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REPORT OF THE INDIVIDUAL REVIEW OF THE GREENHOUSE GAS INVENTORY OF ESTONIA SUBMITTED IN THE YEAR 2001[1]

(Centralized review)

I. OVERVIEW

A. Introduction

1. The Conference of the Parties (COP), at its fifth session, by its decision 6/CP.5, adopted guidelines for the technical review of greenhouse gas (GHG) inventories from Parties included in Annex I to the Convention (Annex I Parties), hereinafter referred to as the review guidelines,[2] for a trial period covering the GHG inventory submissions for the years 2000 and 2001. The COP requested the secretariat to conduct individual reviews of GHG inventories for a limited number of Annex I Parties. The secretariat was requested to use different approaches for individual reviews by coordinating desk reviews, centralized reviews and in-country reviews.

2. In response to the mandate from the COP, the secretariat coordinated a centralized review of seven national GHG inventories submitted in 2001 (Austria, Belgium, Estonia, the European Community, Germany, Greece and Spain), which took place from 8 to 12 October 2001. The review was carried out by a team of nominated experts from the roster of experts working at the headquarters of the UNFCCC secretariat in Bonn. The members of the team were: Mr. Charles Russell (New Zealand), Mr. José Ramon Villarin (Philippines), Mr. Hristo Vassilev (Bulgaria), Ms. Irina Yesserkepova (Kazakhstan), Ms. Nadzeya Zaleuskaya (Belarus), Mr. André Van Amstel (the Netherlands), Ms. Punsalmaa Batima (Mongolia), Mr. Rizaldi Boer (Indonesia), Mr. Josef Mindas (Slovakia), Mr. Charles Jubb (Australia) and Mr. Emilio Sempris (Panama). The review was coordinated by Ms. Rocio Lichte (UNFCCC secretariat). Mr. Charles Russell and Mr. José Ramon Villarin were the lead authors of this report.

3. The principle objective of the review of the GHG inventories was to ensure that the COP had adequate information on the inventories. The review should also further assess the progress of the Parties toward fulfilling the requirements outlined in the UNFCCC reporting guidelines.[3] In this context, the review team checked the Parties' responses to questions raised in the previous

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[1] In the symbol for this document, 2001 refers to the year in which the inventory was submitted, and not to the year of publication. The number (3) indicates that for Estonia this is a centralized review report.

[2] For the UNFCCC review guidelines and decision 6/CP.5, see document FCCC/CP/1999/7, pages 109 to 114 and 121 to 122, respectively.

[3] The guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I: UNFCCC reporting guidelines on annual inventories (FCCC/CP/1999/7) are referred to as the UNFCCC reporting guidelines in this report.

stages of the review process and the consistency of the inventory submissions with the UNFCCC reporting guidelines and the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (hereinafter referred to as the IPCC Guidelines), and identified possible areas for improvement in the inventories of the seven Annex I Parties. Each IPCC sector was reviewed by two experts.

4. The review team also assessed, to a certain degree, whether the reporting fulfilled the requirements included in the IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories (hereafter referred to as the IPCC good practice guidance).[4]

5. The UNFCCC secretariat provided the review team with all the necessary technical guidance, information and data, such as the national inventory submissions and the results of previous stages of the review process. Sources of data and information used for the review of Estonia's inventory are outlined in paragraphs 7 to 10 to below.

6. In accordance with the UNFCCC review guidelines, a draft version of this report was communicated to the Government of Estonia, 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

7. Estonia did not submit a national inventory report (NIR) with its 2001 inventory submission. Estonia provided inventory data for the year 1999 in the common reporting format (CRF) and included most of the tables requested. The CRF was submitted to the secretariat on 10 April 2001 in electronic form only. A revised 1999 CRF was submitted in October 2001 (see paragraph 8 below).

8. The status report 2001, the draft synthesis and assessment (S&A) report 2001 and the UNFCCC secretariat's preliminary key source assessment[5] were provided by the secretariat as additional sources of information. Estonia responded to the preliminary findings raised in the draft S&A report 2001 and provided an updated CRF that includes tables that had previously not been filled in and updated versions of tables 4.D, 6.A and 6.B, with a number of comments that helped to explain the national circumstances pertaining to certain sectoral emissions. However, several publications were cited without a complete list of references being provided. Since Estonia did not submit an inventory in the year 2000, it could not be included in the S&A report for 2000. For this reason, the inventory section of Estonia's Second National Communication (NC2) and the in-depth review (IDR) of the NC2 were also used as supporting information sources.

9. Other materials used, were the preliminary guidance for experts participating in the individual review of GHG inventories and the UNFCCC reporting and review guidelines

[4] According to the conclusions of the Subsidiary Body for Scientific and Technological Advice (SBSTA) at its twelfth session, the IPCC good practice guidance should be applied by Annex I Parties as far as possible for inventories due in 2001 and 2002, and should be used for inventories due in 2003 and beyond. Annex I Parties with economies in transition may phase in the good practice two years later than other Annex I Parties.

[5] The UNFCCC secretariat had identified, for each individual Party, those source categories that 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 that provided a full CRF for the year 1990. The key sources presented in this report are based on the secretariat's preliminary key source assessment. These might differ from the key sources identified by the Party itself.

(FCCC/CP/1999/7). In addition, the expert review team (ERT) had access to the secretariat's GHG inventory database through a data search tool.

10. During the review, the Party was not contacted to request additional information.

C. Emissions profiles, trends and key sources

11. In its emissions trends summary, Estonia reported a large decrease in the three main GHGs since 1990, with an overall decrease of 55%. Carbon dioxide (CO_2) emissions decreased by 56%, methane (CH_4) by 42% and nitrous oxide (N_2O) by 65%, and decreases were observed across most sectors with energy decreasing by 56%, industrial processes by 43%, agriculture by 65% and waste by 19%; CO_2 removals from land-use change and forestry (LUCF) increased by 28%.

