COMPLIANCE COMMITTEE

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3 April 2009

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

Note by the secretariat

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

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Report of the individual review of the greenhouse gas inventories of Sweden submitted in 2007 and 2008*

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

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I. Overview

A. Introduction

1. This report covers the centralized review of the 2007 and 2008 greenhouse gas (GHG) inventory submissions of Sweden, coordinated by the UNFCCC secretariat, in accordance with decision 22/CMP.1. In accordance with the conclusions of the Subsidiary Body for Implementation at its twenty-seventh session,[1] the focus of the review is on the most recent (2008) submission. The review took place from 22 to 27 September 2008 in Bonn, Germany, and was conducted by the following team of nominated experts from the UNFCCC roster of experts: generalists – Mr. Michael McGettigan (Ireland), Mr. Paul Filliger (Switzerland); energy – Mr. Tinus Pulles (Netherlands), Mr. Hongwei Yang (China); industrial processes – Mr. Dušan Vacha (Czech Republic), Mr. Koen Smekens (Belgium); agriculture – Mr. Steen Gyldenkaerne (Denmark), Mr. Mahmoud Medany (Egypt); land use, land-use change and forestry (LULUCF) – Mr. Sandro Federici (Italy), Mr. Peter Stephens (New Zealand); and waste – Mr. Jose Villarin (Philippines), Mr. Hiroyuki Ueda (Japan). Mr. McGettigan and Mr. Villarin were the lead reviewers. The review was coordinated by Mr. Vitor Gois Ferreira and Ms. Astrid Olsson (UNFCCC secretariat).

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

B. Inventory submission and other sources of information

3. The 2008 inventory was submitted on 14 April 2008. It contains a complete set of common reporting format (CRF) tables for the period 1990–2006 and the national inventory report (NIR). This is in line with decision 15/CMP.1. The Party indicated that the 2008 submission is also its voluntary submission under the Kyoto Protocol.[2] In its 2007 submission, Sweden included a complete set of CRF tables for the period 1990–2005 and an NIR, which contains descriptions of the national system and the national registry. Where necessary, the expert review team (ERT) also used the 2006 submission, additional information provided during the review and other information. On 4 February 2009, Sweden submitted revised estimates for its 2008 inventory, which contains a full set of CRF tables and a revised NIR. The revised GHG estimates affect only the LULUCF sector: net removals in 2006 have decreased from 38,006.52 Gg CO2 eq, as originally reported by the Party, to 25,587.16 Gg CO2 eq. Data from the revised emission estimates are used in the analysis provided in this report for the LULUCF sector. The full list of materials used during the review is provided in the annex to this report.

C. Emission profiles and trends

4. In 2006 (as reported in the 2008 annual inventory submission), the main GHG in Sweden was carbon dioxide (CO_2), accounting for 78.3 per cent of total GHG emissions[3] expressed in CO_2 eq; nitrous oxide (N_2O) accounted for 11.5 per cent and methane (CH_4) for 8.4 per cent. Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6) together accounted for 1.8 per cent of the total GHG emissions. The energy sector accounted for 74.1 per cent of the total GHG emissions,

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

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

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

agriculture for 12.9 per cent, industrial processes for 9.4 per cent, waste for 3.1 per cent, and solvent and other product use for 0.5 per cent. Total GHG emissions amounted to 65,748.95 Gg CO_2 eq and decreased by 8.9 per cent between the base year[4] and 2006. In 2005 (as contained in the 2007 inventory submission), total GHG emissions amounted to 66,954.61 Gg CO_2 eq. The shares of gases and sectors in 2006 (2008 annual inventory submission) were similar to those in 2005 (2007 inventory submission).

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

D. Key categories

6. Sweden has reported a key category tier 1 analysis, both level and trend assessment, as part of its 2008 submission. The key category analysis performed by the Party and that by the secretariat[5] produced different results because Sweden applies more detailed disaggregation. Sweden has included the LULUCF sector in its key category analysis, which was performed in accordance with the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories* (hereinafter referred to as the IPCC good practice guidance) and the IPCC *Good Practice Guidance for Land Use, Land-Use Change and Forestry* (hereinafter referred to as the IPCC good practice guidance for LULUCF). There are 26 key categories in the level assessment for 2006 (excluding LULUCF), one more than for 2005 (manufacture of solid fuels and other energy industries). There are 25 key categories in the trend assessment for 2006 (excluding LULUCF). In 2006, three additional key categories were identified by the level and trend assessments when including the LULUCF sector. Compared to 2005 (2007 submission), N_2O emissions from agricultural soils, SF_6 emissions from metal production and N_2O emissions from the category other (3.D) of solvent and other product use are no longer key categories, whereas CO_2 emissions from fugitive emissions from oil and natural gas and from other transportation are new key categories for 2006. The information on key categories in appendix 19 of the NIR would be more useful, and easier to follow, if it is presented in a single table with an appropriate title.

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

[5] The secretariat identified, for each Party, the categories that are key categories in terms of their absolute level of emissions, applying the tier 1 level assessment as described in the Intergovernmental Panel on Climate Change (IPCC) *Good Practice Guidance for Land Use, Land-Use Change and Forestry*. Key categories according to the tier 1 trend assessment were also identified for Parties that provided a full set of CRF tables for the base year. Where the Party performed a key category analysis, the key categories presented in this report follow the Party's analysis. However, they are presented at the level of aggregation corresponding to a tier 1 key category assessment conducted by the secretariat.

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

Greenhouse gas emissions	Gg CO_2 eq								Change base year–2006 (%)
	Base year[a]	1990	1995	2000	2003	2004	2005	2006	
CO_2	56 301.08	56 301.08	58 042.92	53 415.52	56 296.72	55 188.71	52 554.71	51 514.88	–8.5
CH_4	6 719.22	6 719.22	6 676.88	6 080.71	5 724.97	5 739.01	5 602.82	5 508.73	–18.0
N_2O	8 534.73	8 534.73	8 383.29	7 889.86	7 73188	7 643.71	7 547.12	7 545.97	–11.6
HFCs	126.44	3.85	126.44	564.19	709.02	769.24	795.36	823.22	651.1
PFCs	343.43	376.82	343.43	240.52	258.30	253.98	257.14	245.32	–28.6
SF_6	126.74	107.47	126.74	93.59	68.87	81.21	142.48	110.83	–12.5

