ANNEX 12. Quality Assurance checklists (includes review and comparison of the data presented in the reports of previous years)

QA activity and procedures – Energy sector

Quality Assurance analysis bases on guidelines presented in "IPCC Good Practice Guideline and Uncertainty Management in National Greenhouse Gas Inventories" and "2006 IPCC Guidelines for National Greenhouse Gas Inventories", focusing on:

- Verification of the fulfilling of the requirements provided in above named guidelines;
- Checking of the consistency of the information provided in the text of the National Inventory Report to the UNFCCC and in the databases of Reporter;
- Additional determination of possible errors and shortages.

Quality assurance of the Energy sector was carried out by Tiina Randla, assistant of Tallinn University of Technology, Institute of Chemistry, MSc.
Date of review: 19th February – 06th March 2008.

Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
General QA review of the energy sector concentrating on emission comparison and transparency of the information	The scope of the review is to identify possible errors and to consider the completeness, accuracy, transparency and consistency of the Energy sector.	The inventory is generally well presented and complete. Quality control requirements and procedures according to the "IPCC Good Practice Guideline and Uncertainty Management in National Greenhouse Gas Inventories" and "2006 IPCC Guidelines for National Greenhouse Gas Inventories" are fulfilled by the author of the chapter (see Annex 3, Individual Source Category Checklist). Uncertainty analysis was carried out according to the procedures described in the Report and in IPCC Good Practice Guidance. However, checking the text and data provided in the text of the Report and in the Reporter, some questionable aspects (listed below) were found. First of all, the text of the Report is brief and sometimes superficial in comparison with the extremely capacious material presented in the tables of Reporter. Majority of the information presented in Reporter were not investigated in the text.		

General investigation of the reliability of emission factors	In inventories in which country- or region-specific emission factors were used, or in which new methods (other than default IPCC methods) were used, the scientific basis of these emission factors and methods should be completely described and documented – calculations of emission factors should be carefully revised and complemented, if necessary.	In calculations of emissions of Energy sector, both country-specific and IPCC default emission factors were applied, in dependence of the character of the pollution source. Calculation principles and algorithms were discussed profoundly in the case of most important domestic fuels (oil shale and products of its manufacturing). In the case of other energy sources IPCC default values were used in general or the emission factors were calculated using IPCC methodology and country-specific data. Acceptability of IPCC default emission factors and/or the necessity of elaboration of country-specific emission factors were not investigated in the Report. Unfortunately the Energy chapter in the Report does not contain concentrated information about used emission factors and calculation methods in the form of the table. Adding the list of data sources, applied methods and emission factors would to make the information more user-friendly.	A special analysis has been carried out by the researchers of the Tallinn University of Technology on calculation methods for determining the emissions of pollutants of ambient air. This research was ordered and financed by the Estonian Ministry of the Environment. As a result of this research acceptability of IPCC default emission factors and some country specific non-CO_2 emission factors will by specified and used in the next inventory submission. CO_2 emission factors, oxidation factors and net caloric values by fuel are presented in Table **Tõrge! Dokumendis pole määratud laadis teksti.**.6., CH_4 from fuel combustion (kg/TJ in table 1.2.8 and) and N_2O from fuel combustion in the Table 1.2.9.	
General activity data check	Documentation of activity data should include: • frequency of data collection and estimation, • estimates of accuracy and precision; • in the cases when the data are not available directly from the databases, the information and assumptions that were used to derive the activity data; • Comparison of national statistics,	Emissions of Energy sector were calculated for fossil fuel consumption and fugitive emissions applying Tier 1 and Tier 2 methodologies and country-specific or IPCC default emission factors depending on the character of the emission. Following of the reliability of the information, presented in the text of the Report (logics of the emission trends etc) is complicated since majority of the information was presented in the form of the tables. Using figures would to visualise trends and	In the next NIR (2009 inventory submission) figures with trends of GHG emissions by main source-categories will be added.	

	emission factors etc with data provided in international databases	make the information more user-friendly. In the text of the Report only summary data of the emissions of sub-sectors were presented. In the Reporter both summary data and specified information concerning sub-sectors (divided by the consistency of the fuel in general) were presented, but, as it was stated, the investigation of the trends in the text is very brief. Information used in the calculations is provided by ESO (annual reports "Energy balance") in general. The character (initial data of emitters or treated and concentrated data, the frequency of data collection and reliability of the data and conversion factors etc) of the information is not specified in the text of the Report. Only national data were applied in the calculations. Information about possible use of the data derived from international databases was not provided in the Report. The data calculated according to the Sectoral approach were compared with the Reference approach by the author of the chapter. The difference between the estimations was noted to be acceptable.	There are some differences between country-specific and international data due to different methods of data reporting The complete interpretation of methods will be provided in the next submission.	
General check of the emission results	• Significant fluctuations in emissions between years should be explained. • A distinction should be made between changes in activity levels and changes in emission factors from year to year, and the reasons for these changes documented. • If different emission factors are used for different years, the reason for this should be explained and documented.	In current report the fluctuations and reasons of sharp changes were explained too briefly both in the case of implied emission factors and emissions. Emission factors were calculated according to the IPCC default methodology, taking into account country-specific activity data, or the country-specific emission factors were applied, as it was noted before, but the reasons of mutability were not investigated properly. Majority of the information provided in the Reporter was not discussed in the text as it was noted before. In the cases of changing emission factors the information was recalculated in current submission for whole of the period. In the text of the Report	To investigate and explain fluctuations and reasons of sharp changes of emissions in different source-categories is very time-consuming work. In generally, trends of GHG emissions follow always the trends of fuel consumption. Fluctuations of IEF depend of fuel structure used in the different year. The recommendation was taken into account. The	

		results of both calculations were presented. Factors causing change were discussed in the case of oil shale-related processes and products but also in the case of peat briquette.	estimation will be provided in the next submission.	
External peer review	The inventory agency should conduct expert (peer) review when first adopting or revising the method	Calculations of the emission factors connecting with oil shale processing were grounded on the analysis of authorised specialists of republic. In the cases of other fuels the involvement of the experts by revising of methods, emission factors etc is not discussed in the text of the Report.	In the case of other fuels no external expert was involved.	
Emissions from fuel combustion	General QC/QA according to the principles of IPCC Good practice Guidance	The inventory of the topic, using Tier 1 and Tier 2 methods and country-specific or IPCC default emission factors, is generally well presented and complete. It was noted in the text of the Report that absolute majority of Estonian greenhouse gases emissions (mostly CO_2) were originated by fuel combustion. However, observing of the material presented in different sources is complicated since the structure of the Report and the Reporter is different. In Reporter the emissions were primarily characterised according to the character of the fuel (solid, liquid, gaseous or biomass) and additionally according to the sphere of activity. In the text the interpretation was very brief. By the other hand the specification in the text is focusing on characterisation of peculiarities of local fuel consumption (to oil shale and oil shale products). Information of Reporter operates with abstract solid, liquid etc fuels in general. Information on the real character of the fuel (oil shale, peat etc) by its type is not provided in the case of Stationary combustion. Some of the information is presented in "Reference approach" but there the sphere of the use of fuel is not specified. In the case of Mobile combustion the used fuels	According to the IPCC Guideline for preparation of Nation GHG Inventory Reports (NIR) information should be presented by all gases and fuel types: solid, liquid and gaseous or biomass in the main source-categories. For calculation of total emissions from i.e. solid fuel combustion, emissions from every single solid fuel (oil shale, coal, coke, peat, peat briquette) were calculated separately and then summarised. CRF Reporter is only for reporting of GHG inventory data, for calculations every expert uses a special calculation models or tables. The size of this calculation tables is very big and it is not reasonable to put all this big tables into the NIR. This calculation tables can be used like background	

		were classified according to the fuel type in Reporter but not characterised in the text.	information.	
Emissions from stationary combustion	General QC/QA according to the principles of IPCC Good practice Guidance	In the inventory of the topic Tier 2 methodology and country-specific emission factors were applied in the case of oil-shale related activities. In the case of other fuels Tier 1 methodology and IPCC default emission factors were applied in general. The inventory of the topic presented in Reporter is very capacious and extensive. However, investigation of the emissions and trends in the text of the Report is too laconic. By the other hand, the Reporter does not pay enough attention on the real kind of fuel, as it was noted before.	The recommendation was taken into account	
	Comparison of emission estimates using different approaches Comparison of calculations applying Tier 2 with country-specific emission factors and Tier 1 with IPCC default factors. Comparison of the calculations with the reference approach. Accounting of any significant differences.	Calculations were carried out using either Tier 1 or Tier 2 methodologies and corresponding emission factors. Information about possible cross-checking of the calculations using opposite method is not reported. Information concerning calculations in the reference approach is provided in Reporter. The difference between the results of Sectoral approach and Reference approach was noted to be acceptable.	The recommendation was taken into account	
	Activity data check □ The inventory agency should construct national energy balances expressed in mass units, and mass balances of fuel conversion industries. The time series of statistical differences should be checked for systematic effects (indicated by the differences persistently having the same sign) and these effects eliminated where possible. This task should be done by, or in cooperation with, the national agency in charge of energy statistics. □ The inventory agency should also construct national energy balances	National energy balances in mass units (natural units) and energy units are provided by ESO. In the Reporter the information about energy consumption in energy units was presented. Stationary combustion includes “Energy Industries”, “Manufacturing industries and construction”, and “Other sectors”. Information concerning fuel consumption is in the case of “Energy industries” divided into sub-sections “Public electricity and heat production” and “Petroleum refining”; in the case of “Manufacturing industries” into “Iron and steel”, “Non-ferrous metals”, “Chemicals”, “Pulp and paper”, “Food processing …” and “Other” sub-sectors. Sub-chapter “Other sectors” includes emissions from the	The Statistics of Estonia presents energy balances in both units– in natural units and in energy units in the annual brochure “Energy Balance”. The Statistics of Estonia checks every year consistency and reliability of calorific values of fuels. For the Reference Approach, fuel consumption data in natural units is used. For the Sectoral Approach fuel consumption data in	

	expressed in energy units and energy balances of fuel conversion industries. The time series of statistical differences should be checked, and the calorific values cross-checked with IEA values (see Figure 2.2, Decision Tree for Selecting Calorific Values and Carbon Emission Factors). This step will only be of value where different calorific values for a particular fuel (for example, coal) are applied to different headings in the balance (such as production, imports, coke ovens and households). Statistical differences that change in magnitude or sign significantly from the corresponding mass values provide evidence of incorrect calorific values. The inventory agency should confirm that gross carbon supply in the Reference Approach has been adjusted for fossil fuel carbon from imported or exported non-fuel materials in countries where this is expected to be significant. Energy statistics should be compared with those provided to international organisations to identify inconsistencies. There may be routine collections of emissions and fuel combustion statistics at large combustion plants for pollution legislation purposes. If possible, the inventory agency can use these plant-level data to cross-check national energy statistics for representativeness.	small combustion of fuels in "residential, commercial/institutional" and "agriculture/forestry/fisheries" sectors. Used fuels and associated emissions are divided according to the consistency of the fuel (Liquid, Solid and Gaseous fuels and Biomass), but the real type of the fuel was not specified in capacious material presented in Reporter, as it was noted before. Information concerning emissions of most important greenhouse gases (CO_2 in particular but also CH_4 and N_2O) is provided in Reporter – both for whole of the sector, and for its sub-divisions. The reasons of fluctuations and the reliability of the information are not investigated in the text of the Report. What is, for example, the reason of the increase of the emissions of CH_4 and N_2O in the mid of 1990-ies? Why the implied emission factors in the case of the consumption of biomass in Energy industries sub-sector were increased rapidly in 1998? Reason of huge fluctuations in Chemicals, Pulp and paper and Iron and steel sub-sectors (especially Iron and steel at the beginning of 1990-ies) etc? By the other hand Reporter does not provide information about consumption and, accordingly, emissions by fuel type (oil shale, peat etc).	energy units (in TJ) is used because the carbon emission factors are given in tons of carbon per TJ (tC/TJ). All conversion factors (calorific values) of different fuels are presented in the Table 1.1.8 of the NIR. And Energy Balances in natural Units and in Energy units are presented in the Annexes of the Energy Chapter in the NIR. The recommendation was taken into account. In 1998 IEF of CO_2 from biomass consumption was 107.6 all other years the value of CO_2 IEF was 107.44. The biomass consumption data was wrongly entered into the Reporter. The actual figure is 6165 TJ but the figure entered into Reporter was 6156. The mistake is corrected. In sub-category 1.A.2.a. Iron and Steel Industry, in 1991-1993, there was no iron and steel products production at all because of big structural	

		In the text of Report and in data files of Reporter there is no information about the carrying out of comparison of national and international statistics. Information concerning possible cross-checking of plant-level information with national statistics is not provided in the Report. Because of the recalculation of emission factors associated with oil shale industry taking into account of the novel results of the research also the emissions were recalculated. The emissions from Manufacture of solid fuels (oil shale coke and peat briquette) were recalculated because of the methodological considerations. Both initial and recalculated emissions are presented in the text of the Report.	changes in whole economy after regaining of independency in Estonia. The energy sector expert can not make gross-checking of plant level data because of inaccessibility of plant level data.. In Estonia, only Statistics of Estonia has right to collect and process plant level data. However, data of the biggest energy company Eesti Energia AS and also shale oil production companies has been obtained and used in calculations.	
	Emission factors check The inventory agency should construct national energy balances expressed in carbon units and carbon balances of fuel conversion industries. The time series of statistical differences should be checked. Statistical differences that change in magnitude or sign significantly from the corresponding mass values provide evidence of incorrect carbon content. Monitoring systems at large combustion plants may be used to check the emission and oxidation factors in use at the plant.	Calculating and verifying applied emission factors special attention was given to the oil shale industry. Emissions associated with oil shale combustion in power plants were estimated using recalculated emission factors depending on the combustion technology. It was also indicated in the Report that emissions from shale oil production are depending on the technology applied, and that the oil shale gases are divided into two types with different characteristics according to the technology used for oil shale processing. In the case of non-oil-shale fuels IPCC default emission factors were applied. The reliability of the emission factors in country-specific conditions was not investigated in the text.	Please see the first comment.	
	Evaluation of direct measurements The inventory agency should evaluate the quality control associated with facility-level fuel measurements that have been used to calculate site-specific emission and oxidation factors. If it is	Emission factors applied in the case of oil shale industry are based on research made by laboratories of TUT. Information about any additional direct measurements is not provided in the Report.		