12. These emission trends represented the fourth largest decrease in GHG emissions across all Annex I Parties. As this was Estonia's first CRF submission, it was not possible to assess consistency in time-series compared to inventory data from previous submissions.

Table 1. GHG emissions by gas, 1990–1999 (Gg CO_2 equivalent)

GHGs	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent (Gg)									
Net CO_2 emissions/removals	31,787	28,752	18,325	10,858	13,773	11,533	10,657	11,118	9,795	8,664
CO_2 emissions (without LUCF)	38,107	35,915	26,142	20,553	21,378	19,315	20,264	20,225	18,318	16,771
CH_4	4,362	3,668	2,976	2,409	2,631	2,561	2,803	3,016	2,754	2,530
N_2O	1024	1002	817	527	473	410	387	423	430	361
HFCs	0	0	0	0	0	0	0	0	0	0
PFCs	0	0	0	0	0	0	0	0	0	0
SF_6	0	0	0	0	0	0	0	0	0	0
Total (with net CO_2 emissions/removals)	37,173	33,422	22,118	13,794	16,877	14,505	13,846	14,557	12,980	11,554
Total (without CO_2 from LUCF)	43,493	40,585	29,934	23,490	24,482	22,287	23,454	23,663	21,502	19,661

Table 2. GHG emissions by sector, 1990–1999 (Gg CO_2 equivalent)

GHG SOURCE AND SINK CATEGORIES	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
	CO_2 equivalent									
1. Energy	38,827	36,606	26,735	20,958	21,874	19,891	20,948	20,873	18,717	17,157
2. Industrial Processes	614	615	313	193	215	221	207	226	368	347
3. Solvent and Other Product Use	0	0	0	0	0	0	0	0	0	0
4. Agriculture	2,440	2,328	2,050	1,480	1,358	1,117	1,018	1,070	1,002	854
5. LUCF	-6,317	-7,160	-7,814	-9,693	-7,603	-7,782	-9,607	-9,107	-8,522	-8,107
6. Waste	1,608	1,033	834	856	1,033	1,057	1,281	1,494	1,416	1,304
7. Other	0	0	0	0	0	0	0	0	0	0

13. A preliminary key source analysis was carried out on the inventory submitted by Estonia by the secretariat. Energy generation from stationary combustion made up 76.5% of Estonia's

emissions profile. Only a level assessment was feasible, as a CRF for 1990 has not yet been submitted. Estonia did not provide a key sources list.

Table 3. Key sources Estonia 1999: Level assessment (UNFCCC secretariat)[(a)]

Key source	Gas	Level assessment %	Cumulative total %
Stationary combustion – coal	CO_2	58.5	59
Stationary combustion – oil	CO_2	11.2	70
Stationary combustion – gas	CO_2	6.8	76
Solid waste disposal sites	CH_4	5.2	82
Mobile combustion – road vehicles	CO_2	4.6	86
Enteric fermentation in domestic livestock	CH_4	2.0	88
Fugitive emissions: oil and gas operations	CH_4	1.9	90
Cement production	CO_2	1.6	92
Wastewater handling	CH_4	1.4	93
Ammonia production	CO_2	1.1	94
Direct N_2O emissions from agricultural soils	N_2O	1.0	95

[(a)] See footnote 5 of this report.

D. General assessment of the inventory

1. Completeness and transparency of reporting

Completeness

14. Estonia provided its first CRF inventory submission in 2001. The CRF was provided for 1999 only and included many of the required tables. However, notably, the synthetic gases (hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6)) were not reported. In table 9 (completeness), Estonia explained that there were no industries in Estonia emitting these gases, and that no provision had been made by the Estonian government for collecting data on HFCs from imported products. Some, but not all, estimates for the precursor gases were included in the summary tables. Indicators had not been used effectively in the sectoral reports and sectoral background data tables.

15. Estonia did not submit a NIR, which made it difficult to assess transparency and clearly determine the appropriateness of their methodological approaches.

Transparency

16. The inventory was not transparent, largely due to the lack of a NIR. In addition, neither table Summary 3 on methods and emission factors used nor table 7 (overview), had been completed. The information provided in table 9 (completeness) is somewhat confused in that the Party has interpreted completeness as relating to activities that do not occur, rather than activities that do occur but are not estimated or included elsewhere in the inventory. This appears to be due to a misunderstanding of the notation keys and the Party may require assistance to be able to use them correctly and consistently.

17. It was noted that the Party had improved transparency in response to comments in the S&A report and had resubmitted CRF tables that reflect this improvement.

2. Cross-cutting issues

Institutional arrangement

18. The Estonian Institute of Ecology, in conjunction with the Ministry of the Environment, coordinated the preparation of the national GHG inventory. There is no information on the specific institutions involved in the preparation of the GHG inventory for the agriculture sector, since a NIR was not provided.

Verification and quality assurance/quality control (QA/QC) approaches

19. No information was presented by Estonia on QA/QC, such as, whether their inventory data had been subjected to any form of self-verification, quality control or independent review procedures. Table 7 (overview table) had not been completed.

Recalculations

20. The inventory submitted by Estonia did not contain information on recalculations. The 1999 inventory is the first to have been submitted by the Party using the CRF, including trends tables for all years from 1990, which were submitted in response to the draft S&A report. Data for the entire time-series from 1990 onwards were provided for the first time in the revised 1999 CRF. An assessment of the recalculations could therefore not be made.

