

# *National Greenhouse Gas Inventory System in Finland*

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**Tilastokeskus  
Tilastoarkisto**

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## *Foreword*

Statistics Finland has prepared the description of Finland's Greenhouse Gas Inventory System as part of the official documentation for the establishment of the National System in Finland.

The Government resolution of 30 January 2003 on the organisation of climate policy activities of Government authorities means that by the end of 2004 Statistics Finland assumes the responsibilities of the National Authority for Finland's greenhouse gas inventory.

In Finland the National System as intended in the Kyoto Protocol (Article 5.1) is based, besides regulations concerning Statistics Finland, on agreement arrangements between the inventory unit and expert

organisations on the production of emission calculations and reports and on co-operation between the responsible ministries.

This description covers the legal and agreement basis of the inventory system, parties to the National System in Finland and their responsibilities as well as the quality management methods of the inventory. The reporting protocols for the inventory division of labour are appended.

Statistics Finland's activities as the National Authority are also illustrated.

The Ministerial Workgroup on Climate and Energy Policy discussed the description of Finland's greenhouse gas inventory system on 19 November 2004.

Statistics Finland  
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Director General

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# Summary

## *Purpose of the National System*

The National System supports compliance with the Kyoto Protocol. In addition to the annual calculations of greenhouse gas emissions, the system is used to produce estimates about the actual effects of the climate policy and forecasts for future development.

The National System guarantees that the data not only conform to the quality requirements but they are also officially approved by governments. In Finland the National System is established on a permanent footing

in place of the previous, workgroup-based emission calculation and it guides the development of emission calculation in the manner required by the agreements.

The National System must ensure the transparency, consistency, comparability, completeness, accuracy and timeliness of greenhouse gas emission inventories. The quality requirements are fulfilled by implementing consistently the inventory quality management procedures.

## *Parties to the evaluation system and the regulation basis*

The Government resolution of 30 January 2003 on the organisation of climate policy activities of Government authorities means that by the end of 2004, Statistics Finland assumes the responsibilities of the National Authority for Finland's greenhouse gas inventory. In Finland the National System as intended in the Kyoto Protocol (Article 5.1) is based besides regulations concerning Statistics Finland on agreement

arrangements between the inventory unit and expert organisations on the production of emission calculations and reports and on co-operation between the responsible ministries.

The Ministerial Workgroup on Climate and Energy Policy discussed the proposal on Finland's greenhouse gas evaluation system on 19 November 2004.

## *Statistics Finland as the National Authority for the inventory*

Statistics Finland as the general authority of the official statistics of Finland is independently responsible for greenhouse gas emission calculations to the United Nations Framework Convention on Climate Change (UNFCCC), and in its activity as the National Authority for the greenhouse gas inventory the Statistics Finland Act and the Statistics Act are applied.

Statistics Finland defines the placement of the inventory functions in its working order. At the same time, Statistics Finland sets up an advisory board to which representatives from the expert organisations and the responsible Government ministries are invited. The advisory board will decide about changes to the inventory's division of labour as agreed for reporting

sectors. In addition, the advisory board will supervise longer term research and review projects related to the development of the inventory and reporting, as well as the responsibilities of international co-operation in this area (UNFCCC, IPCC, EU), incl. inventory reviews.

Statistics Finland as the National Authority is in charge of the preparation of the national emission inventory and its quality management in the manner intended in the Kyoto Protocol. As the National Authority Statistics Finland also bears the responsibility for the general administration of the inventory and communication with the UNFCCC, co-ordinates participation in reviews, and publishes and archives the inventory results.

## *Responsibilities of expert organisations*

According to the Government resolution, Finland's inventory system includes besides Statistics Finland the expert organisations that have previously taken part in the emission calculation. With regard to this co-operation, separate agreements are made with the Finnish Environment Institute, Agrifood Research Finland and the Finnish Forest Research Institute. Statistics Finland also acquires parts of the inventory as a purchased service.

The agreements confirm the division of responsibilities recorded in the reporting protocols and they specify the procedures for the annual emission calculation and quality management co-ordinated by Statistics Finland. The reporting protocols are based on the responsibility areas of different expert organisations and on Finland's established practice for the compilation of the emission inventory. The sector for which Statistics Finland is responsible is also defined in the reporting protocols.

## The role of responsible ministries in the evaluation system

The resources of the National System for expert organisations are channelled through the relevant ministries' performance guidance (Ministries of the Environment and of Agriculture and Forestry).

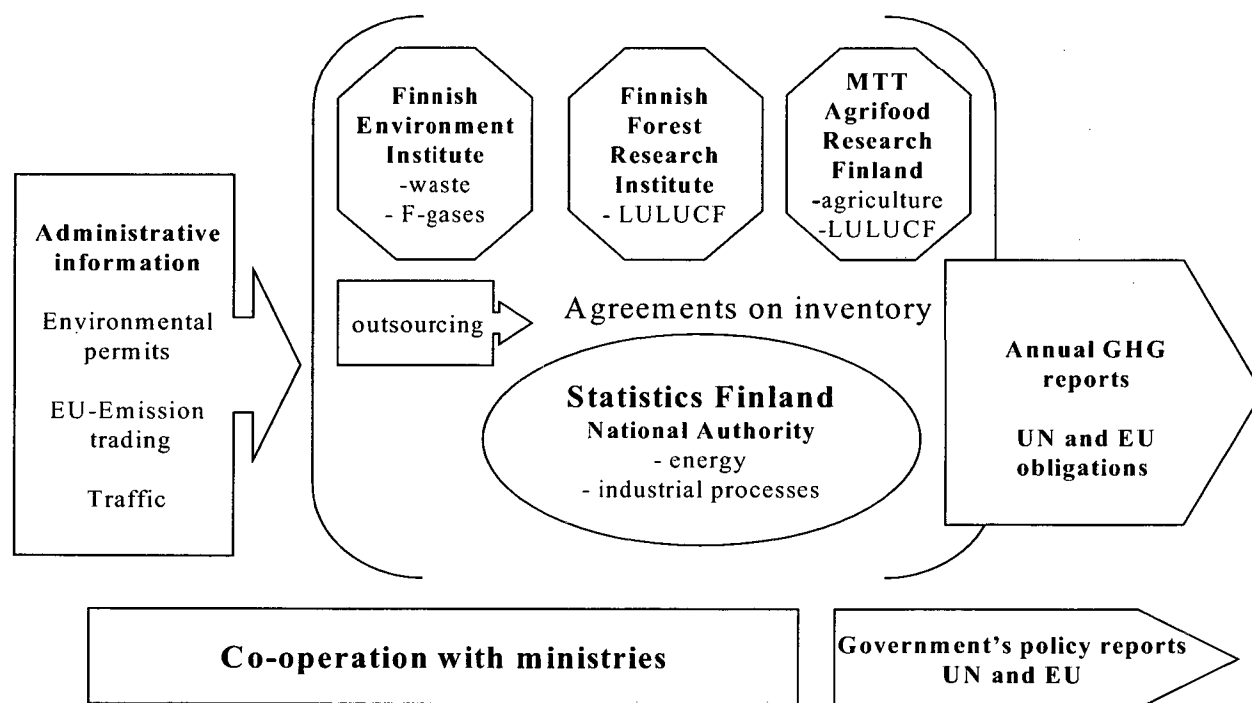
In addition, other ministries participating in preparation of the climate policy advance in their administrative branch that the data collected in management of public administration duties are used in the emission inventory.

In accordance with the Government resolution, the ministries produce the data needed for international

reporting on the content, enforcement and effects of the climate strategy. Separate agreements can be made on co-operation between Statistics Finland and the ministries. The structure of the inventory system corresponds to the horizontally organised preparation of Finland's climate policy.

Statistics Finland assists in the technical preparation of reporting. Statistics Finland will compile technically the National Communication for the year 2005 to be submitted to the UNFCCC.

### National Greenhouse Gas Inventory System in Finland



## *Quality management and improvement of the inventory*

The quality of the inventory is created in the course of the calculation and reporting work. The requirements, principles and elements due to international agreements and guidelines are integrated directly into the institutional and functional practical solutions of Finland's National System, i.e. into its organisation and processes. Explicit inventory documentation produces the required evidence on the compliance and functionality of the inventory system for co-operation of the parties to the Framework Convention on Climate Change and the EU Member States.

In addition to attention to the special requirements of the guidelines concerning greenhouse gas inventories, production of a high-quality inventory is supported by the application of the principles and elements included in the general standard for quality management systems ISO 9001:2000.

Compilation and reporting for the annual inventory consists of four main stages: planning, preparation, evaluation and improvement. Inventory documentation comprises the basic documents of the inventory system and the sector-specific calculation documents and the total inventory level documents of the annual inventory process.

The first stage development projects of the inventory include recalculation of energy-based emissions, supplementation of the emission calculation concerning industrial processes and reallocation of fugitive emissions in peat production. In addition, reviews are needed to meet the Kyoto Protocol reporting requirements especially with regard to land use, land improvement and the forestry sector.



# 1. Purpose of the National System

## 1.1. Obligations of the UN Framework Convention on Climate Change and the Kyoto Protocol

Finland has made a commitment to follow the United Nations Framework Convention on Climate Change that entered into force on 21 March 1994. In 1997 the legally binding Kyoto Protocol was approved under the UN Framework Convention on Climate Change, and it was ratified by the EU and Finland in May 2002. With these agreements Finland is obliged, as part of the EC's common emission target, to limit its emissions of greenhouse gases<sup>1</sup> in the first commitment period, i.e. from 2008 to 2012 to the same average level as the emissions for 1990.

