# QA/QC PLAN

of the Belgian national system for the estimation of anthropogenic greenhouse gas emissions by sources and removals by sinks under Article 5, paragraph 1, of the Kyoto Protocol

***April 2017***

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## List of abbreviations

| | |
|---|---|
| AWAC | Walloon Agency for Air and Climate |
| CCIEP | Coordination Committee for International Environmental Policy |
| CCIEP-WG Emissions | The Working Group of Emissions of CCIEP |
| COP | Conference of Parties |
| CRF | Common Reporting Format |
| EC | European Commission |
| ECONOTEC | Energy and environmental consultants a.o. in charge of F-gas emission inventory for Belgium (with VITO) |
| EMS | Euro Metropol of Strasbourg |
| ETS | Emission Trading Scheme |
| GHG | Greenhouse gases |
| IBGE/BIM | "Brussels Environment" a.o. in charge of GHG inventories |
| ICE | Inter-ministerial Conference for the Environment |
| ICEDD | Private company in charge of energy balances in the Walloon and Brussels regions |
| IPCC | Intergovernmental Panel on Climate Change |
| IRCEL/CELINE | Belgian Interregional Environment Agency a.o. in charge of national GHG inventory compilation. |
| ISO | International Organisation for Standardization |
| MOP | Meeting Of the Parties |
| NIC | National Inventory Compiler |
| NIR | National Inventory Report |
| NIS | National Inventory System |
| QA | Quality Assurance |
| QC | Quality Control |
| UNFCCC | United Nations Framework Convention on Climate Change |
| VITO | Flemish Institute for Technological Research a.o. in charge of energy balances for Flanders and of F-gases inventories (with ECONOTEC) |
| VMM | Flanders Environment Agency a.o. in charge of GHG emission inventory |

# 1 Introduction

## 1.1 General objective

This document establishes and formalizes the quality assurance / quality control (QA/QC) process and its procedures implemented during the planning, preparation and management of the national inventory of Belgium. This plan also defines the specific roles and responsibilities within the Belgium national system with respect to the implementation of QA/QC activities. In this context reference should also be made to the National Inventory System (NIS) (Belgium, 2017) and the National Inventory Report (NIR) (Belgium, 2017)of Belgium of April 2017.

## 1.2 Definitions

The Intergovernmental Panel on Climate Change (IPCC) makes several guidelines. Based on the following guidelines, IPCC 2006 guidelines (vol 1 Chap; 6), IPCC Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories 2000 provides the following basic definitions :

**Quality control (QC):** A system of routine technical activities to assess and maintain the quality of the inventory as it is being compiled. It is performed by personnel compiling the inventory and is designed to provide checks ensuring data integrity, correctness and completeness, identify and address errors and omissions and document, archive and inventory material and record all QC activities.

**Quality assurance (QA):** A planned system of review procedures on the inventory (when it is completed) that will be applied by persons not directly involved in the inventory compilation. The review is performed on completed inventories following the QC procedures. Its aim is to verify that quality and accuracy objectives are respected.

Quality assurance must also achieve a permanent and continuous improvement process.

**Verification:**

The application of methods external to the inventory by persons external to the procedure in order to try and establish its reliability. It includes comparison with estimates done in other countries (regions) and/or with estimates obtained by alternative methods.

## 1.3 Quality objectives

The quality objectives outlined in this plan for the Belgium national Greenhouse Gases (GHG) inventory aim to ensure its consistency with the United Nations Framework Convention on Climate Change (UNFCCC) reporting guidelines for annual inventories, IPCC Good Practice Guidance and with relevant decisions of the COP and COP/MOP.

Quality objectives also aim at continuously improving the quality of the national inventory, and facilitating the review of information submitted under Article 7, as required by Article 8 of the Kyoto Protocol.

In particular, the QA/QC plan, implemented by the national inventory compiler (NIC), aims at :

- State quality objectives;
- Formalize existing QA/QC procedures;

- Classifying types of inventory data by categories, identifying risks of errors or omissions and identify QC procedures and checks in order to manage these;
- Record all information and data flows and list secondary sources of information on which the inventories partly rely and whose quality procedures will have to be checked;
- Describe guidelines for QA activities and allocate roles and responsibilities
- Elaborate a procedure to record, store and archive documentation;
- Establish a process to continually improve the QA/QC plan, its processes and procedures

Quality objectives of a national inventory, as specified by the IPCC Good Practice Guidance, are the following :

Completeness : all GHG sources or sinks occurring on the territory are covered by the national inventory.

Consistency : emissions are estimated in a consistent manner over the complete time series.

Comparability : GHG emissions are estimated and allocated in a consistent way.

Transparency : methods and data used are explained in detail (a.o. in the National Inventory Report - NIR) (Belgium, 2017), which facilitates their evaluation in the quality assurance process.

Accuracy : estimates are as accurate as possible considering the scientific knowledge available, and uncertainties are reduced as far as practicable.

Timeliness : the national system ensures that the national inventory is provided within the required time for its submission to the European Commission (EC) and to the UNFCCC-secretariat.

# 2 Roles and responsibilities for the estimation of anthropogenic GHG emissions by sources and removals by sinks and the QA/QC plan

## 2.1 Structure of the national system

Belgium is a federal state in which the competences are spread between four entities (see Figure 1) : the federal level and the three regions (Flemish Region, Walloon Region, Brussels-Capital Region).

The activities of these four bodies, as regards the preparation of the national GHG inventory based on the three regional emission inventories and the implementation and development of the QA/QC plan, are coordinated via the “Working group on Emissions of the Coordination Committee for International Environmental Policy (CCIEP)” (referred to below as “CCIEP-WG Emissions”).

This group plays a central role in the coordination of the national GHG inventory. It is a permanent platform for the exchange of information between the National Climate Commission, the Energy Observatory, the Belgian UNFCCC National Focal Point, the Interregional environmental agency (IRCEL/CELINE) and the three regions. All methodological aspects of the GHG inventory as well as the implementation and

improvement of the national system, including the QA/QC plan, are coordinated via this CCIEP-WG Emissions. This working group is meeting together on a regular basis and is responsible for coordinating all emission inventory tasks in Belgium. This group proposes a national inventory to the national climate Commission (e.g. the Belgian political level) who sends the inventory and related documents to the UNFCCC-secretariat.

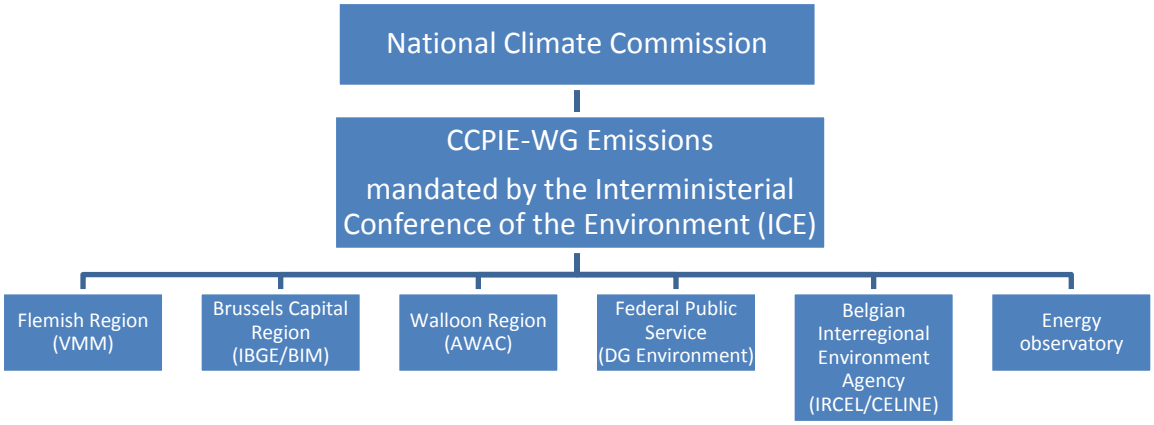


**Figure 1 : Main institutions and organisations involved in the preparation of the national GHG inventory**

## 2.2 National responsibilities

### 2.2.1 The Belgian Interregional Environment Agency (IRCEL/CELINE)

IRCEL/CELINE is established by the Cooperation agreement of 18 May 1994 (modified by the decision of 21 May 1995) about the monitoring of emissions in the atmosphere and the structuring of data. IRCEL/CELINE is the single national entity with overall responsibility for the preparation of the Belgian GHG inventory. IRCEL/CELINE operates as national compiler of GHG emissions in Belgium. It is responsible for :

- The coordination and implementation of the general and specific functions of the national inventory system;
- The compilation of the national inventory, on the basis of the regional datasets (national compiler);
- The establishment, maintenance and archiving of the national inventory database;
- The development and implementation of a QA/QC plan, including the coordination between all actors and the assurance that the various organizations involved in the preparation of the national inventory follow the procedures established in the QA/QC plan. IRCEL/CELINE is the final responsible for the national inventory, and any change at this stage is conducted only by IRCEL/CELINE, after co-ordination with the relevant regional contacts;
- The coordination of review activities (both on European and international level) and contacts with the associated organisations European Environmental Agency (EEA) and the UNFCCC-secretariat (inventory focal point).

