experts: Generalist – Mr. Joe Mangino (United States) and Ms. Inga Konstantinaviciute (Lithuania); Energy – Mr. Leif Hockstad (United States), Mr. Michael Strogies (Germany) and Mr. James Magezi-Akiiki (Uganda); Industrial Processes – Mr. Pierre Boileau (Canada) and Mr. Klaus Radunsky (Austria); Agriculture – Mr. Samuel Adejuwon (Nigeria) and Mr. Bhawan Singh (Trinidad and Tobago); Land-use Change and Forestry – Mr. Jozef Mindas (Slovakia) and Mr. Bubu Jallow (Gambia); Waste – Mr. Eduardo Calvo (Peru) and Ms. Angelina Madete (Tanzania). Mr. Radunsky and Mr. Adejuwon were the lead reviewers of this review. The review was coordinated by Ms. Rocio Lichte (UNFCCC secretariat).

2. In accordance with the UNFCCC "Guidelines for the technical review of greenhouse gas inventories from Parties included in Annex I to the Convention", a draft version of this report was communicated to the Government of 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. The UK in 2003 submitted all required common reporting format (CRF) tables for the years 1990–2001 together with the national inventory report (NIR) containing background information on the methodologies and emission factors (EFs) used, including methodological changes to the inventory for each Intergovernmental Panel on Climate Change (IPCC) sector. 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 2001, the most important GHG in the UK was carbon dioxide (CO_2), contributing 84.8 per cent to total[2] national GHG emissions expressed in CO_2 equivalent, followed by methane (CH_4) – 7.0 per cent, and nitrous oxide (N_2O) – 6.5 per cent. Perfluorocarbons (PFCs), hydrofluorocarbons (HFCs)

[1] In the symbol for this document, 2003 refers to the year in which the inventory was submitted, and not to the year of publication. The number (3) indicates that this is a centralized review report.

[2] In this report, the term total emissions refers to the aggregated national GHG emissions expressed in terms of CO_2 equivalent excluding Land-use Change and Forestry, unless otherwise specified.

and sulphur hexafluoride (SF_6) taken together contributed 1.7 per cent of total GHG emissions in the country.

5. The Energy sector accounted for 86 per cent of total GHG emissions, followed by Agriculture (7 per cent), Industrial Processes (4 per cent) and Waste (2 per cent). Over the period 1990–2001 total GHG emissions without Land-use Change and Forestry (LUCF) decreased by 11.7 per cent. Individual GHG emissions decreased by 5.3 per cent (CO_2), 40 per cent (CH_4), 37.6 per cent (N_2O), 42.7 per cent (HFCs), and 35.4 per cent (PFCs), respectively. Only SF_6 emissions increased, by 55.5 per cent. Total year 2001 GHG emissions (excluding LUCF) amounted to 657,231.6 Gg CO_2 equivalent.

6. The time series of emissions/removals from each source and sink category are generally consistent with the NIR source descriptions and sector changes. The emissions trend data do not indicate any notable or unexplained annual fluctuations for national totals.

D. Key sources

7. The UK has provided a key source analysis based on the *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) tier 2 method for key source identification which uses level, trend and uncertainty analysis. The UNFCCC secretariat performed an assessment of key sources by tier 1 which produced different results.[3] The trend and level assessment values for the key source analysis were not documented in the NIR. Comparison of the UK's key source analysis with that performed by the secretariat shows that the categories of CO_2 and CH_4 fugitive emissions from oil and gas operations, N_2O from adipic acid production, CH_4 fugitive emissions from coal mining and handling, and CO_2 from cement production were not considered as key sources in the UK's analysis, but are listed as key sources in the secretariat's analyses. The fact that the fugitive energy sources are not identified as key sources in the UK's key source analysis does not seem to be consistent with the facts that CH_4 fugitive emissions from oil and gas operations in 2001 made up 18 per cent of total CH_4 emissions and that fugitive emissions from solid fuels have declined by 52 per cent since 1995. However, it should be noted that the estimates of CO_2 and CH_4 fugitive emissions from oil and gas operations as well as cement production are based on tier 2/tier 3 methods and country-specific EFs are used.

8. The chapter in the NIR on key source analysis states that the analysis is based on the tier 2 methodology, but in table 6 of this chapter it is referenced as tier 1.

E. Main findings

9. The national inventory submitted by the UK is generally in conformity with the UNFCCC reporting guidelines with only a few exceptions which the ERT noted for transparency and consistency issues. The methodologies for estimating GHG 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.

F. Cross-cutting topics

Completeness

10. All major source/sink categories and direct and indirect GHGs are reported in the inventory. The UK's NIR generally adheres to the UNFCCC reporting guidelines. The annexes to the NIR include

[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.

detailed descriptions of methodologies, underlying assumptions and EFs in a coherent manner for each sector. References to sources of the underlying activity data (AD) are sufficiently provided. A file on the fuel combustion data used in the inventory is also included.

Transparency

11. Overall, the information provided in the CRF and NIR is transparent. The use of notation keys is appropriate and the information provided in the documentation boxes of the CRF increases the transparency of the inventory. The exceptions are that descriptions for the key source and uncertainty analysis could be improved and clearer documentation could be provided.

Recalculations and time-series consistency

12. The UK provides recalculations for the period 1990–2000 (tables 8(a)) and justifications for the recalculations in CRF table 8(b). The recalculations result in an increase in CO_2 emissions in 2000 of 0.3 per cent (0.2 per cent for 1990), a decrease in CH_4 emissions of 4.3 per cent (0.5 per cent for 1990), and an increase in N_2O emissions of 1.9 per cent (a decrease of 0.02 per cent for 1990). The overall effect of the recalculations on the figures for total emissions (without LUCF) compared to the 2002 submission is a 0.22 per cent increase in 1990 and a 0.0001 per cent increase in 2000. These changes are in agreement with the information reported in the UK's 2002 submission. The largest sectoral changes occurred in the Waste sector for CH_4 emissions from solid waste disposal on land (a 16.3 per cent change).