Uncertainties

21. No assessment of uncertainties was provided. A qualitative assessment of the emissions estimates was not provided in table 7 (overview table).

3. Areas for further improvement

Planned or ongoing work by the Party

22. No information was provided on whether the Party is engaged in ongoing work to improve the quality of its inventory.

Issues identified by the ERT

23. The absence of a NIR in this submission limited the understanding of the methodologies used and national circumstances related to issues of reporting. This did not support the element of transparency, which is an important source of information to the reviewers. An initial recommendation would be that Estonia submit a NIR with its next CRF submission which comments briefly on the sources of activity data used to derive estimates from the default methodologies.

24. While it is recognized that this was Estonia's first CRF submission, it is recommended that, for its next submission, the entire CRF should be completed, including sectoral background data tables, recalculation tables (8(a) and (b)) and completeness table (table 9) for all sectors and gases, and that the notation keys should be used correctly. Some explanatory notes might also be provided in the documentation boxes.

25. It is recommended that Estonia complete the uncertainty tables in the CRF and include any supporting information in the relevant section of the NIR.

26. It is suggested that although Estonia is not required to implement the IPCC good practice guidance this time (see footnote 4 of this report), some elements of good practice guidance could be applied in future submissions to assist the Party in the preparation of its inventory, for example, an internal review could be carried out prior to submission.

4. Conformity with the UNFCCC reporting guidelines and IPCC Guidelines

27. The inventory submitted by Estonia did not meet all the standards for inventory reporting as defined by the UNFCCC reporting guidelines, mainly owing to the absence of a NIR. However, CRF data tables containing emissions estimates and other requested information had been provided, although some tables had not been completed. The lack of a NIR made a detailed sector-by-sector analysis difficult and it was not possible to assess whether the estimates had been derived in accordance with the IPCC Guidelines.

II. ENERGY

A. Sector overview

28. The energy sector's share of total emissions was 82.5%. The main key source was CO_2 from stationary combustion (oil shale , oil and gas), followed by CO_2 from mobile combustion (road vehicles) and fugitive emissions from oil and gas.

29. The general trend for CO_2, CH_4 and N_2O was -56.2%, -46.4% and -6.7%, respectively, from 1990 to 1999.

1. Completeness

30. The sector was not covered completely in terms of IPCC source categories, but the main summary, sector and background tables were provided. Estonia only provided summary level estimates for indirect GHG emissions. Table 9 (completeness) had not been completed for energy.

2. Transparency

31. There was no information in the CRF tables about confidential data. In its response to the draft of this review report Estonia confirmed that no confidential data were used in the inventory, as the data were derived from the Statistical Office of Estonia (ESA) which produces data for public use.

3. Methodologies, emission factors and activity data

32. Estonia used the IPCC calculation method to quantify national emissions. According to the IDR of Estonia's NC2, the underlying energy source data were derived from the official energy balances which are provided on an annual basis by the National Statistics office.

33. Information on the methods and emission factors used was not provided for this sector. There was a reference to the IPCC default emission factors and tier 1 methodology in the IDR of the NC2. Estonia confirmed in its response to the draft of this report that IPCC default emission factors and the tier 1 methodology were used in the preparation of the energy sector inventory.

B. Reference and sectoral approach

1. Reference approach

34. The reference approach was documented in CRF table 1.A(b), but no figures for the quantities used were supplied, for example, for production, export, import and stock change. The only unit used was TJ for apparent consumption. This may have been for confidentiality reasons, although the Party did not provide any explanation in its submission.

35. Estonia explained in its response to the draft of this report that the annual proceeding entitled "Energy Balance" from the ESA provides two different energy balances, one expressed in natural (mass or volume) units and the other in energy units (TJ). In order to prevent any differences in the conversion to energy units, the balance sheets expressed in energy units (TJ) had been used for the inventory. Estonia explained that differences could result from different caloric values for the fuels being used in the conversion from natural units to energy units. The ERT recognizes that there is a consistency issue within the source data for the energy sector and recommends Estonia to investigate further the reasons for the difference between the two energy balances, in order to ensure consistency in the data.

36. CO_2 emissions from fuel combustion were calculated using both the reference and sectoral approaches. There was no difference between the results from the two approaches, which indicates some inaccuracies in the sectoral approach. Estonia explained in its response that since 1999, the Estonian energy balance has been undergoing further construction and that two data sets are compiled in the Estonian energy balance: the *Total Primary Energy Supply* (based on supply data, such as imports and exports, collected by the customer service) and *Total Energy Consumption (*based on the amounts of fuel actually used). There is a statistical difference between the two data sets. Estonia explained that it used the *Total Energy Consumption* data for the reference approach as it considers these data to reflect national circumstances more accurately. The ERT recommends that Estonia consider using the *Total Primary Energy Supply* data for the reference approach and the *Total Energy Consumption* data for the sectoral approach.

37. The draft S&A report 2001 indicated that there were differences between the energy data used in the reference approach and those reported to the International Energy Agency (IEA). One specific difference was that the CRF showed data for oil shale, natural gas liquids and kerosene, while the IEA did not show any apparent consumption of these fuels. Estonia explained in its response that it had limited familiarity with the IEA reporting process, but confirmed that oil shale, natural gas, liquid fuels and kerosene are used in Estonia; these are all covered in the energy balance and, thus, in the GHG inventory. Oil shale, which is the main fuel used in Estonia, is not covered by the IEA. The ERT acknowledges this difference and recommends Estonia to verify whether the source of information reported to the IEA is different from that used for reporting under the UNFCCC.