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

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

Sector	Gg CO_2 eq								Change base year–2006 (%)
	Base year[a]	1990	1995	2000	2003	2004	2005	2006	
Energy	53 398.2	53 398.2	55 237.63	50 793.03	53 496.94	52 340.08	49 478.35	48 736.85	–8.7
Industrial processes	5 900.97	5 792.48	5 905.93	5 846.02	6 030.32	6 094.33	6 410.22	6 151.16	4.2
Solvent and other product use	332.49	332.49	308.55	277.53	292.43	311.50	303.25	303.25	–8.8
Agriculture	9 406.54	9 406.54	9 321.94	8 762.79	8 585.85	8 63639	8 555.45	8 503.64	–9.6
LULUCF	NA	–32 053.37	–25 457.89	–35 603.32	–33 549.67	–32 032.89	–29 139.28	–25 587.16	NA
Waste	3 113.48	3 113.48	2 925.58	2 605.01	2 303.93	2 293.55	2 152.37	2 054.04	–34.0
Other	NO	NO	NO	NO	NO	NO	NO	NO	NA
Total (with LULUCF)	NA	39 989.93	48 241.75	32 681.07	37 159.80	37 642.97	37 760.37	40 161.79	NA
Total (without LULUCF)	72 151.65	72 043.30	73 699.64	68 284.39	70 709.47	69 675.86	66 899.64	65 748.95	–8.9

Abbreviations: LULUCF = land use, land-use change and forestry; NA = not applicable; NO = not occurring.

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

E. Main findings

7. The 2007 and 2008 inventory submissions of Sweden show substantial conformity with the principles of transparency, completeness, comparability, accuracy and consistency. The annual inventories are compiled in accordance the *Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories* (hereinafter referred to as the Revised 1996 IPCC Guidelines), the IPCC good practice guidance and the IPCC good practice guidance for LULUCF. The NIR provides a good account of the inventory compilation process and adequately describes the preparation and results of supporting deliverables in accordance with the specified guidance documents and the UNFCCC "Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories" (hereinafter referred to as the UNFCCC reporting guidelines). The 2008 NIR contains comprehensive information on the national system and the national registry.

8. However, there is some need for improvement of the inventory. Transparency still needs to be improved for the LULUCF sector and quality assurance/quality control (QA/QC) procedures need to be enhanced in the preparation of CRF tables. For some important categories in the industrial processes sector Sweden needs to re-assess the methods used, ensuring that they are in line with the IPCC good practice guidance, and to further detail the methodological descriptions in the NIR. Sweden is encouraged to describe its current use of data from the European Union emissions trading scheme (EU ETS) for national GHG inventory purposes, and to consider making further use of this data source. Categories which are not estimated and for which IPCC methods are available should be addressed in the next annual submission to avoid any possible underestimation of national emissions during the commitment period.

F. Cross-cutting issues

1. Completeness

9. The inventory covers all source and sink categories for the period 1990–2006 and is complete in terms of gases and geographic coverage. Sweden has provided all CRF tables for all years. The NIR mentions that emissions in a number of minor categories, such as fugitive emissions, CH_4 from the chemical industry, and CH_4 and N_2O from industrial wastewater treatment, are not estimated. Future improvements and submissions should address any such categories for which IPCC methods are available with a view to avoiding problems and possible underestimation of national emissions during the commitment period.

2. Transparency

10. Sweden's 2007 and 2008 submissions are of a high quality and a high level of transparency is afforded by the NIR and CRF tables, except in the case of the LULUCF sector, which requires improved descriptions of country circumstances and the approaches to estimating emissions and removals. In general, for other sectors, good concise descriptions of methodologies and data sources are provided. These are supported by descriptions of national system provisions and functionality and the associated fully operational QA/QC system. One area where transparency could be improved is the use of EU ETS data in the national GHG inventory. Sweden makes some use of the EU ETS as a source of data for the GHG inventory but this is not mentioned in the description of the national system. The ERT recommends that Sweden improve this aspect of the national system description in its next NIR. The inclusion of time series of the pertinent activity data (AD) in tabular form in the NIR enhances transparency and facilitates better review and analysis of the CRF tables and emission trends.

3. Recalculations and time-series consistency

11. No major recalculations were reported in the 2007 submission. Sweden provided recalculated estimates in the 2008 submission for all years in the period 1990–2005 in CRF table 8(a) and some explanatory information in CRF table 8(b). The main changes are in the industrial processes and LULUCF sectors. The effect of the recalculations, which are largely due to minor changes in AD, on total annual GHG emissions excluding LULUCF is typically less than 0.5 per cent across the time series. However, there are order-of-magnitude changes in the estimates for LULUCF owing to a revision of land areas, recalculations of carbon stock change for the majority of carbon pools based on increased numbers of sample plots, and a recalculation of N_2O emissions from disturbance associated with land-use conversion to cropland. The ERT recommends that for all recalculations the corresponding CRF tables be completed in a manner consistent with what is reported in the NIR.

4. Uncertainties

12. Sweden presents the results of its tier 1 uncertainty analysis at the same level of aggregation as for the key category analysis, facilitating the use of both these analyses to prioritize inventory development and improvements. The analysis follows the IPCC good practice guidance. Annex 2 to the NIR gives a detailed treatment of uncertainty and indicates that all assigned input uncertainties for the analysis are documented in Swedish Expert Protocols, but they do not account for correlations between gases. The tier 1 level uncertainty is given as 6.0 per cent for 2006 and 6.5 per cent for 1990 in the 2008 submission. The trend uncertainty for 2006 (2008 submission) is low at 2.6 per cent but the trend uncertainty is not given for 2005 in the 2007 submission.

5. Verification and quality assurance/quality control approaches

13. The implementation of rigorous and effective QA/QC procedures for the GHG inventory is ongoing in Sweden under the direction of the Swedish Environmental Protection Agency (Swedish EPA). The QA/QC system is well documented in annex 6 to the NIR. It incorporates a coordinating quality system with specified quality objectives and activity routines operated by the Swedish EPA, linked to internal QC systems for all agencies contributing to the GHG inventory under the control of the Swedish EPA. For its 2007 submission, Sweden started to use the recently developed Technical Production System (TPS) archiving system, which further enhances QA/QC. The TPS also provides greater access to all important components of the inventory and facilitates approval, review and analysis of the inventory, and the export of results to the CRF Reporter.

6. Follow-up to previous reviews

14. Chapter 10 of the NIR outlines the recalculations and improvements undertaken by Sweden and includes a section describing the changes made by the Party in response to the review process. For the 2008 submission these changes included resolution of double counting in iron and steel, recalculations for aluminium, revision of the CH_4 emission factor (EF) for beef cattle, and provision of further information on landfill gas use.

G. Areas for further improvement

1. Identified by the Party

15. All sector descriptions in the NIR include the item “coming improvements”. Extensive further inventory improvements are outlined under this heading in the LULUCF sector but there is none for other sectors. Sweden intends to further develop the methods to quantify carbon stock changes in all biomass pools and will undertake future recalculations as the number of sample plots continues to increase.