	established that there is insufficient quality control associated with the measurements and analysis used to derive the factor, continued use of the factor may be questioned.			
Additional notes and remarks concerning the text of the Report and the tables provided in Reporter	Investigation of possible duplications	Information presented in Tables 1.2.2 and 1.2.3 of the Report "Key categories in Energy combustion ….", with and without the LULUCF sector, is identical. Is it reasonable to present both tables in the text?	The recommendation was taken into account. The second table is deleted.	
	Problems with definition	Table 1.2.3 "The emissions from…" "Petroleum refining – there is no oil refining in Estonia. Under this sub-category emissions from **shale oil processing for shale oil production** are reported". 1.3.1.2 "Source-specific recalculations": 3. "Recalculations are made also in sector CRF 1.A1.b Petroleum Refining (in our case – **oil shale processing for shale oil production**)". Which version is correct – was the oil shale processed for oil production or was the crude oil processing observed?	The correct sentence is following: "Under this sub-category emissions from **oil shale** processing for shale oil production are reported". The recommendation was taken into account. .	
	Incorrect abbreviation	Table 1.2.7 "CO_2 emission factors …" – What is GS in the case of "Source categories" (should it be CS)?	Typing mistake. CS is correct. The mistake is also **corrected** in the NIR.	
	Missing symbol	Table 1.2.13 "Fuel consumption … in 1990–2006 (PJ)" ("–" is missing).	**The mistake is corrected**.	
	Incorrect title	Table 1.3.2 and 1.3.3 "Recalculations …" Column "Recalculated emissions of CH_4" – however, emissions of CO_2 were discussed in general in sub-divisions of the column.	**The mistake is corrected**.	
Mobile combustion	General QC/QA according to the principles of IPCC Good practice Guidance	Emissions of Transport sector include following sub-sectors: "Civil aviation", "Road transportation", "Railways", "Domestic navigation" and "Other transportation" (mobile sources in agriculture sector).		

		Tier 1 method and IPCC default emission factors were applied in calculations. Inventory of the sub-sector is generally well presented and complete. However, as it was noted in the case of stationary combustion, the text of the Report is brief with comparison of extremely capacious information provided in Reporter.		
	Comparison of emissions using alternative approaches For CO_2 emissions, the inventory agency should compare estimates using both the top-down and bottom-up approaches. Any anomalies between the emission estimates should be investigated and explained. The results of such comparisons should be recorded for internal documentation. Revising the following assumptions could narrow a detected gap between the approaches: □ Off-road/non transportation fuel uses; □ Annual average vehicle mileage; □ Vehicle fuel efficiency; □ Vehicle breakdowns by type, technology, age, etc.; □ Use of oxygenates/biofuels/other additives; □ Fuel use statistics; □ Fuel sold/used.	In current inventory report the emissions of $CO_{2,}$ were calculated on bases of the amounts and type of fuel combusted and its carbon content. Calculations based on the distance traveled by vehicle type and road type is appropriate for CH_4 and N_2O. Information about applying both top-down and bottom-up approaches was not presented in the Report since the calculations were based on available statistics provided by ESO.		
	Review of emission factors If IPCC default factors are used, the inventory agency should ensure that they are applicable and relevant to the categories. If possible, the IPCC default factors should be compared to local data to provide further indication that the factors are applicable. For non-CO2 emissions, the inventory agency should ensure that the original data source for the local factors is	IPCC default values were used or the emission factors were calculated using IPCC methodology and country-specific data, but the source and character of applied emission factors was not characterised in the text of the Report. Acceptability of IPCC default emission factors and/or the necessity of elaboration of country-specific emission factors were not investigated in the Report.	Information about CEF used has been added to the NIR.	

	applicable to the category and that accuracy checks on data acquisition and calculations have been performed. Where possible, the IPCC default factors and the local factors should be compared. If the IPCC default factors were used to estimate N2O emissions, the inventory agency should ensure that the revised emission factors in Table 2.7, Updated Emission Factors for USA Gasoline Vehicles were used in the calculation.			
	Activity data check The inventory agency should review the source of the activity data to ensure applicability and relevance to the category. Where possible, the inventory agency should compare the data to historical activity data or model outputs to look for anomalies. The inventory agency should ensure the reliability of activity data regarding fuels with minor distribution, fuel used for other purposes, on and off-road traffic, and illegal transport of fuel in or out of the country. The inventory agency should also avoid double counting of agricultural and off-road vehicles.	Activity data used for calculations was provided by ESO and its quality and reliability was not additionally checked. In the case of Mobile combustion the used fuels were classified not only as liquid, solid etc as in the case of Stationary combustion but also according to the fuel type in Reporter. The investigation of the transport sector activities is brief in the text of Report. Calculations associated with the use of diesel oil and gasoline in agriculture sector were in current submission allocated into category Other transport and because of this the former data were recalculated (in previous submissions those emissions were presented in sub-category Agriculture). However, additional check of the data to avoid possible double counting is advisable. Reasons of fluctuations are not investigated in the text. For example: are the sharply fluctuating data of fuel consumption (and accordingly emissions) of Civil aviation and Navigation sub-sectors realistic?	For the next inventory submission and NIR preparation an additional expert will be contracted to carry out additional data collection and to increase the quality of GHG emissions calculations from Transport sector . There are sent out by the expert some questionnaires to the Ministry of Economic Affaires and Communication to investigate the sharply fluctuating data of fuel consumption of Civil aviation and Navigation sub-sectors. In the next inventory report	

			more explanations could be possible to give on this subject.	
	External review The inventory agency should perform an independent, objective review of the calculations, assumptions, and documentation of the emissions inventory to assess the effectiveness of the QC programme. The peer review should be performed by expert(s) who are familiar with the source category and who understand the inventory requirements. The development of the factors for the non-CO_2 emission estimates is particularly important due to the associated uncertainty.	Information about the possible involvement of the experts in peer reviewing of the data and calculations is not provided in the text.		
Fugitive emissions	General QC/QA according to the principles of IPCC Good practice Guidance	Under fugitive emissions from fuels, Estonia reports CH_4 emissions from solid fuels (oil shale mining and handling) and oil and natural gas, including the following activities: - shale oil production and transport and storage of oil products - transmission and distribution of natural gas and oil products - consumption of natural gas and - CH_4 emissions from venting from oil production. Estimation of fugitive emissions were based on Tier 2 methodology and country-specific emission factors in the case of CH_4 emissions associated with oil-shale mining, processing and handling and utilization. Information concerning oil shale industry was provided by AS Eesti Energia. In other cases Tier 1 approach and IPCC default emission factors, and the information of ESO were applied.		

		The inventory of the topic, although brief, is well-presented and complete in general.		
	Review of direct emission measurements If direct measurements are used to develop country-specific emission factors, the inventory agency should establish whether measurements at the sites were made according to recognised standard methods. If the measurement practices fail this criterion, then the use of these emissions data should be carefully evaluated, estimates reconsidered, and qualifications documented.	Annual activity data was received from the AS Eesti Energia who owns the oil shale mining company AS Eesti Põlevkivi in the case of oil shale mining and handling. The emissions were calculated by multiplying the amounts of produced oil shale with national emission factors. The structure of the CH_4 emissions from mining (underground and surface mining) and post mining activities (underground and surface mining) was given in the Greenhouse Gas Workbook, Vol. 3, 1996. In other cases the activity data are based on the information of ESO and on default emission factors in general. Information concerning possible direct measurements was not provided in the report.	No direct measurement has been provided.	
	Emission factors check The inventory agency should compare measurement-based factors to IPCC default factors and factors developed by other countries with similar industry characteristics. If IPCC default factors are used, the inventory agency should ensure that they are applicable and relevant to the category. If possible, the IPCC default factors should be compared to national or local data to provide further indication that the factors are applicable.	The emission factors used for the calculation of fugitive emissions from oil shale mining were estimated by Estonian oil shale mining experts. Emissions associated with shale oil production and handling were calculated using country-specific emission factors. In other cases the IPCC default emission factors were applied.		
	Activity data check Several different types of activity data may be required for this source category, depending on which method is used. The inventory agency should check different types of activity data against each other to assess	Activity data was provided by AS Eesti Energia (by its oil shale mining company) and by ESO depending on the character of the activity. Information about the availability of multiple data sources and possible comparisons was not presented in the Report. Fluctuations of emission trends and emission factors	Fluctuations in the emission	

	reasonableness. Where possible, multiple sources of data (i.e. from national statistics and industry organisations) should be compared. Significant differences in data should be explained and documented. Trends in main emission drivers and activity data over time should be checked and any anomalies investigated.	were not investigated in the Report. Why the emission factors were rapidly changing in 2005–2006 in the case of mining activities for example?	trends were caused by fluctuations in activity data. There is no fluctuations of emission factors during the whole time series 1990-2006 in the sub sector 1.B.1.a Mining Activities.	
	External review Emission inventories for large, complex oil and gas industries will be susceptible to significant errors due to missed or unaccounted for sources. To minimise such errors, it is important to obtain active industry involvement in the preparation and refinement of these inventories.	Calculations of the emission factors connecting with oil shale processing are grounded on the analysis of authorised specialists of republic. In other cases the involvement of the experts by revising of methods, emission factors etc is not investigated in the text.	Please see the first comment.	

QA activity and procedures – Industrial processes sector

Quality Assurance analysis bases on guidelines presented in "IPCC Good Practice Guideline and Uncertainty Management in National Greenhouse Gas Inventories" and "2006 IPCC Guidelines for National Greenhouse Gas Inventories", focusing on:

- Verification of the fulfilling of the requirements provided in above named guidelines;
- Checking of the consistency of the information provided in the text of the National Inventory Report to the UNFCCC and in the databases of Reporter;
- Additional determination of possible errors and shortages.

Quality assurance of the Industrial processes sector was carried out by Tiina Randla, assistant of Tallinn University of Technology, Institute of Chemistry, MSc.
Date of review: 20th February – 06th March 2008.

Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
General QA review of the Industrial processes sector concentrating on emission comparison and transparency of the information	The scope of the review is to identify possible errors and to consider the completeness, accuracy, transparency and consistency of the Industrial processes sector.	The inventory is generally well presented and complete (chapter concerning F-gases excluded). The account of the emissions concerning F-gases is incomplete, only preliminary data of 2006 are reported in current issue of the GHG report since some sectors are still under investigation. Quality control requirements and procedures according to the "IPCC Good Practice Guideline and Uncertainty Management in National Greenhouse Gas Inventories" and "2006 IPCC Guidelines for National Greenhouse Gas Inventories" are fulfilled by the authors of the chapter according to the text of the Report but corresponding account in the form of the table is not provided in the Report. Checking the text and data provided in the text of the Report and in the Reporter, some questionable aspects (listed below) were found.		

General investigation of the reliability of emission factors	In inventories in which country- or region-specific emission factors were used, or in which new methods (other than default IPCC methods) were used, the scientific basis of these emission factors and methods should be completely described and documented – calculations of emission factors should be carefully revised and complemented, if necessary.	In calculations of emissions from Industrial sector, both country-specific and IPCC default emission factors were applied, in dependence of the character of the pollution source; or the emission factors were calculated using IPCC methodology and country-specific data. (Default emission factors were applied in the case of CO_2 emissions since 1999.) Unfortunately this chapter in the Report does not contain concentrated information about used emission factors and methods in the form of the table. Adding the list of data sources, applied methods and emission factors would to make the information more user-friendly. Acceptability of IPCC default emission factors and/or the necessity of further elaboration of country-specific emission factors as well as the reliability of already used country-specific emission factors were not investigated in the Report.		
General activity data check	Documentation of activity data should include: • frequency of data collection and estimation, • estimates of accuracy and precision; • in the cases when the data are not available directly from the databases, the information and assumptions that were used to derive the activity data; • Comparison of national statistics, emission factors etc with data provided in international databases	Emissions of Industrial processes sector were calculated applying country-specific or Tier 1 (T1a, T1b) methodologies and country specific or default emission factors depending on the character of the emission. Following of the reliability of the information, presented in the text of the Report (logics of the emission trends etc) is complicated since majority of the information is presented in the form of the tables. Using figures would to visualise trends and make the information more user-friendly. Information used in the calculations is provided by ESO or collected from the manufacturing and handling companies (in the case of F-gases the information of ESO is practically missing).* The character (initial data of emitters or treated and concentrated data, the frequency of data collection and reliability of the data) of the information is not specified in the text of the Report. Only national data were applied in the calculations.	*The ESO has no data on which the F-gas inventory and the calculation of F-gas emissions can be based. If data of the ESO could be used – as in	

			case of PU sandwich elements – it is mentioned in the NIR.	
General check of the emission results	• Significant fluctuations in emissions between years should be explained. • A distinction should be made between changes in activity levels and changes in emission factors from year to year, and the reasons for these changes documented. • If different emission factors are used for different years, the reason for this should be explained and documented.	In current report the fluctuations and reasons of sharp changes were explained insufficiently (see remarks below) both in the case of emission factors and emissions. Emission factors were calculated according to the IPCC default methodology, taking into account local activity data, or the country-specific emission factors were applied, as it was noted before, but the reasons of mutability were not investigated properly. Interpretation of the data provided in the Reporter in the text of the Report is sometimes too brief. In the case of recalculations only new, recalculated information was presented in the Reporter and/or in the text. (In other chapters both new, recalculated data and previous data were presented.)		
External peer review	The inventory agency should conduct expert (peer) review when first adopting or revising the method	Calculations of the emission factors connecting with cement and lime industry and ammonia production were grounded on the analysis of authorised specialists of republic. In the cases of F-gases the calculations were only half-done* but the existing information was verified by the local specialists (providers of the information) and by international consultants in the framework of the Twinning Project. In the case of "Other consumption", it is not discussed in the text of the report, are the methods, emission factors etc revised sufficiently.	*fully done for some sectors, not yet done for those still under investigation within the Twinning project.	
Mineral products	General characterisation of the chapter and QC/QA according to the principles of IPCC Good practice Guidance	Non-fuel emissions from cement and lime production were reported in this chapter – emissions associated with the thermal degradation of calcium- and magnesium carbonate, using country-specific or		