13. The reason given for the recalculations for 1.A.2.f Manufacturing Industries and Construction reported in the NIR is a revision of the figures for the consumption of natural gas fuel for autogenerators in 1999 and 2000, but this is not shown in CRF table 8(b). Justification of the recalculation for SF_6 used in 2.C.4 Aluminium and Magnesium Foundries is provided in the NIR, but not in CRF table 8(b).

14. The NIR chapter on "Methodological Changes" in the Waste sector (6.A Landfill) states that the overall level of emissions was predicted to be higher by a factor of two for past years. However, the CRF recalculation tables for this category show increases ranging from 2 to 3 per cent for 1990–1995. This difference may be explained by other reasons, but it is not consistent with the general statement in the NIR and it is not clear if there are other reasons for the changes observed. The UK indicated to provide a revised text in its next NIR to clarify this matter.

Uncertainties

15. Quantitative estimates of uncertainties in the emissions have been calculated using both tier 1 and tier 2 (Monte Carlo simulation) approaches. The results from both approaches are reported in appendices to the NIR. The overall uncertainty of all GHGs in 2001 is estimated as 13 per cent and in 1990 as 15 per cent.

16. The NIR (appendix 8) presents the results of a tier 2 uncertainty analysis; however, total uncertainty estimates for many categories are not presented at the source category level (a footnote indicates "input parameters were uncertainties of AD and EFs"). This does not allow for clear comparison with the tier 1-based results, or for comparison between source categories.

17. The UK's quantitative estimates of uncertainties by the tier 1 methodology presented in table 5 Uncertainty Calculation and Reporting of the NIR show that the EF uncertainty of nitric acid production is 230 per cent. The default value for that EF presented in the IPCC good practice guidance is 10 per cent. The provision of more documentation on the estimation of uncertainties would be useful for the purposes of comparison with the default values and those reported by other Parties. The UK expressed its intention to aim to provide more documentation on uncertainty estimation in its 2004 NIR.

Verification and quality assurance/quality control approaches

18. The UK provided information concerning the national system and the quality assurance/quality control (QA/QC) system and procedures. The current QA/QC system complies with the tier 1 procedures

as outlined in the IPCC good practice guidance. The NIR includes the QA/QC plan up to 2004, which includes tier 2-type QA/QC procedures. The National Environmental Technology Center (NETCEN) is the inventory agency responsible for coordinating QA/QC activities. The Global Atmosphere Division of the Department for the Environment, Food and Rural Affairs (DEFRA) has established continuous high-frequency observations in order to provide verification for CH_4, N_2O, HFC-134 and HFC-152. A schedule of peer review activities has been developed as well.

19. Estimates resulting from the model employed by the atmospheric research station are generally lower than the inventory estimates, with a few exceptions where inverse modelled data indicate higher values. For CH_4 the deviation ranges from –14 per cent to +26 per cent, for N_2O from –12 per cent to +13 per cent, for HFC-134A from –33 per cent to –9 per cent, and for HCF-152A from –66 per cent to –20 per cent. The basis for comparison is three-year average values.

20. Apart from several exceptions noted here, the data provided in the CRF and the NIR are in agreement. For some sources and sink categories in the LUCF sector, CO_2 emissions have been allocated differently in CRF table Summary 1.A and in the corresponding table in the NIR. However, this has no implications for the total net CO_2 emissions/removals, and the Party has provided comments on these differences in the NIR. Also, four different values were identified for total SF_6 emissions for the year 2000 in different parts of the 2003 submission.[4] The Party should report a consistent value for these SF_6 emissions. The UK informed the ERT that the entire time series for fluorinated gases (F-gases) will be revised in the 2004 submission based on a new model, which is expected to also reduce the risk of data entry errors.

Follow-up to previous reviews

21. The UK has implemented an external expert peer review of fuel combustion sources of CO_2 as indicated during the in-country review of the 2000 submission.

22. The ERT notes that the UK's correction to CRF table 10, which was sent in response to the 2003 Synthesis and assessment (S&A) report, contains a discrepancy for the year 2000: the correction (shown in figure 2 of the response) reports a value of 7,408.9 Gg CH_4 for the year 2000, whereas the value reported in the NIR is 2,322.9 Gg CH_4.

G. Areas for further improvement

Identified by the Party

23. The NIR identifies several areas for improvement. The UK has developed an inventory QA/QC plan containing planned improvements and has identified the need for additional activities to comply with tier 2 QA/QC. For forthcoming inventories the UK envisages the implementation of adequate QA/QC procedures for data-supplying agencies, the further development of documentation in the online manual and the implementation of external peer reviews.

Identified by the ERT

24. The ERT identifies the following major areas for improvement related to cross-cutting issues in the inventory. The UK should: provide quantified uncertainty estimates at the source category level and expand the documentation for comparison purposes; expand the documentation of key source analysis to show values in the level and trend analysis; and organize the NIR by sector instead of by pollutant, which will help overall presentation, transparency and comparability.

[4] Summary 2 of the CRF for 2000 reports a value of 1,641.67 Gg CO_2 equivalent; table 10s5 of the CRF for 2001 reports 1,689.25 Gg CO_2 equivalent; table 10s5 of the CRF for 2000 reports 1,540.22 Gg CO_2 equivalent; and, finally, table 11 of the NIR reports 1,673 Gg CO_2 equivalent.

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

II. ENERGY

A. Sector overview

26. Emissions from stationary fossil fuel combustion in the UK inventory are primarily calculated using a tier 2 bottom-up approach. The CRF tables have been completed in a complete and comprehensive manner. One exception is that there is an incorrect fuel consumption value in the 2001 CRF table 1.A(a)s4 listed for residential fuel combustion (1.A.4.b), showing a large decrease from fuel consumption in 2000. The ERT recommends that the Party address this issue as it leads to a large discrepancy in fuel consumption between the reference and sectoral approaches. The UK informed the ERT that residential sector gaseous fuels activity had been reported mistakenly as 401,201.7 TJ but was in fact 1,228,444.1 TJ. This change in AD is consistent with the change in CO_2 emissions. The UK indicated to correct this error in the 2004 submission. The ERT also recommends the UK to provide an entire time series of EFs used in the energy calculations; currently, the NIR only provides current year EFs for fuel combustion. The UK expressed its intention to aim to provide EFs for the whole time series.