2. Identified by the expert review team

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

(a) Provide information on any changes in the national system and any changes in the national registry as distinct items in the NIR;

(b) Sweden may wish to consider further use of EU ETS emissions data in the national inventory, especially for categories that are completely covered by the EU ETS, and the incorporation of formal mechanisms within the national system to secure efficient and systematic use of this data source;

(c) Investigate the availability of methods and data for those categories for which the notation key "not estimated" ("NE") appears in the CRF tables, and make further efforts to include relevant estimates to avoid potential underestimation of national emissions in future years;

(d) The land classification system used by the Party is subjective and the ERT encourages Sweden to revise its methodology for land representation to include a hierarchical order among land uses;

(e) It is critical that Sweden resolve the data transfer errors associated with the CRF regarding the LULUCF sector and test thoroughly its CRF reporting and QA/QC procedures before its next submission.

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

II. Energy

A. Sector overview

18. The energy sector is the main sector in the GHG inventory of Sweden. In 2006, emissions from the energy sector amounted to 48,736.85 Gg CO_2 eq, or 74.1 per cent of total GHG emissions. Emissions from the sector decreased by 8.7 per cent between 1990 and 2006. The key driver for the fall in emissions was the reduction (57.3 per cent between 1990 and 2006) in emissions from commercial/institutional and residential fuel use owing to the switch from individual oil heating to district heating and, in recent years, increased usage of heat pumps and pellet-fired boilers. Within the sector, 41.4 per cent of the emissions were from transportation, 23.3 per cent were from energy industries, 23.3 per cent were from manufacturing industries and construction, and 9.9 per cent were from other sectors; fugitive emissions accounted for 1.6 per cent, and the remaining 0.5 per cent were from other (table 1.A.5).

19. The coverage of categories and gases is complete for 2006 emissions with a few minor fugitive categories reported as "NE": CO_2 and CH_4 from transport of oil; CO_2 and CH_4 from venting of oil, gas and combined; and CO_2, CH_4 and N_2O from flaring of gas. The ERT encourages Sweden to provide estimates for these fugitive emissions where applicable and whenever methodologies are available.

20. Sweden uses plant-specific data for the emission estimates of manufacturing industries and construction, which is in line with the IPCC good practice guidance. Following the recommendations from previous reviews for the strengthening of an institutionalized system-level check to minimize the risk of omitting some plants or data, Sweden has improved the allocation of transformation losses from the iron and steel category to other stationary (1.A.5.a) to enable better comparison of implied emission factors (IEFs) for solid fuels with other countries, and improved emission estimates for iron and steel. The ERT encourages Sweden to further strengthen its QA/QC procedures on the collection, archiving and verification of the plant-specific data.

21. Recalculations have been conducted for CO_2 and CH_4 emissions from petroleum refinery and iron and steel due to the revisions in thermal values for coke oven gas and blast furnace gas according to the new information from the Swedish Energy Agency; these recalculations accounted for 0.23 and 0.007 per cent of the total sectoral decreases in 1990 and 2005, respectively. Sweden followed the recommendations from the previous reviews and provided details of the revised AD and EF, and the rationale for the recalculations.

B. Reference and sectoral approaches

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

22. The CO_2 emissions from fuel combustion were calculated using both the reference and sectoral approaches. For 2006, estimates calculated using the reference approach are 3.6 per cent lower than those calculated using the sectoral approach. Explanations are provided in the documentation box of CRF table 1.A(c). In addition, the NIR provides explanations for the fluctuations in the differences between the two approaches over the years.

23. In general, the apparent fuel consumption reported in the CRF for Sweden corresponds well to that reported to the International Energy Agency (IEA), differences being within 4 per cent for most years. The total apparent consumption over the period 1990–2006 decreased by 7 per cent in the CRF and by 2 per cent in the IEA report; this difference is mainly due to differences in coking coal imports. In addition, differences were identified, for example, for peat production, import/export of lubricants, natural gas import and stock change, and coking coal import. The ERT recommends that Sweden reconcile its reporting to the IEA and to the UNFCCC.

2. International bunker fuels

24. The consumption of international aviation and international marine bunker fuel, as reported in CRF table 1.C, is not always comparable with the data reported to the IEA. The ERT recommends that Sweden reconcile its reporting to the IEA and to the UNFCCC.

25. There are large fluctuations in CO_2 emissions from aviation and marine bunkers. For aviation, the following inter-annual changes in CO_2 emissions have been identified: decrease by 18.5 per cent in 1990/1991, decrease by 17.3 per cent in 1991/1992, increase by 36.7 per cent in 1992/1993, and decrease by 13.9 per cent in 2001/2002. The 2006 value (2,006 Gg CO_2 eq) is 50.3 per cent higher than the 1990 value (1,335 Gg CO_2 eq). For marine bunkers, the following inter-annual changes have been identified: increase by 18.5 per cent in 1990/1991, and increase by 34.5 per cent in 2002/2003. The 2006 value (7,140 Gg CO_2 eq) is 220.5 per cent higher than the 1990 value (2,228 Gg CO_2 eq). The ERT recommends that Sweden investigate the reasons for these large inter-annual variations and include the appropriate explanation in the NIR of its next submission.

3. Feedstocks and non-energy use of fuels

26. Feedstocks are reported in CRF table 1.A(d) with relevant information for lubricants, bitumen, liquefied petroleum gas (LPG) and other (secondary fuels). Sweden explained in the NIR that the quantity of fuels reported for feedstocks and non-energy use is based on a survey of quarterly fuel statistics rather than on a national energy balance. The ERT recommends that Sweden develop a stable and systematic check for this category as part of its QA/QC plan to ensure the completeness and time-series consistency of the estimates.

C. Key categories

1. Road transportation: liquid – CO_2

27. The CO_2 IEF for diesel decreased by 2.5 per cent between 1990 (74.02 t/TJ) and 2006 (72.14 t/TJ), which is a larger reduction than in most of the other Parties. In responding to questions from the ERT during the review, Sweden explained that this was due to the change in the mix of the different types of diesel in Sweden. In 1990 only the high-carbon MK3 diesel was consumed; during the following decade the proportions gradually changed to about 6 per cent MK3 and 94 per cent MK1 (MK1 has a lower carbon content); and in 2001–2007 the share of MK1 in the mix increased to 98 per cent. The ERT recommends that Sweden provide these explanations in its next NIR, together with the specific carbon content values of Swedish MK1 and MK3 diesel.

2. Public electricity and heat production: solid – CO_2, N_2O

28. Blast furnace gas and steel converter gas, which have considerably higher CO_2 EFs and lower N_2O EFs than other solid fuels, have been used in higher relative amounts in recent years than in the early 1990s; this has caused an increase in the overall CO_2 IEF for solid fuels of 31.5 per cent, and a decrease in the N_2O IEF for solid fuels of 39.4 per cent, between 1990 and 2006. The ERT encourages Sweden to provide information on the use of these secondary fuels in this category in its next NIR.