### 2.2.2 Federal Public Service Health, Food Chain Safety and Environment - DG Environment

The **Directorate General Environment** of the **Federal Public Service** Health, Food Chain Safety and Environment (FPS - DG Environment) participates to the activities of CCIEP-WG Emissions in relation with GHG inventories. It is also involved in the national inventory system in its capacity of UNFCCC National Focal Point of Belgium. According to the MRV (Monitoring, Reporting and Verification) law of 28 October 2016 and Royal Decree of 22nd December 2006, the Directorate General Environment of the Federal Public Service Health, Food Chain Safety and Environment is responsible for the reporting, monitoring and evaluation of federal actions communicated by the entities and services of the federal state in possession of the relevant data and information, in accordance with Regulation (EU) no 517/2014 and 525/2013.

### 2.2.3 Federal Public Service Economy, SMEs, Self-employed and Energy – DG Energy

The **Energy Observatory** of the **Directorate General Energy** of the Federal Public Service Economy, SMEs, Self-employed and Energy (FPS - DG Energy) is responsible for realizing the (top down) estimation of energy-related $CO_2$ emissions according to the IPCC-methodology "reference approach", on the basis of the national energy balance. In this quality, it is member of the CCIEP-WG Emissions.

The Energy Observatory's mission is to collect, process and analyse energy data and use these data for prospective studies.

Journal of 31 March 2003), amended by Royal Decree of 16 May 2004 (Belgian Official Journal of 11 June 2004), Royal Decree of 23 May 2006 (Belgian Official Journal of 12 June 2006), Royal Decree of 10 August 2005 (Belgian Official Journal of 19 August 2005), and Royal Decree of 25 March 2016 (Belgian Official Journal of 08 April 2016).

There are also several Ministerial Decrees laying down the models of the questionnaires: Ministerial Decree of 14 June 2005 laying down the models of the questionnaires for the collection of data concerning electricity, heat and natural gas (Belgian Official Journal of 1 July 2005). Ministerial Decree of 14 September 2006 laying down the models of the questionnaires for the collection of data concerning the petroleum balance (Belgian Official Journal of 20 October 2006). Ministerial Decree of 25 March 2016 laying down the models of the questionnaires for the collection of data concerning the petroleum balance (Belgian Official Journal of 8 April 2016).

The collected data is made available on the website http://economie.fgov.be/en/statistics/figures/energy/energy_statistics/

### 2.2.4 The Working group of CCIEP on Emissions (CCIEP-WG Emissions)

The CCIEP-WG Emissions is composed by the regions and federal entities. It plays a central role in the coordination of the national GHG inventory. The CCIEP is the principal organ for coordinating international environmental policy. Its Working group on Emissions is a regular body of exchange of information between the regions, IRCEL/CELINE, the Energy Observatory and the UNFCCC National Focal Point. All technical aspects of the GHG

inventory (methodological choices, emission factors, uncertainty analysis, QA/QC, etc.), as well as organizational aspects of the preparation process, are coordinated via the CCIEP-WG Emissions.

Beside the yearly official submissions of the Belgian greenhouse gas inventories, other reporting requirements such as the National Inventory Report and responses to the review processes are prepared within this group. The CCIEP-WG Emissions is also the forum for the process of improvement of the national inventory system. It is also responsible for streamlining the QA/QC procedures and for the regular evaluation of the implementation of these procedures conducted at the regional level.

### 2.2.5 National Climate Commission

The National Climate Commission, established by the Cooperation agreement of 14 November 2002[1], is composed of representatives of the three Regions and the federal State. Its main responsibilities consists in :

- The establishment, execution and monitoring of the National Climate Plan and the fulfilment of reporting obligations under the UNFCCC and the Kyoto Protocol, and the European "Monitoring Mechanism Regulation" (regulation 525/2013/EC);
- Making sure that methodologies, procedures, data analysis, projections used by the Parties to the agreement are compatible and, if possible, harmonized.

In this respect, this Commission is in charge of the approval of the GHG inventory reports.

### 2.2.6 The Inter-ministerial Conference for the Environment (ICE)

The ICE[2] took a series of decisions that clarify the role and responsibilities of different entities, as regards the preparation of the national GHG inventory. An overview of these decisions, and relevant extracts, are listed below:

(a) Decision of the ICE, 7 October 1999

- [..] future inventories of GHG emissions shall be established on the basis of the data delivered by the regions, and completed, if required, by complementary information.

(b) Decision of the Inter-ministerial Conference for the Environment, 6 March 2002

- [..] The ICE confirms that the Regions shall deliver annually their most recent data on GHG emissions for the purpose of international reporting and for the assessment of the domestic climate change policy. The ICE decides that emission data shall be collected in accordance with procedures as defined in UNFCCC guidelines, concerning the national inventory of GHG emissions. Regions commit themselves to deliver their data on GHG emissions for the previous year as from 31-12-2004 on.

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[1] Cooperation agreement between the Federal State and the Regions for the implementation and the follow-up of a National Climate Plan, and the reporting in the context of the UNFCCC and KP, 14 November 2002

[2] The ICE is a specialized committee devoted to matters for which intergovernmental co-operation is required for implementing environmental policies

- [..] IRCEL/CELINE is in charge of the annual compilation of data of the national GHG inventory, under the Common Reporting Format (CRF) as described in the UNFCCC guidelines, based on data delivered annually by the regions. The ICE decides that the human resources within IRCEL/CELINE must be consolidated so as to ensure compliance with international reporting obligations as regards GHG inventories.
- [..] The ICE gives mandate to the CCIEP-WG Emissions and IRCEL/CELINE, in collaboration with the coordination group "greenhouse effect" of CCIEP, [..] to elaborate a procedure of quality control of the national GHG inventory and to notify this procedure to the ICE.

## 2.3 Regional responsibilities

The three regions are responsible for :

- Collecting the data;
- Realising the estimates of emissions for the sources on their respective territories;
- Compiling this information in regional inventories;
- Providing this information in due time to the NIC;
- Providing any relevant documentation to the NIC, according to the procedures of the national system, such as QA/QC checklists or updated procedures;
- The follow-up of the review activities (both on European and international level) and contacts with the associated organisations EEA and the UNFCCC Secretariat (inventory focal point).

The quality and assurance controls already carried out within the responsible regions, are supplemented by the QA/QC performed to the national Belgian inventory. After completion of the Belgian GHG emission inventory by IRCEL/CELINE, the regions and IRCEL/CELINE carry out further quality control checks of the national inventory before the official submissions take place**.**

Each region has its own legal and institutional arrangements, which are detailed in the NIS (Belgium, 2017).
The three regions in Belgium are responsible for the compilation of the regional emission inventories. Following institutions are responsible for setting up the regional GHG inventories:

- The Flemish region : the Department Air, Environment and Communication of the Flanders Environment Agency (VMM);
- The Walloon Region : The Walloon Agency for Air and Climate (AWAC);
- The Brussels Capital Region : Brussels Environment (IBGE/BIM).

The coordinators of the GHG inventories in the three regions are listed in Table 1. The coordinators are responsible for constructing the regional emission inventory and managing relations with any external organization contributing to them. When completed, the emission inventories are sent to the Belgian coordinator IRCEL/CELINE for aggregation with the other two regional inventories.

These coordinators are supported by a team of experts for the different sectors involved.

Table 1 : List of the coordinators of the GHG emission inventories in the three regions in Belgium.

| Region | Coordinator |
|---|---|
| **Flemish region** | Miet D'heer |
| **Brussels Capital region** | François Goor |
| **Walloon region** | André Guns |

# 3 Improvements

The process of making up the Belgian GHG emissions inventory has improved in several ways in the past years. The quality of the GHG inventory is improving continuously taken into account the results of the different reviews carried out each year, both on European and international level. These improvements are reported each year on a sectoral basis in the NIR. Also the planned improvements, if relevant, are reported in the NIR.

In implementing the new IPCC 2006 Guidelines, a great effort was made to harmonise the methodologies between the three regions. At this time, additional ad hoc meetings and working groups between the regions took place. Sectoral experts from various authorities and agencies were also involved in developing new methodologies and improving existing methodologies.

All the QA/QC check-up tables in Excel have been updated to include the new IPCC 2006 classification. A conversion from the old to the new IPCC codes was performed in all databases, tools and Excel-tables.

The new CRF Reporter Software has been implemented at the level of the three regions as well as the national level. The structure of the navigation tree and the methodology of data entry have been fully harmonized between the three regions. As such, each region makes up a complete GHG emission inventory and imports the data per sector to its own regional CRF reporter. Data are then exported and an extensive quality check at the regional level per sector is performed, before delivering the Excel files to the person in charge of the compilation of the data at Belgian level. Macros have been developed in Excel VBA to (largely) automate the compilation of the data, hence ensuring the quality of the compilation process and greatly reducing the risk of errors.

Improvements have also taken place at the IT/technical level, among others the (further) development of databases, custom-developed electronic reporting tools, validation

software, and tools and macros in Excel. This has greatly improved data flows and reduced the chances of errors.