38. Table 1.B.1 (background table for fugitive emissions from solid fuels) showed coal production as about 11 Mt (about 160,000-260,000 TJ). This quantity was not accounted for in the relevant rows of the reference approach table or the sectoral tables. There was no explanation in the inventory as to why oil shale was reported as constituting only about half (about 110,000 TJ) the total value. Estonia noted that the calorific value of oil shale in 1999 was about 9.15 TJ/t. This results in 97,786 TJ (10,687 kt x 9.15 = 97,786 TJ) and not 160,000 - 260,000 TJ.

2. Treatment of feedstocks and non-energy use of fuels

39. Feedstocks were reported for oil shale only.

3. International bunker fuels

40. Two fuel types from international bunkers (marine bunkers) were reported: residual fuel oil and gas/diesel oil. The split between domestic and international marine bunkers was 5.1% and 94.9%, respectively.

41. Regarding aviation, Estonia reported 100% of the aviation as domestic (949 TJ jet kerosene consumption), but did not provide any figures for actual fuel consumption for international aviation. In its response to the draft of this report Estonia explained that in the state statistics jet kerosene is not split into domestic and international and therefore only the total consumption could be reported. The ERT recommends that the Party consider differentiating between domestic and international fuel use in its energy balance.

C. Key sources

1. Stationary combustion

Emission trends

42. Emissions from stationary combustion (solid, oil and gaseous fuels) represented 76.5% of all reported emissions (without LUCF).

43. CO_2 emissions from the stationary combustion of solid fuels (mostly oil shale) represented 58.5% of all reported emissions in 1999 (without LUCF). The sub-sector, Public electricity and heat production, contributed 94% of these emissions.

44. CO_2 emissions from the stationary combustion of fuel oils represented 11.2% of all reported emissions in 1999 (without LUCF). About 58% were from the sub-sector, Public electricity and heat production.

45. CO_2 emissions from the stationary combustion of gaseous fuels represented 6.8% of all reported emissions in 1999 (without LUCF). Of these, 88.8% were also from the sub-sector, Public electricity and heat production.

Methodology, emission factors and activity data

46. The estimation of emissions appeared to be based on the tier 1 IPCC method. The time-series of total CO_2, CH_4 and N_2O by sub-sector was consistent.

47. No information was provided about the emission factors used. An analysis of the implied emission factor (IEF) showed no significant differences compared with IPCC values.

48. Estonia used activity data on apparent consumption which was identical in both the sectoral and reference approach and matched the CO_2 emissions. This implied that the sectoral approach was at a very early stage of implementation.

2. Mobile combustion: road vehicles – CO_2

Emission trends

49. Emissions from mobile combustion (road vehicles) represented 4.6% of all reported emissions (without LUCF). Total CO_2 emissions from transport have decreased by 55.3% since 1990.

Methodology, emission factors and activity data

50. The Party provided no information on the methodology used. The time-series at the sub-sectoral level was consistent.

51. The emission factors used for CO_2 emissions appeared to be IPCC defaults. The IEFs were in the range of the IPCC defaults. Some clarification of the IEF for gasoline is recommended as it was 6% lower than the average European value. The IEF for natural gas was also low and appeared to be a liquified petroleum gases (LPG) value. In its response to the draft of this report Estonia confirmed that all emission factors used, including those for gasoline (carbon emission factor: 18.9 t C/TJ) had been taken from the IPCC Guidelines.

52. Estimation was based on apparent consumption data.

3. Fugitive emissions: oil and gas operations – CH_4

Emission trends

53. CH_4 emissions from oil and gas operations represented 1.9% of all reported emissions (without LUCF). CH_4 emissions from this sub-sector have decreased by 52.6% since 1990.

Methodology, emission factors and activity data

54. Estimation of emissions was based on the IPCC tier 1 method.

55. The emission factors used were not evaluated during this review.

56. The CH_4 IEF for gas production was very high and equivalent to the IEF for distribution. This implied that the CH_4 IEF for oil storage was zero. Estonia explained in its response that all natural gas is imported and that there is only landfill gas production in Estonia. The Party further explained that the CH_4 IEF for gas production was 458 t CH_4/PJ for consumed gas (IPCC Guidelines, value for the former Soviet Union, Central and Eastern Europe). Following this information, the ERT recommends Estonia to consider allocating the emissions currently reported under Production/Processing to the sub-category Distribution. Regarding oil storage, Estonia explained that the CH_4 IEF value for oil storage was 0.2 t CH_4/PJ for refined oil and that the value of stored oil was low (52,109 PJ), making the CH_4 emissions only 0.01 Gg CH_4 which was shown as "0" in the CRF tables. The ERT recommends the Party to report the actual value in the tables rather than "0" for reasons of transparency and for allowing the calculation of IEFs.

57. There was no information on the sources of the activity data. This implied that although activity data from refining/storage were reported, the IEF was zero.

D. Non-key sources

58. Non-key sources commented on in the S&A report were CH_4 from coal mining and handling and road transportation (CH_4 and N_2O).

Emission trends

59. CH_4 from coal mining and handling decreased by 49.7% between 1990 and 1999.

60. CH_4 from road transportation decreased by 76% between 1990 and 1999.

61. N_2O from road transportation decreased by 50% between 1990 and 1999.

Methodology, emission factors and activity data

62. No assessment of the methods used was provided.

63. The emission factor for CH_4 emissions from coal mining and handling was more than twice as low as the lowest value in the IPCC data range. Estonia explained in its response to the draft of this report that in Estonia there is no coal mining, but there is oil shale mining. The overburden of oil shale layers is very thin, only about 20-30 metres, and the main contribution of CH_4 dates back to the earlier years. The following CH_4 emission factors for oil shale have therefore been used: 2 m^3 CH_4/t oil shale for underground mines and 0.3 m^3 CH_4/t oil shale for surface mines. The ERT recommends that the emission factors used be converted to units consistent with the reporting guidelines and that in future submissions some reference to the country-specific circumstances be detailed in a NIR and in the corresponding documentation box of the CRF.