B. Reference and sectoral approaches

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

27. The differences between the reference and sectoral approaches were mostly attributed to the treatment of non-energy use of fuels as if the fuels had been combusted. The UK reports that the sectoral approach accounts for the carbon stored from non-energy fuel use, as well as providing more certain carbon contents of combusted secondary fuels. Comparison of apparent consumption data in the reference approach with data from the International Energy Agency (IEA) shows close correspondence.

28. As reported in the 2001 CRF, the difference between the national and the reference approaches for energy consumption difference is 20.7 per cent, while the difference for CO_2 emissions is 4.65 per cent. The explanation provided in the documentation box states that the reference approach treats non-energy use of fuel as combustion, although the energy consumption difference is higher than in previous years. The ERT believes that this discrepancy is caused by incorrect reporting of natural fuel consumption at the residential subsector level (specifically, 2001 CRF table 1.A(a)s4). The UK informed the ERT that the error was due to a mistake in table 1A(a)s4, which would be corrected in the 2004 submission. This correction in table 1A(a)s4 would change the differences in energy consumption and CO_2 emissions to 8.0 and 4.8 per cent, respectively, between the two approaches for the year concerned.

International bunker fuels

29. The definition of fuel consumption for the purpose of international traffic follows country-specific methodologies based on official published energy consumption statistics. A few assumptions are used which need more explanation and quality assurance. For example, "Consumption figures for aviation are given in DTI (*Digest of UK Energy Statistics*, 2002). This is the best approximation of aviation bunker fuel consumption available and is assumed to cover international, domestic and military use." This should be described in more detail. Explanations for still existing differences between the national AD used and the international (IEA) published figures should be provided in the Party's next report. The UK expressed its intention to consider this comment and to aim to provide further clarification in the next NIR.

Feedstocks and non-energy use of fuels

30. The NIR references the Industrial Processes section for discussions of stored carbon. The transparency of reporting of carbon stored or emissions associated with fuel combustion varies between different source categories. Further discussion of fuel combustion from industrial processes sources is

necessary in the Energy sector chapter in order to clarify how emissions are allocated in the CRF Energy tables. The UK expressed its intention to consider this recommendation and to aim to provide further clarification in the next NIR.

Country-specific issues

31. In the appendices to the NIR, the UK provides a cross-comparison matching the IPCC categories to the sources in the National Atmospheric Emissions Inventory (NAEI) and fuels in the *Digest of UK Energy Statistics* (DUKES).

C. Key sources

Stationary combustion: coal, oil, and gas – CO_2

32. The approach used for stationary combustion follows the IPCC good practice guidance, with sector-specific reporting of fuel use to the energy statistics agency. Further explanation should be provided as to how source-specific fuel use is reconciled with overall national fuel consumption. The UK expressed its intention to consider this recommendation and to aim to provide further clarification in the next NIR.

33. In the electricity generation sector, in 1999 and 2000 fuel oil consumption reported at national level was lower than consumption reported by power generators. The NIR reports that a correction factor was applied, but details are not provided on reasons for this inconsistency. The UK indicated to provide further clarification on this in the next NIR.

34. A correction factor has been applied to power generators to ensure that coal and oil emissions reported only pertain to fuel combusted. Details are not provided on how the correction factor is derived or how broadly it is applied. The UK indicated to provide further clarification on this in the next NIR.

35. The following implied emission factors (IEFs) for CO_2 in the Energy sector show large differences compared to those of other Parties: gaseous fuels for category 1.A.1.b; liquid fuels for category 1.A.1.c; and gaseous fuels for categories 1.A.2.a and 1.A.2.f. The UK has not provided any explanation on these differences in its 2003 submission, but indicated to provide further clarification on this in the next NIR.

Road traffic: natural gas – CO_2

36. The secretariat's key source analysis shows road traffic emissions (CO_2 and N_2O) as key sources, without disaggregating according to fuel types. The approach used for road traffic follows a tier 3 methodology for N_2O and CH_4 (country-specific and partly based on available (COPERT) methods). For CO_2 emissions a simple approach based on total fuel consumption is used: a breakdown to the tier 3 structure is possible. Regarding the use of natural gas within road traffic since 1996, in the interests of transparency and completeness there should be more explanation in the NIR (e.g., concerning types of cars and how it is incorporated in the COPERT-based structure). The UK expressed its intention to consider this recommendation and to aim to include further explanation in the next NIR.

37. The IEF for CO_2 from natural gas has been identified as the highest among reporting Parties.

D. Non-key sources

Stationary combustion (other): gas – N_2O

38. The NIR lists the EFs for N_2O from fuel gas combustion in offshore gas use, except for the years 1995–1998. Given that emissions are calculated for these years, the EFs used also should be reported. The UK indicated to report these EFs in the next NIR.

Railway traffic: solid fuels

39. A number of countries[5] have reported emissions caused by the use of solid fuels. The UK reports "0". The UK should explain whether this activity is not relevant or negligible for UK since 1990. The UK informed the ERT that steam trains are exclusively operated by small preservation societies and not as part of the standard railway timetable. Therefore these emissions have been considered as negligible since 1990.

Fugitive emissions – CO_2, CH_4, N_2O

40. The UK reports fugitive emissions for all the three main GHGs and precursors. The methodologies used are in line with the IPCC Guidelines. However, in some sections, different EFs were used for different periods, as explained below.

41. For coal mining, the licensed and open-cast factors are taken from Williams (1993). The deep-mined factors for 1990–1992 and the coal storage factor are taken from Bennet et al (1995). The EFs for 1998–2000 are based on operator's measurements of the CH_4 extracted by the mine ventilation systems. There are big annual fluctuations in the EFs for deep mines, which could produce some inconsistency. The ERT suggests that the UK assess the consistency of the time series and provide some further explanation on the annual fluctuations in the EFs. In responding to the draft of this report, the UK referred to its NIR where reference is made to plans on further research to establish a more reliable estimate given recent results from studies on abandoned coal mines (the current inventory covers emissions from only working coal mines). The UK also expressed its intention to examine the possibilities of following the ERTs recommendation.