For instance, in the Flemish region, around 400 companies now all report their annual environmental report via an electronic tool. Via xml, the air emissions data are stored in a custom-developed tool ('air emissions inventory tool'). The tool has been set up to allow thorough checks and validation procedures before the data are written to a Data Warehouse. The air emissions Data Warehouse is still being further developed in order to store data from other sectors and pollutants as well besides the data from the companies.

In the Brussels Region, as the result of an IT audit performed in 2015 a new improved tool was developed, see for more information chapter 6.3.3.

In Wallonia, a new air emission software (WAPI) has been developed since 2015. This software is presented in section 4.2.2.

In general, at each submission efforts are made to ensure the consistency and quality of the data. Thorough controls are performed not only by regional emissions inventory compilers and the person in charge of the compilation of the data at national level, but also e.g. by policy experts and sectoral experts from other authorities. The results of the different reviews carried out each year (both on European and international level) are taken into account. The improvements and recalculations are reported each year on a sectoral basis in the NIR. Also the planned improvements, if relevant, are reported in the NIR.

Depending on available resources, studies are carried out to further improve the quality of the inventory. Where possible, studies are conducted and coordinated at the national level, including results for Belgium and the three regions, thus ensuring consistency in the methodologies. Examples are the annual inventory of F-gases and ozone-depleting substances, the set-up of the common methodology for the land use matrix in the LULUCF sector, transport models – BTEI tool.

# 4 QC procedures

QC procedures are performed both at the regional level and at the national level by IRCEL/CELINE, who carries out further quality control checks specifically on the national inventory, before the official submissions take place. The QA/QC system for the national inventory is in place in Belgium and it is under continuous improvement as the QA/QC procedures at the regional level. The work program is detailed hereunder.

The check procedures recommended by the IPCC 2006 guidelines guide this work of accuracy during the quality control work.

## 4.1 At national level

The NIC is responsible for the QC checks performed during and after the compilation of the national inventory. The CCIEP-WG Emissions is responsible for all the QC checks done at the most detailed level, and for the co-ordination of the Belgian GHG inventory. If an error identified by the NIC originates from one of the three regional sets of data rather than from a compilation problem, the regional agency is consulted by the NIC before any correction takes place, this is necessary to guarantee data consistency between the different levels.

The deadlines for these checks are presented in Annex 1, with "year X" being the year of the submission. A more detailed timeframe is presented in annex 2, which gives an overview of the QC checks performed through the year.

The template used to perform the QC checks per source category is presented in the annexes 3a and 3b.

Due to the specificity of the Belgian NIS (Belgium, 2017), and the responsibility of the regions in collecting primary activity data and realizing emissions estimates at regional / sectoral level, the QC checks related to primary data collection and emission estimates are mainly performed at the regional level. The implementation of these QC checks on the regional level is presented in annex 4.

Uncertainties of the GHG emissions estimates at the national level are calculated according to Tier 1 (see NIR , Chapter 1.7, for more details).

### 4.1.1 Completeness

A detailed record of all sources in Belgium is on national server with regular backup. All necessary “notation keys” for all source categories are filled in using the information provided by the regions and is checked by the national inventory compiler.

Lack of notation keys was identified as the main completeness issue in the Belgian inventory until the 2009 submission. A revision and completeness check of the notation keys was carried out during 2009 submission and remains a permanent focus point.

Furthermore, when national aggregated emission estimates per sector and different vectors are available, these emissions are compared to the sum of the regional estimates (to the highest level of detail if necessary) and potential differences are investigated with the regional experts, justified and documented for archiving. This assessment is yearly reported in a dedicated chapter of the NIR (Belgium, 2017) : report on the assessment of completeness can be found in chapter 1.8 ‘General assessment of completeness’ and in chapter 9 ‘Recalculations and improvements’ of the NIR.

### 4.1.2 Consistency and comparability

The time-series consistency is checked in the national inventory by NIC, through trend analysis on emission estimates, activity variables and emission factors. Checks are performed according to the IPCC 2006 GL, Annex 6A1.

The inconsistencies between regional estimates are also checked. The work is primarily focused on the national key sources in order to make the most efficient use of available resources. This check is mainly conducted by the NIC during the compilation of the three regional inventories and, if necessary, discussed in the working group of Emissions of the CCPIE. This is the case when f.i. any differences in implied emission factors IEF or discrepancy in the time series is highlighted. At that moment the NIC sends a message to the regional sectoral experts to try to explain or correct the differences. Documentation is done at the regional level, or communicated in the recalculation sections of the NIR.

### 4.1.3 Transparency

Detailed information of methodologies, activity data and emission factors used, is included in the NIR. This development is an ongoing task mainly based on the recommendations of the expert review team during the several reviews.

Methods and data are systematically documented to facilitate the use and the evaluation of the inventory by users and reviewers. See ”Documentation and archives” here after in section 8.

### 4.1.4 Accuracy

As a basis, Tier 1 QC checks are applied at both regional and national levels, on the basis of Tier 1 QC procedures described in chapter 4.2, adapted from the IPCC Annex 6A1.

The national key sources are priority checked by inventory compilers as well as by the expert review teams. This analysis considers emissions, activity data and emission factors.

Checks on other source categories are also conducted, although less intensive. Because of limitations in time and resources, priorities need to be fixed.

Source-category specific QC procedures (Tier 2) still has to be applied on a case-by-case basis, at the national and regional level, focusing on key source categories, or source categories where significant methodological or data revisions have taken place. These procedures will also address emission data, activity data, and uncertainty estimates.

The IPCC 2006 guidelines, and in particular chapter 4 in Vol. 1, is used to identify the source categories that have the greatest contribution to overall inventory uncertainty in order to make the most efficient use of available resources.

### 4.1.5 Timeliness

The evaluation of the yearly delivered data is assessed following the timetable as presented in Annex 2.

### 4.1.6 Other aspects

Regarding the secondary activity data and information flows, the existence of adequate QA/QC procedures is described in section 5.

## 4.2 At regional level

All three regions perform their own QC procedures.
The state of the art is briefly described below. The Tier 1 QC checks conducted at the regional level are also described in annex 4.

**Consistency**

Regions are responsible for checking time-series consistencies on their regional inventory, through trend analysis on emission estimates, activity variables and emission factors.

**Comparability**

The choice of the estimation method at the source category level is assessed by means of the decision trees as described in the IPCC 2006 guidelines. The choices of emission factors

and activity data are compared with the information provided in the guidelines. Conform to IPCC guidelines, country or region specific information is used to estimate the emissions, because of higher accuracy of this data.

Due to historical or practical reasons and reasons of availability of data and information in the three regions,
not all methodologies are equal between the regions. However, the regions are devoting large efforts in ensuring the consistency of the methodologies and emission factors used for estimating the emissions. Inconsistencies are evaluated at each submission (e.g. on the basis of reviews on the European and international level) and are discussed in the CCIEP-WG Emissions and ad-hoc meetings and work groups.

Also in implementing the new IPCC 2006 Guidelines, a great effort has been made to harmonise the methodologies and emission factors between the three regions.

The methodologies used per region are described in the relevant chapters in the NIR.

**Accuracy**

The regions are responsible for the checks of the data's accuracy at the regional level.

### 4.2.1 The Flemish region

***Procedures directly applied to the inventories***

In the beginning of 2004, in Flanders, a study started to calculate the uncertainties (both on Tier 1 and Tier 2 level) and to guide in the implementation of a quality system (QA/QC-plan) of the emission inventory of GHG. Final results of this study became available in May 2004.

A complete development of the QA/QC system (among others further description in detail of all the procedures involved) as well as a first internal review became operational in the course of 2005. A responsible for the quality management system of the Flemish GHG inventory was nominated at that time. A full implementation of the quality system for all sectors and on the most detailed level was started in the beginning of 2006.

The quality system set up in Flanders is completely based on the standardized norm ISO 9001:2000. In the process of development of the quality management system in Flanders, a gap-analysis was carried out, a quality structure and different standardized procedures were set up. A quality handbook was published which includes all aspects of a technical and organizational level to set up the emission inventory.

Standardized procedures of different levels have been defined. A summary is given below of all procedures involved in the Flemish QA/QC-system:

General procedures

VMM/KZ/GP/0.004: Procedure for the handling of complains;

VMM/KZ/GP/0.008: Procedure for the performance of audits;

VMM/KZ/GP/0.010: Procedure for setting up a general quality care–management report;

VMM/KZ/GP/0.011: Procedure for the management of documents;

VMM/KZ/GP/0.011: Procedure for the network backup.

Specific procedures

VMM/EIL/GP/5.001: Procedure to determine non-conformities, quality problems and proposals for improvement and follow-up by means of corrective and preventive measures (not yet fully implemented);

VMM/EIL/GP/5.002: Procedure for the training of the personnel of the service "Emissie Inventaris Lucht" (Emission Inventory Air);

VMM/EIL/GP/5.003: Procedure for the main process: setting up the GHG emission inventory;

Besides these procedures, forms are also used in the Flemish quality management system to follow up the inventory process for the different sectors. These forms describe the required characteristics of input data that needs to be collected to ensure accurate emission estimates. All data are verified, consequently an indication of the quality of data is given. These forms also report how the calculation of the emissions occurs and tell something about the trends in that specific sector. These forms were evaluated with all users (responsible for the different sectors) in the course of 2007.