		Tier 1 methods. Because of the varying quality of the raw material, the emission factors were fluctuating. Reasons, why the quality of raw material is varying, were not investigated in the Report. As it was noted in the Report, the calculation algorithm was changed in current submission – previously the emission factors were not collected and calculated in so detail level. However, according to the information provided in Reporter starting from 1999 both default and county-specific emission factors were applied (before 1999 – only country-specific emission factors). Activity data (Table 1.3 in the Report) for cement and lime production was collected mainly directly from the industry and taken partly from industrial statistics.		
Cement production	General QC/QA according to the principles of IPCC Good practice Guidance	The inventory of the topic, although brief, is generally well presented and complete. Tier 2 methods were applied in the case of cement production (according to the Reporter – country-specific methods).		
	Comparison of emissions estimates using different approaches If the bottom-up approach is used to collect activity data, then inventory agencies should compare the emissions estimates to the estimates calculated using national production data for the cement or clinker industry (top-down approach). The results of such comparisons should be recorded for internal documentation, including explanations for any discrepancies.	Calculations presented in the Report and Reporter based on available information. There is no information about using different approaches in the Report because of the lack of the multiple information sources.		
	Review of emission factors Inventory agencies should compare aggregated national emission factors	Country-specific emission factors used in calculations were provided by the national cement producing company Kunda Nordic Cement.		

	with the IPCC default factors in order to determine if the national factor is reasonable relative to the IPCC default. Differences between national factors and default factors should be explained and documented, particularly if they are representative of different circumstances. If the aggregated top-down approach is used, but limited plant-specific data are available, inventory agencies should compare the site or plant level factors with the aggregated factor used for the national estimate. This will provide an indication of the reasonableness and the representativeness.	Emission factor depends on the CaO and MgO contents of clinker. Factors influencing the choice of the raw material were not investigated in the text.		
	Site-specific activity data check For site-specific data, inventory agencies should review inconsistencies between sites to establish whether they reflect errors, different measurement techniques, or result from real differences in emissions, operational conditions or technology. For cement production, inventory agencies should compare plant data (content of CaO in clinker, content of clinker in cement) with other plants. Inventory agencies should ensure that emission factors and activity data are developed in accordance with internationally recognised and proven measurement methods. If the measurement practices fail this criterion, then the use of these emissions or activity data should be carefully evaluated, uncertainty estimates reconsidered and qualifications documented. If there is a	Activity data and emission factors used in calculations were from Kunda Nordic Cement and partly from industrial statistics. The calculation algorithm was not investigated in the text of the Report. Also the reliability of the data and the emission trends were not discussed in the Report.		

	high standard of measurement and QA/QC is in place at most sites, then the uncertainty of the emissions estimates may be revised downwards.			
	Expert review Inventory agencies should include key industrial trade organisations associated with cement and clinker production in a review process. This process should begin early in the inventory development process to provide input to the development and review of methods and data acquisition. Expert review is particularly important for the content of CaO in clinker, sources of CaO, differences in cement composition, and irregularities in annual production. Third party reviews are also useful for this source category, particularly related to initial data collection, measurement work, transcription, calculation and documentation.	Activity data and emission factors associated with cement production were provided by the national cement producing company Kunda Nordic Cement, as it was noted before. Hence the local specialists are involved in the reporting process of current submission.		
Lime production	General QC/QA according to the principles of IPCC Good practice Guidance	The inventory of the topic, although brief, is generally well presented and complete. Tier 1 methods were applied in the case of lime production.		
	Comparison of the emissions estimates using different approaches If the bottom-up approach is used, then inventory agencies should compare the emissions estimates to the estimate calculated using national lime production data (top-down approach). The results of such comparisons should be recorded for internal documentation, including explanations for any discrepancies.	Calculations presented in the Report and Reporter based on available information. There is no information about using different approaches in the Report because of the lack of the multiple information sources.		
	Activity data check	Activity data and emission factors used in		

	Inventory agencies should confirm the correct definitions of the different types of lime produced in the country (i.e. CaO and MgO content, high-calcium quicklime (CaO), and dolomitic quicklime (CaO·MgO). They should check the completeness of national statistics for limestone, lime and dolomite use by comparing them with the default list of industries using limestone provided in the *IPCC Guidelines*, Vol. 3, p 2.9).	calculations are from AS Nordkalk and partly from industrial statistics. Emission factor for lime production was taken from the IPCC's 1996 Revised Guidelines and based on the estimate CaO and MgO contents of lime derived – default emission factors were applied. However, according to the information provided in Reporter before 1999 the country-specific emission factors were applied. Calculation principles were not investigated in the text of the Report. Also the reliability of the data and the emission trends were not discussed properly in the Report.		
Additional notes and remarks	Missing information	1.2.4 "Source-specific recalculations including changes made in response to the review process" – Cement and lime production – "Emissions from cement production have been recalculated. Activity data and emissions factors have been updated. Emissions from lime production have been recalculated using improved emission factors". In other chapters both previous and recalculated data are presented for comparison what makes the information more profound and comprehensive.		
Chemical industry – ammonia production	General QC/QA according to the principles of IPCC Good practice Guidance	This category includes the non-fuel emissions from ammonia production (Table 1.4 in Report). All ammonia currently produced in Estonia is produced in one company AS Nitrofert. Tier 1 a and Tier 1 b methods were applied in calculations according to the Reporter. However, according to the text of the Report only Tier 1b method was used in sub-chapter 1.3 Chemical industry. In the sub-chapter 1.6 "Feedstock and…" and in Annex 1, CO_2 emissions from ammonia production using Tier1a method was presented. It is not unambiguously clear, is the double-counting of emissions presented in different sub-chapters (1.3 Chemical industry and 1.6 Feedstock and non-		

		energy use…) avoided.		
	Comparison of emission factors Inventory compilers should check if the estimated emission factors are within the range of default emission factors provided for the Tier 1 method, and also ensure that the emission factors are consistent with the values derived from analysis of the process chemistry. For example, the CO_2 generation rate based on natural gas should not be less than 1.14 tonnes of CO_2 per tonne of ammonia produced. If the emission factors are outside of the estimated ranges, it is *good practice* to assess and document the plant-specific conditions that account for the differences.	The emission factor for calculation of CO_2 emissions from ammonia production is country specific and bases on technology used in the factory.		
	Plant-specific data check The following plant-specific data are required for adequate auditing of emissions estimates: · Activity data comprising input and output data (input data should be total fuel requirement – fuel energy input plus feedstock input; · Calculations and estimation method; · List of assumptions; · Documentation of any plant-specific measurement method, and measurement results. If emission measurements from individual plants are collected, inventory compilers should ensure that the measurements were made according to recognised national or international standards. QC procedures in use at the site should be directly referenced and included in the QC plan. If the measurement practices were not	The annual ammonia production figures 1990–2006 have been obtained from the production plants and presented in the text of the Report (in Table 1.4) as it was noted in the text) and in the database of Reporter. The character and reliability of the data and emission trends (reasons of fluctuations, sharp decreases in 1993 and 2002) were not discussed in the Report.		

	consistent with QC standards, the inventory compiler should reconsider the use of these data.			
Other production	General QC/QA according to the principles of IPCC Good practice Guidance	This source category includes the NMVOC emissions from the pulp and paper and food industries. The non-fuel based CO_2 emissions from pulp and paper industry were estimated to be negligible in Estonia. All N_2O emissions from the pulp and paper and food industry were reported as fuel based emissions under CRF 1, as it was stated in the Report. NMVOC emissions from the pulp and paper and food industry were calculated at the Department of Thermal Engineering of the Tallinn University of Technology. Activity data were obtained from ESO – for 1990–2002 from annual proceeding of the Statistics Estonia "Industry" and for 2003–2006 from the electronic database on the web site of statistical office. Emission factors were taken from the IPCC 1996 Guideline. All SO_2 emissions of different sulphur compounds were calculated as SO_2 equivalents. Information about calculated emissions and applied emission factors were presented in Reporter. Emission trends, reliability of the data and used emission factors etc were not properly discussed in the Report. However, since the emissions are rapidly fluctuating or missing (data of 1994 in the case of NO_x, SO_2 and CO due to the pulp and paper industry) the additional check of the information is advisable.		
F-gases	General characterisation of the chapter and QC/QA according to the principles of IPCC Good practice Guidance	HFCs, PFCs and SF6 are not produced in Estonia. By-product emissions and production-related emissions of Halocarbons and SF6 do not occur according to the Report.		

		The consumption of Halocarbons and SF6 in Estonia depends on import. Up to now the country had so far no database on domestic consumption of halocarbons and SF6. In the second half of 2007 the Twinning Project EE2005/IB/EN/01 "Enhancing the capacity to reduce the emissions of fluorinated greenhouse gases in Estonia" (Twinning project between the Estonian Ministry of Environment and the German Ministry for the Environment, Nature Conservation and Nuclear Safety) started. Within the framework of this project a basic inventory of F-gas consumption in Estonia will be established up to mid 2008. In this NIR, a first assessment of F-gas consumption in Estonia based on results from the Twinning project was given, applying country-specific methodologies and emission factors (Tier 2a or 2b methodology according to IPCC guidelines 2006, as it was noted in the text of the Report). However, according to the information provided in Reporter both country-specific and Tier 1 methods were applied.* It was stressed that the actual report on F-gases was of preliminary nature. Only some sectors and sub-sectors of F-gas consumption were already covered in total and investigated properly in the text of the Report (e.g. Foam Blowing, Stationary Air-Conditioning, Metered Dose Inhalers). In other sectors relevant sub-sectors are still under investigation and the information concerning some sub-divisions is partially or totally missing.** Hence probably only about 1/3–½ of the total emissions of the sector were covered by current report, as it was noted in the text of the Report.	*Data provided in the CRF tables are gained by the methods described in the NIR (CS; Tier 2a or b). ** This is mentioned in the NIR in each case.	
	Comparison of emissions estimates using different approaches Inventory agencies should compare total national potential SF6 emissions	As it was noted, current report covers the F-gases emissions only partially and because of this there are no information about possible use of different approaches.*	* As mentioned in the NIR all possible sectors of SF6	

	(minus the amount allocated to the electrical equipment use category, the semiconductor manufacturing use category, the metal production category and the SF6 production category) to the estimated SF6 emissions from other uses. The potential national emissions can be used as an upper bound on emissions.		consumption and emissions will be *empirically* studied within the Twinning project (eg. shoe soles, car tyres etc.).	
	Activity data check Inventory agencies should compare the activity data submitted by different producers and distributors*, and, adjusting for relative size or capacity of the companies, to identify significant outliers. Any outliers should be investigated to determine if the differences can be explained or if there is an error in the reported activity.	Unfortunately the data collection schemes of ESO do not include information connected with emissions of F-gases and therefore collecting, processing and verification of the reliability of relevant information in the framework of national GHG inventory is complicated.** The data needed for completing of National Inventory Report to the UNFCCC, depending from the character, were derived by the authors of the chapter from the official Car Register, service companies, Estonian Ship Register and ferryboat companies, Estonian Refrigeration Association, Estonian Heat Pump Association, from companies manufacturing and selling of products associated with foams, from medical board and other relevant companies and enterprises etc – thus the plant level information was collected and interpolated in the case of Industrial processes sector. The reliability of the data was investigated in cooperation with the specialists of the field in the framework of the Twinning Project described above. To increase the quality of the information and the efficiency of data collection and processing the adding of appropriate materials to the databases of ESO should be strongly recommendable in the future.* Times series were not yet established in the case of majority of the F-gases as 2006 was the first year of investigation and the previous information is	* This was done. **It is well known – and was discussed with the ESO – that the Statistical Office has scarcely possibilities to collect basic data on F-gas consumption and emissions in the different sectors of F-gas appliance. General import data can be used for comparison if the F-gas sector is completely investigated. *just contrariwise: within the Twinning project it is discussed how the ESO can	

		missing. However, trends of HFC-134s** and CF6 starting from 1995 were presented in the case of some sub-sectors. Emission of HFCs increased rapidly in 2006 according to the provided information. Since the information bases on the one hand on preliminary results of the Twinning Project and on the other hand on linear extrapolation data, the quality of the information is questionable, as it was also stated in the Report.*** Estonia is a country in transition with rapidly changing economy and because of this interpolating of the possible former transformations taking into account of the analogies of neighbouring countries is extremely complicated.**** Problems associated with the availability and reliability of the information were discussed in the Report only briefly.	improve its database on F-gases. ** 134a *** The NIR underlines explicitely that it is impossible to compare the F-gas data from 2006 with those from the previous years as the last one are not empirically based. **** This method would be nonsense and is not used within the NIR and Twinning project.	
	Comparison of emissions with other countries Inventory agencies should compare the emissions from other SF6 end-uses included in the national inventory with information submitted by other similar countries. For each source, emissions per capita or per unit of GDP with other countries should be compared. If national figures appear to be relatively very high or very small, a justification should be provided.	As it was stressed in the Report,* the report has only preliminary character since the potential emission sources are covered partially. Therefore presenting of trustworthy and authentic comparisons is complicated in current stage.** However, performing of the comparisons with other countries will be strongly recommendable in future.	* this has been stressed several times within the NIR * A comparison can be given for each sector of F-gas appliance; this will be done at the end of the Twinning project.	

QA activity and procedures – Agriculture sector

Quality Assurance analysis bases on guidelines presented in "IPCC Good Practice Guideline and Uncertainty Management in National Greenhouse Gas Inventories" and "2006 IPCC Guidelines for National Greenhouse Gas Inventories", focusing on:

- Verification of the fulfilling of the requirements provided in above named guidelines;
- Checking of the consistency of the information provided in the text of the National Inventory Report to the UNFCCC and in the databases of Reporter;
- Additional determination of possible errors and shortages.