64. The IEF values for N_2O emissions from road transport were the same for diesel and gasoline (0.6 kg/TJ) and were very low compared to all other Parties. Estonia explained in its response that it used the N_2O default emission factor from the IPCC Guidelines (Reference Manual, table 1-8) for gasoline and diesel, which is 0.6 kg/TJ. The ERT recommends that Estonia verifies the appropriateness of this emission factor to its national circumstances.

65. There was no information in the submission on the sources of the activity data. Estonia confirmed in its response to the draft of this report that the ESA had supplied the energy balance.

III. INDUSTRIAL PROCESSES AND SOLVENT USE

A. Sector overview

1. Completeness

66. Most of the tables for the industrial process sector were completed, but not all the required data were provided. Table 2(II).F was not provided and table 2(II) contained information on SF_6 only (notation key "0"). No data were reported in table 2(II).C,E, but the notation key "0" had been used. In table 9 (completeness), explanations were only provided for HFCs and PFCs.

B. Key sources

67. Emissions from cement production were estimated as contributing 1.6% to total aggregate GHG emissions in 1999.

68. In the draft S&A report, the significant differences between the reported activity data for cement production in the CRF (644.8 kt) and the 1999 United Nations' data (360 kt) was highlighted. The Party responded that cement production (which also included clinker production) had been 644.8 thousand tonnes (kt) in 1999.

69. The draft S&A report pointed out that no information had been provided on emissions from solvent and other product use in the CRF. Estonia responded that GHGs from this sector were not calculated owing to the lack of a methodology and emission factors.

C. Areas for further improvement

70. The ERT recommends that Estonia prepare estimates on solvent and other product use in future CRF submissions.

IV. AGRICULTURE

A. Sector overview

Table 4. Summary overview: Provision of information in the agriculture sector

Sectoral report tables	Yes, only 1999
Notation keys	No
Sectoral background tables	Yes, only 1999
National inventory report	No
Methods	No explanation
Emission factors	No explanation
Explanation of non-IPCC method	No
Uncertainty	No
Emission trends	Yes, CRF table 10
Procedure for QA/QC	No
Complete set of CRF tables - agriculture	No
Plans for future improvements	No information

71. Estonia provided all the necessary tables for 1999, according to the CRF. According to table Summary 2, the agricultural sector contributed 7.3% to the total aggregate GHG emissions for 1999. Emissions from this sector decreased by more than 60% from 1990 to 1999.

1. Completeness

72. Categories 4.E Prescribed burning of savannas, 4.F Field burning of agricultural residues and 4.C Rice cultivation, were reported as "zero". However, it is not clear whether they were estimated as "0" or were not estimated. In its response to the draft of this review report Estonia explained that these sources of emissions do not exist in Estonia and that the notation key "NO" should have been used in the CRF for these sources.

2. Methodologies, emission factors and activity data

73. No information was provided in CRF table Summary 3 on methods and emission factors used.

74. Table 1 of the IDR of Estonia's NC2 stated that the Revised 1996 IPCC methodology with default emission factors had been used to estimate emissions from agriculture, and that activity data had been obtained from "Statistical Year Book, Estonia".

B. Key sources

75. According to the secretariat's key source analysis for 1999, the following two key sources were identified: CH_4 emissions from enteric fermentation and direct emissions of N_2O from agricultural soils.

Table 4.1. Key sources in agriculture sector

Key source	Gas	%	
		1990	1999
Enteric fermentation	**CH_4**	-	2.0
Agricultural soils (total)	**N_2O**	-	1.0

1. 4.A Enteric fermentation – CH_4

Emissions trends

76. According to CRF table 10, CH_4 emissions decreased by 63% from 1990 to 1999. This decline appears to be due mainly to reduced livestock numbers.

Methodology, emission factors and activity data

77. Emission factors for dairy and non-dairy cattle were the same as the IPCC defaults for Eastern Europe.

78. Animal population and emissions factors were provided in table 4.A, but the average daily feed intake and CH_4 conversion were not provided and there was no supplementary explanation.

Findings from the draft S&A report

79. Reported cattle and swine population data were 15% and 14% lower than in the Food and Agriculture Organization of the United Nations (FAO) statistics (267 versus 308 thousand head for cattle and 286 versus 326 thousand head for swine). Estonia explained in its response to the draft S&A report that this was the result of a different reporting time (data provided by FAO is based on statistics from 1998, while the data used in the emissions inventory is from *Statistical Yearbook*, Estonia, 01.01.1999). In its response to the draft of this report Estonia explained further that the data provided by FAO is based on mean annual numbers of cattle and swine, while the *Statistical Yearbook* data provide the total number of livestock as at 1 January of each year.

2. 4.D Agricultural soil – N_2O

Emissions trends

80. According to table 10 of the CRF, N_2O emissions decreased over the period 1990 to 1996, but increased between 1996 and 1998. However, emissions decreased by 67.6% in 1999 compared with the base year.

81. This is discussed in paragraph 20 of the IDR of Estonia's NC2. The inventory team noted that N_2O emissions grew between 1996 and 1998 due to the increased application of nitrogenous fertilizer per hectare, even though the area of arable land under cultivation decreased slightly over the same period.

Methodology, emission factors and activity data

82. The Party provided no information on methodologies and emission factors. Disaggregated activity data were not provided either.

C. Non-key sources

1. 4.B Manure management – CH_4 and N_2O

83. CH_4 and N_2O emissions from this sub-source were estimated. CH_4 emissions accounted for 0.7% of the national total.