A translation of these forms into the IPCC table 8.1 with QC checks was carried out in the course of 2009 for the first time in the Flemish region for all key sources of the GHG inventory. If necessary, an actualization of the procedure VMM/EIL/GP/5.003 for the main process (setting up the GHG emission inventory) is carried out.

The optimization of these procedures became official in the beginning of 2008.

From 2007 on and on an annual basis, a management evaluation of the quality system was performed. This document formulates conclusions and recommendations to improve the system with respect to the improvement of the effectiveness of the quality system and the involved processes in relation with the requirements of the clients and the needs of resources.

From 2005 on internal audits are performed on an annual basis with the overall responsible of the quality systems carried out in the Flemish Environmental Agency. Checks are carried out during the audits to test the compliance with the ISO-norm. In 2006 an external audit with Det Norske Veritas took place.

All the technical procedures involved and an example of one of the forms used in the quality management system of the Flemish GHG inventory are presented in the Belgian National Inventory Report.

All information needed to set up the Flemish GHG inventory (incl. Flemish energy balance and all basis data) is stored on a central server of the Flemish Environmental Agency. Backups of all these data are made on a regular basis.

***Procedures on secondary data***

GHG inventories rely for a large part on energy balances established annually. In Flanders, the procedures to prepare the Flemish energy balance, set up by the Flemish Institute for Technological Research (VITO), are part of a certified ISO 9001 system since July 2000. The certification is extended and expanded and is at this moment a fully operational quality and environmental management system, meeting all the requirements of the **ISO 9001: 2008, OHSAS 18001: 2007 and ISO 14001: 2004** standards (see certificate below). These management systems outline properly developed measures and procedures to guarantee the quality of delivered services and products in conformance to the expectations of its customers, where attention is continuously given to the impact of VITO's work on the environment. This certificate is currently applicable to research activities with focus on cleantech in the areas of sustainable chemistry, energy, health, land use and materials, development of innovative technology, products and processes in these domains, provision of independent advice and services on sustainable resource management, close material cycles, new business models, more efficient chemical processes, recycling of valuable components from waste streams, optimisation of thermal energy systems, healthy living and working environment and sustainable land use. The activities are excluding the proficiency testing and recognitions and the activities of Certipro.

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Lloyd's Register LRQA

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**De activiteiten i.k.v. de ringtesten&erkenningen en de activiteiten van Certipro zijn uitgesloten.**

Certificaat no: ANT1240061/QMS

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| Datum van uitgifte eerste ISO 9001 certificaat | : | 21 december 2007 |
| Datum van uitgifte eerste ISO 14001 certificaat | : | 24 March 2007 |
| Datum van uitgifte eerste OHSAS certificaat | : | 21 February 2013 |
| Datum van uitgifte huidig certificaat | : | 21 februari 2016 |
| Certificaat vervaldatum | : | 14 september 2018 |

Afgegeven door: Lloyd's Register EMEA, Antwerp Office
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UKAS MANAGEMENT SYSTEMS 001

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Specific for the preparation of the energy balance the quality system includes 7 procedures.

| | |
|---|---|
| Energy Balance_GENERAL MES_3_2_A | General procedure with methodology and timing to prepare an energy balance for a specific year. |
| Energy Balance_HOUSEHOLDS MES_3_2_B | The procedure describes the methodology to collect data and to determine the energy consumption for the households in Flanders for a specific year. Sector specific QC checks are included |
| Energy Balance_INDUSTRY MES_3_2_C | The procedure describes the methodology to collect data on energy consumption and production in the industrial sectors in a specific year.<br>The procedure describes the methodology to determine the energy consumptions from the industry in Flanders for a specific year.<br>Sector specific QC checks are included |
| Energy Balance _AGRICULTURE MES_3_2_D | The procedure describes the methodology to collect data on energy consumption and production in the agricultural sectors in a specific year.<br>The procedure describes the methodology to determine the energy consumptions from agriculture in Flanders for a specific year.<br>Sector specific QC checks are included |
| Energy Balance_ TERTIAIRY MES_3_2_E | The procedure describes the methodology to collect data on energy consumption and production in the service sectors in a specific year.<br>The procedure describes the methodology to determine the energy consumptions from the service sectors in Flanders for a specific year.<br>Sector specific QC checks are included |
| Energy Balance_TRANSFORMATION MES_3_2_F | The procedure describes the methodology to collect data on energy consumption and production in the transformation sector in a specific year.<br>The procedure describes the methodology to determine the energy consumptions and production (energy and products) from the transformation sectors in Flanders for a specific year.<br>Sector specific QC checks are included |
| Energy Balance_TRANSPORT MES_3_2_G | The procedure describes the methodology to collect data on energy consumption in the transport sectors in a specific year.<br>The procedure describes the methodology to |

| | |
|---|---|
| | determine the energy consumptions from the transport sectors in Flanders for a specific year.<br><br>Sector specific QC checks are included |
| Energy Balance_CHP MES_3_2_H | The procedure describes the methodology to collect data on energy consumption and production and on the technical characteristics of the cogeneration facilities in Flanders. The procedure describes the methodology and timeline to prepare a CHP-inventory for Flanders for a specific year.<br><br>Sector specific QC checks are included |

The general procedure on the energy balance describes the general methodology used to establish a yearly energy balance for Flanders. Purpose of this procedure is to give information and instructions to be able to establish in a coherent way an energy balance for Flanders in a specific year. The procedure refers where appropriate to the other procedures for specific sectors.

The mentioned procedures for the preparation of the energy balance for Flanders are project-specific procedures. These are part of the covering quality system of VITO. An example of a general procedure is the procedure on non-conformities, deviations and recommendations for improvement (VITO-301-PRO-E)This procedure describes the responsibilities and actions to be taken of all staff members in case aberrations occur.

### 4.2.2 The Walloon region

In the Walloon Region, the inventory is conducted by AWAC.

QC checks are routinely applied during the development of inventories. Notes covering validity checks and recalculations are filed and stored by inventory compilers. Among others, activity data and emissions factors reported by industrial companies under the European Emission Trading Scheme (ETS) and validated by independent experts are systematically cross-checked with data from the regional energy balance to ensure consistency of both ETS and GHG inventory reporting.

The QC checks according to the IPCC Annex 6A1 are conducted in the Walloon region since 2009 for all key sources of the GHG. In 2014, a new inventory software was developed in Wallonia (WAPI) improving the quality of the regional and the national inventory. Until the 2014 submission, Wallonia used the database Collecter to manage the inventory data's (one collecter database by year). But since the 2015 submission, a new air emission software (WAPI) has been developed. This software allows the seeing of all data's of a plant or an area source on the complete time series and avoids mistakes during recalculations (jump, zero, errors of unit,...). This new software is also used to report some sectors of the LRTAP inventory. It also allows direct plot of the data for visual check of the time series and identification of possible outliers in AD, EF or emission estimates.

The AWAC is currently organising the designation of a back-up expert for each sectoral expert involved in the inventory preparation. These second experts will also be in charge of QC checks, as they will need a complete understanding of all the calculation and reporting files.

***Procedures on secondary data***

The energy balance in the Walloon region is established by Institut de Conseils et d'Etudes en Développement Durable (ICEDD), an independent institute whose activities are covered by an ISO 9001 certification.

CO2 country-specific emission factors used in the inventories are determined in the framework of the EU-ETS system.

The operator of the EU-ETS plant must have declared and verified its emissions from the previous year through the ETSWAP application. The verification must be carried out by an independent auditor accredited according to ISO14065 and according to the European Accreditation and Verification Regulation.

The Monitoring Plans follows the Commission Regulation 601/2012 on the monitoring and reporting of GHG emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council.

$CH_4$ and $N_2O$ country-specific emission factors used in the inventories are determined from air emission measurements, performed by laboratories which must be agreed by the official institute ISSEP. The agreement covers a review of material and methodologies used and checks the compliance with the requirements of a legal decree.[3]
http://awac.be/index.php/guichet-technique/agrements/laboratoires.

The updated list of agreed laboratories is published on the website of AWAC. http://awac.be/images/Pierre/tech_Labo/A.%20Liste%20des%20laboratoires%20agr%C3%A9%C3%A9s%20en%20RW.pdf.

### 4.2.3 The Brussels Capital Region

During 2016, an audit on the system used to implement the emission inventory has been conducted. Afterwards, a new tool called "BRAINSNG" has been developed following the audit recommendations to improve the quality of the emission inventory and the Quality check procedure. The calculation of the emission was partly automatized avoiding some human errors.

The BRAINSNG tool has been implemented to answer to the recommendations of UNFCCC in terms of QC: completeness consistency, comparability, transparency, accuracy and timeliness. Previously to the development of the BRAINSNG tool, an IT audit was done and summarize the shortcomings of the old BRAINS system. BRAINSNG solves the shortcomings summarize in this IT audit.