3. Iron and steel: solid – CO_2

29. Sweden allocates the CO_2 emissions from iron and steel into six subcategories: public electricity and heat production, manufacture of solid fuels and other energy industries, iron and steel, other stationary (table 1.A.5.a), other fugitive emissions from solid fuels (table 1.B.1.c) in the energy sector, and iron and steel production in the industrial processes sector. This allocation approach is not consistent with the IPCC good practice guidance, and increases the risk of double counting or omitting emission estimates. The ERT highlights the importance of the elaboration of carbon balance checks in such cases and recommends that Sweden conduct this check for the whole time series for its next submission.

D. Non-key categories

Residential: biomass – CH_4

30. The CH_4 IEF shows an overall decreasing trend and the 2006 value (250.3 kg/TJ) is 10.4 per cent lower than the 1990 value (279.4 kg/TJ). The 1990, 1999–2000 and 2003–2006 values of the CH_4 IEF (242.1–279.4 kg/TJ) are lower than the IPCC default value (300.0 kg/TJ) and there are no explanations for this in the NIR. Sweden, in response to questions raised in previous stages of the 2008 review, explained that this results from the improvements in biomass combustion technology. The ERT recommends that Sweden provide specific information in its next NIR on how technology improvements influence the CH_4 EFs from biomass burning.

III. Industrial processes and solvent and other product use

A. Sector overview

31. In 2006, emissions from the industrial processes sector amounted to 6,151.16 Gg CO_2 eq, or 9.4 per cent of total GHG emissions, and emissions from the solvent and other product use sector amounted to 303.25 Gg CO_2 eq, or 0.5 per cent of total GHG emissions. Between the base year and 2006, emissions from the industrial processes sector increased by 4.2 per cent and emissions from the solvent and other product use sector decreased by 8.8 per cent. The key contributors for the rise in emissions in the industrial processes sector are consumption of halocarbons and SF_6 and mineral products; however, emissions from chemical industry and metal production decreased and partially offset

this increase in emissions. In 2006, within the industrial processes and solvent and other product use sectors, 70.9 per cent of GHG emissions were CO_2, 12.8 per cent were HFCs, 10.7 per cent were N_2O and 3.8 per cent were PFCs; SF_6 accounted for 1.7 per cent, and the remaining 0.1 per cent were CH_4.

32. In 2006, the largest share of the sectoral emissions (37.3 per cent) came from metal production; mineral products accounted for 35.3 per cent, consumption of halocarbons and SF_6 for 13.3 per cent, chemical industry for 8.0 per cent, and other production (table 4.D) for 1.4 per cent. Solvent and other product use accounted for 4.7 per cent of both sectors combined. The following categories are reported as "NE": CO_2 from non-iron ore mining and dressing, and from food and drink; CH_4 from carbon black production, from base chemicals for plastic industry, from non-ferrous metal production, from ferroalloys production, from aluminium production, from other non-specified chemical industry, from other inorganic chemical production, from pharmaceutical industry, and from sinter and coke production; N_2O from other non-specified chemical industry; HFCs, PFCs and SF_6 from solvent consumption; and the amount destroyed of HFCs and PFCs. The ERT encourages Sweden to reduce the number of non-estimated categories. Emissions from the production of halocarbons and SF_6 do not occur in Sweden.

33. Sweden's inventory of emissions from these sectors is mostly complete, and according to the Party the missing categories for CH_4 and N_2O are expected to be small. Generally, the reporting is transparent and follows the Revised IPCC 1996 Guidelines and the IPCC good practice guidance; higher tier methodologies are applied where appropriate. However, for some categories, including some key categories, such as CO_2 from iron and steel production and CO_2 from lime production, the country-specific methods are reported in a non-transparent way, and the ERT recommends that Sweden improve its reporting in this regard.

34. The major difference between the 2007 and 2008 submissions concerns the recalculation of emissions of PFCs from aluminium production, following the recommendations made in the initial review report. This recalculation results, on average, for the whole time series, in a 13.0 per cent decrease in emissions for this category. Other small recalculations were made for the following categories: CO_2 from lime production and from limestone and dolomite use; CO_2 and CH_4 from other chemical industries; CO_2 and CH_4 from pig iron production; potential emissions of HFCs and SF_6 from consumption of halocarbons and SF_6; AD for, and HFC-134 emissions from, refrigeration and air-conditioning equipment; AD for, and HFC emissions from, heat pumps; SF_6 from electrical equipment; and AD for, and CO_2 from, solvents.

B. Key categories

1. Iron and steel production – CO_2

35. Sweden uses a country-specific method to estimate and allocate CO_2 emissions from pig iron production, which is not in line with the IPCC good practice guidance as this method allocates all CO_2 emissions to the output (i.e. the blast furnace), rather than using an input based CO_2 calculation method. Sweden does not present a complete overview of the estimated amount of emissions. In the chapter on energy in the NIR, Sweden mentions an allocation rule, but the emissions allocated to each category are not presented. The issue of lack of transparency in reporting methodology, as well as the lack of information on the extent to which all emissions were considered, has been raised in previous reviews.

36. The ERT noted a 19.9 per cent decrease in emissions between 2005 and 2006 (390.02 Gg CO_2 or 0.6 per cent of Sweden's total GHG emissions for 2006) for this category, but there were no explanations for this decrease in the NIR. According to the methodology reported by Sweden, some CO_2 emissions should have been allocated to the energy sector, but the 2006 emission inventory does not show any traceable emission increases in the relevant categories in the energy sector that could balance the reported emission decrease in this category. Responding to questions posed at the time of the review, Sweden explained that, when estimating CO_2 emissions from primary iron production, it considers only the amount of blast furnace gas used in the blast furnace, and not the quantity of coke oven gas. In

response to comments by the ERT, Sweden agreed that the data and methodology for estimating CO_2 emissions from iron and steel production need to be revised. Sweden is planning to carry out such revisions after considering the conclusions of a study made by the Swedish EPA in 2008, and plans to submit revised estimates in 2010. The ERT welcomes these proposed revisions and recommends that Sweden provide in its next submission a detailed and transparent description of the CO_2 emission calculation, including the tracking of carbon flow through the process (chapter 3.1.3.1 of the IPCC good practice guidance).

2. Cement production – CO_2

37. A tier 2 methodology was applied for this category and sufficient information is provided in the NIR to justify the use of a higher EF in comparison with other Parties. However, the increasing trend in the IEF observed since 2005, after the period 1990–2004, when the values were more or less constant, should be explained in the next submission. Sweden is also encouraged to provide the time series for the content of calcium oxide (CaO) in clinker in order to assess the validity of using a single average value (65 per cent) for the whole period.