42. The UK reports fugitive emissions from solid fuel transformation processes. However, the IPCC Guidelines do not provide any methodology for such estimates, and emissions are therefore estimated largely on the basis of other literature.

43. The EFs for coke production are based on USEPA (1997) factors for different parts of the coke production process that are appropriate to the SSF (solid smokeless fuel) processes used in the UK. For AD, national statistics are used.

44. The aggregate EFs for well testing are much smaller in 2000 and 2001 than in other years. It is also pointed out that the number of wells tested is only a small proportion of the wells explored and fluctuates greatly from year to year. This could be the cause of the annual fluctuations in the EFs. More work needs to be done on well testing. The UK expressed its intention to examine the possibilities of following this recommendation.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

45. For the year 2001, the Industrial Processes sector for the UK contributed 4.3 per cent[6] of total national GHG emissions while the Solvent and Other Product Use sector contributed only non-methane volatile organic compound (NMVOC) emissions. The sector contributes 2.2 per cent of total CO_2 emissions, 0.15 per cent of total CH_4 emissions, and 12.7 per cent of total N_2O emissions.

46. In the UK total emissions from this sector have decreased by 51.3 per cent since 1990. CO_2, CH_4 and N_2O emissions have decreased by 16.5 per cent, 59.8 per cent and 81.6 per cent, respectively. During the same period PFC emissions decreased by 69 per cent, while HFCs increased until 1998

[5] E.g. Australia, Austria, Greece, Portugal, Germany, Poland.

[6] The CRF originally submitted contained erroneous totals for CH_4 and N_2O in the CRF trend tables 10s2 and s3. The UK has recognized this error and provided corrected CRF trend tables. The figures given in this section were calculated using corrected formulas in table 10s5 (sectoral totals).

(+75.5 per cent) then decreased to 23.7 per cent below 1990 levels. SF_6 emissions have increased over the period by 143 per cent.

47. The emissions estimates for the sector are complete with the exception of CO_2 emissions from 2.A.5 Asphalt Roofing and 2.A.6 Road Paving with Asphalt. CH_4 emissions from 2.B.1 Ammonia Production, 2.C.2 Ferroalloys Production and 2.C.3 Aluminium Production are also not reported. Different reasons are given for these gaps, ranging from the fact that the emission sources are negligible to lack of methodology.

48. No information is provided on sector-specific QA/QC. The ERT would welcome detailed information on the planned improvements to the QA/QC system with a focus on key sources and emission estimates reported directly from industrial facilities. The UK informed the ERT that collection of information about QA/QC procedures used by industry has started (this is considered a large task due to the large number of facilities involved), which would be pursued further during the next phase of AD collection with a focus on key sources and emission estimates reported directly from the industrial facilities.

49. CRF table 9 has been used to report instances where emission estimates are not produced but the Party has not reported specific details about the "included elsewhere" ("IE") notation key. For greater transparency, the ERT would welcome use of table 9 to specify in which categories the "IE" emissions have been included. The UK expressed its intention to aim to follow this recommendation.

50. An inconsistency in table 10s4 has resulted in an incorrect estimate of the recalculation in table 8(a) (year 2000) for SF_6. The total reported for SF_6 in the year 2000 CRF is 1,642 Gg CO_2 equivalent, while the 2001 CRF reports total SF_6 emissions as 1,689 Gg CO_2 equivalent (table 10s4). It appears that the 1,689 Gg CO_2 equivalent figure is obtained from a link to an external spreadsheet that was not available to the ERT. The UK confirmed that indeed the external link is the reason for the inconsistency and that the correct value is 1,642 Gg CO_2 equivalent.

51. An inconsistency was noted in the estimates of HFC emissions reported in table 2(II)s2 and those reported in Summary 1.As1 (8,674.4 vs 8,677.6 Gg CO_2 equivalent). The reporting of HFCs in table 2(I)s1 and table 2(I)s2 is inconsistent with the remaining estimates in table 2(II).C,E, table 2(II).Fs1 and table 2(II).Fs2, mainly because data values are not linked. Rather, those in table 2(I)s2 appear to be manual inputs. For greater transparency and improved consistency, the ERT would recommend keeping the existing links between the CRF tables and making manual entries only where required. The UK informed the ERT that manual inputs were made to provide data at a higher level of aggregation than required, for reasons of confidentiality. The UK also indicated it will revise the entire time series on F-gas emissions in its 2004 submission based on a new model, which is expected to also reduce the risk of data entry errors.

B. Key sources

2.B.2 Nitric acid production – N_2O

52. N_2O emissions from nitric acid production show inter-annual fluctuations: –30.2 per cent (1994–1995), +15.2 per cent (1997–1998), +43.5 per cent (1998-1999), –21.9 per cent (2000–2001). The IEF has also changed: 0.006 t/t (1990–1994), 0.004 t/t (1995–1995), 0.007 t/t (1999–2001). The NIR notes that abatement systems have been installed and that the Party has had difficulty in obtaining complete data from industry. The ERT recommends that the UK recalculate the trend using historical production data rather than production capacity. This would be considered good practice. The UK expressed its intention to consider this comment; however, the possibility to follow this recommendation would depend on the availability of complete historical production data which may be confidential.

2.B.3 Adipic acid production – N_2O

53. The IEF fluctuates by less than 10 per cent between 1990 and 1998 (in 1990 it was 0.305 t/t), but it then drops sharply to 0.015 t/t (1999), 0.031 t/t (2000) and 0.039 t/t (2001). The NIR mentions a reduction of N_2O by 91 per cent (2000) due to an N_2O abatement system installed in 1998. The

emissions reduced by the abatement technology have been included in the CRF with the resulting total EF ((emissions + emissions reduced)/AD) showing a decrease of 18 per cent from 1997 to 1998 and an increase of 11 per cent from 1998 to 1999. The ERT would welcome further information in the NIR on the reasons for the fluctuations. The UK expressed its intention to consider this recommendation and to aim to provide further information on this matter in the next NIR.