[3] The ERT raised questions during the 2016 review on the consistency of methodologies and emission factors between regions. The Party responded and ERt concluded (provisional main findings) that "progress has been made by the Party to use the most appropriate EFs for each region and the Party are commended for using the best data possible"

The QC procedures occur on the following levels:

- On release data (in file RD.* must be present in External data in the Configuration file);
- On the emissions;
- On the final reporting.

The QC checks developed are generic, not source specific. Source specific QC can then always be added.

### TRANSPARENCY

BRAINSNG improves the transparency of the data by:

- File naming convention;
- Files are structured and are more transparent: Each activity data in the 10-Compilation \ 0_Sources directory is written to an RD * file in which a QC tab is present. This tab describes the data, informs about the dependency of the different files on this data (data tracking) and sometimes on the reference of the data (sources). A year-base archiving is used;
- The input data are saved at one place and not be duplicated to avoid error;
- Documentation to explain BRAINSNG (Bruxelles Environnement, 2016) indicates where the files are saved : external data, data calculated;
- Extended change/history logging are saved;

### ACCURACY AND CONSISTENCY

The new structure improves the accuracy and consistency of the emission inventory within:

- Use of best Excel practices (Tables, Names, one single final result in DB Pivot, very limit number of sheets, excel error checking macro…);
- Extended data source reference specification;
- Uniformity;
- Consistent process flow;
- Inside the Configuration file you specify an expected unit:
  - AD in Emission Sources ;
  - EF in Emission Factor (or Emission Output if calculated).
- Emission units themselves are specified inside the Model, for each pollutant the reporting unit is indicated;
- The RD files themselves also export their units;
- QC checks are done on the compatibility between the activity data, emission factors, emissions and Configuration/RD units;
- Up to date dependency checks ;
- Internal consistency checks ;

Figure 2 describes the model of the BRAINSNG tool.

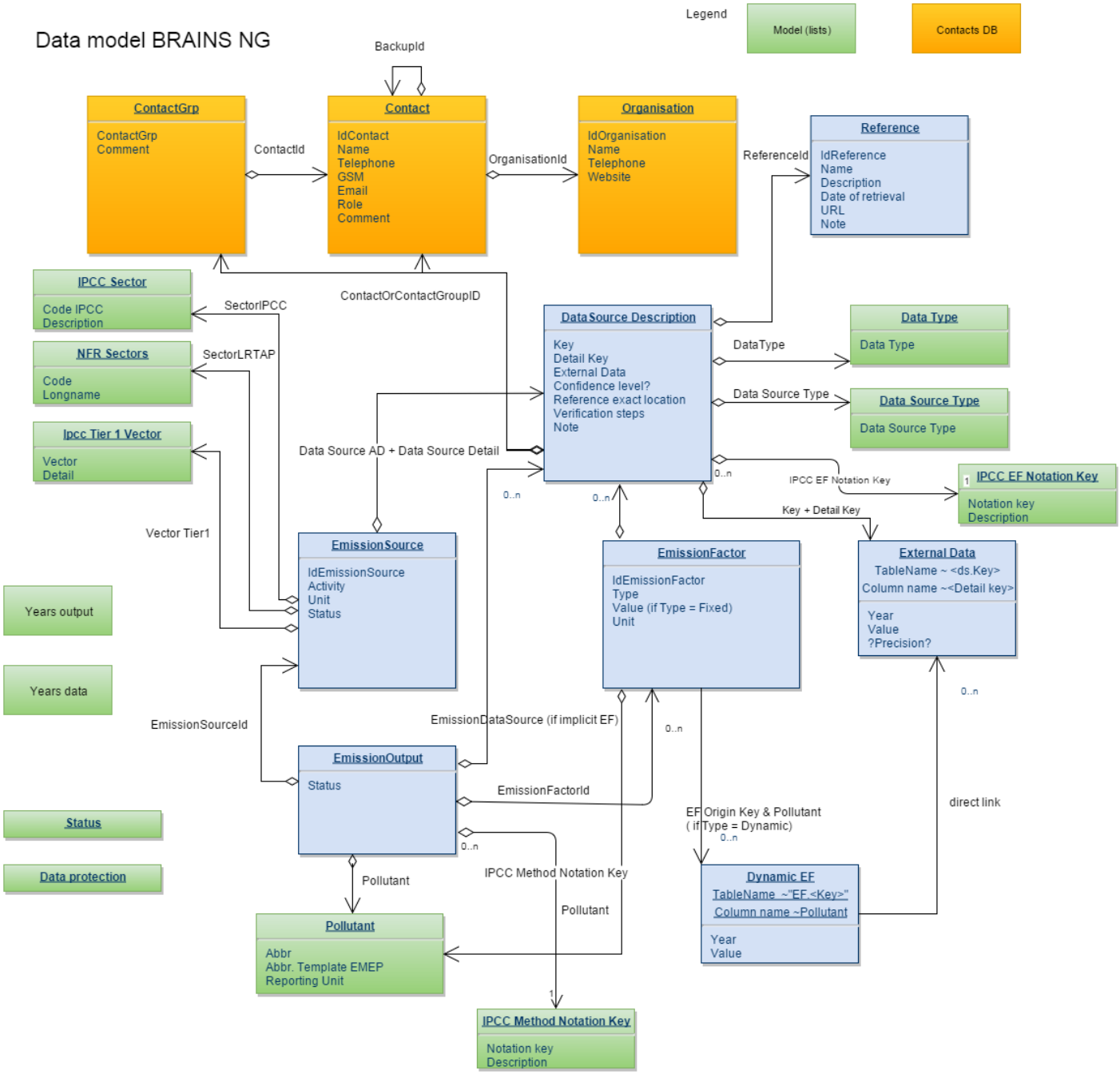


**Figure 2: Data model BRAINSNG**

## COMPLEMENTARY QC CHECK

Completing the "built-in checks" within BRAINSNG, some extra QC-tools which operate on different data levels are added.

The Release Datastreams with the ones of the previous official release are compared. Changes detected should be annotated in the QC-Doc-Changes file. For every datastream that changes, a "Change set" describing the difference is added.

Changes between actual and previous submission has been summarized. This information should be copied in the "QC-Doc-Changes" file, as mention before. Graphs have been also created to identify the changes between the different submissions of the emission

inventory. The outliers of the release data are also detected by a specific check. All the changes have been documented with a specific tool.

The emissions corresponding of year n are comparing with the ones for year n-1. The times series are analyses to detect some potential errors.

A centralized file is also used to centralize changes between the emission inventories at year n compared to the one at year n-1. The expected values of the emission inventory are also saved in this file; they will be compared with the emission determined in the quick check procedures.

Some visualization tools are developed to check easier the emissions and the data release.

***Procedures on secondary data***

The Brussels Capital region is an urban region; consequently the most important share of GHG originates from energy consumption.

Between 1990 and 2013, the Brussels energy balance is established by ICEDD, whose activities are covered by an ISO 9001 certification. These activities are strictly planned in order to get the information needed for updating the inventory in the required times.

Uncertainties analyses on energy balances in the Brussels-Capital Region have been conducted by the ICEDD.

For many source categories, estimation methods rely on the use of activity data and associated input variables that are not directly prepared by institutes responsible for inventories.

For the energy balance since 2014, the methodologies used previously are checked and if necessary revised. The methodologies used are described in details within several technical report.

# 5 Information flows and secondary data sources

For many source categories, estimation methods rely on the use of activity data and associated input variables that are not directly prepared by institutes responsible for inventories. This is the case not at least for setting up of the regional energy balances, important data source when producing GHG inventories, as well as for the national statistics.

Another example is that the emissions of the fluorinated GHG are established by an external consortium of consultants (Econotec/VITO), both on the regional and the national level. See in this context also the National Inventory System for more information as well as the National Inventory Report (chapters 1.3 Inventory preparation and 1.4 Brief general description of methodologies and data sources used).

Information about the results of this study can be found on http://www.cnc-nkc.be/en/reports

Institutes responsible for the above tasks have their own QC procedures implemented which are not recorded in this document.

See in this context, the *IPCC Good Practice Guidance and Uncertainty Management in National GHG Inventories,* chapters 8.6 (General QC Procedures - Tier 1) and 8.7 (Source5 Category-Specific QC procedures - Tier 2): 'responsible institutes for inventories have to verify that adequate QC procedures have been implemented by consultants, agencies or offices producing these data'.

Different "status of data" have to be considered: site-specific data, secondary data sources and emissions estimated by a consultant.

# 6 Quality Assurance procedures

Quality assurance is performed by means of reviews on the compiled and verified datasets. Reviews are led by external persons to the inventory process and/or by peers.

## 6.1 At international level

Existing QA procedures such as the performed internal and external reviews of the regional GHG inventories, the approval of the inventories by the National Climate Commission, reviews performed by the EC in collaboration with the Topic Centre on Air & Climate Change and reviews under the UNFCCC and the Kyoto Protocol are in place. The follow-up of these reviews, which are greatly extended over the years, is an almost continuous task for the regions. The results of these reviews are taken into account on a yearly basis, as far as necessary resources are available, to further improve the Belgian GHG inventory.