3. Lime production – CO_2

38. Sweden identified three different industries producing lime: the conventional lime production industry, the sugar industry, and the pulp and paper industry. Following suggestions in the initial review report, Sweden has improved the reporting on the methodology for estimating CO_2 emissions and removals. However, the methodology that has been used to estimate emissions and removals in the pulp and paper industry is still not transparently described. The ERT recommends that Sweden improve the reporting of the methodology used to estimate the CO_2 removals in the pulp and paper industry for this category in its next submission.

4. Aluminium production – PFCs

39. In the 2008 submission, following the recommendation of previous reviews, Sweden has re-estimated PFC emissions from this category for 1990–2006 using the tier 2 approach, by making use of IPCC good practice guidance slope factors instead of those from the European Aluminium Association. Consequently, PFC emissions from this category have decreased by 12.9 per cent in 2005 and by 12.0 per cent in 1995. Emissions in 2006 are 27.2 per cent lower than in the base year as a result of process improvements (reduction in the number and duration of anode effects). Sweden is encouraged to continue using the tier 2 approach of the IPCC good practice guidance methodology in future emission estimates.

C. Non-key categories

1. Limestone and dolomite use – CO_2

40. Despite recommendations from previous reviews, Sweden is still using a methodology that is not presented in a transparent way in the NIR. Currently, Sweden uses a hybrid approach which follows both the Revised 1996 IPCC Guidelines and recognized international scientific literature. This may lead to double counting or omissions; for example, the ERT found that emissions from limestone use in iron and steel production were, according to the 2008 NIR, allocated to both the iron and steel industry energy emissions and to limestone and dolomite use. Sweden agreed, during the review, that the textual description in the NIR is not correct. The ERT encourages Sweden to correct and improve its reporting in its next NIR, and to improve the transparency of the applied approach by, for example, adding an allocation table of the annual amounts of limestone used and emissions for each category.

2. Solvent and other product use – CO_2, N_2O

41. The ERT noted that Sweden reported identical emission estimates for 2005 and 2006 in its 2008 submission, as 2006 AD were not available in time to be included in the 2008 submission. The ERT recommends that Sweden improve its data collection procedures in order to estimate final emissions in a timely manner for future submissions.

IV. Agriculture

A. Sector overview

42. In 2006, emissions from the agriculture sector amounted to 8,503.64 Gg CO_2 eq, or 8.0 per cent of total GHG emissions. Emissions from the sector decreased by 9.6 per cent between 1990 and 2006. The key driver for the fall in emissions is the structural changes that affected the agriculture sector in the past 50 years and, in particular, since 1995, when Sweden joined the European Union. Within the sector, 55.6 per cent of emissions were N_2O from agricultural soils, 32.9 per cent were CH_4 from enteric fermentation, and 11.5 per cent were CH_4 and N_2O from manure management.

43. Reporting for agriculture is complete in terms of gases, categories and years covered. Additional information tables and documentation boxes in the CRF were filled in, except for the tier 2 table for enteric fermentation.

44. EFs are mainly country-specific, but are not sufficiently explained in the NIR (e.g. N_2O emissions from manure management and from agricultural soils). Following the recommendations from previous reviews, the ERT recommends that Sweden provide detailed information in its NIR on the assumptions and national conditions supporting the calculation/selection of EFs.

B. Key categories

1. Enteric fermentation – CH_4

45. Enteric fermentation accounts for 50.7 per cent of total national CH_4 emissions and for more than 85 per cent of the CH_4 emissions from agriculture. Country-specific EFs are used for cattle and reindeer, whereas the IPCC default EFs are used for other animals. The Party obtains the population of each animal category from national data sources. Sweden has reduced the EFs for beef cows from 98 kg/head/day to 78 kg/head/day as recommended in the initial review report. The country-specific CH_4 EFs for dairy cattle (ranging from 120 kg/head/yr in 1990 to 131 kg/head/yr in 2006) are retained. The ERT accepts that these comparatively high values are supported by the milk yield data and the gross energy intake values available from Swedish national studies. For reindeer, Sweden uses the tier 2 methodology from the IPCC good practice guidance and the EF of 19.9 kg/head/day, as developed by Finland, following the recommendations from the initial review report.

2. Manure management – N_2O

46. The ERT detected that in the 2008 submission, CRF table 4.B(b) is not filled in correctly for all years because the sum of the excreted N across animal waste management systems does not equal the quantities derived from the given animal populations and their respective N-excretion rates. In addition, the N-excretion rates of 185 kg/year for non-dairy cattle and 46.8 kg/year for swine were implausible. In response to questions raised by the ERT on this matter Sweden provided a revised table 4.B(b) for 2006 and explained that the CRF table 4.B(b) reported originally had incorrect units and the N-excretion rates for non-dairy cattle and swine were incorrectly reported as totals for individual subcategories rather than weighted means. Also in CRF table 4.B(b), N excretion from grazing sheep has been reported as "not occurring" ("NO"), which is not consistent with the fact that a grazing period of six months has also been reported for sheep. In the revised table 4.B(b) provided by Sweden during the review week, N excretion by sheep at pasture is included. The ERT recommends that Sweden re-examine the preparation of

table 4.B(b) to ensure that it accounts for all N excretion for the estimation of N_2O from manure management and for the quantification of N input for manure applied to soils and excretion on pasture range and paddock (table 4.Ds1). The ERT also recommends that Sweden ensure that its QA/QC procedures provide for accurate and correct completion of CRF tables in the agricultural sector.

47. According to the Swedish Board of Agriculture (Rapport 2001:13), the N-excretion rate for piglets is 0.5 kg N/produced piglet. This value is used by Sweden in compiling CRF table 4.B(b) without taking into account the number of rotations per year. The ERT recommends that Sweden revise this N-excretion rate in accordance with the conditions it is reporting for the number of pigs, that is, number of animals produced (including rotations) or number of average livestock at a given time.

48. Sweden used a tier 2 method to estimate N_2O emissions and EFs based on the IPCC good practice guidance. The ERT noticed a slight decrease in the IEF for solid storage from 0.0197 kg N_2O-N/kg N in 1990 to 0.0192 kg N_2O-N/kg N in 2006, which is not fully explained in the description of EFs in the NIR. The ERT encourages Sweden to further clarify this decrease in the NIR and indicate which management systems underlie the IEF of 0.02 kg N_2O-N/kg N in the category other.

3. Manure management – CH_4

49. The initial review report mentioned that Sweden was using a methane correction factor (MCF) of 0.10 for liquid systems in accordance with the Revised 1996 IPCC Guidelines rather than the default value of 0.39 which is recommended in the IPCC good practice guidance. The NIR states that the value of 0.10 is more appropriate given Sweden's cold climate and the practice of covering liquid storage units.