Quality assurance of the **Agriculture sector** was carried out by Tiina Randla, assistant of Tallinn University of Technology, Institute of Chemistry, MSc.
Date of review: Review of preliminary text in December 07–January 08; control of final version and Reporter 11–29th February 08.

	Description of QA procedure	Brief description of review scope and the character of the problem	Major conclusions from the review	Action taken	Place where it is filed
1	General QA review of the agriculture sector concentrating on emission comparison and transparency of the information	The scope of the review is to identify possible errors and to consider the completeness, accuracy, transparency and consistency of the agriculture sector.	The inventory is generally well presented and complete. Tier 1 and Tier 2 approaches and both country-specific and IPCC default emission factors were applied for calculations of CH_4. Emissions of N_2O were calculated using Tier 1 methodology and default emission factors. Quality control requirements and procedures according to the "IPCC Good Practice Guideline and Uncertainty Management in National Greenhouse Gas Inventories" and "2006 IPCC Guidelines for National Greenhouse Gas Inventories" were fulfilled by the author of the chapter (see Annex 3, Individual Source Category Checklist). However, checking the text and data provided in Tables and Figures of the text of the Report and in the Reporter, some questionable aspects (listed below) were found.		
2	General review of emission factors	In inventories in which country- or region-specific emission factors were used, or in which new methods (other than default IPCC methods) were used, the scientific basis of these emission factors and methods should be completely described and documented – calculations of emission factors should be carefully revised and complemented, if necessary.	Currently the character of renovations and reformulations is explained insufficiently. In the cases of application of IPCC default emission factors, the acceptability of the factors or calculation methods was not discussed in the text.	IPCC Guidelines stipulates that due to the lack of country-specific emission factors, IPCC default emission factors should be employed in the estimates.	

3	General activity data check	Documentation of activity data should include: • frequency of data collection and estimation, • estimates of accuracy and precision; • in the cases when the data are not available directly from the databases, the information and assumptions that were used to derive the activity data; • Comparison of national statistics, emission factors etc with data provided in international databases	To increase the transparency of the information is desirable to specify the character (initial data of emitters or treated and concentrated data, the frequency and reliability of the data) of the information provided by ESO, EARC, EEIC etc data sources (see Chapter 4.1.1, Table 4.2 "List of institutions ….". Both international and national statistical data are presented in the report but the interpretation of the differences is insufficient. There are two methodological changes causing substantial fluctuations of emission trends, currently discussed insufficiently in the Report. In the case of **livestock the methodology of activity data collection was changing in 1999,** for addition **the manure management system was changing in 2003** – before the Eastern Europe module was used, in 2003 the Western-European module was applied.	It was mentioned the difference between country-specific and international data occurs due to different methods of data reporting (Table 4.4). The complete interpretation of methods will be provided in the next submission.	
4	General check of the emission results	• Significant fluctuations in emissions between years should be explained. • A distinction should be made between changes in activity levels and changes in emission factors from year to year, and the reasons for these changes documented. • If different emission factors are used for different years, the reason for this should be explained and documented.	In current report the fluctuations and reasons of sharp changes were explained insufficiently (see remarks below) both in the case of emission factors and emissions. Emission factors were calculated according to the IPCC default methodology, taking into account country-specific activity data, or the country-specific emission factors were applied, as it was noted before, but the reasons of mutability are not investigated properly. Since great part of the fluctuations were caused by	The recommendation	

			methodological changes noted, it would be reasonable to use both methods in transition period and to make overlapping calculations for 2–3 years.	was taken into account. The estimation will be provided in the next submission.	
5	External peer review	The inventory agency should conduct expert (peer) review when first adopting or revising the method	That is not unambiguously clear from the text of the report, are the experts involved by revising of methods, emission factors etc. Peer review of the information presented in current issue of National Inventory Report to the UNFCCC in the framework of the Quality Assurance was not feasible since the expert was receiving already completed version of the text and the files of Reporter.	Activity data used and parameters employed in the estimates were obtained from statistical datasets. No external expert was involved.	
6	Additional notes and remarks concerning the text of the Report and the tables provided in Reporter	Use of abbreviation	Abbreviations – most of used abbreviations are correctly defined at the beginning of the chapter but since the chapter is quite capacious and terse, the following of the abbreviated text is complicated. However, there are problems with defining of abbreviations used in calculations (coefficient Cf in Table 4.7 used in calculation of net energy for maintenance, F_{SN} in Table 4.44 etc).	The recommendation was taken into account and the abbreviations were defined.	Chapter 4.2.3.2.1 and Chapter 4.3.3.1
7		Terminology	Inexact use of terms – histosol (correct) *versus* histosoil.	The omission made was fixed.	Chapter 4.3.7.2
8	**Livestock population characteristics**	General QC/QA according to the principles of IPCC Good practice Guidance	The inventory of the topic using both national and FAO databases is generally well presented and complete. However, the sub-chapter 4.2.2 “Livestock activity data” in the Report is superficial, methodological changes of data collection and fluctuations of the trends are investigated insufficiently in the sub-chapter.		
9		**Activity data check** The inventory agency should check for consistency in the livestock characterisation data that are used in the emission estimates for each of the pertinent source categories. Standard QC checks should verify that there is consistency in the data used across source categories. If data are available the inventory	Activity data were obtained from Estonian National Statistic and other authorised organisations (EARC, EEIC). The reliability and representativeness of provided data was not additionally checked during the reporting process. Annual average data by livestock categories were presented by counties and for the whole republic. Percentage of cows that give birth was provided for 2005. Percentage of pregnant animals was presented for whole		

		agency should compute the change in total population over time using the population, birth and death rates, slaughter rates, and imports/exports for each of the animal categories or sub-categories and compare this to statistics on total population to ensure consistency. The inventory agency should make this calculation across years (e.g. 1990 to 1991 to 1992, and so on) as well as across seasons within individual years. The analysis across seasons is particularly important in countries with seasonal production conditions that create large variations in livestock populations during the year. The inventory agency should compare total production (e.g. meat, milk and wool) for the animal categories and sub-categories with the statistics on total production to ensure consistency. Feed intake estimates developed to support the Tier 2 enteric fermentation emissions estimates should be checked for reasonableness. For ruminant animals, the feed intake in dry matter (kg/day) should be on the order of 1% to 3% of the weight of the animals.	period. However, the default factors were used until 2004. Only data of 2005 and 2006 were provided from the dataset of EARC. Data consisting seasonal changes, annual birth and death rates, imports/exports were not provided in the report, probably supposing, that there are no substantial seasonal changes in the numbers of population and the import/export rates are nonessential. Additional check of the availability of the data is advisable. **Methodology of activity data collection was changing in 1999,** causing fluctuations of trend-lines. In the case of swine ESO started to gain the data on 6 sub-categories instead of 3 sub-categories, in the case of cattle in 5 sub-categories instead of former 3 sub-categories. However, the character of noted changes was not investigated properly in the text of the report (which categories were modified and how – in the case of pigs, for example – calculation of categories P20 (piglets, live weight less than 20 kg), P80 (pigs, live weight 50-80 kg) etc before 1999 and F (fattening pigs) after 1999). Moreover, sub-chapter "Livestock activity data" contains figures (Figures 4.6 and 4.7) representing information about animal population by sub-categories. However, the fact that the classification system was changed in 1999 was not investigated in the sub-chapter. Annual average milk yields were presented by counties and for whole republic since 1994; detail information consisting fat content is provided for 2005 in the text of he Report. In the Reporter the data are presented for whole of the period.	The recommendation was taken into account. The data were obtained from reports published annually by Estonian Office of Statistics. The data was collected in accordance with methodologies developed by the Office. Figure 4.6 illustrates population of Non-Dairy Cattle by sub-categories. Figure 4.7 demonstrates population of pigs by sub-categories. The detailed investigation of the methodologies will be provided in the future.	

10		□ The inventory agency should review QA/QC associated with secondary data sources (e.g. national food and agriculture agencies, agricultural trade associations, agricultural research organisations). Many of the organisations preparing the livestock-related data will have their own procedures for assessing the quality of the data, independent of what the end use of the data may be. If the QA/QC satisfies the minimum activities listed in the QA/QC plan, reference the QC activity conducted by the statistical organisation. If it is inadequate, establish independent QC checks on the secondary data, re-assess the uncertainty of the emissions estimates derived from the data, or reconsider how the data is used. □ The inventory agency should cross-check activity data against other available reference sources. For example, country-specific data should be compared to FAO statistics for livestock population data and milk production data. Investigate large discrepancies.	Information consisting meat, wool, eggs etc production was not presented in the report.	Tier 1 approach was employed in order to estimate CH_4 emission from sheep enteric fermentation, therefore reporting of the parameters mentioned is not necessary.	
			Information consisting feed intake of ruminant animals was not provided separately in the text of the Report and therefore checking of the reasonableness of the data is complicated. In Reporter the feeding situation was characterised – stall feed in the case of dairy cattle and Pasture – in the case of other categories. Information about digestibility of feed was provided from IPCC Guidelines. The information about feed intake in comparison with the weight of the animals was not provided. Information about the energy intake per head (MJ/head/day) was provided for the cattle and for swine but the reason of sharp increase in1999 (in the case of non-dairy cattle and swine) was not investigated. Annual summary data consisting livestock population was presented using both national and international (FAO) databases. Because of the methodological differences the data provided in the databases differ substantially. Only national (ESO) data were used in the calculations. However, the character of the discrepancies was not investigated in the text. To	The data on average gross energy intake were reported in the CRF (4A). Table 4.20 also provides related information. The common methodology presented in the IPCC Guidelines was used in order to estimate gross feed intake (Chapters 4.2.3.2.1 and 4.2.3.3.1). Parameters used in the estimates are described. Thus, the reporting dependence of feed intake on animal weight is not necessary. The recommendation will be taken into account. The description of each method of data collection (by ESO and FAO) will be presented	

			increase the comprehensibility of the material is advisable to comment the nature of the discrepancies since the data are quite different.	in the next submission.	
11		**External review** □ The inventory agency should conduct expert peer review on the livestock characterisation data, involving agricultural experts and specialists.	The involvement of the experts in peer reviewing of livestock characterisation data is not investigated in the text.	IPCC methodologies were used, country-specific activity data, IPCC default and country-specific parameters were employed in order to estimates emissions in agriculture sector. No external expert was involved.	
12	**CH_4 emissions from enteric fermentation in domestic livestock**	General QC/QA according to the principles of IPCC Good practice Guidance	The inventory of the topic is generally well presented and complete. Investigating emissions from enteric fermentation the Tier 2 methodology was used in the case of cattle. Emissions connected with swine and other animals were studied using Tier 1 method (in the case of swine also Literature method was applied according to the Table 4.1 in the text of the Report). Emissions connected with poultry were not studied in the report. Investigating trends the character of fluctuations was discussed too briefly.	The sharp decrease in cattle enteric fermentation EF (Figure 4.12) is explained by applying of a module Western-Europe manure management system in 2003.	
13		**Review of emission factors** □ If using the Tier 2 method, the inventory agency should cross-check country-specific factors against the IPCC defaults. Significant differences	Both IPCC default and country-specific emission factors were used for cattle, but also for pigs. Country-specific emission factors were calculated using Tier 2 methodology, taking into account weight, feeding situation and in the case of cattle milk production and		

		between country-specific factors and default factors should be explained and documented.	fat content. However, the application of calculated country-specific emission factors is not unambiguously clear from the text ("Uncertainties …" – "The estimations of CH_4 emissions from enteric fermentation of swine were estimated based on sub-categories of pigs. However, all IPCC default parameters were used in the estimates.") Calculated country-specific and IPCC default emission factors differ substantially but the reasons of the discrepancies were not discussed properly in the text. Averaged swine enteric fermentation emission factor was decreasing rapidly in 1999 (as well as the weight and average gross energy intake, but the reasons of the change were not discussed in the text of the Report (is it connected with the changing methodology of data collection?) Averaged emission factors for non-dairy cattle were fluctuating (see Reporter) but the reasons of the fluctuations were not investigated.	The omission made was fixed. Country-specific parameters used for the estimation were specified. The country-specific factors were estimated employing the methodology presented in Chapter 4.2.4.2.1. The parameters used in the estimates are reported in the NIR. Changing of one or another parameters (reported) causes changes in EF. The sharp decrease in swine enteric fermentation EF was caused by changing of the methodology of activity data collection. *Averaged* EFs for mature non-dairy cattle are reported in the CRF (1990-2006). The changes in the trend are explained by negligible fluctuation in population structure of Mature Non-Dairy in 1990-2006.	Chapter 4.2.3.5.
14		**External review** □ If the Tier 2 method is being used, the inventory agency should conduct expert	Information about the possible involvement of the experts in peer reviewing of the data and calculations is not provided in the text.	Activity data used in the estimates were obtained from Estonian	

		peer review, including from industry, academic institutions, and extension expertise. □ It is important to maintain internal documentation on review results.	Uncertainties were estimated using literature data (experience of Austria) according to the Report.	statistics. Parameters and methods employed are cited to references. No external expert was involved. Tier 1 approach was used in order to estimate uncertainties related to 'CH_4 emission from enteric fermentation' sub-category. Default IPCC uncertainty rates and experiences of other counties were employed.	
15	Additional notes and remarks concerning the text of the Report and the tables provided in Reporter	Explanation of the methodological difference	4.2.3.2.1. Methodology, data… – "Methane emission factors were estimated based on above presented method (Tier 2 method), available Estonian data and IPCC default parameters (Table 4.11)." It would to be reasonable to comment what is the reason of the difference between IPCC default emission factors also provided in the table and calculated emission factors.	Taking into account country-specific data on milk production and fat content increased values of EF.	
16		Explanation of the calculations; Explanation of the trend	Table 4.17 "CH_4 emissions from Enteric Fermentation of other livestock in 1990–2006 in Estonia" – what was calculated on the row "%, 2006"? (The sum is ~102%.)	The data reported (%) in the table were rounded up	
17		Explanation of the recalculations	4.2.3.6. Source specific recalculations – "There is one important recalculation in the 2008 submission. The emissions from cattle were recalculated due to an omission made in the 2007 submission." It would to be advisable to comment the character of the omission. However, there are no obvious differences between the submissions.	The omission was made in the process of the calculation.	
18		Changing of default values	Values of default average gross energy intake and weight for cattle and swine were changing substantially in 1999 according to the information provided in Reporter. Is it caused by changing classification system?	Values of averaged gross energy intake and swine weight are reported in the CRF.	