2.E.1 Other (production of halocarbons and SF_6 - by-product emissions) – HFCs, PFCs

54. Emissions of HFCs increased until 1998 (+47.2 per cent compared to 1990) and then decreased (by 70.3 per cent in 2001 compared to 1990). PFC emissions increased by +1260 per cent in 2001 compared to 1990. Inter-annual changes amount to +128 per cent (1991–1993) and +103.5 (1993–1994). The NIR does not give explanations for these changes in the emissions trend. The ERT would welcome such explanations. The UK indicated it will provide additional comments on emission trends and a revised description of the methodology in its 2004 NIR (see also comments in paragraphs 20 and 51 regarding recent revisions of F-gas emissions).

55. As explained in the NIR, by-product PFC emissions from aluminium production are reported in an aggregated manner, so that the IEF is not comparable, and an assessment of the methodology is not possible, as no detailed information on the methodology is provided in the NIR. For the years 2000 and 2001 no information on the source of emission estimates is provided in the NIR. The ERT would welcome disaggregation of the PFC emissions and an explanation of the methodology used for estimating PFC emissions. The UK indicated it will provide additional comments on emission trends and a revised description of the methodology in its 2004 NIR (see also comments in paragraphs 20 and 51 regarding recent revisions of F-gas emissions).

2.F.1 – 2.F.5 Ozone depleting substances substitutes

56. The UK has reported both actual and potential emissions, as required by the UNFCCC reporting guidelines. Total actual emissions of HFCs increased by a factor of 8230 between 1990 and 2001 and total actual emissions of PFCs by 92.5 per cent. The potential/actual (P/A) ratio of HFCs is 2.1, which is similar to those of other countries. The P/A ratio of PFCs is 1.14.

C. Non-key sources

2.A.2 Lime production – CO_2

57. Lime production decreased by 10.7 per cent from 1990 to 1991 and increased by 18.5 per cent from 1994 to 1995. There was a further increase in CO_2 emissions of 33 per cent from 1996 to 1997. Between 1999 and 2000, emissions decreased by 17.9 per cent; between 2000 and 2001 the decrease was 21.4 per cent.

58. The CO_2 IEF (0.44) seems relatively low compared to those of other Parties. The NIR states that limestone consumed in the production of lime was used as AD rather than lime production, which explains the low IEF. The ERT recommends indicating in the documentation box that the CO_2 EF (0.44t/t) is equivalent to the IPCC default (0.79t/t) when the basis for the AD is converted to lime (CaO). The UK indicated it will follow this recommendation.

59. The Party reports that no data on dolomitic lime is available so estimates are based on an assumption that all lime is quicklime. Thus the Party may be underestimating emissions. The ERT recommends the use of the IPCC default value presented in the IPCC good practice guidance for the split into high-calcium and dolomitic lime. The UK expressed its intention to consider this recommendation, and to modify its estimation procedure if applicable.

2.A.7 Other mineral products – CO_2

60. As stated in the NIR, plant-specific emission data for Fletton Brick Production are only available for recent years (1999–2001). For earlier years the IEF is significantly higher (37.9 per cent higher for

years prior to 1999). No explanation is provided in the NIR. The ERT would welcome more specific information on this change. The UK indicated to provide more information on this matter in the NIR 2004.

Ammonia production

61. CH_4 emissions from this source are not estimated ("NE" reported). The CRF explains that no emissions have been reported by the plant operator and that emissions are assumed to be negligible (see Table 9 – Completeness). The ERT would welcome an explanation of why a default estimate of emissions is not provided. The UK indicated to investigate whether an estimate using a default emission factor could be provided.

62. For this emission source there is a decrease of 20 per cent in the CO_2 IEF from 1996 to 1997, followed by an increase of 14 per cent from 1997 to 1998, again an increase of 10 per cent from 1999 to 2000, and finally an increase of 34 per cent from 2000 to 2001. In response to a comment by ERT for more information on this variation in the IEF, the UK explained that these variations are largely caused by varying demands for methanol production from a methanol plant which is directly linked to one of the largest ammonia plants.[7] The ERT would welcome that information on these variations be included in the NIR.

63. A different EF unit of measure (tCO_2/PJ NG) for this emission source was noted in the CRF documentation box. The use of consistent units (i.e., t CO_2/t NH_3) is considered good practice. The ERT would recommend the use of consistent units or an explanation of the need to use different units. The UK expressed its intention to follow this recommendation if the necessary core information is available.

2.B.5 Other chemical industry – CH_4

64. Emissions for (i) Chemical industry (all), (ii) Chemical industries (methanol) and (iii) Chemical industry (ethylene) are reported in the NIR. However, the CRF only includes one value for Chemical industry (all) whereas emissions from ethylene are reported as "0" and emissions from methanol as "IE" without further explanation in table 9. The ERT would welcome greater disaggregation in the CRF if data are available. The UK expressed its intention to consider and, if possible, try to follow this recommendation.

2.C Iron and steel production – CO_2

65. For CO_2 emissions, an annual increase of 109 per cent was noted between 1998 and 1999. The ERT would welcome an explanation for this change in emission trend. The UK explained that this large increase appears to be due to significant differences in reported coke use and blast furnace gas production between those years, however, this issue would be subject to further review.

66. A detailed methodology for estimating CO_2 emissions from iron and steel production has been applied and explained in the NIR. The negative emissions and IEF reported in the CRF are a result of this methodology. CO_2 emissions from the use of blast furnace gas as a fuel were accounted for in category 1.A.2.a. However, according to the IPCC good practice guidance, these emissions would preferably be reported in 2.C.1. If these emissions were reported here there would be no negative emissions or IEFs. The ERT would discourage reporting of negative emissions since these are typically reserved for reporting sink values. The UK expressed its intention to consider, and if possible comply, with this recommendation.