4. Direct soil emissions and pasture, range and paddock manure – N_2O

50. Sweden uses the IPCC default methods for this category. Country-specific values are used for the fraction of N input for manure applied to soils that is volatilized and the proportion of N excretion on pasture range and paddock. Country-specific EFs are used to estimate N_2O emissions from N input for synthetic fertilizers, N input for manure applied to soils, and N excretion on pasture range and paddock. Sweden's approach is unusual in that substantially different rates of N_2O emission apply to the various N inputs to soils. The NIR states that the EFs were collected from literature sources but it does not clarify or justify their particular suitability for Swedish circumstances. The ERT recommends that Sweden provide more information in this regard in its next submission.

51. The ERT acknowledge Sweden's improvement in reporting in CRF table 4.D showing the quantity of N in sewage sludge used as fertilizer; this makes it possible to calculate the IEF and compare it with those of other Parties. The N from animal manures applied to soils in table 4.D is not consistent with the information in table 4.B(b) and $Frac_{GASM}$, which probably reflects the errors in table 4.B(b) mentioned above. The ERT recommends that Sweden ensure the consistency of information between CRF tables 4.B(b) and 4.D

5. Indirect emissions – N_2O

52. Sweden does not provide sufficient information in the NIR on the volatilization ratios of ammonia (NH_3) and nitrogen oxide (NO_X) from the use of synthetic fertilizers, and the application of animal manure. The ERT reiterates the recommendations in the initial review report and recommends that Sweden include in its future NIRs relevant information on how these volatilization ratios are determined.

V. Land use, land-use change and forestry

A. Sector overview

53. In Sweden's original 2008 submission on 14 April, the LULUCF sector was a net sink in 2006, with net removals amounting to 38,006.52 Gg CO_2 eq. Between 1990 and 2006, net removals decreased

by 34.4 per cent but the time series shows large inter-annual fluctuations. Within the LULUCF sector, 81.1 per cent of the GHG emissions/removals were from forest land, 15.0 per cent were from grassland, 2.6 per cent were from cropland, 1.0 per cent were from settlements and 0.3 per cent were from wetlands. Most of the emissions/removals in the sector (99.6 per cent) were CO_2; the rest were N_2O (0.3 per cent) and CH_4 (0.1 per cent). The following categories were not estimated in the original submission (although in most cases the notation key "not applicable" ("NA"), rather than "NE", is used): dead organic matter, and mineral and organic soils in land converted to forest land; dead organic matter, and mineral and organic soils in land converted to cropland (with the exception of other land converted to cropland); dead organic matter, and mineral and organic soils in land converted to grassland; living biomass, and dead organic matter in wetland remaining wetland; living biomass, dead organic matter, and soil organic matter in land converted to wetland; living biomass, dead organic matter, and soil organic matter in other land; and non-CO_2 emissions from drainage of soils and wetlands.

54. In response to issues raised by the ERT during the review, Sweden reported that "an error has been diagnosed in the figure previously submitted for the LULUCF sector. The high between-year variations for the time series 1990–2006 are inaccurate due to an incorrectly specified reporting generator and not from errors in the inventory database as such". On 4 February 2009, when providing comments to the draft report of the individual review, in accordance with decision 22/CMP.1, Sweden submitted a revised inventory for 2008 for the LULUCF sector. In the estimates contained in the revised CRF tables and NIR, the LULUCF sector was a sink in 2006, with net removals amounting to 25,587.16 Gg CO_2 eq. Between 1990 and 2006, net removals decreased by 20.2 per cent. Annual net removals for the time series are now more stable and decreased from 32 053.37 Gg CO_2 eq in 1990 to 25587.16 Gg CO_2 eq in 2006, while the notation key "NE" is now applied to the majority of carbon pools for land-conversion categories previously reported as "NA". The revised estimates do not show high inter-annual variations. The ERT encourages the Party to improve the completeness of its reporting in its future annual submissions by providing estimates and relevant information for categories that are not estimated. Data from the revised emission estimates are used in the analysis provided in this report for the LULUCF sector.

55. The information contained in the NIR does not fully allow the reader to understand, for each category, how estimates provided in the CRF tables have been calculated, which methodologies have been applied, and which assumptions and background data have been used. The ERT recommends that Sweden improve the transparency of its inventory by providing all the necessary documentation and information in its future submissions, in accordance with the IPCC good practice guidance for LULUCF.

56. The ERT noted that, for LULUCF categories, some very small (±1 g C) total net changes of carbon stocks are reported, causing high inter-annual changes of 1 million or even 1 billion per cent. During the review, Sweden justified reporting a whole number for very small real changes as the Party uses the carbon stock change method, which cannot produce gains and losses independently and can only produce a single value for net change, while the reporting software does not allow zero to be used for gains or losses. The ERT recommends that Sweden consider the use of notation keys "NO" or "IE" for one of the values, either for gains or losses, when the stock change method is applied.

57. The ERT found an inconsistency between land-use definitions applied by the Party and those provided by the IPCC good practice guidance for LULUCF: the subcategory mire has been reported under wetlands although elements of grassland are present, and according to the IPCC definitions grassland takes precedence over wetland use (IPCC good practice guidance for LULUCF, page 3.135). The ERT is of the view that, although a country may decide its own land-use category definitions, it must ensure that its national approach distinguishes between unmanaged and managed land in a transparent manner and that the definitions adopted are consistent with those used by the Party when providing land-use related data under other international processes. The ERT recommends that Sweden report the subcategory mire under grassland, further distinguishing between managed and unmanaged land subcategories.

58. The ERT noted that the plot-level land-use classification system is based on the subjective judgement of field team members. Two major issues arise from the applied methodology. The first pertains to assessing the predominant use (i.e. when more than one land use exists for the same plot area), which is subject to the judgement of visiting field staff and not the classification rules on land-use hierarchy. The second pertains to assessment of the proportion of the plot that falls under one of many land-use categories, which is based on observations made by the visiting field staff on the sample plot and on an undefined surrounding area. The ERT believes that there is no objective set of rules regarding land representation, including any stated hierarchical order (although Sweden refers to database processing steps aimed at removing unreal land-use transfers); consequently, changes identified in land use could merely result from differences in judgement of visiting field staff. Moreover, the ERT found that a consistent time series of AD related to land use and land-use change has not been provided in the CRF tables. For example, the total land area fluctuates from 45.123.33 Mha in 1991, to 45,120.97 Mha in 2002, to 45.157.40 Mha in 2004 and to 45.120.00 Mha in 2006. The ERT encourages Sweden to review its methodology for land representation, to include a hierarchical order for land uses, and to reduce as far as possible the degree of subjectivity in both land-use detection and the classification system.