The Kyoto Protocol (Article 5.1) requires that the parties have in place a National System by the end of 2006 at the latest for estimating anthropogenic

greenhouse gas emissions by sources and removals by sinks and for reporting and archiving the results. In the Decision of the European Parliament and of the Council concerning a mechanism for monitoring Community greenhouse gas emissions (280/2004/EC) it is required that Member Countries establish a national greenhouse gas inventory system as fast as possible and by the end of 2005 at the latest and that the Commission adopts the EC's inventory system by 30 June 2006.

The Government resolution of 30 January 2003 on the organisation of climate policy activities of authorities requires that Finland's inventory system is already launched by the end of the year 2004.

## 1.2. Functions of the National System

The National System defined in the agreements (UNFCCC Decision 20/CP.7) produces for the UNFCCC and for each country reliable and comparable monitoring data on compliance with the Kyoto Protocol obligations. Reporting in accordance with the National System is reviewed yearly, with the aim of developing the annual inventories. The future use of the Kyoto mechanisms is also based on that the parties have in place an internationally examined and approved National System.

The National System supports compliance with the Kyoto Protocol. In addition to annual emission inventory, it is used to produce estimates about the actual effects of the climate policy and forecasts for future development.

The EU's greenhouse gas monitoring mechanism (280/2004/EC) combines annual emission inventories, the climate strategy and the evaluation of the effect of the policy measures and planning of new measures into

a dynamic process. The Commission decision on the implementing provisions of the monitoring mechanism (29.10.2004) specifies in detail the content of the reports to be submitted to the Commission. By means of the monitoring system, common EU reports can be prepared for the UNFCCC.

The National System guarantees that the data are not only in compliance with the quality requirements but that they are also officially approved by governments. In Finland the National System is established on a permanent footing in place of the previous, workgroup-based emission calculation and it guides the development of emission calculation to meet the requirements of the agreements.

In setting up Finland's National System, experiences of other Nordic Countries and the Netherlands have been used for the administrative arrangements of emission monitoring.

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<sup>1</sup> The greenhouse gases intended in the Kyoto Protocol are carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O) and halogenated hydrocarbons, or so-called F-gases (HFC compounds, PFC compounds and sulphur hexafluoride SF<sub>6</sub>).

Finland will implement the National System in the manner described below, on the basis of **the following general functions of the National System specified in the agreements** (UNFCCC Decision 20/CP.7):

(a) Establish and maintain the institutional, legal and procedural arrangements necessary to perform the functions defined in these guidelines for national systems, as appropriate, between the Government agencies and other entities responsible for the performance of all functions defined in these guidelines;

(b) Ensure sufficient capacity for timely performance of the functions defined in these guidelines for national systems, including data collection for estimating anthropogenic GHG emissions by sources and removals by sinks and arrangements for technical competence of the staff involved in the inventory development process;

(c) Designate a single national entity; with overall responsibility for the national inventory;

(d) Prepare national annual inventories and supplementary information in a timely manner in accordance with Article 5 and Article 7, paragraphs 1 and 2, and relevant decisions of the COP and/or COP/MOP;

(e) Provide information necessary to meet the reporting requirements defined in the guidelines under Article 7 in accordance with the relevant decisions of the COP and/or COP/MOP.

In order that the objectives of the National System would be met and the above-described general functions would be performed, each country has to carry out special functions connected to the planning, preparation and management of the inventory. The designated National Authority (see c above) is in charge of these functions, which will be detailed in Section 4.

### *1.3. Quality requirements of the emission inventory*

The National System must ensure the transparency, consistency, comparability, completeness and accuracy of greenhouse gas emission inventories. The EU's decision on the monitoring mechanism also requires timeliness of the inventory. The quality requirements are fulfilled by implementing consistently the inventory quality management procedures.

The transparency of the inventory means that the methodologies, assumptions and references used in the inventory are documented clearly so that the evaluation and where necessary, replication of the inventory would be possible on the basis of the documentation.

The consistency of the inventory requires that the used methodologies are the same both in the inventory base year and in the years following it and that consistent data sets have been used as the basis for emission and sink estimates. When the methodology changes, recalculation of the inventory must be performed transparently in accordance with the IPCC Good Practice Guidance.

The comparability of the inventory requires that the methodologies (IPCC guidelines) and the mode of presentation (CRF tables) agreed in the Conference of the Parties to the UNFCCC are used in the inventory calculation and reporting. The emission source and sink classification must follow the IPCC guidelines on the level of summary and sectoral tables.

The completeness of the inventory means both regional completeness and that the inventory covers all the emission sources, sinks and gases and all the significant emission source and sink categories mentioned in the IPCC guidelines.

The accuracy of the inventory illustrates the exactness of emission or sink estimates: the calculation results are not systematic over or under estimations with regard to the actual emissions or sinks and also, uncertainties are as small as possible.

The timeliness of the inventory requires preparation and reporting of the inventory to the agreed annual schedule.

## 2. *Legal and agreement basis of the inventory system in Finland*

Emission data on Finland have been reported to the UN Framework Convention on Climate Change since 1994 and to the European Commission since 1999. In addition, National Communications have been sent to

the UNFCCC in the years 1995, 1997 and 2001. The Ministry of the Environment has been responsible for the reports made to the UNFCCC in accordance with the Government's division of labour.

### 2.1. *Government resolution*

The Government resolution of 30 January 2003 on the organisation of climate policy activities of Government authorities means that Statistics Finland is the National Authority responsible for Finland's greenhouse gas inventory.

In the resolution the National System as intended in the Kyoto Protocol is defined so that it comprises the national inventory unit, the contractual arrangements it concludes with different expert organisations and the entire production system of emission statistics and reporting.

Statistics Finland as the National Authority is in charge of the compilation and finalisation of inventory reports and of their submission to the UNFCCC Secretariat and the EC Commission. Statistics Finland compiles technically the National Communication to the UNFCCC, which is discussed in the Ministerial Workgroup on Climate and Energy Policy.

The inventory data and the descriptions of the inventory system needed for the inventory report and other reports are prepared by the inventory unit with its contracting parties. The Ministry of Trade and Industry is in charge of the descriptions and evaluation of the policy actions and of the preparation of the scenario assessments needed in the reports. The sector ministries supply the separate data needed in the reports.

The Government resolution defines the structure and the principal responsible bodies for Finland's National System. The present description of the National System specifies these definitions and the division of responsibilities. The Framework Convention on Climate Change and the EU's monitoring mechanism also require such description as part of reporting. The Ministerial Workgroup on Climate and Energy Policy discussed this description on the greenhouse gas evaluation system on 19 November 2004.

### 2.2. *Statistics Finland Act and Statistics Act*

The Statistics Finland Act (24 January 1992/48) charges Statistics Finland with the duty to compile statistics and reports describing the conditions in society and to provide for the general development of official statistics in collaboration with other Government authorities. Statistics Finland also performs other duties that may be assigned to it by decree or order.

In the performance targets agreed with the Ministry of Finance Statistics Finland is committed to function as the National Authority for the inventory.

The Statistics Act (23 April 2004/280) defines the national statistical service authorities and it regulates the principles of data collection, compilation of statistics, confidentiality and release of data and other issues steering the national statistical service. Statistics Finland as the general statistical authority compiles those statistics whose collection has not been

specifically assigned to some other authority. Statistics on the environment are not assigned to any authority.

The above-mentioned regulations are applied to the functioning of Statistics Finland as the National Authority for the greenhouse gas inventory as specified in the Kyoto Protocol.

Statistics Finland as the general statistical authority is independently responsible for the greenhouse gas emission inventory to the UNFCCC and to the European Commission. This concerns the annually supplied national reports (UNFCCC Decision 18/CP.8), including the emission calculation and the methodological report on the inventory. These reports are not dealt with yearly in the Ministerial Workgroup. The regulations and operating principles related to the national statistics service lend support to the preparation of the emission inventory in line with the requirements.

### 2.3. Statistics Finland's working order

Statistics Finland's working order (31 January 2003) specifies the operating organisation, organisation units and their duties, Statistics Finland's management and settlements of issues, presentation of matters and some other procedures. Statistics Finland determines the placement of inventory tasks in its working order. Statistics Finland also sets up an advisory board to which representatives from the expert organisations and the responsible Government ministries are invited.

The advisory board decides about any changes to the inventory's division of labour agreed in the calculation protocols attached to this description. In addition, the advisory board deals with longer term research projects and studies connected to the development of the inventory and reporting and the responsibilities of international co-operation in this area (UNFCCC, IPCC, EU), incl. inventory reviews.

### 2.4. Agreements and other arrangements

According to the Government resolution, Finland's inventory system includes besides Statistics Finland the expert organisations that have previously taken part in the emission inventory. Separate agreements are made on this co-operation.

The agreements with the expert organisations specify the division of responsibilities recorded in the reporting protocols and Statistics Finland's co-ordination in the annual emission inventory and in its quality management. The protocols are based on the responsibility areas of different expert organisations and Finland's established practice for the compilation of the emission inventory. The reporting protocols were prepared in 2004 according to Table (1) and they are presented in Annex to this description. Other quality management methods and documentation are discussed in Section 4.

Statistics Finland also acquires parts of the calculation and development work from expert organisations as a purchased service.

The Government resolution specifies the responsibilities of different ministries for the

preparation and reporting of climate policy. Separate agreements can be made on co-operation between Statistics Finland and the ministries.

The climate policy organisations mentioned in the Government resolution will be responsible for other reporting or estimates based on the National System, especially evaluation of the compliance with the Kyoto Protocol and the reports required by the EU's monitoring mechanism on the national climate strategy and its effects, as well as the reports on the impacts of different measures, and Statistics Finland will assist in the technical preparation of the reports.