Besides, the following reviews are carried out on a yearly basis on the international level:

- QA/QC-checks, initial checks and status reports by the European Environmental Agency and their contractors since 2007 on;
- UNFCCC-reviews: centralized reviews on a yearly basis since 2005 except for the years 2003, 2007, 2012 where an in-country review took place;

- ESD (Effort Sharing Decision)-review: review of national GHG inventory data pursuant to Article 19(1) of Regulation (EU) No 525/2013 for the years 2012 (voluntary) and on a yearly basis from 2015 on.

## 6.2 At national level

### 6.2.1 External audit

Member states are yearly subjected to several reviews (see above). As a consequence no resources remain available to carry out other external reviews of the national inventory.

### 6.2.2 A two level peer-review process

The compilation and aggregation of regional inventories to build the national database constitutes a first opportunity to check the consistency and emissions allocations between regional datasets. The procedure is led by IRCEL/CELINE and the main responsible personnel of the regional inventories (sectoral experts). It includes the verification that methodologies applied to estimate emission levels always respect UNFCCC requirements (i.e. basically Tier 2 methods to be applied for all identified key sources).

A second level consists in a peer review with similar foreign countries following the completeness of the inventory. Such an exercise has been performed in Belgium in collaboration with the Netherlands in the course of 2005.

All the outcomes of the QA evaluation are used for continuous improvement of the regional and national inventories.

### 6.2.3 A process of approval of the national inventory by the National Climate Commission

This procedure is applied since 2005. Relevant documents are archived on the website of the *National Climate Commission*: www.cnc-nkc.be

## 6.3 At regional level

### 6.3.1 The Flemish Region

The implementation of a procedure for the main process is already fully implemented by the Flemish region and actualized each year (see section 4.2). Nevertheless, in the Flemish region internal audits carried out by people responsible of the quality management system in the Flemish Environment Agency are carried out since 2005 on a more or less yearly basis. An external audit performed by Det Norske Veritas was carried out in February 2006. The results of these audits can be obtained through the person in charge of the quality system of the GHG inventory in the Flemish region.

In the Flemish region a management review system has been conducted since 2007 on an annual basis.

### 6.3.2 The Walloon region

An external audit of the Walloon inventory was conducted by Artur D. Little in August 2003 (Report on Emission Inventories Compilation in the Région Wallonne and IRCEL-CELINE) to assess :
- The compliance of the emission inventories with current reporting obligations
- The future requirements to be introduced which will increase reporting obligations in the Région Wallonne and CELINE

This audit lead to the engagement of additional resources dedicated to inventory reporting.

Envirnement reporting by the industrial plants has been subject to external assessment of the methodology, conducted by ICEDD.

### 6.3.3 The Brussels Capital Region

#### AUDIT ON THE INVENTORY EMISSIONS ITSELF

The emission inventory of the Brussels Capital Region have been checked in 2016 by two French emission inventory teams “ATMO grand Est” and “AIRPARIF (AIRPARIF et ASPA, 2016). They have already checked other French emission inventories and a German one.

The methodology for this review included an analytical desk review of the content based on:
- A quality checks performed during emission inventory compilation process relating to the requirements of the European and international legislations (in particular the guidelines of UNFCCC and EMEP/EEA)
- A comparison of the methodologies used in the Brussels emission inventory and the French emission inventory made by CITEPA (in charge of the French national emission inventory) and the regional emission inventories for Paris and EMS (European Metropol of Strasbourg).

This report is based on a detailed comparative analysis of methodologies, inputs and emission factors by sector and in particular on the sectors identified by a preliminary review.

When there are differences in emission factors between the three territories, the Brussels emissions will be determined with the emission factors used in Paris and in EMS in order to estimate the discrepancies between the three calculations. In the case of French average factors, these factors are taken from the OMINEA report of CITEPA.

Conclusions of this audit are summarized below.

Concerning the methodology and the organization of the emission inventory determination, several aspects guarantee the reliability and the consistency of the emission inventory:

- All the key sources are well estimated and the minor sources which are not been estimated have an insignificant impact on the estimation of the emission (only few sectors are note estimated like bier production, tobaccos consumption; wood working,…);
- The key sources are well estimated based on local data as the regional energy balance;
- The primary sources are in general very good. The emission factors and the parameters corresponding to that data are well documented and consistent;

- An integrated approach is used between the Brussels emission inventory, the other two emission inventories of the Walloon and the Flemish emission inventory and the federal level with the energy balance;
- The international guidelines (IPCC, EMEP/EEA) are well known;
- The time series are consistent thanks to the methodology used;
- The Brussels emission inventory team has shown a strong motivation to improve the quality of the emission inventory and to have an exhaustive emission inventory.

#### IT AUDIT

In 2015, an audit on the IT system BRAINS used for the emission inventory was done. A new staff member, with IT-background was temporarily engaged to make an analysis of the current data inventory, propose improvements and help implement them (Bruxelles Environnement, 2015). The first part of the audit consisted of an analysis of the IT system. It highlighted it shortcomings and offered recommendations. This audit led to an improved BRAINS which adheres to the general requirements of a quality software tool. It aims to be reliable, user friendly, maintainable, flexible and extendible.

Because of this audit, the development of the new tool BRAINSNG (see section 4.2.3) by this external expert could be done to solve the problems detected during the audit:

- The nomenclature of the files used for the emission calculation are revised;
- The structure of the repertories are also strongly revised;
- A more hierarchical approach is advised to support QA/QC, eg. using the IPCC sectors;
- Use more clear filenames like “DS. Incinerateur” inside the folder structure, it will be more users friendly;
- There are no more duplicated files/data.

## 7 Verification

In the present plan, Belgium considers that the verification process is part of the QA process. Actually, it is already performed by the secretariat of UNFCCC itself, which regularly establishes comparisons among national inventories and issues questions to inventory experts.

Besides the EC in collaboration with the Topic Center on Air and Climate Change (ETC/ACC) perform similar activities on the national GHG inventories in Europe.

In the Brussels Capital region, the Brussels emissions of the main GHG emissions have been also compared with the emissions in Paris and in the Eurometropol of Strasbourg (EMS) (AIRPARIF et ASPA, 2016). All the sectors and sub sectors (except LULUCF and F gases) have been checked.

Concerning the comparison between the Brussels Capital region, EMS and Paris, the indicators checked are:

- The sectorial distribution of the emissions for year 2013;

- The emissions per inhabitant;

- Only with EMS, the temporal evolution of the emissions for the period 2000 – 2013.

#### INTERNAL CHECK

As mentioned in the previous section, the emission inventory teams of the three regions are composed of several experts with coordinators for the European and international reporting.

The regional compilers of the reporting of GHG emissions have to check their complete emission inventory before sending to the national inventory compiler and it is the responsibility of the sectoral experts and the coordinators to detect errors in the emission inventories.

Crossed checks between the experts are carried out to assure the comparability and consistency in the inventories.

# 8 Documentation and archiving

## 8.1 Archiving

The objectives of archives are :

- Store and secure inventory data on the regional and the national level;
- Store, organize and secure a thorough documentation of all emission sources, data, uncertainties, calculation methods and models as well as of the various information sources;
- Record all QA/QC procedures and checklists;
- Establish an information databank to facilitate reporting and review processes.

National archives are also maintained, with the objective to contain :

- The official national inventory datasets;
- The documentation covering the consolidation process that IRCEL/CELINE performs to aggregate regional datasets;
- The result and trace of QA/QC procedures on the national dataset;
- A record of the successive submissions of the national inventory, the history of official data and documentation submitted to the UNFCCC;
- A record of the recalculations performed;
- A record of the internal (national) and external (UNFCCC) reviews;
- Documentation on annual key sources identification.

Following the expert review team recommendations, archives of the inventory data should preferably be located at a unique central location. However, due to the peculiarity of Belgium, documentation and methodologies are developed and maintained by the regional experts involved in the inventory process. The adequate maintenance of archives, which is a permanent process, regularly implementing improvements and recalculations in inventories, imposes a close proximity between datasets and documentation. Moreover, some data has been transmitted to regional experts under cover of confidentiality and cannot be transferred without very particular care.

Consequently, the notion of “unique central location” in Belgium applies mainly to each regional inventory location. This ensures that the necessary documentation is not spread among different administrations and persons, but that the obligations related to the archiving and documentation of information respect the minimum requirements involved.

The regions are also responsible for archiving their own datasets, and all documentation related to their information sources, calculation methods and models. They also archive QC procedures and checklists done at the regional level and streamlined by the CCIEP-WG Emissions. Systematic procedures and labelling in all three regions will be pursued in order to facilitate the reviewing and QA processes. The regions will provide annually a copy of QC procedures documentation to the NIC.

The NIC will also keep up-to-date a general catalogue of existing archives.

Finally, the NIC is responsible for defining and implementing a secure back-up procedure of all official documents, including official inventory datasets.