59. There is an inconsistent time series for land-use change for the period 1990–2006 in both 2008 submissions, as the sum of areas converted from forest use to other land uses in a given period does not equal the change in area of forest land remaining forest land for the same time period. For example, from 1990 to 1991, the total area of land converted from forest use to other land uses was 11,826 ha, while in the same period the forest land remaining forest land area increased by 42,350 ha. The ERT recommends that Sweden improve its approach for determining land-use change in order to report a consistent time series of annual land-use change matrices, as is suggested in the IPCC good practice guidance for LULUCF.

60. The total area of organic soil reported in the LULUCF sector does not match the area of cultivated organic soils reported in the agriculture sector (CRF table 4.Ds1). For instance, the area reported for 2006 in the LULUCF sector is 295,523 ha (249,800 ha of cropland and 45,723 ha of grassland), whereas the area reported in the agriculture sector is 252,574 ha. The ERT encourages Sweden to improve consistency across all sectors.

B. Key categories

1. Forest land remaining forest land – CO_2

61. The Party reported in table 7.15 of the original NIR that the dead organic matter pool is generally losing carbon, although the living biomass and soils pools are increasing. The ERT noted that such a trend is unrealistic. During the review, the Party explained that these errors were caused through use of the CRF Reporter; they have been corrected in the revised submission.

2. Land converted to forest land – CO_2

62. With the exception of the years 1993, 1999, 2003 and 2006, the Party reports a net carbon stock decrease in living biomass associated with this land-use change. Considering that land-use change to forest land is generally followed by an increase in living biomass, the ERT has difficulty understanding such a decrease. During the review, the Party explained that these errors were caused through use of the CRF Reporter; they have been corrected in the revised submission.

3. Cropland remaining cropland – CO_2

63. Sweden reports a net carbon increase for the living biomass (except 1991) and dead organic matter pools for all years. During the review, Sweden explained that this increase was due to the existence of woody vegetation in areas classified as cropland. Considering that the NIR does not report the presence

of perennial crops and that information on methodologies applied for estimating those pools is not reported, the ERT has difficulty in understanding such an increase. The ERT recommends that Sweden provide an explanation for this trend in its next NIR in order to improve the transparency of its reporting.

4. Land converted to cropland – CO_2

64. With the exception of the years 1991, 1997, 2002 and 2003, Sweden reports a net carbon increase in living biomass associated with land-use change from forest land to cropland. Moreover, with the exception of 2005, the Party reports a net carbon increase in living biomass associated with land-use change from grassland to cropland. Considering that forest land and grassland usually have higher carbon contents than cropland, the ERT does not understand such an increase. During the review, the Party explained that these errors were caused though use of the CRF Reporter; they have been corrected in the revised submission.

5. Grassland remaining grassland – CO_2

65. Sweden reports that the dead organic matter pool is generally losing carbon, although the living biomass and soils pools are increasing. The ERT noted that such a trend is unrealistic. During the review, the Party explained that these errors were caused through use of the CRF Reporter; they have been corrected in the revised submission.

6. Forest land converted to grassland – CO_2

66. With the exception of the years 2002, 2003 and 2005 Sweden reports a net carbon increase in living biomass associated with land-use change from forest land to grassland. Considering that forest land usually has a higher carbon content than grassland, the ERT has difficulty understanding such an increase. The ERT recommends that Sweden provide an explanation for the outlined trend in its next NIR.

7. Land converted to settlements – CO_2

67. With the exception of the years 1992 and 2006, Sweden reports a net carbon increase in living biomass associated with land-use change from forest land to settlements. Considering that settlements usually do not contain a higher level of carbon stocks than natural and semi-natural ecosystems, the ERT had difficulty understanding such an increase. To improve the transparency, the ERT recommends that Sweden provide an explanation for the outlined trend in its next NIR.

8. N_2O emissions from disturbance associated with land-use conversion to cropland – N_2O

68. Sweden has not been able to separate emissions from organic and mineral soils (CRF table 5 (III)), and, accordingly, all emissions have been reported as organic soils. The ERT recommends that Sweden improve its methodology in order to be able to report the two soil categories separately.

VI. Waste

A. Sector overview

69. In 2006, emissions from the waste sector amounted to 2,054.04 Gg CO_2 eq, or 3.1 per cent of total GHG emissions. Emissions from the sector decreased by 34.0 per cent between 1990 and 2006. The key driver for the decline in emissions is solid waste disposal on land. Within the sector, 89.8 per cent of the emissions were from solid waste disposal on land, 6.8 per cent were from wastewater handling, and 3.4 per cent were from waste incineration.

70. Recalculations in the 2007 and 2008 submissions were made for nitrogen discharge from municipal and industrial wastewater, respectively, and are clearly explained in the NIR and CRF.

B. Key categories

Solid waste disposal on land – CH_4

71. Following the recommendation of the initial review report, Sweden has provided qualitative and quantitative information on the use of gas recovery in the NIR (i.e. the recovered gas that is used mainly for heating and electricity production).

72. The municipal solid waste deposited on landfills is composed of household, industrial, construction and demolition waste. Time-series AD on the amounts of household waste are provided clearly in the NIR. Industrial organic waste AD for certain types of industrial waste are available from 1994 to 2000, and AD for the other years are extrapolated. The ERT recommends that Sweden include in its next NIR information on time series for industrial organic waste in order to provide a more complete picture of municipal solid waste AD.

73. CO_2 emissions in this category are reported as "NE". If there is no on-site combustion of waste at the solid waste disposal sites, these emissions could be better reported using the notation key "NO". The ERT recommends that Sweden revise the notation key accordingly.

C. Non-key categories

1. Wastewater handling – CH_4

74. CH_4 emissions from wastewater treatment have been reported as "NE", as recommended in the previous review. Emissions from private or smaller plants, even if they are relatively insignificant, should be calculated using default methods and EFs. The ERT recommends that Sweden attempt to estimate these emissions as part of the general assessment for "NE" categories and to provide the background data on industrial wastewater in CRF table 6.B.

75. CH_4 emissions from sludge treatment are reported as "included elsewhere" ("IE") and emission estimates are calculated together with solid waste disposal on land. In estimating emissions from sludge treatment, it is important to include separately emissions associated with sludge that is landfilled and emissions from sludge treated during the wastewater handling process, as both treatment processes are responsible for emissions. In Sweden, if a proportion of sludge is treated during the wastewater handling process, then emissions associated with that proportion must be reported under the category wastewater handling (sludge) both for industrial wastewater and for commercial and domestic wastewater. The ERT recommends that Sweden change the notation key from "IE" to "NE" for the emissions from sludge resulting from treatment during the wastewater handling process.