Statistics Finland will compile technically the National Communication for the year 2005 to be submitted to the UNFCCC, which is discussed in the Ministerial Workgroup in question. The ministries involved in the preparation of the climate policy produce for the National Communication data on the content, enforcement and effects of the climate strategy in their own sectors. Statistics Finland is in charge of the printing of the approved report.

**Table 1. Reporting protocols and their responsible organisations in 2004**

| <b>Reporting protocols</b>  | <b>Responsible organisations</b>                                       |
|---|--|
| <b>A.</b> Point sources, stationary combustion<br>– fuel combustion in point sources, such as power plants, heating boilers, industrial combustion plants and processes | Statistics Finland   |
| <b>B.</b> Mobile sources<br>– transport and off-road machinery  | Technical Research Centre of Finland (VTT)<br>(as a purchased service) |
| <b>C.</b> Other fuel combustion (agriculture, households, services, public sector, etc.)  | Statistics Finland   |
| <b>D.</b> Fugitive emissions from fuels   | Statistics Finland   |
| <b>E.</b> Emissions from industrial processes   | Statistics Finland   |
| <b>F.</b> Emissions of F-gases  | Finnish Environment Institute  |
| <b>G.</b> Non-methane volatile organic compounds, NMVOC   | Finnish Environment Institute  |
| <b>H.</b> Emissions from agriculture, non-combustion emissions  | Agrifood Research Finland (MTT)  |
| <b>I.</b> Emissions from land use and land use change   | Finnish Forest Research Institute, Agrifood Research Finland           |
| <b>J.</b> Emissions from waste treatment  | Finnish Environment Institute  |
| <b>K.</b> Other emissions   | Statistics Finland   |

### 3. Parties to the National System and their responsibilities in Finland

#### 3.1. Statistics Finland's responsibilities as the National Authority

On the basis of the performance targets agreed with the Ministry of Finance and within the limits allowed by the budget, Statistics Finland has undertaken the responsibility for the functions listed below:

- co-ordination of the annual greenhouse gas inventory, compilation of the results and their reporting according to the guidelines of the UNFCCC and the EU greenhouse gas monitoring mechanism and by following the schedules;
- preparation of Statistics Finland's contribution to inventory in accordance with the reporting protocols A. (Stationary sources), C. (Other fuel combustion), D. (Fugitive emissions from energy production and distribution), E. (Emissions from industrial processes), and K. (Other emissions);
- administration of Finland's greenhouse gas inventory system, including maintenance of the agreements and reporting protocols and preparation for the meetings of the advisory board;
- co-ordination of the inventory quality management (QA/QC procedures), inventory uncertainty assessments and preparation of the inventory improvement plan;
- co-ordination of the archiving of inventory-related data and preparation of Statistics Finland's contribution;
- participation in UNFCCC reviews and co-ordination of the national feedback given in them;
- production of Finland's contribution to the EC inventory and participation in co-operation according to the decision on a monitoring mechanism (Article 8);
- publishing of the inventory results according to the annual plan and production of inventory data in Finnish;
- participation in the Climate Change Committee and its workgroups in matters related to the EC inventory system;
- national co-ordination of the expert work for international development of the inventory (UNFCCC, IPCC; EU) as agreed yearly in the advisory board;
- calculation of the annual indicators in accordance with the implementing provisions of the EU's greenhouse gas monitoring mechanism.

#### 3.2. Responsibilities of expert organisations in the evaluation system

In addition to Statistics Finland, the authorities participating in the inventory are the Finnish Environment Institute, Agrifood Research Finland and the Finnish Forest Research Institute. The expert organisations are committed in the agreements they conclude with Statistics Finland:

- to produce emission calculations following the division of labour defined in the reporting protocols and according to the UNFCCC guidelines in force;
  - to follow the inventory quality management procedures co-ordinated by Statistics Finland and to produce for it the required documents (incl. descriptions of inventory calculation by CRF category and internal documentation) and to be responsible for archiving its own original data;
  - to take part, where necessary, in inventory reviews.
- In addition, the expert organisations take account of Statistics Finland's publication plan when they publish inventory results and background data. The organisations have the possibility to name their representatives to the advisory board set up by Statistics Finland and present annually to the advisory board a plan on their participation in international collaboration for the development of the inventory and on the resources needed for that.

#### 3.3. Outside assignments

Statistics Finland commissions as a purchased service, within the limits allowed by its budget and with consideration to the rules on competitive tendering:

- calculation on emissions from traffic
- other reports related to development of the inventory
- work requiring special knowledge such as that of a scientific editor for international reporting.

### 3.4. Agreements with the responsible ministries

The resources of the National System for expert organisations come through the relevant ministries (Ministries of the Environment and of Agriculture and Forestry). In addition, the ministries (Ministries of the Environment, of Transport and Communications and of Trade and Industry) can in their administrative branches advance that Statistics Finland uses the data collected through public administration duties for the emission inventory when making decisions related to databases and use of information technology, for example. Separate agreements can be made on co-operation between Statistics Finland and the ministries.

In their performance guidance the ministries see to the resources needed by the organisations participating in the calculation (Finnish Environment Institute, Finnish Forest Research Institute and Agrifood Research Finland) for their contribution according to the inventory calculation protocols.

Statistics Finland uses or will use in the emission inventory the following administrative data produced under different ministries, aiming to utilise as high-quality emission and activity data as possible:

- the environmental administration information system (VAHTI), from the sector of the Ministry of the Environment
- plant-specific emission monitoring data related to emissions trading and the emissions trading balances from the Energy Market Authority, from the sector of the Ministry of Trade and Industry
- traffic data from the Finnish Maritime Administration, VR-Group and the Finnish Road Administration, from the sector of the Ministry of Transport and Communications.

The quality of the administrative records is primarily the responsibility of the Government agencies and ministries but the inventory quality criteria are also applied to these (see 1.3).

Statistics Finland invites representatives of the ministries to the advisory board it establishes.

Reporting according to the EU's greenhouse gas monitoring mechanism requires close collaboration between Statistics Finland and the ministries.

According to the implementing provisions concerning the monitoring mechanism (29 October 2004), reports to the Commission are compiled in the following way:

- Statistics Finland supplies the inventory results to the register recording Finland's assigned amount units according to the Kyoto Protocol as well.
- Statistics Finland attaches to the reports to the Commissions the information derived from the register authorities on changes in the national emission balance caused by the Kyoto mechanisms as well as the reporting related to the use of Articles 3.3 and 3.4 of the Kyoto Protocol.
- Statistics Finland produces the indicators specified in the implementing provisions (Article 7) and their activity data on all emission sectors.
- Statistics Finland appends to the reports made to the Commission and to the National Communication the information concerning the policy measures, scenarios and Kyoto mechanisms in the implementing provisions (Articles 8 to 11), which according to the Government resolution ministries produce in their preparation of the climate policy.
- in the inventory report in 2006 Statistics Finland will produce an inventory on the base year 1990, which is combined to the other data intended in the implementing provisions (Article 23) to be submitted to the Commission by 15 January 2006 as the report for Finland, for determination of Finland's assigned amount in line with the Kyoto Protocol and in accordance with the agreement concerning the division of burden of the European Community and the Member States according to Article 4 of the Kyoto Protocol.

## 4. Inventory quality management

The objective is that the inventories produced by the Finland's National Greenhouse Gas Inventory System and the reporting on them are of high quality. The high quality of the inventory means that the inventory is in compliance with the requirements and it is suitable to its intended use, that is, to produce for the parties to the Framework Convention on Climate Change in usable form the information needed about Finland on its advancement in fulfilling the obligations of the Kyoto Protocol. The information needs of the EU's monitoring mechanism of greenhouse gases are also met.

The starting point for accomplishing high quality for the greenhouse gas inventory is identification and understanding of the expectations and requirements directed to the inventory. The requirements set for monitoring of greenhouse gases – transparency, consistency, comparability, completeness, accuracy and timeliness – are dimensions for the quality of the inventory that form the set of criteria for assessing the quality of the inventory.

The quality of the inventory is created in the course of the compilation and reporting. The requirements,

principles and elements arising from international agreements and guidelines are integrated directly into the institutional and functional practical solutions of Finland's greenhouse gas inventory system, i.e. into its organisation and processes. Explicit inventory documentation produces the required data on the compliance and functionality of the inventory system for the parties to the Framework Convention on Climate Change and to the EU Member States.

The special knowledge on the inventory quality management lies within the National Authority. A workgroup has been established to advance communication between the inventory unit and the expert organisations in charge of different sectors. The planned electronic operating manual will be a key instrument for communication between the different parties of the inventory, for steering of quality management and for management of inventory documents. An extranet application for the greenhouse gas inventory databank and the inventory unit's Internet pages have already been introduced.

### 4.1. Specific functions of the National System

Sections 12 to 17 of the guidelines for national systems (UNFCCC Decision 20/CP.7) list the specific functions related to the inventory planning, preparation and management intended to be performed by the national system, which will assist in the attainment of the objectives set for the national systems and in the performance of their general functions (see 1.2).

Practical quality management solutions made in Finland's Greenhouse Gas Inventory System are based on the accomplishment of the special functions of the national systems. The quality management activities according to the requirements aim for an undisturbed inventory process and for systematic, continuous, fact-based improvement of the inventory.