Emissions trends

84. According to tables 10s2 and 10s3 (emissions trends), in 1999 CH_4 and N_2O emissions decreased by 64.1% and 63.3%, respectively, compared with 1990.

Methodology, emission factors and activity data

85. The emission factors for dairy and non-dairy cattle and swine corresponded to the IPCC defaults for temperate Eastern Europe. However, the emission factor for sheep was low compared with the IPCC default for cool developed countries (0.16 versus 0.19 kg CH_4 /hd/yr). It was not clear to which climate region (cool or temperate) the emission factors applied. Estonia's comment on the draft S&A report did not clearly explain why this low emission factor for sheep had been used.

86. Data on population size and nitrogen excretion were not provided.

V. LAND-USE CHANGE AND FORESTRY

A. Sector overview

Table 5. Summary overview: Provision of information in the LUCF sector

Sectoral report tables	Available
Notation keys	No
Sectoral background data	Available
National Inventory Report	No
Methods	IPCC
Emission factors	Country-specific
Explanation of non-IPCC method	-
Uncertainty	No information
Emission trends	Yes (1990–1999)
Procedure for QA/QC	No information
Complete set of CRF tables (LUCF)	Yes (Only for 1999)
CO_2 reported	Yes
Non-CO_2 gases reported	No
Plans for future improvements	No information

87. LUCF in Estonia offset CO_2 emissions from other sectors quite significantly. In the period 1990 to1999, this sector consistently increased its share of CO_2 removal from the national

total from 14.5% (equivalent to –6,317 Gg CO_2) to 41.2% (equivalent to –8,107 Gg CO_2) with an annual mean of 33%.

1. Completeness

88. Estonia provided GHG inventory data for the time-series from 1990 to 1999. All sectoral background data tables for all categories (5.A–5.D) were provided. Notation keys were not used.

89. Emission estimates for non-CO_2 gases were not provided in the current submission. However, in Estonia's NC2, emissions estimates of non-CO_2 trace gases were provided.

2. Transparency

90. Notation keys were not used in all the categories, thus, it was not clear whether emissions or removals of GHGs from sources or sinks in the categories were not estimated ("NE"), included elsewhere ("IE"), not occurring ("NO") or "0".

3. Recalculation

91. The CRF recalculation table (table 8) was not provided. However, it was indicated that the estimates of CO_2 removals in the First and Second National Communications (NC1 and NC2) and the current GHG inventory submission differed significantly. In NC1, net removal of CO_2 in 1990 for this sector was about 11,317 Gg, in NC2 it was about 7,947 Gg, and in the current GHG inventory submission, it was about 6,317 Gg. Estonia did not provide a detailed explanation of the factors which had caused these changes.

B. Source and sink categories

1. 5.A Changes in forest and other woody biomass stock

Trends

92. Estonia only reported CO_2 removal from boreal forest. In 1999, it was estimated that total CO_2 removal by this type of forest was 12,244 Gg. In the sectoral report (table 5), the Party also provided estimates of CO_2 emissions (5,752 Gg); however, in the sectoral background data table (table 5.A) these emissions were not reported.

93. In response to the observation made in paragraph 92 above, Estonia noted that it reported data for biomass removals in sectoral background data table 5.A (total biomass removed in commercial harvest: 2,602 kt; traditional fuelwood consumed: 884 kt) and that the sectoral report and background data tables for 1999 include the same data as the tables from previous years. For reasons of consistency between tables 5 and 5.A the ERT recommends that Estonia also provide the corresponding values of carbon release from biomass removal and fuelwood consumption in table 5.A., as in the current CRF only activity data from these activities are reported. The ERT also recommends that, in table 5, Estonia allocate CO_2 emissions from this category to the corresponding sub-source (5.A.3 Boreal forests).

Methodology, emission factors and activity data

94. The methodology used by the Party followed the IPCC Guidelines. The assumptions and default data recommended by the IPCC Guidelines were used when a national assumption or national data were not available.

95. The sectoral background data table presented data on the area of boreal forest and the amount of biomass removed through commercial harvest. It could not be determined whether the increase in CO_2 removal under this category was due to the increase in the area of boreal forest, a decrease in emissions, or a change in mean annual growth of the forest. In its response to the draft of this report the Party referred to its third national communication (NC3), where the increases in both forestland area and annual growth rates causing the increase of CO_2 removal are explained. The ERT acknowledges that the NC3 was not available at the time of the review and was not subject to this review.

96. The average annual growth rate (MAI) of boreal forest used in 1999 was 4.28 t dm/ha/yr, equivalent to 1.93 t C/ha/yr. Estonia explained that this value was not high as the average MAI of boreal forest in Annex I countries could be 4.5 t C/ha/yr (Watson *et al.* 2000).

2. 5.B Forest and grassland conversion

Trends

97. The rate of conversion of boreal forest (mixed broadleaf and coniferous) in 1999 was approximately 60 ha, which generated CO_2 emissions of 35.1 Gg (mainly from the decay process). However, Estonia did not use the notation keys to report non-CO_2 trace gases. In the sectoral background data table, Estonia gave a value of "0". With reference to the IPCC Guidelines, this would mean that the rate of emissions was less than 0.5 and leads to a misinterpretation of the situation. In its NC2, Estonia provided emission estimates of non-CO_2 trace gases. The Party is recommended to clarify this issue. Estonia explained in its response to the draft of this report that the area of forest and grassland conversion is minute and that the experts' judgements are uncertain, resulting in no provision of reliable estimates of non-CO_2 trace gases.