[7] The UK provided the following explanation: The CO_2 EF from this source is influenced a little by the variation in plant efficiencies as reported via the UK Pollution Inventory. However, the most significant influence on the CO_2 IEF is that one of the largest ammonia plants in the UK is directly linked to a methanol plant. CO_2 emissions from the ammonia plant are used as feedstock gases in the methanol plant and incorporated into the product. Hence the reported CO_2 emission from the ammonia plant varies significantly according to the demand for methanol production from the associated methanol plant. As there are very few ammonia plants in the UK, this has a big impact on the industry-wide IEF.

67. The assumed carbon content of steel (0.17 per cent) as presented in the NIR is very low compared to the IPCC default range of 0.5–2 per cent. The ERT would welcome an explanation of the carbon content difference. The UK explained that this value has been derived from data supplied by the British Iron and Steel Producers Association in 1997, and that it would review its validity in the UK context.

2.F.8 Other consumption of halocarbons and SF_6

68. Although the NIR indicates that for aerosols it is assumed that all the fluid is emitted in the year of manufacture, the IEF for product life is less than 100 per cent (97 per cent). The ERT would welcome an explanation of this parameter. The UK indicated it will revise the entire time series on F-gases for the 2004 submission and provide a revised description of the methodology (see also comments in paragraphs 20 and 51).

3 Solvents – CO_2

69. No estimates for CO_2 have been provided, although estimates of NMVOC are included in the CRF. As indicated below CRF table 3, the quantity of carbon released in the form of NMVOC shall be included in both the NMVOC and the CO_2 column. The ERT would welcome an estimate of emissions from the carbon in NMVOC indicated in the CO_2 column. The UK expressed its intention to consider, and if possible comply, with this recommendation in the next submission.

IV. AGRICULTURE

A. Sector overview

70. Since 1990, emissions from cattle have declined by 11.6 per cent. In 2001, cattle contributed 31 per cent of the UK's total CH_4 emissions. Sheep contributed 8 per cent to the total, with pigs, goats, horses and poultry making up the remainder.

71. There have been only small changes in emissions of CH_4 from the Agriculture sector. These have occurred as a result of a decrease in enteric fermentation from sheep (31,408 Gg CH_4) and an increase in emissions from manure management from poultry (3,069 Gg CH_4) for the period 1990–2001.

72. N_2O emissions in the UK are dominated by the Agriculture sector, which accounted for 64 per cent of the total in 2001. N_2O emissions from agriculture have declined by 15 per cent over the period 1990–2001, driven by a reduction in the use of synthetic fertilizers and a decline in animal populations. Total emissions from the sector declined by 6 per cent between 2000 and 2001. The main reasons for this decrease appear to be a reduction in the use of synthetic fertilizers and in emissions from crops. The burning of agricultural stubble was banned in the UK in 1993, resulting in a slight decrease in emissions from agriculture. The UK informed the ERT that residues have since been left to decay, which may be expected to increase denitrification and hence N_2O emissions, but there may also be a temporary immobilization of nitrogen (N).

B. Key sources

4.A Enteric fermentation – CH_4

73. The CH_4 IEFs for sheep for the years 1990–2001 (4.6-4.8 kg CH_4/head/year) are the lowest among reporting Parties and half of the IPCC default value (8). In response to earlier reviews, the UK explained that this discrepancy is due to the fact that the EF for lambs is assumed to be 40 per cent of that of adult sheep, whose EF is the same as the IPCC default value (8 kg CH_4/head/year). However, other reporting Parties with similar conditions (e.g., New Zealand) report this percentage to be about 80 per cent. Although the choice of EF for lambs is referenced in the NIR, the ERT would welcome further information on the underlying assumptions for instance, as to whether this estimate is based solely on the size/weight of lambs (<1 year old) compared to other sheep, and as to whether there are any supporting studies or statistics. In

response to this question, the UK explained that the value of 40 per cent for the emission factor for lambs is based on animal weight, and referenced the underlying sources of information.[8] The ERT would welcome that information on the underlying assumptions be included in the NIR. The UK also informed the ERT that implementation of the tier 2 methodology is being considered.

4.D Agricultural soils – N_2O

74. The UK has employed methodologies developed nationally as well as those indicated in the IPCC good practice guidance. The EFs adopted for calculating direct N_2O emissions from agricultural soils consist of country-specific EFs as well as the IPCC default values. The country-specific EFs correspond with the IPCC default values, as exemplified in the EF of 5 used for direct emissions of N_2O from cultivation of histosols. This value has, however, resulted from recalculation undertaken by the UK after the earlier observed IEFs were discovered to be outliers.

C. Non-key sources

4.B Manure management, sheep – CH_4

75. As in case of CH_4 emissions from enteric fermentation, the Party assumes that the EF for lambs (0.076 kg CH_4/head/year) is 40 per cent of that for adult sheep (0.19 kg CH_4/head/year) and this causes the CH_4 IEF for sheep to be lower than that of other reporting Parties. The ERT would welcome further information on the underlying assumptions. The UK explained that the same assumptions as explained in response to paragraph 73 were applied.

4.B Manure management – N_2O

76. The ERT encourages the UK to provide some explanation of the higher N_2O IEF for other animal waste management systems (AWMS) for the year 1999. The UK informed the ERT that the default IPCC EF of 0.005 was used in all calculations of emissions from the 'other' AWMS category; the variation in IEF is due to annual demographic variations and changes in the amount of poultry manure incinerated that had not been fully taken into account in the submitted CRF.

77. The N excretion rate of 120 kg N/head/year for dairy cattle appears to be high compared to those of most other reporting Parties. The UK informed the ERT that this value is the result of an error in the CRF (the correct value should be 112 kg N/head/year), but does not affect calculated emissions.[9] The ERT would welcome that explanation on this matter be provided in the NIR.