				The sharp change in the parameters reported is explained by the change in the methodology of data collection.	
19	**CH_4 emissions from manure management**	General QC/QA according to the principles of IPCC Good practice Guidance	The inventory of the topic is generally well presented and complete. Investigating emissions from manure management Tier 1 method was used.		
20		**Activity data check** □ The inventory agency should review data collection methods, checking the data to ensure they were collected and aggregated correctly. The data should be cross-checked with previous years to ensure the data are reasonable. Inventory agencies should document data collection methods, identify potential areas of bias, and evaluate the representativeness of the data.	CH_4 emissions from manure management were calculated using country-specific data and IPCC default factors in general. Problems of the congruence of the data of different years are probably mostly caused by **changing of the manure management system – before 2003 the Eastern Europe module was used, in 2003 the Western-European module was applied.** However, the reason of the discrepancies of systems as well as the reliability and representativeness of the data were not investigated in the text. Investigating trends the character of fluctuations was discussed insufficiently.	Estonia joined to the EU in 2003. Due to this fact, the module on Western Europe manure management system was employed in the estimates (Table B-3 of the 1996 Guidelines).	
21		**Review of emission factors** □ If using defaults, the inventory agency should review the available default emission factor values and document the rationale for selecting specific values. □ If using the Tier 2 method (i.e. where country-specific emission factors by animal and manure management type are used to calculate emissions), the inventory agency should cross-check the country-specific factor parameters (i.e. VS excretion rates, Bo, and MCF) against the IPCC defaults. Significant differences between country-specific parameters and default parameters should be explained and documented.	For addition of IPCC default emission factors in some cases also country-specific emission factors were applied (in the case of dairy cattle and swine according to the Table 4.1 and in the case of swine according to the Reporter). The investigation of reasonableness of applied emission factors was not provided in the report. Reasons of differences between country-specific and IPCC default emission factors as well as the representativeness of used default factors were not discussed in the report. The sharp decrease in emission factors estimated in 1999 in the case of swine was explained by changing of a methodology of activity data collection (see also remarks in Livestock population characterisation).	IPCC Guidelines stipulates that due to the lack of country-specific emission factors, IPCC default parameters should be used. The methodology used in the estimates of country-specific EF is described in the NIR (Chapter 4.2.4.2.1). The parameters used are considered. Thus, the explanation of the	

		□ If using the Tier 1 method (using default IPCC emission factors), the inventory agency should evaluate how well the default VS excretion rates and Bo values represent the defined animal population and manure characteristics of the country. □ Any available country-specific data should be used to verify relevant default components. □ Inventory agency should review the method used to determine the country- or region-specific VS and Bo values, particularly in terms of the standardised procedures previously described. A detailed description of the equations used to estimate emission factors should be reviewed as well, including the numbers used in each calculation and the source of any data collected.	Fluctuation of emission factors in 2003 was caused by changing of manure management system (see previous remark). However, the character of noted changes was not investigated properly and therefore the reliability of the data is not unambiguously clear from the text.	difference between IPPC default EF and country-specific EF is not necessary.	
22		**External review** □ If using the Tier 2 method, the inventory agency should conduct an expert peer review of the manure management practice assumptions by involving individuals with specific knowledge in disciplines associated with the parameters used to calculate factors (e.g. manure management practices and animal nutrition). □ If using the Tier 2 method, the inventory agency should provide a proper justification for country-specific emission factors via peer-reviewed documentation.	Information about the possible involvement of the experts in peer reviewing of the data and calculations as well as the information about justification of country-specific emission factors is not provided in the text. Uncertainty analysis bases on the analogies of other countries according to the text of the Report.	Activity data were obtained from Estonian Statistics. Parameters and methods used were employed from IPCC Guidelines. No external expert was involved. Tier 1 approach was used in order to estimate uncertainties in 'CH_4 emission from manure management' sub-category.	
23	Additional notes and remarks concerning the text of the Report	Investigation of the fluctuations, incorrect date	"Averaged reported in the CRF factors on CH_4 emission from pig manure management system are reported in Fig 4.16. The sharp decrease in emission factors estimated (averaged) in 1990 is explained by changing	The omission was made. The correct year should be 1999. The omission was fixed in	Chapter 4.2.4.3.1

	and the tables provided in Reporter		of a methodology of activity data collection…" – named method was changed in 1999! What was the reason of the rapid decrease in 1991?	the NIR.	
24		Formulation, Investigation of the fluctuations	4.2.4.5 Source specific recalculations – "There is one recalculation was carried out due to an omission made in the 2007 submission (Table 4.29, Figure 4.18). The module of Eastern Europe cattle manure management system has been taken into the estimates, however it was reported that Estonia uses the module of Western Europe cattle manure management system." Formulation of the sentence – it is not clear, what module was used in calculations of different periods. What is the reason of the rapid change in 2003 – NB! Decrease according to the 2007 submission, increase according to the recalculations (Figure 4.18). Since the differences caused by the use of Western- and Eastern European systems are large, the comment of the nature of the differences is really necessary as it was noted before.	The statement was re-worded. As it is mentioned in the NIR, the module of Eastern Europe manure management system was applied for 1990–2003 and the module of Western Europe manure management system was used in order to estimate emissions for 2004–2006.	Chapter 4.2.4.5
25	**N_2O emission from manure management**	General QC/QA according to the principles of IPCC Good practice Guidance	The inventory of the topic is generally well presented and complete. Investigating emissions from manure management Tier 1 method was used.		
26		**Review of emission factors** □ If using country-specific emission factors, the inventory agency should compare them to the default factors, and differences noted. The development of country-specific emission factors should be explained and documented, and inventory agencies are encouraged to ensure that good practice methods have been used and the results have been	Emission factors were calculated using IPCC default parameters or the Country-specific emission factors were applied (according to the Table 4.1 in the text of the Report). Nitrogen excretion factors for cattle and swine based on IPCC defaults and country-specific information were estimated using the algorithm presented in Chapter 4.2.3.2.1 according to the text of Report. However, in this chapter the CH_4 emission factors were calculated. Is	The omission made was fixed in the NIR.	Chapter 4.2.5.2.1

		peer-reviewed.	the information provided in the chapter entirely applicable for calculations of N_2O emission factor? Sharp decrease of the excretion factors in 1999 (especially for pigs) was probably caused by changing of a methodology of activity data collection (see also remarks in Livestock population characterisation), but that was not investigated properly in the text. In the case of "other animals" the IPCC default emission factors and N excretion factors were applied.	The sharp decrease in the trend of averaged nitrogen excretion factor (Figure 4.20) was caused by the change in the methodology of activity data collection.	
27		**Activity data check** □ If using country-specific data for Nex(T) and MS(T,S), the inventory agency should compare these values to the IPCC default values. Significant differences, data sources, and methods of data derivation, should be documented.	The data of population of livestock by categories were obtained from database of ESO. The sharp decrease of emissions in 2003 was explained by applying of Western-Europe module of manure management system in Estonia (see also the remarks of previous chapter). Investigating trends the character of fluctuations was discussed insufficiently in the text of the Report.	The modules on manure management system are reported in Tables B-3 and B-4 of the 1996 IPCC Guidelines.	
28		**External review** □ The inventory agency should utilise experts in manure management, animal nutrition, and GHG emissions to conduct expert peer review of the methods and data used.	Information about the possible involvement of the experts in peer reviewing of the data and calculations as well as the information about justification of country-specific emission factors was not provided in the text. Uncertainty analysis bases on the information provided in IPCC Guidelines.	Activity data on livestock population, parameters and methodologies used in the estimates are cited to references. No external expert was involved. Tier 1 method was applied in order to carry out uncertainty analysis.	
29		Investigation of the fluctuations	Figure 4.20 "Averaged Nitrogen excretion factor reported in the CRF for 1990–2006, kg N/head/year" The comment of the rapid change in 1999 is recommended. It was noted, that the reason of difference is the methodological change, but since the difference is big, a more detailed comment is necessary,	The sharp decrease was caused by the change in the methodology of activity data collection. Parameters used in the estimates are reported	

			as it was noted before.	in Box 2 of the NIR.	
30		Double information	"Source-specific recalculations" – information of Figure 4.22 "CH_4 emissions from…" and Table 4.40 was already presented in the Chapter 4.2.4, Figure 4.18 and Table 4.29.	Figure 4.22 and Table 4.40 were deleted due to double-reporting in the NIR.	Chapter 4.2.5.7
31		Fluctuation of emission factor	"Source-specific recalculations" Figure 4.24 "N_2O emissions from pig manure management…." "The emission factor (EF_3) was changed as well in the estimates of N_2O emissions from pig manure management system. 0.005 kg N_2O-N/kg N excreted (Cattle and deep litter manure system, <1 month) was employed in the 2007 submission, and the estimates of the 2008 submission were based on 0.02 kg N_2O-N/kg N excreted (Cattle and deep litter manure system, >1 month)". Explanation of so great change of the emission factor and therefore the data according to the 2007 and 2008 submissions is recommended.	The emission factor was applied basing on expert judgment and taking into account low-quality data presented by Estonian Office of Statistics.	
32	**CH_4 and N_2O emissions from agricultural residue burning**	General QC/QA according to the principles of IPCC Good practice Guidance	Emissions from crop residue burning were not calculated due to the lack of activity data.		
33	**Direct N_2O emissions from agricultural soils**	General QC/QA according to the principles of IPCC Good practice Guidance	The inventory of the topic is generally well presented and complete. Investigating emissions from direct N_2O emissions Tier 1 method was used.		
34		**Review of emission factors** □ The inventory agency should review the default emission factors and document the rationale for setting specific values. □ If using country-specific factors, the inventory agency should compare them to the IPCC default emission factors, and, if accessible, the country-specific emission factors used by other countries with comparable circumstances. Differences between country-specific factors and default or other country	IPCC default emission factors were used in calculations. The representativeness of used default factors is not discussed in the Report.	IPCC Guidelines stipulates that due to the lack of country-specific emission factors, IPCC default factors should be used in the estimates.	

		factors should be explained and documented.			
35		**Review of any direct measurements** If using factors based on direct measurements, the inventory agency should review the measurements to ensure that they are representative of the actual range of environmental and soil management conditions, and inter-annual climatic variability, and were developed according to recognised standards (IAEA, 1992). The QA/QC protocol in effect at the sites should also be reviewed and the resulting estimates compared between sites and with default-based estimates.	Factors based on direct measurements were not applied in calculations.		
36		**Activity data check** The inventory agency should compare country-specific data on synthetic fertiliser consumption with fertiliser usage data from the IFA and synthetic fertiliser consumption estimates from the FAO. The inventory agency should ensure that N excretion data are consistent with those used for the manure management systems source category. National crop production statistics should be compared to FAO crop production statistics. The inventory agency should ensure that the QA/QC described in Section 4.1 for livestock population characterisation has been implemented and that a consistent livestock population characterisation is used across sources. Country-specific values for various parameters should be compared to IPCC defaults.	The activity data were derived from ESO, EEIC and the map-information from CORINE cover map and Estonian soil map. Nitrogen excretion generated per type of animals and per animals waste management system was estimated in the Chapter "N_2O emissions from manure management." Livestock activity data were obtained from Estonian National Statistic and other authorised organisations. The reliability of provided data was not additionally checked during the reporting process (see also notes of sub-chapter "Livestock activity data"). The comparison of national and international (FAO and IFA) data was not presented in the report.	The recommendation was taken into account. The data on crop production from the international datasets will be presented in the next submission.	

			Character of fluctuations of emissions was discussed insufficiently in the Report.	Fluctuations in the emission trends were caused by fluctuations in activity data.	
37		**External review** The inventory agency should conduct expert (peer) review when first adopting or revising the method. Given the complexity and uniqueness of the parameters used in calculating country-specific factors for these categories, involve specialists in the field should be involved in such reviews.	Information about the possible involvement of the experts in peer reviewing of the data and calculations was not provided in the text. Uncertainty analysis bases on the analogies of other countries or information provided in the IPCC Guidelines.	Activity data were employed from Estonian Office of Statistics, parameters and methodologies used were obtained from IPCC Guidelines. Tier 1 approach was employed in order to carry out uncertainty analysis.	
38	Additional notes and remarks concerning the text of the Report and the tables provided in Reporter	Investigation of the fluctuations	Figure 4.28 "N_2O emissions from growing of N-fixing crops in 1990–2006 in Estonia, Gg" and corresponding data in Reporter – what is the reason of rapid changes? Is it realistic, that emission from N-fixing crops (and fixation of nitrogen by N-fixing crops) was practically missing before 1995?	Activity data on N-fixing crop production for the whole period (1990-2006) were obtained from Estonian Office of Statistics.	
39		Investigation of the fluctuations (soil)	Figure 4.33"Areas of cultivated organic soils in 1990–2006 in Estonia, 1000 ha" and corresponding information in Reporter – additional check of the data and adding comments is recommended – is it feasible that the areas of cultivated soils are fluctuating so rapidly from year to year?	It was mentioned in the NIR, activity data on cultivation of organic soils in Estonia were interpolated taking into account three datasets: 1990 and 2000 CORINE maps, and ESO (the cultivated areas). Interannual change rates of organic soil cultivated correspond to interannual change rates of the total arable land in 1990–2006.	