## 8.1 Documentation

All information needed to set up the GHG inventories in the regions is documented in the NIR (Belgium, 2017). Methodologies used as well as sources of activity data and implied emission factors are described in this document and actualized on an annual basis. Besides a key source analysis and uncertainty calculations as well as trend analysis are yearly performed on the national level.

Some documents (such as the National Inventory System and the National Inventory Report) explain the procedure of the preparation and management of the emission inventory (see Figure 3 with an example of the data flux and planning of the emission inventory in the Brussels Capital Region).

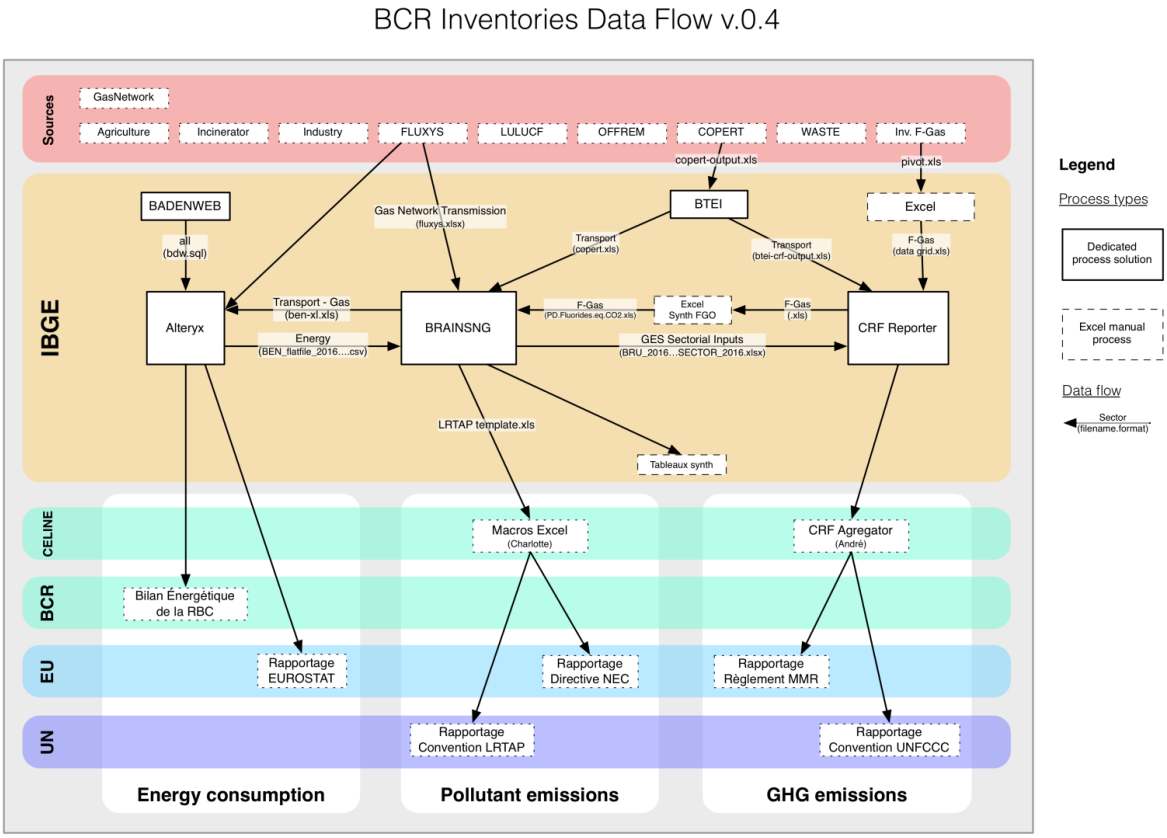


**Figure 3 : Data flux in the Brussels Capital Region**

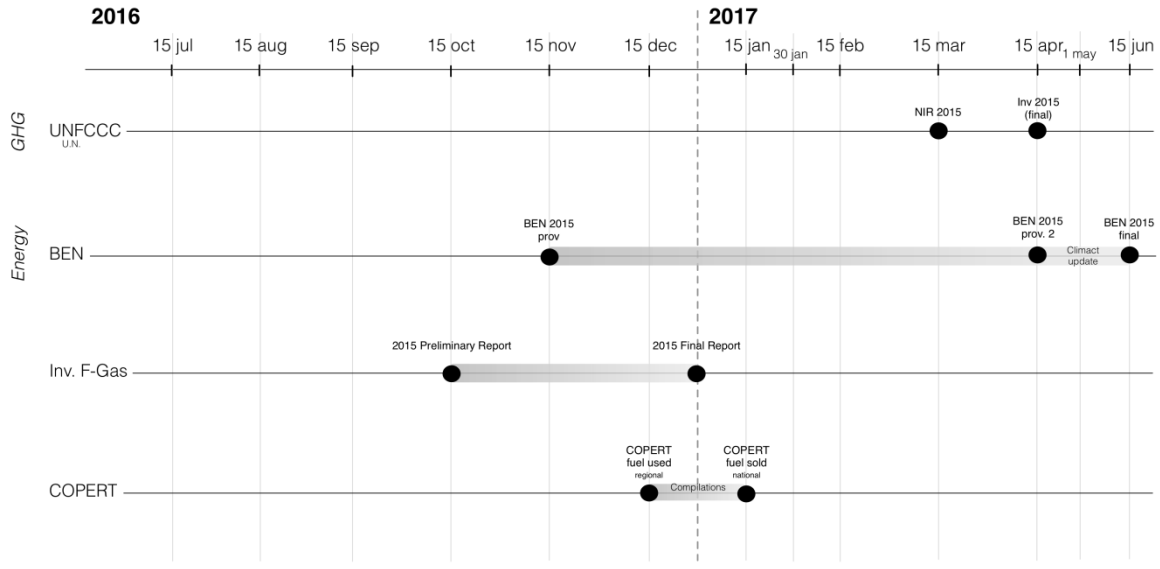


**Figure 4 : Timetable of the energy balance and the emissions inventory in the Brussels Capital Region**

## 8.2 Reporting

GHG inventories (and their derived tasks) are yearly reported for the complete time series (from 1990 to year (X-2) in the framework of the MMR Regulation (EU) 525/2013

(Monitoring Mechanism Regulation) (art. 8). Provisional data are reported on January 15th of the year (X-2), definitive data on March 15th.

Besides information on GHG inventories is yearly reported in the framework of the UNFCCC Convention and under the Kyoto Protocol.

Within the different institutions at the regional and national level, reporting of GHG emissions occur on a regular basis, for instance the Flemish report on 'Emissions in the air from 2000 to year (X-1)' becomes available each year in December of the year X. The Air Emissions Inventory Team also delivers data for other reports such as the State of the Environment (MIRA) Reports and Air Quality Reports of the Flanders Environment Agency, Antwerp Seaport environmental reports, etc.

Within the audit made by AIRPARIF and ATMO Grand Est, some elements could be integrated in a summary document to explain the activities performed in the Brussels Capital Region, which review was done. The BRAINSNG manual (Bruxelles Environnement, 2016) explains the process used to do the emission inventory and the times series trends. BRAINSNG contains some information about the data and methodology used in the Brussels Capital Region as:

- The assumptions and criteria for the selection of activity data and emission factors;
- The sources of the activity data and the emission factors;
- Changes between the emission inventory in year n and n-1;
- Uncertainties of the emission factors and activity data and the methods used to calculate uncertainties;
- Rationale of choice of methods.

# 9 Future improvements

Future improvements for the Belgian inventory on GHG emissions are summarized in the NIR section 9 (Belgium, 2017).

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# Annex 1: Tier 1 QC checks

| | | | |
|---|---|---|---|
| **QC activity** | **Tasks and procedures** | **Responsible** | **Deadline** |
| 1. Check that assumptions and criteria for the selection of activity data and emission factors are documented. | • Cross-check descriptions of activity data and emission factors with information on source categories and ensure that these are properly recorded and archived.<br>• Check that any quality control (ISO, verified emissions, accredited laboratory,…) is properly recorded<br>• Check that changes in data or methodology are documented<br>• Check for consistency with IPCC inventory guidelines and good practices, particularly if changes occur | CCIEP-WG Emissions | Augustus 31 ( year X-1) |
| 2. Check for transcription errors in data input and reference | • Cross-check a sample of input data from each source category (either measurements or parameters used in calculations) for transcription errors.<br>• Confirm that bibliographical data references are included (in spreadsheet or paper file) for every primary data element<br>• Randomly check bibliographical citations for transcription errors | CCIEP-WG Emissions | October 31 ( year X-1) |
| 3. Check that emissions are calculated correctly. | • Reproduce a representative sample of emissions calculations. | CCIEP-WG Emissions | October 31 ( year X-1) |