Methodology, emission factors and activity data

98. The methodology used by the Party followed the IPCC Guidelines. Information on the sources and/or methods used to obtain activity data and develop emission factors (e.g., expert judgement, field measurement) was not provided in the inventory submission. Estonia provided the following information in its response. Data on forestland area and annual growth rates are based on field assessments conducted by the Estonian Forest Inventory Centre, harvest data are based on the number of forest felling licences issued by governmental forestry departments, and data on forest grassland conversation are based on forestry expert judgements.

99. Estonia provided activity data on boreal forest conversion.

100. Estonia estimated that the fraction of biomass left to decay after conversion was about 0.35. Thus, the remaining fraction would be burned either on and/or off site. However, these figures were not included and emission estimates of non-CO_2 gases could not be calculated. Estonia commented that the remaining fraction could also include commercial wood instead of burning. The burning of biomass on site is quite uncommon in Estonia. The branches and stamps are left to decay (approximately 35%) and the remainder is used as fuelwood or as commercial wood. Forest/grassland conversion is a very rare process and adds a negligible quantity of emissions to the Estonian GHG inventory. The Party further commented that due to scarcity of funding, exact measurements have not been undertaken; however, some expert judgement is presented in the NC3.

3. 5.C Abandonment of managed lands

Trends

101. The Party reported that about 2,296 Gg of CO_2 had been removed as a result of the development of boreal forest on abandoned land.

Methodology, emission factors and activity data

102. The methodology used by the Party followed the IPCC Guidelines. However, no explanation was provided about the sources or methods used to obtain or estimate activity data (e.g., area of abandoned land) or to develop the emission factor (e.g., rate of above-ground biomass carbon uptake). Estonia provided the following explanation in its response. The area of abandoned lands was calculated as the difference between the forestland area of the current year and that of 20 years earlier. Data on the forestland area are based on field work conducted by the Estonian Forest Inventory Centre. The growth rate was taken as the Estonian average (calculated by the Estonian Forest Inventory Centre).

103. The area of abandoned land developed into boreal forest in the last 20 years was about 325 thousand ha. The Party did not mention a reference source or the method used to estimate this area.

104. It was estimated that the rate of above-ground biomass carbon uptake in growing boreal forest was 1.93 t C/ha/yr. This value might be an overestimate. In tropical countries, the rate of biomass growth of secondary forest developed from grassland was less than that value (between 0.5-1.5 tC/ha/yr). Estonia explained in its response to the draft of this report that in the boreal zone, soil fertility does not change and that the growth rate of secondary forests is the same as that for primary forests. The ERT recommends that in future submissions Estonia provide a scientific reference to this observation in its NIR.

4. 5.D CO_2 Emissions and removals from soils

Methodology, emission factors and activity data

105. The methodology used by the Party followed the IPCC Guidelines. No explanation was provided regarding the sources or methods used to obtain or estimate activity data (e.g., area of abandoned land) or to develop emission factors (e.g., rate of above-ground biomass carbon uptake).

106. The total area of cultivated mineral soils was estimated at about 1.21 million ha (0.4 million ha for high activity soils, 0.53 million ha for low activity soils and 0.28 million ha for sandy soils). The area of cultivated organic soils was 1,923 ha.

107. Estonia reported the average carbon uptake by mineral soils as about 0.1 t C/ha/yr for high activity soils and 0.32 t C/ha/yr for low activity soils.

108. The rate of carbon emission due to cultivation of organic soils for pasture was about 4.3 t C/ha/yr.

C. Areas for further improvement

109. Estonia could improve its GHG inventory report by: including information on the methodology or techniques used to estimate or develop emission factors (this could be expert

judgement, field measurement, modelling, remote sensing, etc.); using correct notation keys for each source and sink category; and providing explanations for any information that might need further clarification, such as the recalculation of estimates, plans for improving the quality of the estimates, etc.

VI. WASTE

A. Sector overview

110. Emissions from the waste sector accounted for 6.6% of total GHG emissions in 1999 (compared to 3.7% in 1990, based on data in table 10, sheet 5, which was included in the revised CRF submission). Emissions of CH_4, the main GHG reported, decreased by 18.9% from 1990. The waste sector has two key sources: solid waste disposal on land, which contributed 5.2% of total emissions in 1999, and wastewater handling, which contributed 1.4% of total emissions in 1999.

1. Completeness

111. Table 6 does not include complete notational entries. This means that it was not clear whether the gases and sources that had been omitted were not occurring or not estimated. A large number of cells in table 6.A,C had been left blank. In particular, table 6.A included entries under methane correction factor (MCF) for unmanaged waste disposal sites, but no notation keys were used in the other cells. No notation key had been used under CO_2 from managed waste disposal on land; it should be either "NE" or not applicable "NA". In its response to the draft of this review report, the Party confirmed that there is no waste incineration in Estonia ("NO"). Regarding CO_2 from managed waste disposal, Estonia explained that notation keys "NO"/"NE" should have been entered.

112. In the additional information box for table 6.A,C, entries for many of the variables were missing. The notation keys, "NE", "NO" or "NA", as appropriate, should have been used. These issues were raised in the draft S&A report, specifically the use of notation keys and the value shown for degradable organic carbon (DOC). Estonia responded to the comment on DOC by pointing out that they had used the IPCC default fraction, but later remarked that they had used a "factor given by Finland colleagues". It was assumed that this comment referred to the original factor used (1.0) and not the IPCC default factor for DOC_f (0.77). DOC should range from 0.08 to 0.21, based on the IPCC defaults. The default for DOC_f is 0.77. The IPCC good practice guidance notes that the appropriate factor is within the range 0.50 to 0.60 and this will need to be taken into account in the future. The fraction of municipal solid waste (MSW) disposed of in solid waste disposal sites (SWDS) for Finland is 0.77 and it was assumed that this was the value used by Estonia. The identity of the DOC_f and this fraction could cause some confusion. No information was available on the fate of the remaining 23% of MSW. This issue requires further clarification and explanation.