2. Wastewater handling – N_2O

76. The ERT commends Sweden for estimating N_2O emissions from industrial wastewater. The ERT recommends that Sweden provide, in its next submission, more information on the estimation of N_2O from municipal and industrial wastewater, and from human sewage. The ERT notes that the default EF from the Revised 1996 IPCC Guidelines (0.01 kg N_2O-N/kg sewage N produced) is recommended for human sewage, but it is also used by Sweden for the two other categories of wastewater – commercial and industrial. The ERT recommends that Sweden include in its NIR the justification for applying this default value to non-sewage types of wastewater.

77. N_2O emissions from human sewage have remained constant over the years. The Party explained that this is because there are no documented variations over the years. The ERT encourages Sweden to revise, if necessary, this constant trend as it does not seem plausible that the number of people served by wastewater treatment has remained constant from 1990 to 2006.

3. Waste incineration – CO_2, CH_4, N_2O

78. In response to queries from the ERT regarding waste incineration, Sweden stated during the review that the biogenic fraction of incinerated municipal waste is about 30 per cent, according to a 2003 report by Swedish Waste Management (Boström, 2003). The ERT recommends that Sweden include such information in its next NIR, and update and validate this value regularly as the biogenic fraction of incinerated municipal solid waste varies over time. It is good practice to assume that the composition of incinerated municipal solid waste is similar to that of generated municipal solid waste (IPCC good practice guidance, page 5.28).

79. The CO_2 IEF for incinerated municipal waste decreased from 32.7 kg CO_2/GJ (for all years before 1996) to 25 kg CO_2/GJ (for 1996 and subsequent years), according to the values listed in appendix 18 of the NIR. Sweden explained during the review that this decrease reflects the recommendation of a 2004 study (Boström et al, 2004). In the absence of data and information for other years, the ERT recommends that only one value (e.g. 25 kg CO_2/GJ) be used for all years in order to maintain time-series consistency and consistency with reporting on incineration in category 1.A.

80. CH_4 and N_2O emissions from waste incineration are reported as "NE" because, as Sweden explained during the review, more measurements are still needed in order to obtain correct estimates. The ERT recommends that Sweden calculate these emissions (however insignificant) using IPCC default EFs, rather than wait for the outcome of actual measurements.

VII. Other issues

1. Changes to the national system

81. Sweden has not reported on any changes to its national system in the 2008 submission. In response to questions raised by the ERT during the review, Sweden provided information on changes to the national system, which include the implementation of the TPS archiving system. The ERT considers that these changes enhance conformity with the requirements for national systems, as defined in decision 19/CMP.1. Following the recommendation by the ERT, Sweden plans to report on this change in its next annual submission under the Kyoto Protocol.

2. Changes to the national registry

82. Sweden included a detailed description of its national registry in its 2008 submission. There are no differences with earlier descriptions that would constitute a change to the national registry that should be reported in accordance with paragraph 21 of the annex to decision 15/CMP.1.

3. Commitment period reserve

83. Sweden has not reported its commitment period reserve in the 2008 submission. In response to questions raised by the ERT during the review, Sweden reported that its commitment period reserve has not changed since the initial report review for Sweden (337,669,705 t CO_2 eq). The ERT agrees with this figure. The ERT recommends that Sweden include information on its commitment period reserve in its next annual submission.

VIII. Conclusions and recommendations

84. Sweden submitted its original 2008 inventory on 14 April, in accordance with the deadline established by the UNFCCC guidelines. The inventory comprises a complete set of CRF tables and an NIR, and is complete in terms of geographical coverage, years and sectors. It is also generally complete in terms of categories and gases, except for some small categories that are noted in this report. On 4 February 2009, when providing comments to the draft report of the individual review, Sweden

submitted a revised inventory for 2008, containing a full set of CRF tables and an NIR, with revised emission estimates for the LULUCF sector.

85. The ERT concludes that the inventory is consistent with the UNFCCC reporting guidelines, the Revised 1996 IPCC Guidelines and the IPCC good practice guidance. It conforms to the principles of transparency, completeness, consistency, comparability and accuracy, reflecting the effective functioning of the national system, including the implementation of extensive QA/QC procedures.

86. The ERT noted, however, that Sweden needs to further enhance transparency in its reporting on the LULUCF sector and the QA/QC procedures applied in the preparation of CRF tables; the Party's failure to do so originally required the resubmission of the inventory. It also noted that, in its next submission, Sweden needs to provide estimates for categories that are currently not estimated and for which relevant IPCC methodologies are available, with a view to avoiding any possible underestimation of national emissions during the commitment period. The other key recommendations for further improvements are:

(a) Re-assess the methods used for some important categories in the industrial processes sector, in particular CO_2 emissions from iron and steel production, and lime production in the pulp and paper industry, in order to ensure that they are in line with the IPCC good practice guidance and that the relevant methodological descriptions in the NIR are sufficiently detailed;

(b) Describe the current use of data from the EU ETS for national GHG inventory purposes and consider making further use of this data source;

(c) Provide justification for the country-specific EFs for some N_2O emissions categories in agricultural soils.

87. The ERT highlighted a small number of unresolved issues in Sweden's GHG inventory and noted that it should be possible for Sweden to resolve these issues in advance of reporting for the first commitment period given the well functioning national system in Sweden. The ERT recommends that Sweden give high priority to resolving these issues with a view to ensuring that its GHG inventory is fully transparent and all methodologies are fully in accordance with the IPCC good practice guidance.

IX. Questions of implementation

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

Annex

Documents and information used during the review

A. Reference documents

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

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

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

"Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories". FCCC/SBSTA/2006/9. Available at <http://unfccc.int/resource/docs/2006/sbsta/eng/09.pdf>.

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

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

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

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

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

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

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

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

FCCC/IRR/2007/SWE: Report of the review of the initial report of Sweden. Available at <http://unfccc.int/resource/docs/2007/irr/swe.pdf>.

B. Additional information provided by Sweden

Responses to questions during the review were received from Mr.Hakam Al-Hanbali (Swedish Environmental Protection Agency, Stockholm), including additional material on the methodology and assumptions used. The following documents were also provided by Sweden:

Boström, C-Å. 2003. *Förstudie, emissionsfaktorer för avfallsförbränning.* På uppdrag av Naturvårdsverket, Svenska MilijöEmissionsData (SMED)

Boström, C-Å, Flodström, E, D Cooper. 2004. *Emissionsfaktorer för stationär förbränning. Rapportserie SMED och SMED&SLU Nr 3 200.* På uppdrag av Naturvårdsverket Svenska MilijöEmissionsData (SMED)

Naturvårdsverket. 2008. *Fortsättning av riktad kvalitetskontrollstudie av utsläpp från industrin i Sveriges internationella rapportering, Utsläpp rapporterade till UNFCCC, EU Monitoring Mechanism, CLRTAP och NEC*, Bromma (Swedish only)

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