[8] The full explanation provided by the UK is as follows: The study on which the EFs for lambs were based (Sneath et al. 1997) did arrive at the figure of 40 per cent emission based on animal weight. No direct measurements of CH_4 emission by lambs are available in the UK, but this figure has been supported by an independent UK expert (Bruce Cotterill, ADAS). Based on energy intake of a 55 kg sheep (1.5 units) and a 30 kg lamb (1.2 units), and the fact that lambs only live for 6 months on average, methane emission of a lamb would be 1.2/(1.5*2) = 40 per cent of that of a sheep (Cottrill, *pers. comm*. 2004). Data from France (Vermorel, 1997) would certainly support a relative emission factor of this order or smaller. In fact in this study, grazing lambs emitted 2.9 m^3 CH_4 $year^{-1}$, compared to 16.7 m^3 $year^{-1}$ from a suckling ewe and 17.8 m^3 $year^{-1}$ for a dairy ewe. (Also, in this study the emission from a grazing lamb was 3 times that of an indoor fattened early weaned lamb).

[9] The UK further explained that the value of 112 kg N/head/year reflects a combination of classes of dairy cow. The base data of 106 kg N ha^{-1} for the dairy breeding herd in 1990 were taken from a review of literature figures for N excretion (Smith and Frost 2000). In the past the UK has assumed an annual increase of dairy cattle body weight of 1 per cent, as data on average body weight is not readily available. The UK has then used a relationship between body weight and N excretion to estimate the latter.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

78. Net CO_2 emissions from the LUCF sector decreased from 8,791 to 3,220 Gg over the period 1990–2001, representing 1.5 per cent of total CO_2 emissions from the UK in 1990 and 0.6 per cent in 2001. Since 1990, net CO_2 emissions/removals from the LUCF sector have decreased by 63 per cent, mainly due to a decrease in CO_2 emissions from soils.

79. The UK has provided emissions and removals data for categories 5.A Changes in Forest and Other Woody Biomass Stocks, 5.D CO_2 Emissions and Removals from Soil, and 5.E Other, for all individual years within the period 1990–2001. Other categories (5.B, 5.C) are reported as not occurring ("NO") or "NE". The inventory data reported are transparent, and the CRF tables provide complete inventory data, but without reporting of AD. QA/QC standards and control measures are applied at all stages of the inventory process.

80. Inventory data are reported only in CRF table 5. Sectoral background data tables 5.A to 5.D were not used for reporting because the UK does not use the IPCC default methods. Recalculations have been reported for category 5.D.

81. The category 5.B is reported as negligible in the NIR (Note: the ERT encourages the UK to indicate this in the CRF by using the notation key "NE") but there are calculations of non-CO_2 GHG emissions from deforestation in the NIR. However, those emissions have not been reported in the CRF. The UK informed the ERT that although data on deforestation were presented in the NIR 2003, such data will only be included in the CRF of the 2004 submission.

82. The NIR provides all the information needed related to methodology, AD, reporting tables and inventory improvements. Progress has been made in category 5.B Forest and Grassland Conversion and this category will be included in the next submission.

B. Sink and source categories

5.A Changes in forest and other woody biomass stocks – CO_2

83. The UK has used a country-specific methodology for calculating CO_2 emissions/removals in category 5A. A carbon accounting model is used for the calculation of the net change in pools of carbon in standing trees, litter, soil in broadleaf forests and products. 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. The carbon changes in non-forest biomass include changes in lands used for agriculture, horticulture and urbanization, and are reported in category 5E.

5.D Emissions and removals from soils – CO_2

84. A country-specific methodology for the calculation of CO_2 emissions/removals from soil has been used. AD are structured according to land cover types (land matrix), soil types and soil management intensity, and are based on national inventories and surveys. CO_2 emissions/removals from soils are reported in the following different categories according to the NIR: 1. Removals to forest soils (5.A); 2. Removals to agricultural soils due to set aside (5.D); 3. Emissions from soils due to upland drainage (5.E); and 4. Emissions from soils due to lowland drainage (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 in addition information on emissions and removals in the CRF, and consistent grouping between the CRF and the NIR, in order to facilitate comparison, for instance, between Parties. This should not exclude the presentation of data according to the format used until now in the NIR in order to maintain historical consistency. The ERT expects that this problem will be overcome once Parties report according to the revised CRF tables for Land Use, Land-use Change and Forestry (LULUCF), starting from their inventory submissions due in 2005, in accordance with decision 13/CP.9.

VI. WASTE

A. Sector overview

85. The Waste sector is the third-largest contributor of CH_4 emissions in the country, with a share of 23.9 per cent of the total (mainly from landfills, 22.2 per cent). Since 1990, emissions from the sector have dropped by 55 per cent as a result of: the implementation of CH_4 recovery systems for solid waste disposal sites (SWDS); slightly reduced CO_2 emissions from chemical waste incineration; an order of magnitude reduction in N_2O and CH_4 emissions from waste incineration due to a sharp reduction in sewage sludge incineration; and a slight decrease of N_2O emissions from waste-water handling. These reductions largely compensate for moderate increases in CH_4 emissions from waste-water handling.

86. The inventory in the Waste sector is mostly complete in terms of emissions, sources and geographical coverage. Estimates of industrial and commercial waste are based on a recent survey. The ERT noted that there are still some gaps (e.g., private waste-water treatment) and encourages the UK to provide the missing emissions data in its next submission.

87. The inventory is well documented with clear explanations of the assumptions and methodologies used. In some categories, however, the information needed to facilitate replication and assessment of the inventory is not provided in the NIR or the CRF, although supporting literature is referenced. This situation can be exemplified in the key source solid waste disposal on land, where there is not sufficient information about the characteristics and coverage of the surveys developed in relation to SWDS. This also applies to the study developed to determine the degradable organic carbon (DOC) and DOCf values used, in which no explanation for exclusive use of cellulose and hemicellulose is presented. No information has been provided on the EF used to determine N_2O emissions from human sewage. Though the UK quoted sources where information on the proportion of cellulose and hemicellulose are provided,[10] the ERT encourages the UK to provide such information in the NIR.

B. Key sources

Solid waste disposal on land – CH_4

88. The UK has used the first-order decay (FOD) model to estimate emissions. The NIR states that the waste composition data are based on two data sources, but the CRF explains that the model uses data derived using the LQM Methane National Assessment Model 2002 and coming from assumptions, not measurements. In responding to the draft of this report, the UK explained that until 1994, data are based on actual data from waste surveys using the LQM model which supersedes the previous AEA model. After 1994, data are based on a new study which uses updated waste survey data for 1999: the years 1995 to 1998 are extrapolated backwards from 1999 data, while years ahead of 1999 are extrapolated based on waste disposal projections. The ERT would welcome that such further explanations be provided in the NIR.