113. Table 6.B was incomplete with several cells left blank. CH_4 recovered was shown as 0.00. It needs to be explained whether the correct entry really is "NE", or whether it is known that there is no recovery or flaring of CH_4, in which case the notation should be "NO". The N_2O emissions and emission factor cells were left blank and no estimate of N_2O emissions from human sewage was provided.

114. Table 6.C had not been completed.

2. Recalculations

115. It was noted that recalculations will be required once the IPCC good practice guidance is implemented and the DOC_f value for SWDS is revised from 0.77 (current IPCC default) to 0.50 or 0.60 (as recommended in the IPCC good practice guidance).

3. Consistency with the UNFCCC reporting guidelines and the IPCC Guidelines

116. The application of the IPCC default methodology for solid waste and wastewater handling appears to be consistent with the Guidelines and tier 1 methodologies as classified in the IPCC good practice guidance.

B. Key sources

1. 6.A Solid waste disposal on land – CH_4

Emissions trends

117. CH_4 emissions from solid waste disposal on land have decreased by 27.7% over the period 1990 to 1999. No information was provided which explains this reduction. Estonia explained in its response to the draft of this review report that one reason for the decrease is that the population has decreased from 1,571 thousand inhabitants in 1990 to 1,442 thousand in 1999. Secondly, the amounts of solid waste disposed of in landfills are smaller, because of preliminary sorting and separation by households before disposal. However, there have been no specific investigations undertaken to establish the quantities of waste sorted and separated by households.

Methodology, emission factors and activity data

118. The IPCC default methodology was used to estimate emissions. Based on the data provided, total waste was:

$= 1{,}442 \times 1.08 \times 365 = 568{,}436.4$ tonnes = 568.4Gg

Of this waste, 0.77 was disposed of in SWDS, the waste had a DOC content of 0.18, DOC_f is 0.77 and the CH_4 fraction in landfill gas was 0.50 multiplied by 16/12 to convert C to CH_4. Therefore:

CH_4 emitted $= 568.4 \times 0.77 \times 0.18 \times 0.77 \times 0.50 \times (16/12) = 40.4$Gg compared with the Party's estimate of 48.77Gg.

The source of this discrepancy requires explanation.

Estonia explained in its response to the draft of this report that in the additional information box, the value of waste disposed to SWDS (0.77) is incorrect and that it should be 1 as was used in the worksheets. Thus, CH_4 emitted $= 569 \times 1 \times 0.175 \times 0.77 \times 0.50 \times (16/12) - 2.35 = 48.77$ Gg, where 2.35 is recovered methane per year Gg/CH_4.

119. Emission factors as commonly understood are not entered directly into the default methodology. CH_4 emissions are related to the DOC contained in the waste and the fraction of DOC that dissimilates. An emission factor is implied from the final result but is not used directly in the derivation.

120. No information was available on the source of the activity data. This was raised in the draft S&A report and was not addressed in the Party's response. It was assumed that the decrease in emissions resulted from a decrease in waste per capita. Further information is required. Estonia commented in its response to the draft of this report that the source of data was the ESA and that further explanation is provided in chapter 9 of the NC3.

121. Additional information is required on the fate of the MSW (23%) that was not disposed of in SWDS. Estonia commented that all waste was disposed of in landfills.

2. 6.B Waste-water handling

Emissions trends

122. Emissions from waste-water handling increased by 46% from 1990 to 1999.

Methodology, emission factors and activity data

123. The waste-water handling methodology was raised in the S&A report and Estonia responded that the IPCC default methodology had been used to estimate emissions from industrial and domestic and commercial waste water. The domestic and commercial default methodology was driven by population with the sole sources of variability from year to year being changes in population. The industrial default methodology required data on industrial waste-water flows. These flows were shown in table 6.B under Additional information.

124. The emission factors used were the default factors provided in the IPCC Guidelines.

125. The sources of data (population data and industrial waste-water flows) were not specified. No additional information was available. Further information should be provided on industrial waste-water flows. The IDR of Estonia's NC2 (p.8) noted that the decline in emissions from waste was attributable to a decline in emissions from industrial waste water. However, waste-water emissions have increased by 46% since 1990. Further explanation is required. The data in table 3 of the IDR of Estonia's NC2 (p. 9) are not consistent with the data shown in table 10, sheet 2, of the resubmitted CRF. In its response to the draft of this report Estonia explained in its response to the draft of this report that the source of activity data (including population) is the *Annual Yearbook* produced by the ESA. Industrial waste-water flows are estimated based on the quantities of final product manufactured using water. The products included were determined based on the availability of emission factors for relevant waste-water flows (such as food, wine, beer, paper and pulp). Waste-water emissions have increased since 1995, when some paper and pulp factories that had been shut down for a time became operational again.

3. Results from previous reviews

126. The draft S&A report 2001 noted certain issues related to solid waste disposal on land and waste-water handling. The Party resubmitted its CRF and attempted to respond to those issues. In particular, additional information was provided on the source of some of the parameters used to estimate emissions from SWDS, and the Party indicated that the IPCC default methodology had been used for waste-water handling. The sources of the activity data were unclear. Additional information on the sources of activity data was provided in Estonia's response to the draft of this review report.

C. Non-key sources

127. No data were reported for 6.C Waste incineration and 6.D Other. It is not known whether these activities were not estimated or not occurring. Notation keys should be included. Estonia commented in its response to the draft of this report that there is no waste incineration in Estonia.

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