The quality management activities are a management tool for the inventory unit, which directs and steers Finland's greenhouse gas inventory system to fulfil the specific functions defined for national systems and to produce an inventory meeting the requirements. Quality management comprises practical solutions with which

- a systematic inventory process is established, where the inventory planning stage is followed by the inventory preparation, evaluation and improvement stages

- the different parties of the inventory and their duties and responsibilities in the inventory process are itemised
- the standards for the inventory quality requirements (transparency, consistency, comparability, completeness, accuracy and timeliness) are set in the inventory planning stage and they are recorded as the quality objectives of the inventory
- the quality assurance and quality control activities to be made during the inventory processes required for attaining the quality objectives are planned and they are recorded as the quality control/quality assurance plan
- compliance with the IPCC guidelines is ensured in identification of the key source categories, preparation of emission estimates, uncertainty assessment, recalculations and in quality control and quality assurance implementation
- the planned general Tier 1 level quality control procedures are performed
- in the key source categories and in source categories, where significant methodological changes have occurred, the Tier 2 level quality control procedures are applied, where possible.



- the planned inventory evaluations (basic review/ extensive review) are made – in accordance with the guidelines, preferably by an independent party – before the submission of the inventory
- the inventory is documented and archived according to the requirements
- the review processes of the inventory are enabled
- the inventory and the inventory process are improved continuously on the basis of reviews and of the experience and factual knowledge gained and from e.g. quality control checks and quality assurance evaluations in order to meet the set quality objectives.

## *4.2. Principles of the International Standard ISO 9001:2000*

In addition to consideration to the special requirements of the guidelines concerning greenhouse gas inventories, production of a high-quality inventory is supported by the application of the principles and elements stated in the general standard for quality management systems ISO 9001:2000. The requirements of the ISO 9001 standard are based on eight quality management principles which are fairly analogous with the international guidelines concerning quality management of greenhouse gas inventories: customer focus, leadership, involvement of people, process approach, system approach to management,

continual improvement, factual approach to decision-making and mutually beneficial supplier relationships.

The application of the principles of the ISO 9001 standard facilitates international comparability of the quality management of Finland's greenhouse gas inventory system. The aimed evaluation of the inventory by an independent party could be arranged so that the quality management system would be supplemented in line with the requirements of the ISO 9001 standard and the system would be certified. This would specifically concern evaluation of the system.

## *4.3. Reporting of the annual inventory*

The UNFCCC and the EU's greenhouse gas monitoring mechanism require Finland to submit annually a National Inventory Report (NIR) and Common Reporting Format (CRF) tables. The reported data indicate consistently the emissions during the year before last (x-2).

The organisation of the preparation and reporting of Finland's greenhouse gas inventory and the duties of its different parties are detailed in the previous section (3). The expert organisations acting as the parties to the inventory system are in charge of the inventory data of the reporting sectors according to the reporting protocols. Statistics Finland as the National Authority compiles from the data produced by expert organisations national reports meeting the requirements of the UNFCCC and the EU's monitoring mechanism and

submits them to the UNFCCC Secretariat and to the European Commission.

The preparation of the annual inventory follows the schedule of the reporting. In the EU's monitoring mechanism the national inventory from the year (x-2) is submitted to the Commission by 15 January. The Member States may complement and update their submission by 15 March. The joint EU inventory is compiled from the Member States' submissions and it is supplied to the UNFCCC Secretariat by 15 April. The Commission uses the inventory data submitted annually by Member States also when evaluating the progress of the Community towards the set greenhouse gas emission objectives. Finland's final greenhouse gas inventory for the year (x-2), identical with the EU inventory, is presented to the UNFCCC Secretariat by 15 April.

**Table 2. Reporting of Finland's annual greenhouse gas inventory to the EU's monitoring mechanism and to the United Nations Framework Convention on Climate Change**

| Function   | Reporting   | Responsible body   | Time period | Further information  |
|--|---|--------------------|-------------|--|
| Submission of the National Inventory Report (CRF tables and certain NIR parts) | The EU's greenhouse gas monitoring mechanism /European Commission | National Authority | 15 January  | Content of submission: 280/2004/EC 3(1)  |
| Submission of updated and complementary inventory data and of the final NIR    | The EU's greenhouse gas monitoring mechanism /European Commission | National Authority | 15 March    | Submission of the final NIR: 280/2004/EC 3(1)<br><br>Updating of submission (only missing data and inconsistencies) 280/2004/EC 4(1) |
| Submission of the National Inventory Report (CRF tables and NIR)               | UNFCCC /UNFCCC Secretariat  | National Authority | 15 April    | 18/CP.8: UNFCCC reporting guidelines on annual inventories   |

#### 4.4. Annual inventory process

The compilation and reporting for the annual inventory consist of four main stages: planning, preparation, evaluation and improvement.

At the **inventory planning stage** the methodological and organisational solutions for the coming inventory round are made, the resources are reserved for the inventory work and the schedules are decided. In addition, the inventory quality objectives are set, the inventory quality assurance and quality control plans are made and the inventory description documents are updated.

At the planning stage the inventory unit drafts an annual general plan for compilation of the inventory and supplies it to the expert organisations responsible for the calculation sectors. The annual general plan for inventory compilation specifies the schedules for the coming inventory round and the procedures of the inventory unit in the compilation and reporting of the inventory. In addition, the quality objectives relating to the entire inventory are recorded in the plan, as are the planned quality control checks and quality assurance evaluations.

The expert organisations update the inventory descriptions by CRF category on their reporting sectors during the inventory planning stage. The inventory descriptions contain information by CRF category on the future inventory concerning:

- the organisation, work process and schedules of the inventory preparation
- the used methods and source data
- uncertainty assessments
- recalculations

- possible quality objectives and planned quality control checks and quality assurance procedures
- verification
- the planned improvement measures
- documentation and archiving.

The **inventory preparation stage** comprises inventory calculation (regarding the total inventory: compilation of the inventory), the quality control checks and uncertainty assessments performed during it according to the quality control plan. In addition, the stage also includes the production and archiving of internal documentation for the calculation and reporting on the inventory results.

Inventory Quality Control (QC) is a set of routine technical activities to measure and supervise the quality of the inventory as it is being prepared. The purpose of quality control is to provide routine and consistent checks to ensure data integrity, correctness and completeness, to identify and address errors and omissions, and to document and archive the inventory material and record all QC activities.

The quality control activities comprise general (Tier 1) methods, such as accuracy checks on data acquisition and calculation and the use of approved standardised procedures for emission calculations, measurements, estimating uncertainties, archiving information and reporting. The general inventory QC procedures concern all the source categories of Finland's greenhouse gas inventory and also the total inventory.

The general inventory QC checks and the related procedures are in accordance with Table 8.1 of the IPCC Good Practice Guidance.

In addition to general QC checks, source category specific QC checks (Tier 2) are applied for the key source categories and source categories with significant changes in the methodology or source data. These source category specific QC activities comprise technical reviews of the source categories, activity data, emission factors and methods.

The CRF tables are produced as a result of the inventory preparation stage. Expert organisations supply the data needed in the CRF tables to the inventory unit according to the reporting protocols. The inventory unit assembles from these a set of CRF tables. The inventory preparation stage also involves production of the contributions concerning inventory documentation to the National Inventory Report (NIR). Once the inventory calculation is completed, the expert organisations update the inventory descriptions by CRF category to correspond to the actual inventory calculation and supplement them by the planned inventory improvement measures.

The quality assurance activities of the inventory recorded in the quality assurance plan are performed at the **inventory evaluation stage**.

Quality Assurance (QA) required of the inventory comprises a planned system of review procedures. Where possible, the review should be made by personnel not directly involved in the inventory compilation process. The reviews preferably by an independent third party should be directed after the implementation of QC procedures to the finalised inventory. The evaluations verify that data quality objectives are met, ensure that the inventory represents the best possible estimate of emissions and sinks given the current state of scientific knowledge and data available, and support the effectiveness of the QC programme.

The review stage is divided into parts that have different viewpoints and timing. The internal evaluation takes place between the completion of the CRF tables and the updating of inventory descriptions by CRF category. At this stage the evaluation procedures recorded in the QA plan are performed, where the realised activity and the attained results are appraised and compared with the objectives set and the plans made. The differences are analysed and documented as

part of the internal documentation of the calculation and reported on the appropriate level in the NIR. Depending on the objective set for the review, it can be carried out as an internal evaluation of the calculation sectors according to the calculation protocols, as an expert peer review, where the evaluators are experts from other reporting sectors of the inventory or external to it, or as auditings directed by the inventory unit to different calculation sectors. When desired, emission and activity data can be verified by comparing them with other available data compiled independently of the greenhouse gas inventory system.

The conditions for the practical implementation of the verification by an independent party external to Finland's National System are being examined. The procedures to be applied are connected to the decision on the possible ISO 9001:2000 certification of the quality management system.

The review teams named by the UNFCCC Secretariat carry out international reviews of the inventory according to the annual schedule after the transmission of the final inventory report. The first comments are obtained at the end of April. The inspections may take the form of written reviews (centralised or desk reviews) produced in September or October, or expert visits to locations (in-country reviews) according to a separately agreed schedule. The National Authority co-ordinates the participation of the parties to the Finland's Greenhouse Gas Inventory System in the reviews, as well as responses to the issues raised by the reviews of the UNFCCC Secretariat.

In the **inventory improvement stage** conclusions are made on the measures needed to improve the inventory based on the observations of the inventory review stage (internal and planned external evaluations by independent parties), the review feedback received from the UNFCCC Secretariat on the previous inventory, and other accumulated data (e.g. issues raised in the QC checks). The expert organisations record the planned inventory improvement measures into inventory descriptions by CRF category. The inventory unit updates the improvement plan for the whole inventory. In addition to the improvement measures by CRF category the inventory improvement plan includes horizontal inventory development projects and those located at the interfaces of different reporting sectors.

## **4.5. Documentation and archiving**

Documentation for the inventory comprises the inventory data and metadata related to the calculation. The main contents of the inventory documentation are annually compiled into the National Inventory Report.