89. According to the CRF (table 6.A, Additional information), the fraction of municipal solid waste disposed of to solid waste disposal sites is 61 per cent. In responding to the draft of this report, the UK stated that this fraction corresponds to the portion that goes to landfills, while the rest is recycled, incinerated or composted, and that hardly any waste goes to unmanaged sites. The ERT recommends that for purposes of transparency, the UK quantify the fractions of recycled, incinerated and composted waste, and provide this information in the respective part of the CRF as additional information.

[10] The UK referenced the LQM report, according to which cellulose and hemicellulose are known to make up approximately 91 per cent of the degradable fraction, whilst other potential degradable fractions which may have a small contribution (such as proteins and lipids) are ignored. The UK further explained that the proportion of cellulose and hemi-cellulose in each waste component and the degradability of these fractions was based on a study by Barlaz et. al. (1997) "Biodegradative analysis of municipal solid waste in laboratory scale landfills", prepared for the US Environmental Protection Agency Office of Research and Development. EPA-600/R-97-071. USEPA, Washington DC.

90. The NIR mentions that DOC has been estimated on the basis of a national study and arises solely from the cellulose and hemi-cellulose content of the waste. The oxidation factor used in the model is not specified and seems to be higher than the recommended value of 0.1 in spite of the indication in the IPCC good practice guidance that values higher than 0.1 are probably too high for national inventories. The fraction of CH_4 recovered is derived from estimates and not from measured data. As a consequence, the IEF (0.01) is among the lowest reported by Parties. The UK informed the ERT that the oxidation factor is the result of a study undertaken for the UK and hence represents the official estimate. The UK also expressed its intention to request information from the authors of the model about the reasoning behind the choice of this factor. The ERT would welcome that such explanations be provided in the NIR.

Emissions from human sewage – N_2O [11]

91. There is inconsistency in the reporting of protein consumption in the NIR (the range is 8.28–8.65 kg/person/year) and CRF table 6.B (3.42 kg/person/year). The IEF (0.07 kg N_2O-N/kg sewage N produced) is high, but still within the range provided by the IPCC good practice guidance. The ERT recommends the Party to provide information on the assumptions made.

C. Non-key sources

Waste-water handling – CH_4

92. The UK uses a country-specific methodology which diverges from the IPCC default in several aspects. The NIR does not provide information regarding the validation of this methodology as recommended in the 2000 in-country review report.[12]

93. In the CRF the overall parameters used are reported, but most of the specific parameters and EFs used are not provided, although the source is referenced in the NIR. This important reference was not available to the reviewers.[13] The ERT encourages the UK to include such relevant information in its next NIR.

94. Emissions from private industrial treatment plants have not been estimated.

95. No information is included in the NIR as to whether the contribution of this source was analysed in greater depth, according to the recommendation of the 2000 in-country review report.[14] The ERT encourages the Party to perform this analysis and to report the results in its next submission.

Waste incineration

96. The UK uses country-specific EFs. From 1997 to 2000, CO_2 emissions are reported as constant, declining in 2001. In this submission the activities chemical waste incineration and animal carcass incineration are included for the first time, but in the CRF it is not clear under which category these emissions are reported.

97. The NIR reports that EFs for CH_4 and N_2O have not been estimated for the categories mentioned above or for cremation.

98. The NIR reports that, in the estimation of CO_2 from clinical waste incineration, an EF from the IPCC good practice guidance has been used but table Summary 3 reports that the EF used is country-specific.

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[11] Identified as a key source only by the key source analysis of the UK.

[12] See document FCCC/WEB/IRI/2000/GBR.

[13] The document referenced, Hobson, J., Palfrey, R., Sivil, D., Palfrey, E. and Day, M., (1996) Control Measures to Limit Methane Emissions from Sewage and Sludge Treatment and Disposal, WRC, Report No DOE 4118, was provided to the review team of the in-country review but has not been used, as that report was not part of this centralized review.

[14] See document FCCC/WEB/IRI/2000/GBR.

ANNEX 1: MATERIALS USED DURING THE REVIEW

A. Support materials used during the review

2002 and 2003 Inventory submissions of the United Kingdom of Great Britain and Northern Ireland. 2003 submissions including CRF for years 1990–2001 and an NIR.

UNFCCC secretariat (2003). "Report of the individual review of the greenhouse gas inventory of the United Kingdom submitted in the year 2002 (Desk review)." FCCC/WEB/IRI(1)/2002/UK (available at http://unfccc.int/program/mis/ghg/countrep/ukdeskrev02.pdf)

UNFCCC secretariat. "2003 Status report for the United Kingdom" (available at http://unfccc.int/program/mis/ghg/statrep03/uk03.pdf)

UNFCCC secretariat. "Synthesis and assessment report of the greenhouse gas inventories submitted in 2003. Part I." FCCC/WEB/SAI/2003 (available at http://unfccc.int/program/mis/ghg/s_a2003.html); and Part II – the section on the United Kingdom) (unpublished).

The United Kingdom's comments on the "Draft synthesis and assessment report of the greenhouse gas inventories submitted in 2003" (unpublished).

UNFCCC secretariat. Review findings for the United Kingdom (unpublished).

UNFCCC secretariat. "Handbook for review of national GHG inventories." Draft 2003 (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." FCCC/CP/1999/7 (available at http://www.unfccc.int/resource/docs/cop5/07.pdf).

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

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

IPCC. *IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000* (available at http://www.ipcc-nggip.iges.or.jp/public/gp/gpgaum.htm).

IPCC/OECD/IEA. *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, volumes 1–3, 1997* (available at http://www.ipcc-nggip.iges.or.jp/public/gl/invs1.htm).

B. Additional materials

Responses to questions during the review were received from Mr. Watterson (National Environmental Technology Centre) including additional material on the methodology and assumptions used.

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