40		Formulation	4.3.8.4 "Source-specific recalculations" – N_2O emissions from pasture, range and paddock are included in detailed reporting by categories of livestock in Chapter 4.2.5.7. Additional check (is all of the information presented in named sub-chapter and is the double-counting avoided) is advisable.	The data was checked. The data reported is correct.	
41	**Indirect N_2O emissions from nitrogen used in agriculture**	General QC/QA according to the principles of IPCC Good practice Guidance	The inventory of the topic is generally well presented and complete. Investigating emissions from indirect N_2O emissions Tier 1 method was used.		
42		**Review of emission factors** □ The inventory agency should review the parameters, equations and calculations used to develop the emission factors. These QC steps are particularly important for subcategories in this source category because of the number of parameters that are used to construct the emission factors. □ If using country-specific factors, the inventory agency should compare them to the IPCC default factors. This is particularly important for the emission factors for deposited N and for discharged sewage, where caution should be used in developing country-specific factors.	IPCC default emission factors were used in calculations. The representativeness of used default factors is not discussed in the report.	IPCC stipulates that due to the lack of country-specific emission factors, IPCC default factors should be used in estimates.	
43		**Activity data check** □ Since many of the activity parameters used for this source category are also used for other agricultural sources, it is critical to ensure that consistent values are being used. □ If using country-specific values for various parameters, (i.e. FracLEACH), the inventory agency should compare them to the IPCC defaults. Rigorous documentation of the development of country-specific values should also be	Because of noted circumstances the additional check of the information is advisable to avoid double-counting. Country-specific information about the use of fertilisers (both synthetic and organic) and IPCC default emission factors were used in calculations.		

		maintained.			
44		**External review** Agricultural specialists (particularly nitrogen cycle specialists) as well as agricultural industry and other stakeholders, should peer review the inventory estimates and all important parameters and emission factors.	Information about the possible involvement of the experts in peer reviewing of the data and calculations is not provided in the text. Uncertainty analysis bases on the information provided in IPCC Guidelines and analogies of other countries according to the text of the Report.	No external expert was involved. Tier 1 approach was used in order to carry out uncertainty analysis.	
45		Investigation of the fluctuations	Figures 4.35 and 4.36 "Atmospheric deposition …" and "Indirect N_2O emissions from agricultural soils in 1990–2006, Gg". Sharp decreases of the emissions/depositions are probable the reason of decrease of consumption of fertilizers. A brief comment of the nature of the processes is necessary.	As known, indirect N_2O emission from agricultural soils (Atmospheric deposition and Run-off) depends on amounts of synthetic fertilizers and animal manure applied on agricultural soils. These data are reported in Tables 4.D.1.1. and 4.D.1.2 of the CRF.	
46		Uncertainties	Table 4.62 "Estimated values of uncertainties used in agriculture sector". Why the uncertainties of emission factors in the case of leaching and run off are so great (-92–380%)?	The uncertainty rate was obtained from Table 4-23 of the 1996 IPCC Guidelines (p. 4.105)	
47	**CH_4 emissions from rice production**	General QC/QA according to the principles of IPCC Good practice Guidance	Rice production is not occurring in Estonia and therefore the calculations are not carried out.		

QA activity and procedures – Land use, land use changes and forestry sector

Quality Assurance analysis bases on guidelines presented in "IPCC Good Practice Guidance for LULUCF", focusing on:

- Verification of the fulfilling of the requirements provided in above named guidelines;
- Checking of the consistency of the information provided in the text of the National Inventory Report to the UNFCCC and in the databases of Reporter;
- Additional determination of possible errors and shortages.

Quality assurance of the **LULUCF sector** was carried out by Tiina Randla, assistant of Tallinn University of Technology, Institute of Chemistry, MSc.
Date of review: Review of preliminary text in January 08; control of final version and Reporter 11–29th February 08.

	Description of QA procedure	**Brief description of review scope and the character of the problem**	**Major conclusions from the review (include a reference to the review)**	**Action taken**	**Place where it is filed**
1	General QA review of the LULUCF sector concentrating on emission comparison and transparency of the information	The scope of the review is to identify possible errors and to consider the completeness, accuracy, transparency and consistency of the LULUCF sector.	The inventory using Tier 1 methodology and default emission factors is generally well presented. In calculations of CO_2 also country-specific emission factors were applied in 2005 and 2006. However, only estimations of CO_2 from Forest land remaining forest land and CO_2, CH_4 and N_2O from Biomass burning were presented in current submission of the Report. Quality control requirements and procedures according to the "IPCC Good Practice Guideline and Uncertainty Management in National Greenhouse Gas Inventories" and "2006 IPCC Guidelines for National Greenhouse Gas Inventories" were fulfilled by the author of the chapter (see Annex 3, Individual Source Category Checklist). However, checking the text and data provided in Tables and Figures, some questionable aspects and complicating issues (listed below) were found. First of all, the study area is extremely restricted in the case of current submission. Estonia as a Party of Annex A is required to prepare a full LULUCF inventory. However, the inventory of 2008 submission includes only carbon removals due to the forest biomass increment, emissions from forest biomass felling and biomass burning, calculated, using Tier 1 methods and IPCC default emission factors. Problems hindering of the completing of full report of the LULUCF sector were investigated in the text of the Report.		

2	General review of emission factors	In inventories in which country- or region-specific emission factors were used, or in which new methods (other than default IPCC methods) were used, the scientific basis of these emission factors and methods should be completely described and documented – calculations of emission factors should be carefully revised and complemented, if necessary.	Only IPCC default emission factors were used in the report of the sector. However, according to the "Summary report for methods an emission factors used" and Reporter also country-specific emission factors were used in the case of CO_2 (in 2005-2006) but that is not noted in the text of the Report.	There is an error in the CRF. The error will be fixed.	
3	General activity data check	Documentation of activity data should include: • frequency of data collection and estimation, • estimates of accuracy and precision; • in the cases when the data are not available directly from the databases, the information and assumptions that were used to derive the activity data; • Comparison of national statistics, emission factors etc with data provided in international databases	To increase the transparency of the information is desirable to specify the character (initial data of emitters or treated and concentrated data, the frequency and reliability of the data) of the information provided by ESO, CFPS etc data sources (see Chapter 5.1 – Overview of source category). Both international and national statistical data were presented in the report, but due to the methodological contradictions only FAO statistics was used in calculations.		
4	General check of the emission results	• Significant fluctuations in emissions between years should be explained. • A distinction should be made between changes in activity levels and changes in emission factors from year to year, and the reasons for these changes documented. • If different emission factors are used for different years, the reason for this should be explained and documented.	In current report the fluctuations and reasons of sharp changes were explained insufficiently (see remarks below) both in the case of emission factors and emissions. Emission factors were calculated according to the IPCC default methodology, taking into account country-specific activity data, as it was noted before, but the reasons of mutability were not investigated properly.		
5	External peer review	The inventory agency should conduct expert (peer) review when first adopting or revising the method	The involvement of experts by revising of methods, emission factors etc is not discussed in the text of the Report. Since only part of the emissions of the sector are presented in current submission of the Report, the involving of the specialists expertise is recommendable in the future.	Activity data were obtained from Estonian statistics, parameters used were employed from IPCC Guidelines. No external expert was involved.	

6	**Forest**	General QC/QA according to the principles of IPCC Good practice Guidance	The inventory of the sector was compiled using Tier 1 methodology and IPCC default emission factors in general (see also remarks above). Report is generally well presented and complete. However, quite questionable is the restriction of the study area. Forest Land section of the GHG report includes two sub-sections: 'Forest land remaining Forest Land' and 'Forest Land converted to Forest Land', but 2008 submission considers only carbon flows related to 'Forest Land remaining Forest Land'.		
7		The characteristics of the LULUCF sector mean that estimates of emissions and removals of GHGs to be reported by national inventories can have different level of precision, accuracy and levels of bias. Moreover, the estimates are influenced by the quality and consistency of data and information available in a country, as well as gaps in knowledge; in addition, depending on the tier level used by a Party, figures can be affected by different sources of errors, such as sampling errors, assessment errors, classification errors in remote sensing imagery, model errors, that can propagate to the total estimation. Agencies which collect data are responsible for reviewing the data collection methods, checking the data to ensure that they are collected and aggregated or disaggregated correctly, and cross-checking the data with other data sources and with previous years to ensure that the data are realistic, complete and consistent over time. The basis for the estimates, whether statistical surveys or ´desk estimates´, must be reviewed and	Problems compromising the data availability and reliability were described properly in the Report.		

		described as part of the QC process. Documentation is a crucial component of the review process because it enables reviewers to identify inaccuracy, gaps and suggest improvements. Documentation and transparency in reporting is most important for highly uncertain source categories and to give reasons for divergences between country-specific factors and default or factors used by other countries. Countries with similar (ecological) conditions are encouraged to collaborate in the refinements of methods, emissions factors and uncertainty assessment.			
8		**ACTIVITY DATA CHECK** The inventory agency should, where possible, check data comprising of all managed land areas, using independent sources and compare them. Any differences in area records should be documented for the purposes of review. Activity data area totals should be summed across all land-use categories to insure that total area involved in the inventory and its stratification across climate and soil types remains constant over time. This ensures that land areas are neither 'created' nor 'lost' over time, which would result in major errors in the inventory. When using country-specific data (such as data on standing biomass and biomass growth rates, carbon fraction in aboveground biomass and biomass expansion factors, synthetic fertiliser consumption and synthetic fertiliser	By completing of the GHG inventory of LULUCF sector in Estonia the activity data were obtained from the ● Centre of Forest Protection and Silviculture (CFPS) – ♦ data concerning the National Forest Inventory; ♦ data on land cover by land category (forest, grassland, wetlands, build-up area); ♦ data on forest biomass stock, biomass increment; and ● Statistics of Estonia (ESO) – data on forest fire areas.		
			Because described in the Report methodological changes of data collection and the problems of classification as well as due to the changing ownership the reliability and completeness of the data, (especially in the period 1991–1999) are problematic. Not all of the data about land cover is available in Estonia, causing fluctuations and discrepancies. Taking into account above noted circumstances the additional control of the land-cover information presented in the report is advisable. Also the data considering forest felling is contradictory and incomplete due to the illegal harvesting. Data of NFI were used to increase the reliability of information.	Datasets needed for estimation of all GHG flows related to LULUCF sector are being under development in Estonia.	

		consumption estimates) the inventory agency should compare them to the IPCC default values or internationally well-established values such as those provided by the FAO and the International Fertilizer Industry Association (IFA), and note the differences. The country-specific parameters should be of high quality, preferably peer-reviewed experimental data, adequately described and documented. The agencies performing the inventory are encouraged to ensure that *good practice* methods have been used and the results have been peer-reviewed. Assessments on test areas can be used to validate the reliability of figures reported. The inventory agency should make sure that QA/QC in the Agriculture source category has been implemented and that nitrogen excretion, volatile losses and application rates to forest are consistent with the Agriculture source category and overall consumption of fertilisers and organic wastes, avoiding double counting. The inventory agency should make sure that the entire area of drained forest peatlands is considered, not only the recent drainage in the reporting year, and that repeated drainage of a given area is not counted as new area.	Obviously due to the above listed problems the fluctuations of the flows presented in the Tables and Figures of the chapter were huge (see, for example, Fig 5.3 "Net emissions/removals of CO_2 by Estonian forest biomass …"; Fig 5.14 "Carbon emissions/removals from forest land remaining …" as well as the corresponding information in Reporter). Data concerning net emissions/removals were fluctuating extremely rapidly and the differences between 2007 and 2008 submissions were enormous. However, the investigation of the reasons (and reliability) of the fluctuations in the text of the Report is too brief.	The list of the recalculation carried out was reported in the NIR (Chapter 5.2.2.4). Figure 5.14 summarizes the data reported in Figures 5.11 and 5.12, whereas the explanations for the recalculations made are presented.	
			Only IPCC default emission factors were used in calculations of the chapter. There were some references to the differing country-specific emission factors (in the case of drained wetlands, for example) but in order to avoid methodological difficulties only IPCC default values were used. Taking into account that calculations were focusing to the forest areas remaining forest, only the areas covered with forests for at least 20 years were involved in calculations. Fact, that wetlands were drained and turned into agricultural or forest areas, was mentioned but appropriate calculations were not provided. Changes in carbon stock in soils were calculated, taking into account country-specific data on forest areas by categories, based on direct estimations and the Tier 1	As it was mentioned in the NIR (Chapter 5.2), the 2008 submission considers only carbon flows related to 'Forest Land remaining Forest Land'. The data on areas of organic soils under forest biomass was estimated by combining process of CORINE maps (1990 and 2000) and Estonian soil map (Chapter 5.2.2.1).	