Documentation has a key position in inventory quality management. Meeting the requirement on the transparency of the inventory necessitates systematic documentation and it enables external evaluation of the

inventory and, where necessary, its replication. Documentation also stands as evidence to the compliance and functionality of the National System. In addition, continuous, fact-based improvement of the inventory is steered by an analysis of the materials accumulated during the inventory process.

The inventory documentation system consists of the following document types:

1. The basic documents of the National System that are produced, updated and archived by the National Authority according to Statistics Finland's archiving system:
  - description of Finland's Greenhouse Gas Inventory System
  - reporting protocols
  - agreements and orders related to the calculation
  - quality guidelines.
2. The annual inventory process documents by reporting sector, which are produced, updated and archived in the expert organisations responsible for the sectors according to the reporting protocols:

- inventory descriptions by CRF category (exception: archived in the inventory unit)
  - descriptions of administrative or other data used in the inventory (exception: administrative agencies and the ministries steering them as responsible bodies are in charge of producing and updating these materials; archived in the inventory unit)
  - primary material for the calculation
  - internal documents for the calculation
  - CRF tables of the calculation sectors.
3. The total inventory level documents of the annual inventory process, which are produced, updated and archived in the inventory unit according to Statistics Finland's archiving system.
    - the general plan for compiling the inventory
    - internal documents for compiling the inventory
    - the set of CRF tables and the National Inventory Report (NIR)
    - the inventory improvement plan.

## 4.6. Improvement

The improvement of the greenhouse gas inventory aims to develop calculation and reporting of the inventory so that the inventory fulfils the quality objectives set for it and produces reliable estimates of total emissions of greenhouse gases in different emission categories.

Statistics Finland co-ordinates the development of the inventory's different sectors. Each calculating organisation bears the primary responsibility for the development of its own sector. The advisory board of the inventory handles horizontal development projects and the resources needed for development.

Statistics Finland compiles yearly an inventory improvement plan to which are collected different horizontal development needs and those detected in different reporting sectors, and the planned or proposed improvement measures. The inventory improvement plan is discussed in the advisory board set up by Statistics Finland before starting the next calculation round.

The organisation responsible for each sector is mainly in charge of the resources for the internal development projects of that reporting sector. Horizontal projects or those beyond the resources of the expert organisations are prepared and followed in the advisory board.

The inventory improvement plan starts from the shortcomings and weaknesses found in Finland's greenhouse gas inventory that have appeared:

- through the quality management system
- in inventory reviews

- from those in charge of the calculation
- or from other possible sources (e.g. international or bilateral comparisons).

In addition to the IPCC guidelines, the improvement of the inventory is steered by the feedback received from inventory reviews and key source analyses obtained through uncertainty assessments.

The development of the inventory typically contains the following procedures, which can be separate or partly overlapping:

- recalculations
- methodological revisions
- new data sources
- updating of emission factors
- reallocation of emissions
- inclusion of missing emission sources in the calculation
- improvement of documentation.

Determination of the country-specific and the EU's common assigned amount is based on the emission data for 1990, which are reported in the inventory submission of the year 2006 (including emission time series from 1990 to 2004).

The first stage of the improvement plan aims to produce updated and supplemented emission time series as a basis for fixing the assigned amount. In practice, the majority of the data need to be complete by the end of 2005, and to ensure this studies and research projects are launched.

The first stage focuses first of all on recalculation of energy-based emissions including updating of activity and emission factor data, as well as on supplementation and updating of emissions in industrial processes and fugitive emissions from fuels and in addition on revision of the LULUCF (land use, land-use change and forestry) calculation.

The inventory calculation also needs to be supported by longer term research projects by which to respond to the reporting requirements of the Kyoto Protocol.

The new reporting guidance for the LULUCF sector (GPG LULUCF 2003) will influence Finnish inventory practices in the emission calculation of peat production areas and agricultural land. Reporting will be made as an experiment on that basis first for the inventory submission in 2005.

## 4.7. Uncertainty assessments

According to the IPCC guidelines, an uncertainty assessment is made on the greenhouse gas inventory to establish the uncertainties related to different emission sources and the uncertainty of total emissions for the base year 1990 and the latest inventory year and the so-called trend uncertainty.

The uncertainty assessment helps to identify the key categories whose effect on the total uncertainty of the inventory is highest. By means of such assessment the improvement measures can be directed so that the total uncertainty of the inventory can be lowered as effectively as possible with the available resources. The methods used in the calculation of different key categories are defined in the decision trees given in the IPCC Good Practice Guidance. Stricter requirements are set for calculation of key categories than on other emission source categories.

Uncertainty assessments have been made on Finland's greenhouse gas inventory from the inventory of 1998 onwards. At first the assessments were made using the Tier 1 level method of the IPCC guidelines,

The new reporting instructions increase considerably the sector's reporting obligation from before. Reporting must be made by land use category and included are emissions from five different carbon pools. National implementation and monitoring of the land use classification needs much development. From the inventory transmission of 2006 onwards the surface areas of land use categories and changes between them are at least initially based on the National Forest Inventory (NFI).

Estimation of greenhouse gas balances in soil carbon pools according to different land use categories and changes between land use categories divided into organic and mineral land requires both basic and further development. Uncertainty assessments must also be produced for surface areas and carbon pools.

which is based on processing of uncertainty estimates assumed to be normally distributed. From the 2001 inventory, use has been made in the uncertainty assessment of both the Tier 1 level method and the Tier 2 level Monte Carlo simulation, by which it is possible to take particular account of the non-symmetrical probability distributions connected to emission factors.

In the inventory concerning the year 2002, the uncertainty of the total amount of greenhouse gas emissions calculated with the 95 per cent confidence interval is -5...+6 per cent, which is at an internationally acceptable level.

The methods and applications used in uncertainty calculations have been developed by Technical Research Centre of Finland (VTT) as special assignments, but after this Statistics Finland will be responsible for the production of the uncertainty assessment and the Monte Carlo calculation application will be used for it. In future, the uncertainty assessment will include the calculation sectors at the moment missing from it.

## References and sources

*Commission Decision of 29 October 2004 laying down rules implementing Decision 280/2004/EC of the European Parliament and of the Council concerning a mechanism for monitoring community greenhouse gas emissions and for implementing the Kyoto Protocol.*

*IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, 2000.*

*IPCC Good Practice Guidance for LULUCF, 2003 (GPG LULUCF).*

*Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories.*

*UNFCCC Decision 18/CP.8. Guidelines for the preparation of national communications by Parties included in Annex I to the Convention, Part I. UNFCCC Reporting guidelines on annual inventories.*

*UNFCCC Decision 20/CP.7. Guidelines for national systems under Article 5, Paragraph 1, of the Kyoto Protocol.*

*VTT 2003: Monni Suvi & Syri Sanna. Uncertainties in the Finnish 2001 Greenhouse Gas Emission Inventory. VTT Research Notes 2209.*

*VTT 2004: Monni, Suvi. Uncertainties in the Finnish 2002 Greenhouse Gas Emission Inventory, VTT Working Papers: 5.*

# *Reporting protocols for the greenhouse gas inventory in Finland*

## *A. Point Sources, Stationary Combustion*

### *Scope and definitions*

Point sources are defined as combustion of fuels in stationary combustion plants, including e.g. power plants, district heating plants, industrial boilers and other industrial combustion units and processes.

Point sources belong to the following branches of industry:

C 10–14 Mining and quarrying

D 15–37: Manufacturing

E 40: Electricity, gas and steam and hot water supply.

### *CRF reporting categories*

Emissions from point sources are reported in CRF categories:

1.A.1. Energy Industries

1.A.2. Manufacturing Industries and Construction

### *Organisation and responsibilities*

The responsible unit for the calculation is Statistics Finland.

### *Estimation methods*

Emissions from point sources are calculated using the ILMARI calculation system of Statistics Finland.

Emissions are calculated at as detailed a level as possible using company, site, plant, boiler and process-specific data obtained from various sources. Emission data are partly reported direct by companies, partly calculated from fuel consumption. The calculation is consistent with the IPCC Tier 2 approach. All emission components that are reported to the UNFCCC (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CO, NMVOC, NO<sub>2</sub>, SO<sub>2</sub>) are calculated using the same system and same level of detail.

Detailed description of the calculation will be prepared by the end of 2004.

### *Data sources and responsible organisations*

The most important information sources are the Regional Environment Centres' VAHTI database, Statistic Finland's statistics on energy consumption and energy production, and statistics compiled by federations in the energy sector.

### *Annual schedule*

Calculation of emissions from point sources begins in August and has to be completed by the end of October. The calculation depends on the completion of annual data in the VAHTI database, where the target schedule is the beginning of June. In practice, checking of unit-specific data and acquisition of additional information requires around 2 to 3 months.

## *B. Mobile Sources*

### *Scope and definitions*

Mobile sources include road transportation, aviation, navigation, railways and drivable and moveable working machinery. Vehicles of civil transportation belong to this protocol irrespective of the branch by which they are used or owned.

### *CRF reporting categories*

Emissions from mobile sources are reported in CRF categories

- 1.A.3.a. Civil Aviation
- 1.A.3.b. Road Transportation
- 1.A.3.c. Railways
- 1.A.3.d. Navigation
- 1.A.3.e. Other transportation / Other off-road machinery
  
- 1.A.2.f. Manufacturing Industries and Construction / Construction machinery
  
- 1.A.4.c. Other sectors /Agricultural machinery
- 1.A.4.c. Other sectors / Forest machinery
- 1.A.4.c. Other sectors / Fishing vessels
  
- International Bunkers / Aviation
- International Bunkers / Marine

### *Organisation and responsibilities*

The VTT performs the emission calculation of transportation as an outsourced service, and obtains emission data on aviation from the Civil Aviation Administration (CAA). Statistics Finland is responsible for integrating the results as part of the reporting to the UNFCCC and total energy balance, and for general directing of the calculation.

The results from the model of each transport mode are collected into the VTT's LIPASTO model. The summary results needed for the inventory are fed into the ILMARI calculation system at Statistics Finland.

Evaporation of fuel from cars is calculated at the VTT from data on traffic performance. The emission data are sent to the Finnish Environment Institute, where they are integrated as part of the calculation of Protocol G and reporting in the CRF category 1.B.2.a. (Fugitive Emissions from Fuels / Oil, NMVOC).

The calculation models by transport mode and the responsible organisations are

- ILMI, civil aviation / Civil Aviation Administration (CAA)
- MEERI, navigation / VTT
- RAILI, railways / VTT
- LIISA, road transportation / VTT
- TYKO, off-road machinery / VTT
- International bunkers / Statistics Finland



## *Estimation methods*

Emission calculation of mobile sources is performed using a specific calculation model for each mode of transportation. The calculation models are based on the measured traffic performance of each form of transport or, where such data are unavailable, on estimated traffic performances and data on vehicle stock.

The calculation is mainly consistent with the IPCC Tier 2 and Tier 3 approaches.

All emission components that are reported to the UNFCCC (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CO, NMVOC, NO<sub>2</sub>, SO<sub>2</sub>) are calculated using the same system.

For detailed description of the calculation see: <http://lipasto.vtt.fi/indexe.htm>

## *Data sources and responsible organisations*

In addition to calculations performed at the VTT and CAA, the following data sources are used in the inventory:

- Finnish Road Administration: datafile of traffic performance on public roads from the national road register (separate query from the register)
- Finnish Maritime Administration : port traffic service data, fuel consumption of ice-breakers, fishing vessels (previously recorded by the Ministry of Agriculture and Forestry)
- State Provincial Office of Western Finland: data on leisure boats from the boat register (separate query from the register)
- VR Ltd: datafile of gross tonne kilometres by rail section

Responsible organisations for the other data sources used in the calculation:

- Cities of Helsinki, Espoo and Vantaa: street traffic performance
- Traffic Information Centre: forecasts on car sales
- Finnish Oil and Gas Federation: statistics on sales of liquid fuels
- Statistics Finland: vehicle file from the vehicle register

## *Annual schedule*

The calculations using the LIPASTO model are performed by the end of March (in the year following the calculation year), when the ILMI data also have to be available.

The schedule for the LIPASTO calculations demands acquisition of the main data (traffic performance, stock) during February.

Projections done in 2000 are used in the calculation for off-road machinery (TYKO) . Because the data change very little annually the calculation is updated when necessary (at intervals of a few years) under a separate assignment.

The data are sent to Statistics Finland by the end of August.

## *C. Other Fuel Combustion*

### *Scope and definitions*

Other fuel combustion includes, e.g., fuels used for space heating in different sectors (agricultural, residential, commercial, institutional, etc), fuels used by the defence forces and coastguard, and other non-specified use of fuels.

Other fuel combustion also includes statistical corrections of total fuel consumption.

### *CRF reporting categories*

Emissions from other fuel combustion are reported in CRF categories

1.A.4. Fuel Combustion Activities / Other sectors

1.A.5. Fuel Combustion Activities / Other

All emission components that are reported to the UNFCCC (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, CO, NMVOC, NO<sub>2</sub>, SO<sub>2</sub>) are calculated using the same system and the same level of detail.

### *Data sources and responsible organisations*

The responsible unit for the calculation is Statistics Finland.

### *Estimation methods*

Emissions from other fuel combustion are calculated using the ILMARI calculation system of Statistics Finland basing on fuel consumption figures. The availability of fuel consumption statistics for the purpose of annual energy statistics determines the level of detail used in the calculation.

The calculation is mainly consistent with the IPCC Tier 1 approach.

### *Data sources and responsible organisations*

The main data sources for the calculation are those of energy statistics. The most important ones are statistics on fuel consumption or fuel sales compiled by federations in the energy sector, Statistics Finland's model for the calculation of energy for space heating, data on the building stock and on the fuel use of different types of military vehicles and equipment.

### *Annual schedule*

Emission calculation of other fuel combustion is done during autumn and has to be completed by the end of October. The calculation depends on the completion of other fuel consumption data (Protocols A and B) and annual energy statistics.

## *D. Fugitive Emissions from Fuels*

### *Scope and definitions*

In Finland, fugitive emissions comprise emissions from peat fuel production, oil refinery, storage and distribution of oil products and distribution and transmission of natural gas. (Note: In former inventories, this category also comprised fugitive emissions from peat piles, peat production fields and peatlands prepared for peat production. The emissions are probably allocated to Protocol I basing on an on-going study).

### *CRF reporting categories*

Fugitive emissions from energy production and distribution are reported in CRF categories

1.B.1. Fugitive Emissions from Fuels / Solid fuels

1.B.2. Fugitive Emissions from Fuels / Oil and natural gas

The emission compounds to be reported include direct greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) and non-methane, volatile organic compounds (NMVOC). Calculation of NMVOCs comes under Protocol G.

### *Data sources and responsible organisations*

The responsible unit for the calculation is Statistics Finland.

### *Estimation methods*

The calculation is consistent with the IPCC Tier 1 approach.

### *Data sources and responsible organisations*

The calculation is based on the energy statistics of Statistics Finland and on a separate, plant-specific data collection.

### *Annual schedule*

The data have to be ready by the end of October.

## *E. Emissions from Industrial Processes*

### *Scope and definitions*

Emissions from industrial processes mean non-combustion emissions from industrial processes.

### *CRF reporting categories*

Emissions from industrial processes are reported in CRF categories

2(I).A. Industrial processes / Mineral Products

2(I).B. Industrial processes / Chemical Industry

2(I).C. Industrial processes / Metal Production

2(I).D. Industrial processes / Other Production

The emission components that are reported are direct greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) and sulphur compounds (SO<sub>x</sub>).

### *Data sources and responsible organisations*

The responsible unit for the calculation is Statistics Finland.

### *Estimation methods*

Emissions are calculated using a simple equation: emission = activity data \* emission factor. Either production or consumption data are used as activity data. The emission factors are IPCC defaults or country or plant-specific factors.

The calculation is consistent with the IPCC Tier 1 and Tier 2 approaches.

### *Data sources and responsible organisations*

The calculation is based on Statistics Finland's statistics on manufacturing and partly on a separate, plant-specific data collection. In respect of sulphur compounds, the main data source is the Regional Environment Centres' VAHTI database.

### *Annual schedule*

The data have to be ready by the end of October.

## *F. Emissions of F-gases*

### *Scope and definitions*

Hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF<sub>6</sub>) are F-gases.

### *CRF reporting categories*

Emissions of F-gases are reported in the following categories:

- 2.C. Industrial processes/ Metal production
- 2.F. Industrial processes/ Consumption of Halocarbons and SF<sub>6</sub>

Category 2.F is divided into several sub-categories (see Data sources below).

The complete list of the F-gases in the CRF tables can be found in a report of Teemu Oinonen; Finnish 2002 Inventory of HFC, PFC and SF<sub>6</sub> Emissions. The report is available on the Internet at: <http://www.environment.fi>, keyword FE686.

### *Organisation and responsibilities*

The F-gases emission inventories are compiled at the Chemicals division of the Finnish Environment Institute.

### *Estimation methods*

The methods used in the inventory are described in detail in the earlier mentioned report. The inventory uses the Tier 1a, Tier 1b and Tier 2 methods. Statistics Finland is provided an annual, full description of how the emission inventory has been compiled for the five main sources (refrigeration, foam blowing, aerosols, electrical equipment and other).

### *Data sources and responsible organisations*

The data used in the F-gases emission inventory are obtained direct from corporate entities which number altogether 800 in the inventory of the year 2003.

The vast majority of the information is collected from companies in the refrigeration business. Other data sources are the metal and electric industries (magnesium die casting and semiconductor manufacturing), electrical engineering (gas insulated switchgear and circuit breakers), plastics industry (foam products, etc.) and companies importing other products (for instance, refrigerants and refrigeration equipment, extinguishing agents in fixed fire fighting systems, shoes).

### *Annual schedule*

Preparations for the data collection are started in December and the F-gases emission inventory is finished by the end of June. The information is sent to Statistics Finland in September.

## *G. Emissions of Non-energy NMVOCs (Non-methane volatile organic compounds)*

### *Scope and definitions*

In this protocol, non- methane volatile organic compounds refer to emissions of NMVOCs developed in sectors other than energy combustion. The emissions of NMVOCs from fuel consumption are presented in protocols A to C.

### *CRF reporting categories*

Data on NMVOC emissions are reported in the following CRF categories:

- 1.B.2. Fugitive Emissions from Fuels / Oil and Natural Gas
  
- 2.A. Industrial processes / Mineral Products
- 2.B. Industrial processes / Chemical Industry
- 2.C. Industrial processes / Metal Production
- 2.D. Industrial processes / Other Production
  
- 3.A. Solvent and Other Product Use / Paint Application
- 3.B. Solvent and Other Product Use / Degreasing and Dry Cleaning
- 3.C. Solvent and Other Product Use / Chemical Products, Manufacture and Processing
- 3.D. Solvent and Other Product Use / Other

### *Organisation and responsibilities*

The NMVOC emission inventories are compiled at the Environment Management division of the Finnish Environment Institute.

Evaporation of fuel from cars is calculated at the VTT from data on traffic performances. The emission data are sent to the Finnish Environment Institute, where they are integrated into the calculation of this protocol and reporting in the CRF category 1.B.2.a. (Fugitive Emissions from Fuels / Oil, NMVOCs).