			approach. The emission from soils (Figure 5.13) was changed slightly since 1990, what is quite logical result. However, the data about carbon stock change in soils and in living biomass (Reporter Table 5.A) are extremely changeable.	Table 5.A of the CRF reports quantities of carbon emissions due to forest biomass harvest (Table 5.10) and carbon removals due to forest biomass increment (Figure 5.7).	
			Estimation of GHG emissions due to the forest biomass burning includes greenhouse gas emissions (CO_2, CH_4 and N_2O) from biomass burning on forested land due to wildfires. The annual fluctuations as well as uncertainties of the sub-sector are great, due to the sporadic character of the processes and because of the methodological difficulties, but the character of the processes and possible reasons of fluctuations are not investigated properly in the text.	The methodology employed in order to estimate emissions from forest biomass burning and activity data are reported in the NIR (Chapter 5.7.1). Sharp increase or decrease in GHG emissions depends on area of forest biomass burned.	
			Sub-chapter 5.7 in the Report should contain non-CO_2 greenhouse gases according to the title. However, for addition of non-CO_2 emissions also CO_2 emissions are provided in Figure 5.21. Additional flows of nitrogen associated with the use of fertilisers etc are not discussed in the chapter.	The title of Chapter 5.7 was changed to 'Emissions of GHG from biomass burning'	Chapter 5.7
9		**INTERNAL AND EXTERNAL REVIEW** The review processes as set out in Chapter 5 should be undertaken by experts preferably not directly involved in the inventory development. The inventory agency should utilize experts in GHG removals and emissions in LULUCF to	The involvement of the experts by revising of methods, emission factors etc is not discussed in the text of the Report.	Activity data were obtained from Estonian statistics, parameters used in the estimates were employed from IPCC Guidelines. No external expert	

		conduct expert peer-review of the methods and data used. Given the complexity and uniqueness of the parameters used in calculating country-specific factors for some categories, selected specialists in the field should be involved in such reviews. If soil factors are based on direct measurements, the inventory agency should review the measurements to ensure that they are representative of the actual range of environmental and soil management conditions, and inter-annual climatic variability, and were developed according to recognized standards. The QA/QC protocol in effect at the sites should also be reviewed and the resulting estimates compared between sites and with default-based estimates.	Actually only IPCC default emission factors were used in calculations but to increase the representativeness and reliability of the information the elaboration of country-specific emission factors as well as the complementing of the methodology is advisable in the future.	was involved.	
10	Additional notes and remarks concerning the text of the Report and the tables provided in Reporter	Investigation of the fluctuations – territorial changes	5.2.1.3 Quantitative overview …", see also Fig 5.6 "Forest area…" – "The forest area increased 1.6 fold by 2006 in comparison with the base year" – Checking of the data and the sentence is advisable. What is the base year, taking into account that the changes with the comparison with 1990 are inessential?	The omission was made. It should be reported that 'the forest area increased 1.2 fold by 2006 in comparison with the base year'. The omission was fixed.	Chapter 5.2.1.3
11		Investigation of the fluctuations – carbon gain	Fig 5.7 "Carbon gain by forest biomass…" and corresponding information in Reporter – "The averaged value is increasing due to the better management of Estonian forest biomass". Actually the values are fluctuating and in recent years slightly decreasing.	It was mentioned correctly in the NIR. The average value is increasing in comparison by 2006 with the base year.	
12		Investigation of the fluctuations – biomass burning	Fluctuation of the annual areas of wildfires and the emissions should to be explained by irregular character of the processes. However, what is the reason of extremely rapid increase of emission factor in 2006?	As it is mentioned in the NIR, GHG emissions from forest burning were estimated using activity data	

				reported by Estonian Office of Statistics. The sharp increase in GHG emission in 2006 was caused by unpredictable damage of large forest area by fires.	
13	**Cropland**	General QC/QA according to the principles of IPCC Good practice Guidance	Estonia is still developing datasets required to estimate carbon emissions/removals associated with Cropland. Since, not all data requested in GPG LULUCF was available to perform a complete GHG inventory in this land category using the Tier 1 method. Thus, Estonia is unable to report emissions from Croplands in current submission.		
14	**Grassland**	General QC/QA according to the principles of IPCC Good practice Guidance	Estonia is still developing datasets required to estimate carbon emissions/removals associated with Grassland. Since, not all data requested in GPG LULUCF was available to perform a complete GHG inventory in this land category using the Tier 1 method. Thus, Estonia is unable to report emissions from Grasslands in current submission.		
15	**Wetland**	General QC/QA according to the principles of IPCC Good practice Guidance	Estonia is still developing datasets required to estimate carbon emissions/removals associated with Wetland. Since, not all data requested in GPG LULUCF was available to perform a complete GHG inventory in this land category using the Tier 1 method. Thus, Estonia is unable to report emissions from Wetlands in current submission.		
16	***Other***	*General QC/QA according to the principles of IPCC Good practice Guidance*	*Estonia is still developing datasets required to estimate carbon emissions/removals associated with the category Other land. Since, not all data requested in GPG LULUCF was available to perform a complete GHG inventory in this land category using the Tier 1 method. Thus, Estonia is unable to report emissions from Other lands in current submission.*		

QA activity and procedures – Waste sector

Quality Assurance analysis bases on guidelines presented in "IPCC Good Practice Guideline and Uncertainty Management in National Greenhouse Gas Inventories" and "2006 IPCC Guidelines for National Greenhouse Gas Inventories", focusing on:

- Verification of the fulfilling of the requirements provided in above named guidelines;
- Checking of the consistency of the information provided in the text of the National Inventory Report to the UNFCCC and in the databases of Reporter;
- Additional determination of possible errors and shortages.

Quality assurance of the **Waste sector** was carried out by Tiina Randla, assistant of Tallinn University of Technology, Institute of Chemistry, MSc.
Date of review: Review of preliminary text in December 07 and January 08; control of final version and Reporter 11–29th February 08.

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
1	General QA review of the waste sector concentrating on emission comparison and transparency of the information	The scope of the review is to identify possible errors and to consider the completeness, accuracy, transparency and consistency of the waste sector.	The inventory is generally well presented and complete. Applying Tier 1 or the FOD methodology and IPCC default or country-specific emission factors CO_2, CH_4 and N_2O emissions were calculated. Quality control requirements and procedures according to the "IPCC Good Practice Guideline and Uncertainty Management in National Greenhouse Gas Inventories" and "2006 IPCC Guidelines for National Greenhouse Gas Inventories" were fulfilled by the author of the chapter (see Annex 3, Individual Source Category Checklist). However, checking the text and data provided in Tables and Figures of the text of the Report and in the Reporter, some questionable aspects (listed below) were found.		
2	General investigation of the reliability of emission factors	In inventories in which country- or region-specific emission factors were used, or in which new methods (other than default IPCC methods) were used, the scientific basis of these emission factors and methods should be completely described and documented – calculations of emission factors should be carefully revised and complemented, if necessary.	IPCC default or country-specific emission factors (according to the table 6.1 in the text of the Report in the case of Solid waste disposal) were used or the emission factors were calculated using IPCC methodology and country-specific data. However, the information about possible applying of country-specific emission factors was not provided in Reporter. Acceptability of IPCC default emission factors	Only IPCC default emission factors were used in order to estimate CH_4 emission from 'Solid waste Disposal on Landfills' sub-category. There is an omission made in Table 6.1	Chapter 6.1.

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
			and/or the necessity of elaboration of country-specific emission factors were not investigated in the text of the Report.		
3	General activity data check	Documentation of activity data should include: • frequency of data collection and estimation, • estimates of accuracy and precision; • in the cases when the data are not available directly from the databases, the information and assumptions that were used to derive the activity data; • Comparison of national statistics, emission factors etc with data provided in international databases	To increase the transparency of the information is desirable to specify the character (initial data of emitters or treated and concentrated data, the frequency of data collection and reliability of the data) of the information provided by ESO, EEIC etc data sources (see Chapter 6.1.1 – References – sources of information). Both international and national statistical data were presented in the report but interpretation of the differences is insufficient. **In 1999 a waste classification system adopted from the European Waste Catalogue** was applied by the EEIC, causing possible fluctuations of emission trends (see Fig 6.4 for example – is the reason of the decrease of the amount of waste in 1999 changing classification system), but the differences of approaches were discussed insufficiently in the Report.	There is no international data reported in the NIR. The slight decrease in the total amount of solid waste generated in 1999 was caused by the decrease in the amount of inert waste generated in oil shale industry (Figure 6.4). The oil shale industry is a leader in inert waste generation in Estonia (more than 95% of the total amount of inert waste generated).	
4	General check of the emission results	• Significant fluctuations in emissions between years should be explained. • A distinction should be made between changes in activity levels and changes in emission factors from year to year, and the	In current report the fluctuations and reasons of sharp changes are explained insufficiently (see remarks below) both in the case of emission factors and emissions. Emission factors were calculated according to the		

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
		reasons for these changes documented. • If different emission factors are used for different years, the reason for this should be explained and documented.	IPCC default methodology, taking into account country-specific activity data, as it was noted before, but the reasons of mutability are not investigated properly. In several cases information provided in the text of the Report and in the Reporter differs substantially. Because of this the origin of the data provided in Report is sometimes indistinct or the results of the calculations presented in Reporter are not discussed in the text. For example, in the text of the Report are provided "Amounts of waste generated..." and "Quantity of DOC generated…" in tonnes (Figures 6.4 and 6.5); however, in Reporter the Waste generation rate kg/person/day is presented. Information concerning "Managed waste" is provided in the Reporter but not discussed in the text of the Report etc.	The datasets (Figures, Table) mentioned can not be comparable due to different data reported. Figure 6.4 illustrates data on the total amount of waste generated in 1990–2006. Amounts of degradable waste reported in the figure are presented in table of the CRF (6.A.1). Figure 6.5 demonstrates quantities of DOC (Degradable Organic Content) generated and ratio of DOC landfilled to DOC generated. Table in the CRF (6.A) reports amounts of municipal waste per capita generated in Estonia, the data correspond to Table 6.4 of the NIR (2006). Default parameters, typical for managed SWDS, were used in order in the estimates	

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
				(Table 6.6).	
5	External peer review	The inventory agency should conduct expert (peer) review when first adopting or revising the method	The involvement of the experts by revising of methods, emission factors etc is not discussed in the text of the Report.	Activity data were obtained from EEIC. Parameters used and methods were employed from IPCC Guidelines. No external expert was involved.	
6	Additional notes and remarks concerning the text of the Report and the tables provided in Reporter	Investigation of possible duplications	6.1. Overview of... – "N_2O emissions from sludge application in agriculture are reported in the Agriculture Sector. However, the estimates are provided in the waste chapter." To avoid the duplication of the emission data the follow-up control of the calculations of both chapters is advisable.	In order to guarantee the transparency in activity data, the estimates of N_2O emission from sludge applied on fields were reported in Waste sector.	
7		Control of the numbering	Incorrect numbering of figures (and possible Tables), for example, Figure 6.3 is occurring at least twice ("The map of operating landfills…"; "CH_4 recovered from landfills").	The omission made was fixed.	Chapter 6.2.1 and afterwards
8		Explanation of used methods and abbreviations	Table 6.1. "Methods and emission factors used…" and the text of the Report – to increase the transparency of the information is advisable to add brief description of the methods and definition of the abbreviations used (the abbreviations were defined only partially).	Table 6.1 summarizes data and emission factors employed in the estimates. The explanation of each method used is given throughout the NIR.	
9		Investigation of the fluctuations	Figure 6.2 "Trends of GHG emissions in the waste sector…" in the Report and general tables of the Waste sector of the Reporter – emissions of N_2O and the share of emissions from waste incineration are fluctuating. Additional check of the calculations (data) is needed. If the calculations are reliable, is advisable to comment the processes (see also Chapter 6.3 "Waste incineration").	CO_2-equiv emission from waste sector is reported in Figure 6.2. Emissions from waste incinerated were estimated taking into account activity data reported in annual	

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
				reports of EEIC.	
10	**CH_4 emissions from solid waste disposal sites**	General QC/QA according to the principles of IPCC Good practice Guidance	The inventory of the topic, using FOD method, is generally well presented and complete. Emissions and recovery of CH_4 were calculated in the sub-chapter.		
11		**Estimate of the emissions using different approaches** If the emissions are estimated with the FOD method, inventory agencies should also estimate them with the IPCC default method. The results can be useful for cross-comparison with other countries. Inventory agencies should record the results of such comparisons for internal documentation, and investigate any discrepancies.	The FOD approach was firstly applied in the 2008 submission in Estonia. Previous data were recalculated (both calculations were presented) but the reasons of discrepancies were not investigated properly.	The distinctions in CH_4 emissions are explained by implementation of two different methods – Tier 1 approach and the FOD method.	
12		**Review of emission factors** Inventory agencies should cross-check country-specific values for estimation with the available IPCC values. The intent of this comparison is to see whether the national parameters used are considered reasonable relative to the IPCC default values, given similarities or differences between the national source category and the emission sources represented by the default.	IPCC default emission factors were used in calculations according to the Table 6.6 "Emission factors and parameters used in the calculations", and Reporter. However, according to the Table 6.1 "Methods and emission factors used for estimation of emissions from waste sector" both IPCC and country-specific emission factors were applied. Actually, emission factor of CH_4 was calculated taking into account country-specific information. Check of the formulation and application of the emission factors is needed. The acceptability of IPCC default emission factors or the necessity of elaboration of country-specific factors was not investigated in the text. According to the Reporter the calculated values of	The omission made in Table 6.1 was fixed, only IPCC default parameters were used in order to estimate emissions from 'solid waste disposed on landfills'. IPCC Guidelines stipulates that due to the lack of country-specific emission factors (parameters), IPCC default parameters should be used in the estimates. CH_4 emission factor	Chapter 6.1 and Chapter 6.2.2.

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
			emission factor were rapidly fluctuating. What is the reason of sharp decrease in 1996?	depends on amount of waste disposed and composition of degradable waste disposed. Thus, the sharp decrease in values of EF in 1996 was due to changes in above-mentioned parameters.	
13		**Review of activity data** □ Inventory agencies should compare country-specific data to IPCC default values for the following activity level parameters: MSWT, MSWF, and DOC. They should determine whether the national parameters are reasonable and ensure that errors in calculations have not occurred. If the values are very different, inventory agencies should characterise municipal solid waste separately from industrial solid waste. □ Where survey and sampling data are used to compile national values for solid waste activity data, QC procedures should include: (i) Reviewing survey data collection methods, and checking the data to ensure they were collected and aggregated correctly. Inventory agencies should cross-check the data with previous years to ensure the data are reasonable. (ii) Evaluating secondary data sources and referencing QA/QC activities associated with the secondary data preparation. This is particularly important for solid waste data, since most of these data are originally prepared for purposes other than greenhouse gas inventories.	Use of emission factors – see previous remark. Comparison of IPCC default values with country-specific data is not provided in the Report. Information concerning solid waste in total and managed solid waste was provided in the Reporter. According to the Table 6.7 "Default DOC content of different waste types" – default values were used for determination of DOC content. Country-specific information was provided by Statistic of Estonia, Estonian Environmental Information Centre and by Waste Data Bureau, activity data of CH_4 recovery (biogas production) from "Energy balance" of ESO. However, because of the lack of the earlier data, a waste composition investigated in Netherlands was used for FOD calculations before 2000. The reliability of the information as well as the matter of fluctuations was not investigated in the text.	There are no country-specific EFs used. Country-specific activity data were obtained from ESO, EEIC. The applying of the FOD requires to use data on amount of waste generated and landfilled since 1950. However, composition of waste generated is changing from one decade to another. Due to the lack of country-specific data, the experience of the Netherlands was implemented in the	

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
				estimates.	
			Data presented in the text of the Report and in the tables of Reporter differs partially – information provided in Reporter was not provided and investigated in the text of the Report and *vice versa*. For example information concerning total amounts of generated and landfilled wastes (Fig 6.4 and 6.5 in the text) was not presented in the Reporter. Character of information provided in some tables of Reporter ("Fraction of MSW disposed to SWDS", "Fraction of DOC in MSW" in the case of "Managed Waste" etc) was not investigated in the text.	Figure 6.4 illustrates the data on the total amount of waste *generated* in 1990–2006. Amounts of degradable waste reported in the figure are presented in table of the CRF (6.A.1). Figure 6.5 demonstrates quantities of DOC (Degradable Organic Content) generated and ratio of DOC landfilled to DOC generated. Table in the CRF (6.A) reports amounts of municipal waste per capita generated in Estonia, the data correspond to Table 6.4 of the NIR (2006).	
14		**Involvement of industry and government experts in review** □ Inventory agencies should provide the opportunity for experts to review input parameters. For example, individuals with expertise in the country's solid waste management practices should review the	The involvement of the experts in reviewing of input parameters is not investigated in the text of the report.	Activity data were obtained from EEIC. Parameters and methods were employed from IPCC Guidelines. No expert was involved.	