### *Estimation methods*

Due to the incoherence of the emissions sector, many different methods are used in the inventory.

### *Data sources and responsible organisations*

Emissions are calculated at as detailed a level as possible using the following data sources:

- Regional Environment Centres' VAHTI database (point sources)
- Questionnaires to companies (non-VAHTI companies are asked for information on their chemical and product use or emissions)
- Industry federations (data on products or emissions)
- Customs statistics
- Expert institutes

### *Annual schedule*

The NMVOC inventory is started with questionnaires in June and is completed by the middle of November. The inventory is dependent on the completion of annual data in the Regional Environment Centres' VAHTI database. Completion of the inventory (acquiring and checking the data, and the calculation itself) takes about three months.

## *H. Emissions from Agriculture (non-combustion emissions)*

### *Scope and definitions*

The Emissions from Agriculture sector includes CH<sub>4</sub> emissions from enteric fermentation of domestic livestock and from manure management, and N<sub>2</sub>O emissions from manure management and agricultural soils.

Agricultural emissions do not include combustion emissions

### *CRF reporting categories*

Agricultural emissions are reported in the following CRF categories:

- 4.A. Enteric Fermentation (reported gas: CH<sub>4</sub>)*
- 4.B. Manure Management (reported gases: CH<sub>4</sub> and N<sub>2</sub>O)*
- 4.D. Agricultural Soils (reported gas: N<sub>2</sub>O)*
- (4.F. Field Burning of Agricultural Residues, not reported)*

### *Organisation and responsibilities*

AgriFood Research Finland (MTT)

### *Estimation methods*

Emissions from agriculture are calculated with the model developed by the Technical Research Centre of Finland (VTT) (Microsoft Excel).

Calculation of agricultural emissions follows the IPCC guidelines. Tier level 2 methods are in use in calculating emissions from Enteric Fermentation and CH<sub>4</sub> emissions from Manure Management (Cattle). Other emission sources are calculated by using Tier level 1 methods.

Emission factors are mainly IPCC default factors.

Detailed documentation about annual calculation processes under the MTT's reporting responsibility will be delivered to Statistics Finland.

### *Data sources and responsible organisations*

Activity data used in calculations is received mainly from the following information sources:

- Publications of the Ministry of Agriculture and Forestry (Yearbook of Farm Statistics, Maataloustilastotiedote and Tietokappi) and the Matilda database. The information received annually from these data sources include animal numbers (excluding horses), crop yields, volume of N fertilisers sold annually and fat content of milk.

Other information sources used in calculations:

- Finnish Trotting and Breeding Association (Suomen Hippos) (number of horses 1.5)
- Finnish Environment Institute, VAHTI database of Finland's environmental administration (amount of N from sewage sludge applied annually to fields)
- Pro Agria (agricultural expert organisation in Finland) (annual milk production of dairy and mother cows, length of pasture season, weights (cattle), daily weight gain, mature weight)
- MTT Environmental Research (area of cultivated organic soils)

- Literature (distribution of different manure management systems, N excretion in manure during the year)

## *Annual schedule*

Collection of data begins in May and data will be delivered to Statistics Finland by the 15 November.



# *I Emissions from Land Use and Land Use Changes*

## *Part Ia. Responsibilities of the Finnish Forest Research Institute (Metla) in the Reporting to the United Nations Framework Convention on Climate Change*

### *Scope and definitions*

In the reporting to the United Nations Convention on Climate Change, the Finnish Forest Research Institute is responsible for reporting greenhouse gas emissions and removals from Land Use, Land Use Changes and the Forestry Sector from the following IPCC land use categories and land use changes as agreed with Agrifood Research Finland (MTT):

- Forest land
- Cropland
- Grassland
- Wetlands
- Settlements
- Other land

Starting from the 2006 inventory submission, area data from the different land use categories and land use changes between them will mainly be based on data by the IPCC classification of the National Forest Inventory (NFI). Additionally, the data registers of the Information Centre of the Ministry of Agriculture and Forestry and the total land area statistics of the National Land Survey of Finland will be utilised.

Greenhouse gas emissions and removals are reported for all the land use categories and for the following carbon pools as applicable: above ground biomass, below ground biomass, litter, dead wood and soil.

### *CRF reporting categories*

#### *Forest Land 5A*

*5.A.1 Forest land remaining Forest land*

*5.A.2 Land (cropland, grassland, wetlands, settlements or other land) converted to Forest land*

#### *Cropland 5B*

*(5.B.1 Cropland remaining Cropland (MTT is responsible for soil estimates))*

*5.B.2 Land converted to Cropland (Metla is responsible for tree biomass estimates)  
(reported gas: CO<sub>2</sub>)*

#### *Grassland 5C (MTT is responsible for soil estimates)*

*5.C.1 Grassland remaining Grassland (reported gas: CO<sub>2</sub>) (MTT is responsible for soil estimates)*

*5.C.2 Land (forest land, wetlands, settlements) converted to Grassland (Metla is responsible for tree biomass estimates, if notable)*

#### *Wetlands 5D*

*5.D.1 Wetlands remaining Wetlands (optional so far, possible soil estimates)*

*5.D.2 Land (forest land, cropland, grassland, settlements, other land) converted to Wetlands*

## Settlements 5E

*5.E.1 Settlements remaining Settlements (optional so far, possible area estimates)*

*5.E.2 Land (forest land, wetlands, cropland, grassland, other land) converted to Settlements (tree biomass estimates, if notable)*

## Other Land 5F

*5.E.1 Other land remaining Other land (area estimates)*

*5.E.2 Land (forest land, wetlands, settlements) converted to Other land (tree biomass estimates, if notable) (Rare in Finland)*

Aggregate estimates for all conversions of land to a specific land use category may be reported when data are not available for reporting them separately.

In addition, the Finnish Forest Research Institute is responsible for the reporting of the following data required in the CRF tables 5(I) – 5(V):

5(I) Direct N<sub>2</sub>O emissions from N fertilisation on forest land

5(II) N<sub>2</sub>O emissions from drainage of soils (optional so far)

5(V) Biomass burning (if notable)

## Organisation and responsibilities

The Finnish Forest Research Institute (Metla)

## Estimation methods

Changes in carbon pools from the above mentioned land use categories will be calculated in accordance with the IPCC Good Practice Guidance for Land Use, Land Use Change and Forestry (IPCC GPG LULUCF). The estimation methods used mainly correspond with the GPG LULUCF Tier level 2 and 3 methods. Metla produces emission estimates using the data currently available. The estimates and methods will be revised and improved as new data come available. Detailed documentation about the annual calculation processes under Metla's reporting responsibility will be delivered to Statistics Finland.

### Biomass (below and above ground)

National method, Tier level 3 method (either biomass models or biomass expansion factors). Tree biomass exists on forest land and to a small extent on the wetlands that do not meet the criteria of Forest land. Metla is also responsible for the biomass estimates of forested former croplands.

### Litter

Forest land: Tier level 2 and 3 methods. (At the moment there are only methods for the humus layer, while production models for stand canopy litterfall and ground vegetation litterfall are under preparation).

### Dead wood

Forest land: Tier level 3 method

### Soil

Tentative plan for Forest land: Tier level 2 and 3 methods. Measured data on the amount of organic carbon in the mineral soil of the sample plots of the NFI can be used as input data to derive regression equations relating soil carbon concentration to the NFI variables, or the dynamic soil model Yasso can be used. Reporting can also be done for Wetlands.

## *Data sources and responsible organisations*

Biomass: (below and above ground): NFI, information provided by sampled roundwood purchasers, Metla is responsible for the calculations.

Dead wood: NFI is responsible for the calculations.

Litter: VMI, expert estimates, separate measurement data (or IPCC default emission factor if Tier level 1 method is chosen), Metla is responsible for the calculations.

Soil: VMI, Metla is responsible for the calculations.

Stock changes in litter, deadwood and soil carbon pools are calculated and reported with the Yasso model (Liski et al. 2004). Dead wood and plant matter calculated from the forest inventory data will be used as the input data for the Yasso model (Peltoniemi et al. 2004, Integrated 2004). Application of methods for the reporting is in progress. The methods will be ready to be applied to the inventory submission of 2006 (data for the year 2004).

Stock changes in litter and soil pools on drained peatlands will be calculated with the help of litterfall input derived from forest resource (inventory) data, and emission factors produced in the research programme "Greenhouse impacts of the use of peat and peatlands in Finland". The results are not ready for the inventory submission of 2005.

Stock change of dead wood pool on peatlands will be calculated in a way similar to the one used for mineral soils. The schedule is also the same.

## *Annual schedule*

Only emissions from biomass stock change will be reported in the inventory submission of 15 January 2005. Stock change in soil pool will be included in the inventory submission of 15 January 2006, at the latest. Litter and dead wood pools will also be included in the inventory submission of 15 January 2006.

Activity data of harvest removals will be collected during the preceding year and forest resource (inventory) data between 1 May and 15 October. The data from the preceding year will be calculated by the end of September. The calculation results will be entered into the CRF tables during October and delivered to Statistics Finland by 15 November.

# Part Ib. Responsibilities of Agrifood Research Finland (MTT) in the Reporting to the United Nations Framework Convention on Climate Change

## Scope and definitions

In the reporting to the United Nations Convention on Climate Change, Agrifood Research Finland is responsible for reporting greenhouse gas emissions and removals from Land Use, Land Use Changes and the Forestry Sector from the following IPCC land use categories and land use changes as agreed with the Finnish Forest Research Institute (Metla):

- Forest land
- Cropland
- Grassland
- Wetlands
- Settlements
- Other land

Starting from the 2006 inventory, the submission of area data from the different land use categories and the land use changes between them will mainly be based on data on the IPC classification of the National Forest Inventory (NFI). Additionally, the data registers of the Information Centre of the Ministry of Agriculture and Forestry and total land area statistics of the National Land Survey of Finland will be utilised.

Greenhouse gas emissions and removals are reported for all the land use categories and for the following carbon pools as applicable: above ground biomass, below ground biomass, litter, dead wood and soil.

## CRF reporting categories

### Cropland 5B

- 5.B.1 Cropland remaining cropland (soil estimates)*
- 5.B.2 Land (grassland, wetlands, settlements, forest land) converted to Cropland (soil estimates) (reported gas: CO<sub>2</sub>) (Metla is responsible for tree biomass estimates)*

### Grassland 5C

- 5.C.1 Grassland remaining Grassland (reported gas: CO<sub>2</sub>)*
- 5.C.2 Land (cropland, wetlands, settlements, forest land) converted to Grassland (soil estimates) (reported gas: CO<sub>2</sub>) (Metla is responsible for tree biomass estimates)*

### Settlements 5E

- 5.E.2 Land (cropland, grassland) converted to Settlements (reported gas: CO<sub>2</sub>)*

### Other land 5F

- 5.F.2 Land (cropland, grassland) converted to Other land (reported gas: CO<sub>2</sub>)*

Aggregate estimates for all conversions of land to a specific land use category may be reported when data are not available for reporting them separately.

In addition, Agrifood Research Finland is responsible for the reporting of the following data required in the CRF tables 5(III) – 5(V):

- 5(III) N<sub>2</sub>O emissions from disturbance associated with land use conversion to cropland*
- 5(IV) Carbon emissions from agricultural lime application*

*(5(V) Emissions from biomass burning from the area of the MTT's reporting responsibility (i.e. cropland, grassland) are marginal and are not currently reported in the Finnish inventory)*

## Organisation and responsibilities

Agrifood Research Finland, (MTT) (Environmental Research, Soils and Environment)

## Estimation methods

Changes in carbon pools from the above mentioned land use categories will be calculated in accordance with the IPCC Good Practice Guidance for Land Use, Land Use Changes and Forestry (GPG LULUCF). The estimation methods used mainly correspond with the GPG LULUCF Tier level 1 and 2 methods. Initially, Tier level 1 methods are used in the calculations, while Tier level 2 methods can be introduced if more national data come available. Detailed documentation about the annual calculation processes under the MTT's reporting responsibility will be delivered to Statistics Finland.

CO<sub>2</sub> emissions arising from carbon stock changes in soil (mineral soil, organic soil, liming) are calculated in the Cropland category. In addition, N<sub>2</sub>O emissions from land conversion to cropland are calculated.

The MTT does not produce emissions estimates from tree biomass stock changes. As agreed, Metla produces CO<sub>2</sub> emissions estimates from tree biomass stock change, if notable. Carbon stock changes in biomass (annual plants), litter and dead wood will not be reported.

## Data sources and responsible organisations

Cropland 5.B

### *5.B.1 Cropland remaining Cropland (reported gas: CO<sub>2</sub>)*

Soil:

*Mineral soil:*

- IPCC method, Tier level 1, GPG LULUCF as data source.
- Mineral soils are divided into activity classes, with default reference carbon stock for each activity class, MTT or GPG LULUCF as data sources.

*Organic soil:*

- IPCC method, Tier level 1, GPG LULUCF as data source
- The total area of cultivated organic soils is divided into different vegetation zones, MTT as data source
- National or IPCC default emission factors

*Liming:*

- Amount of lime applied to fields annually, data source the Finnish Liming Association
- Emission factor, GPG LULUCF as data source

(Biomass below and above ground:

change in below ground biomass will not be reported, change in above ground biomass will be reported, Metla will produce stock change estimates of tree biomass, if notable.)

### *5.B.2 Land converted to Cropland*

Soil: See 5.B.1 Cropland remaining Cropland

(Biomass: Change in above ground biomass will be reported, if notable, Metla will produce stock change estimates of tree biomass, if notable.)

#### Grassland 5C

*5.C.2 Land (cropland, wetlands, settlements, (forest land: soil)) converted to Grassland (reported gas: CO<sub>2</sub>)*

Soil: See 5.B.1 Cropland remaining Cropland

(Biomass: Change in above ground biomass will be reported, if notable, Metla will produce stock change estimates of tree biomass, if notable)

#### Settlements 5E

*5.E.2 Land (cropland, grassland) converted to Settlements (reported gas: CO<sub>2</sub>)*

Soil: See 5.B.1 Cropland remaining Cropland

(Biomass: Change in above ground biomass will be reported, if notable, Metla will produce stock change estimates of tree biomass, if notable)

IPCC default value: above ground biomass after conversion is zero

#### Other Land 5F

*5.F.2 Land (cropland, grassland) converted to Other land (reported gas: CO<sub>2</sub>)*

Soil: Soil carbon stock on land converted to Other land has IPCC default value of zero after conversion

(Biomass: Change in above ground biomass will be reported, if notable, Metla will produce stock change estimates of tree biomass, if notable.)

*5(III) N<sub>2</sub>O emissions from disturbance associated with land use conversion to cropland*

- IPCC method, Tier level 1, IPCC GPG LULUCF as data source
- C/N ratio, IPCC default value or national value
- IPCC default or national emission factor

*5(IV) Carbon emissions from agricultural lime application*

- Amount of lime applied to fields annually, data source the Finnish Liming Association.
- Emission factor, GPG LULUCF as data source.

## Annual schedule

- Collection of activity data, 1 May-30 September.
- Entering data into the CRF tables and updating of the NIR (to be agreed with Metla), 1 October-31 October. Delivery to Statistics Finland by 15 November.

## *J. Emissions from Waste Treatment*

### *Scope and definitions*

Emissions from solid waste disposal on land are calculated in this category, as well as emissions from the combustion of waste in landfills, although the latter does not occur in Finland.

Emissions from waste incineration are reported in the energy sector and the reporter is Statistics Finland.

The waste sector includes municipal (domestic) and industrial wastewater handling plants and uncollected domestic wastewaters. The N<sub>2</sub>O emissions generated from the nitrogen input of fish farming are also included in the Finnish inventory.

### *CRF reporting categories*

Emissions of waste management are reported in the following CRF categories

6.A. *Waste / Solid Waste Disposal on Land*

6.B. *Waste / Waste Water Handling*

### *Organisation and responsibilities*

The emission inventories from waste treatment are compiled at the Environment Management division of the Finnish Environment Institute.

### *Estimation methods*

#### *Emissions from landfills*

The method used to calculate methane emissions is called FOD (First Order Decay, Tier 2) which considers delay times in the forming of methane emissions. The emission sources include solid waste disposal sites containing solid municipal, industrial, construction and demolition wastes, and municipal (domestic) and industrial sludges which contain biologically decomposable carbon.

NM VOC emissions are estimated from documented records.

#### *Emissions from wastewater treatment*

The method corresponds to the IPCC Guidelines with one application; methane emissions of wastewater and sludge treatment are calculated using combined activity and emission factor data. The emissions from sludge disposal on land are estimated and reported in the Solid waste disposal on land (landfills) subsector.

## *Data sources and responsible organisations*

### *Emissions from landfills:*

The activity data used in the calculation are derived from the Regional Environment Centres' VAHTI database and from the Finnish Biogas Plant Register (Kuittinen & Huttunen 2004).

For the beginning of the 1990s, the disposal data (amount and composition) on industrial, construction and demolition waste are based on the surveys and research by Statistics Finland (Vahvelainen & Isaksson 1992; Isaksson 1993; Puolamaa et al. 1995) and the Technical Research Centre of Finland VTT (Perälä & Nippala 1998; Pipatti et al. 1996).

Before the year 1990, estimated data on waste amounts are based on the report of VTT (Tuhkanen 2002).

### *Emissions from wastewater treatment:*

The activity data used in the calculation are derived from the Regional Environment Centres' VAHTI database direct or as revised by the Environment Management division.

## *Annual schedule*

The waste inventory with checkings are carried out during autumn and are finished by the beginning of November. The inventory is dependent on the completion of annual data in the Regional Environment Centres' VAHTI database. Completion of the inventory (acquiring and checking of the data, and the calculation itself) takes about two months.



## *K. Other Emissions*

### *Scope and definitions*

This protocol comprises all emission sources not mentioned earlier. The contents and definitions will be reviewed as improvements are made to the inventory.

### *CRF reporting categories*

Emissions from the use of nitrous oxide in different sectors are reported in the CRF category 3 Solvent and other product use

Emissions from use of fuels in the non-energy sector are currently reported in the CRF category 7, Other. This will change in the near future and these emissions will be reported in the CRF categories 2(I) A–D.

### *Organisation and responsibilities*

The responsible unit for the calculation is Statistics Finland.

### *Estimation methods*

There are no specific Tier methods for this category. Emissions are calculated by combining available plant level data and statistics on total amounts. The method is comparable to the Tier 1 and Tier 2 methods of other emission sources.

### *Data sources and responsible organisations*

The calculation is based on the energy and manufacturing industry statistics of Statistics Finland and on a separate, plant-specific data collection. In future, other data sources will be included if necessary.

### *Annual schedule*

The data must be ready by the end of October.

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Statistics Finland assumes by the end of 2004 the responsibilities of the National Authority for Finland's greenhouse gas inventory. This description covers the legal and agreement basis of the inventory system, parties to the National System in Finland and their responsibilities as well as the quality management methods of the inventory. The reporting protocols for the inventory division of labour are appended.