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
		characteristics of the solid waste stream and its disposal. Other experts should review the methane correction factors.			
15		**Verification of emissions** □ Inventory agencies should compare national emission rates with those of similar countries that have comparable demographic and economic attributes. This comparison should be made with countries whose inventory agencies use the same landfill CH_4 estimation method. Inventory agencies should study significant discrepancies to determine if they represent errors in the calculation or actual differences.	There is no information about described comparisons in the text.		
16	Additional notes and remarks concerning the text of the Report and the tables provided in Reporter	Missing data; variability	Table 6.4 "Population number and amounts of …" Data of the urban population of Rapla county is absent. Why? Waste generation per capita of urban population in different counties differs more than 3 times. Additional verification of the calculations (data) is recommendable. If the calculations are reliable, is reasonable to explain briefly the matter of differences.	The data was not reported by Estonian Office of Statistics. The amounts of waste generation per capita were calculated taking into account number of population and amount of waste generated by counties. These data were checked, the estimates were carried out correctly.	
17		Comparison of methods; explanation of the trend	Figure 6.4 "Amounts of waste generated in Estonia…". "Since 1992 the EEIC has started to collect the waste data in accordance with Estonian waste classification, however in 1999 a waste classification system adopted from the European Waste Catalogue was applied by the EEIC".		

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
			Description of the differences of used methods (what waste sources were not involved using new method since the amounts of waste were decreasing rapidly after implementation of new classifier) is advisable. A brief comment why the amounts of waste are increasing in last years is desirable.	Amounts of waste generated and disposed in 1990–2006 are reported in Appendix. The sharp decrease in 1999 is explained by decreasing in inert waste generation (from oil shale industry).	
18		Reporter – explanation of the fluctuation	"Waste generation rate, kg/person/day" – amount of generated waste decreased rapidly in 2001 – why? Correlation with the Figure 6.4 of the Report and with the emission of CH_4?	Table in the CRF Reporter illustrates amounts of municipal waste generated per capita [kg/person/day]. Before 2001 amount of sludge generated was included in municipal waste category, after 2001 quantities of sludge generated is reported separately. The FOD approach was employed in order to estimate CH_4 emission from solid waste disposed, whereas data on waste generation since 1945 were taken into account. Thus, it is not necessary (possible) to figure out correlation between disposal of	

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
				degradable waste and CH_4 emission.	
19		Explanation of the trend, Investigation of the fluctuations; Definition of the abbreviation	Figure 6.5 "Quantity of DOC generated …" Explanation of the trends (is that realistic that at the same time when the amount of waste generation is rising the share of landfilled waste is decreasing) is recommendable. Additional control of the data of 2002 is advisable. If the calculations are reliable, is reasonable to explain the matter of the fluctuation. Definition of DOC should to be added.	The data was checked. The data reported was correct. The common methodology (from IPCC Guidelines) was used for the estimates. Therefore, reporting of definition of DOC is not necessary.	
20		Reformulation of the sentence	"The data presented in Figure 6.6 – Figure 6.9 illustrate **flows of the most important flows** of biodegradable waste in Estonia in 2006." Reformulation of the phrase is advisable.	The sentence is written correctly and re-wording is not necessary.	
21		Investigation of the fluctuations	Table 6.5 "Breakdown of DOC generated …" – additional check of the data (fluctuations, especially – Paper after 2001; Textiles 1994 and 2001) is advisable.	The data were checked. All data reported are correct.	
22		Investigation of the fluctuations; definition of the term; incorrect numbering	Figure 6.3 "CH_4 recovered…" and corresponding information in Reporter – information concerning recovery is provided starting from 1995 and it is rapidly fluctuating. Why the earlier information is absent? (Because of the lack of corresponding plant?) Definition of the concept of "recovery" in current context is advisable.	The data was obtained from Estonian Office of Statistics ('Energy balance' annual report). CH_4 gas started to be recovered firstly in 1995. The common methodologies (from	

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
			NB! Numbering of the figure in the case of the text!	IPCC Guidelines) are used in the estimates, therefore reporting of the definition is not necessary.	
23		Specification of the use of methods;	6.2.2. "Methodology, data availability…" – "The earlier data on waste composition is not available, so a waste composition analysis from the Netherlands was employed in the earlier estimates of the FOD. However, since 2000, some researches have been carried out in Estonia. Thus, in order to estimate CH_4 emissions from solid waste landfilled, the country-specific data were used." It is not unambiguously clear, in what causes were used the Netherlands analogy, when the homeland data.	The incorrectness in the statement was corrected.	Chapter 6.2.2.
24		Specification of the use of methods	6.2.4. "Source-specific recalculations" – "There is one recalculation carried out in the 2008 submission. The FOD approach was employed in order to estimate CH_4 emissions from solid waste disposed on landfills." Explanation the difference of used approaches is needful – why the results are so different (until 2001 the initial data are smaller than recalculated data, after 2001 *vice versa*.	The IPCC Guidelines stipulates methodological differences between two approaches (Tier 1 and the FOD). Therefore, any additional explanations of the methods are not necessary.	
25	**Emissions from waste incineration**	General QC/QA according to the principles of IPCC Good practice Guidance	The inventory of the topic using Tier 1 method is generally well presented and complete. However, because of the rapid fluctuations of amounts of burned waste and emissions additional control of the initial data and calculations is recommended.	The control of activity data was carried out. The data obtained from 'waste reports' provided by EEIC is correct.	
26		**Review of direct emission measurements** □ Where direct measurement data are available, inventory agencies should	The estimation of GHG emissions from waste combustion is carried out taking into account activity data (amounts of waste burned) and		

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
		confirm that internationally recognised standard methods were used for measurements. If the measurement practices fail this criterion, then the use of these emissions data should be carefully evaluated. Where emissions are measured directly, inventory agencies should compare plant-level factors among plants, and also to IPCC defaults. They should review any significant difference between factors.	emission factors. There is no information about direct measurement of the emissions.		
27		**Review of emission factors** Inventory agencies should compare country-specific or plant-specific values of the carbon content of waste, the fossil carbon as fraction of total carbon, and the efficiency of combustion for the incinerator to the default values in Table 5.6. Inventory agencies should review the QC procedures associated with the waste incineration data and analysis used to develop site-specific emission factors. If there is insufficient QC, the uncertainty of the national estimates should be assessed and the use of those data may need to be evaluated.	IPCC default emission factors were used in general (except N_2O for MSW – an experience of Germany – see Table 6.16 **"**N_2O emission factors for incineration of waste"). Information concerning calculation of emission factors was not provided in the text of the Report. According to the text (Fig 6.14 "Averaged CO_2 emission factors …", 6.15 "Averaged N_2O emission factors …") and to the Reporter the emission factors are fluctuating rapidly but the reasons of the fluctuations were not investigated properly. Control of the calculations is advisable. If the calculations are reliable, brief comment of the trends is needed. The notification that the sharp increases in emission factors implied are explained by different composition of amounts of wastes burned is insufficient.	The parameters were obtained from the 2006 IPCC Guidelines. As it was mentioned, the averaged EFs are reported in Figures mentioned. The value of the factors depends on amount of waste burned and composition of waste burned. The sharp decrease or increase in amounts of waste burned is explained in the NIR (Chapter 6.3.2). Table 6.14 illustrates amounts of waste burned by category of waste and Table 6.15 demonstrates parameters required for the estimates.	

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
			Information concerning waste incineration data quality control and investigation of the necessity of development of site-specific emission factors were not provided in the Report. The reliability of used emission factors (calculation methods) in country-specific conditions was not verified according to the text of the report.	The data on amounts of waste incinerated annually collected and reported by EEIC. As it was mentioned in the NIR, Tier 1 approach was employed in the estimates.	
28		**Involvement of experts in the peer review** Expert peer review should be directed at the characterisations of waste fuel and situations where default data are not used. This is particularly true for hazardous and clinical waste, because these wastes are often not quantified on a plant basis and can vary significantly from plant to plant.	The GHG emissions from Waste Incineration were estimated and reported firstly in the 2008 submission. Information about the possible involvement of the experts in peer reviewing of the data and calculations is not provided in the text.		
29	Additional notes and remarks concerning the text of the Report and the tables provided in Reporter	Use of units	6.3.1. "Activity data" – Checking and unification of the use of units (tonnes, Gg) is advisable. (In other sub-chapters the amounts of wastes are presented in tonnes and emissions in Gg in the text of the Report).	The unit reported is correct.	
30		Explanation of the trend	Table 6.14, Fig 6.12 "Amounts of waste burned …" – "As seen, a sharp increase in waste burned was in 1995–1996 due to increases in organic waste (pig manure) and wood waste burned." Check of the text or data is recommendable. After 1996 the amounts of burned waste decreased sharply according to the figure but that isn't investigated in the comments, as well as the reasons of noted increase.	The data presented in Figure 6.13 is based on the data reported in Table 6.14. No additional explanation is required.	
31		Investigation of the fluctuations	Fig 6.13 "Quantity of fossil carbon …" – additional check of the data and calculations (especially 2004) is needed – fluctuations.	The explanation of the sharp increase in 2004 is given in the NIR.	
32		Uncertainties	6.3.4. "Uncertainties…" – uncertainties provided in	As it was mentioned	

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
			Table 6.17 "Estimated values …" are enormous (especially paper/cardboard). Check of the data and adding comment is desirable.	(cited) in the NIR, uncertainty rates were obtained from the 2006 IPCC Guidelines.	
33	**Waste composting**	General QC/QA according to the principles of IPCC Good practice Guidance	The Tier 1 approach was employed in order to estimate emissions from biological treatment of solid waste and sludge application. Emission factors were derived from literature or the IPCC default factors were used. There is no information about the use of country-specific emission factors. The data were provided by EEIC; the reliability of the data as well as the matter of fluctuations was not discussed in the text. Since titles of the sub-chapter in the text of the Report and in the Reporter are different (in Reporter the information is located in chapter "Other"), the comparison of the information presented in different sources is complicated. Is the information about N_2O emissions from sludge application presented in Reporter?	EFs were obtained from IPCC Guidelines, this information was mentioned in the NIR. Table 4.D.1.6 of the CRF reports N_2O emissions from sludge applied on agricultural land.	
34	Additional notes and remarks concerning the text of the Report and the tables provided in Reporter	Investigation of the fluctuations	Table 6.21 "Amounts of municipal sludge …" Checking of the data (especially 2004–2006) is advisable. If the calculations are reliable, brief comment of the matter of the fluctuations is needful. Fig 6.21 "Emissions of N_2O from sludge applied	Activity data on sludge generation, disposal and use for agricultural purposes were obtained from annual reports published by EEIC. The data reported in the NIR were compared with those reported in annual waste reports. No omissions were noted. Activity data were	

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
			…" – Checking of the data (1992, 2004–2006) and correcting of the comment is desirable (comparison with the base year, explanation of the fluctuations, especially the reasons of the sharp decrease in 2004 etc).	obtained from EEIC. Activity data were checked. They are reported correctly. The sharp decrease in 2004 was caused by a law established.	
35	**CH_4 emissions from wastewater handling**	General QC/QA according to the principles of IPCC Good practice Guidance	The handling of wastewater under anaerobic conditions produces CH_4. Since there is not any wastewater treatment plant using anaerobic method in Estonia according to the reported data, the emissions are not occurring.		
36		Incorrect date	6.6.1. "Activity data" – "In **1996**, Estonia built its first wastewater treatment plant." Checking of the date is advisable!	The omission made was fixed. The first wastewater treatment plant was built in 1966.	Chapter 6.6.1
37		Explanation of the recalculations	Table 6.23 "CH_4 emissions from wastewater …" Additional check of the table and the text is needed – what was recalculated according to the 2008 submission? (Recalculated emissions according to the 2008 submission are missing, obviously because of the lack of anaerobic treatment. However, according to the 2007 submission the emissions were calculated – how?)	It was investigated in 2008, that mechanical, biological and chemical wastewater treatment methods are used in Estonia (this information is mentioned in the NIR). Thus, incorrect information given in the preceding submissions was corrected.	
38	**N_2O emission from human consumption followed by municipal sewage treatment**	General QC/QA according to the principles of IPCC Good practice Guidance	The default IPCC (Tier 1) method and the default emission factors were used in calculations. The data of population were obtained from the ESO, the annual per capita protein consumption from FAO statistical databases; the reliability of the data is not discussed in the text.		

	Description of QA procedure	Brief description of review scope and the character of the problems	Major conclusions from the review (include a reference to the review)	Action taken	Place where it is filed
			Since the titles of the chapter in the text of the Report and in the Reporter are different (information concerning N_2O emissions is provided in the chapter "Wastewater handling" in Reporter), comparison of the information provided in different sources is complicated. Investigation of the emissions of the sector in the text of the Report is superficial.	The title of the sub-chapter specified N_2O emission from human sewage indicates a table reported emissions in the CRF (Table 6.B.2.2).	
39	Additional notes and remarks concerning the text of the Report and the tables provided in Reporter	Explanation of the recalculations	6.7.4. Source specific recalculations. "There is one recalculation carried out in the 2008 submission due to an omission made in the preceding submission." Investigation of the character of the omission is needed since recalculated emissions differ from previous calculations.	The omission was made in the process of the calculation. Therefore, reporting of explanation is not necessary.	