| | | | |
|---|---|---|---|
| | • Selectively mimic complex model calculations with abbreviated calculations to judge relative accuracy.<br>• Review spreadsheets with computerized checks and/or quality check reports | | |
| 4. Check that parameter and emission units are correctly recorded and that appropriate conversion factors are used. | • Check that units are properly labelled in calculation sheets.<br>• Check that units are correctly carried through from beginning to end of calculations.<br>• Check that conversion factors are correct.<br>• Check that temporal and spatial adjustment factors are used correctly. | CCIEP-WG Emissions for the calculation sheets.<br><br>IRCEL/CELINE for the national inventory in CRF Reporter. | October 31 ( year X-1)<br><br>March 31 (year X) |
| 5. Check the integrity of database files. | • Confirm that the appropriate data processing steps are correctly represented in the database.<br>• Confirm that data relationships are correctly represented in the database.<br>• Ensure that data fields are properly labelled and have the correct design specifications.<br>• Ensure that adequate documentation of database and model structure and operation are archived. | CCIEP-WG Emissions | October 31 ( year X-1) |
| 6. Check for consistency in data between source categories. | • Identify parameters (e.g. activity data, constants) that are common to multiple source categories and confirm that there is consistency in the values used for these parameters in the emissions calculations. | CCIEP-WG Emissions is responsible for the internal consistency of the inventory and the harmonisation of parameters where | October 31 ( year X-1) |

| | | | |
|---|---|---|---|
| | | relevant.<br><br>IRCEL/CELINE is responsible for the consistency after compilation. | March 31 (year X) |
| 7. Check that the movement of inventory data among processing steps is correct. | • Check that emissions data are correctly aggregated from lower reporting levels to higher reporting levels when preparing summaries.<br>• Check that emissions data are correctly transcribed between different intermediate products.<br>• Check a representative sample of calculations, by hand or electronically | CCIEP-WG Emissions up to the data preparation<br><br>IRCEL/CELINE for the compilation of the inventory . Cross check between results of the database aggregation and representative samples in excel are used. | October 31 ( year X-1)<br><br>March 31 (year X) |
| 8. Check that uncertainties in emissions and removals are estimated or calculated correctly. | • Check that qualifications of individuals providing expert judgement for uncertainty estimates are appropriate.<br>• Check that qualifications, assumptions and expert judgements are recorded. Check that calculated uncertainties are complete and calculated correctly. | IRCEL/CELINE | March 31 (year X) |

| | | | |
|---|---|---|---|
| | • If necessary, duplicate error calculations or a small sample of the probability distributions used by Monte Carlo analyses. | | |
| 9. Undertake review of internal documentation. | • Check that there is detailed internal documentation to support the estimates and enable duplication of the emission and uncertainty estimates.<br>• Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review.<br>• Check integrity of any data archiving arrangements of outside organisations involved in inventory preparation. | CCIEP-WG Emissions for all sources categories calculated at the regional level.<br>IRCEL/CELINE for the F-gases inventory and the reference approach. | Augustus 31 ( year X-1)<br>March 31 (year X) |
| 10. Check methodological and data changes resulting in recalculations. | • Check for temporal consistency in time series input data for each source category.<br>• Check for consistency in the algorithm/method used for calculations throughout the time series.<br>• When methods or data have changed, check consistency of time series inputs and calculations | CCIEP-WG Emissions for the methodology consistency.<br>IRCEL/CELINE for time series consistency of the compilation results. | October 31 ( year X-1) |

| | | | |
|---|---|---|---|
| | | | March 31 (year X) |
| 11. Undertake completeness checks. | • Confirm that estimates are reported for all source categories and for all years from the appropriate base year to the period of the current inventory.<br>• Check that known data gaps that result in incomplete source category emissions estimates are documented. | CCIEP-WG Emissions<br>IRCEL/CELINE for data gaps and notation keys consistency. | October 31 ( year X-1)<br>March 31 (year X) |
| 12. Specific checks on aggregation of 3 regional inventories | • Check the consistency of type of input data and units between the inventories<br>• Check the consistency in allocation of source categories<br>• Cross-check the national aggregated data with the sum of input inventories, by hand or electronically, to ensure that emissions are correctly aggregated from lower reporting levels to higher reporting levels.<br>• Check that the average values for emission factors or other parameters are properly calculated. | IRCEL/CELINE | March 31 (year X) |
| 13. Compare estimates to previous estimates. | • For each source category, current inventory estimates should be compared to previous estimates. If there are significant changes or departures from expected trends, recheck estimates and explain any difference. | CCIEP-WG Emissions<br>IRCEL/CELINE | October 31 (year X-1) |

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| | | | March 31 (year X) |

# Annex 2: Annual QC checks : scheduled time frame.

Main steps in the inventory preparation :

**15 December** (year X-1)**:** regional inventory submission to the NIC, start of the national compilation

**31 December** (year X-1)**:** end of the compilation of the Belgian GHG inventory and submission is sent to the National Climate Commission for approval

**15 January** (year X) **:** submission of the draft national inventory under the Monitoring Mechanism Regulation nr. 525/2013 (art. 8) (EU)

1 March (year X): definitive national inventory is sent to the National Climate Commission for approval

**15 March** (year X) **:** final submission of the national inventory under the Monitoring Mechanism Regulation nr. 525/2013 (art. 8) (EU)

**31 March** (year X) **:** submission is sent to the National Climate Commission for final approval

**15 April** (year X)**:** submission of the national inventory to the UNFCCC.

| Quality control checks | organisation involved | May | June | July | August | Sept | Oct | Nov | Dec | Jan | Feb | March | April |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Check that assumptions and criteria for the selection of activity data and emission factors are documented. | CCIEP-WG Emissions | | | | | | | | | | | | |
| 2. Check for transcription errors in data input and reference | CCIEP-WG Emissions | | | | | | | | | | | | |
| 3. Check that emissions are calculated correctly. | CCIEP-WG Emissions | | | | | | | | | | | | |
| 4. Check that parameter and emission units are correctly recorded and that appropriate conversion factors are used. | CCIEP-WG Emissions | | | | | | | | | | | | |
| | IRCEL/CELINE | | | | | | | | | | | | |

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| 5. | Check the integrity of database files. | CCIEP-WG Emissions | | | | | | | | | | | | | |
| 6. | Check for consistency in data between source categories. | CCIEP-WG Emissions | | | | | | | | | | | | | |
| | | IRCEL/CELINE | | | | | | | | | | | | | |
| 7. | Check that the movement of inventory data among processing steps is correct. | CCIEP-WG Emissions | | | | | | | | | | | | | |
| | | IRCEL/CELINE | | | | | | | | | | | | | |
| 8. | Check that uncertainties in emissions and removals are estimated or calculated correctly. | IRCEL/CELINE | | | | | | | | | | | | | |
| 9. | Undertake review of internal documentation. | CCIEP-WG Emissions | | | | | | | | | | | | | |
| | | IRCEL/CELINE | | | | | | | | | | | | | |
| 10. | Check methodological and data changes resulting in recalculations. | CCIEP-WG Emissions | | | | | | | | | | | | | |
| | | IRCEL/CELINE | | | | | | | | | | | | | |
| 11. | Undertake completeness checks. | CCIEP-WG Emissions | | | | | | | | | | | | | |
| | | IRCEL/CELINE | | | | | | | | | | | | | |
| 12. | Specific checks on aggregation of 3 regional inventories | IRCEL/CELINE | | | | | | | | | | | | | |
| 13. | Compare estimates to previous estimates. | CCIEP-WG Emissions | | | | | | | | | | | | | |
| | | IRCEL/CELINE | | | | | | | | | | | | | |

# Annex 3a : Source categories for QC checks

(level assessment 2014 – with and without LULUCF – MMR Regulation 525/2013 (March 2017)

| Source categories |
|---|
| 1A1a Public Electricity and Heat Production |
| 1A1b Petroleum Refining |
| 1A1c Manufacture of Solid Fuels and Other Energy Industries |
| 1A2a Iron and Steel |
| 1A2b Non-Ferrous Metals |
| 1A2c Chemicals |
| 1A2d Pulp, paper and print |
| 1A2e Food Processing, Beverages and Tobacco |
| 1A2f Non-metallic minerals |
| 1A2g Other |
| 1A3b Road Transportation |
| 1A3d Navigation |
| 1A4a Commercial/Institutional |
| 1A4b Residential |
| 1A4c Agriculture/Forestry/Fisheries |
| 1B2b Natural Gas |
| 2A1 Cement Production |
| 2A2 Lime Production |
| 2A3 Glass production |
| 2A4 Other process uses of carbonates |
| 2B1 Chemical industry / Ammonia Production |
| 2B2 Chemical industry / Nitric Acid Production |
| 2B4 Chemical industry / Caprolactam, glyoxal and glyoxylic acid production |
| 2B8 Chemical industry / Petrochemical and carbon black production |
| 2B9b Fluorochemical production / fugitive emissions |
| 2B10 Chemical industry / Other |
| 2C1 Iron and Steel Production |
| 2F1 Refrigeration and Air Conditioning Equipment |

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| 3A1 Enteric Fermentation / Cattle (dairy and non-dairy) |
| 3A3 Enteric Fermentation / Swine |
| 3B1 Manure Management / Cattle (dairy and non-dairy) |
| 3D1 Direct N2O emissions from agricultural soils |
| 3D2 Indirect N2O emissions from agricultural soils |
| 3G Agriculture / liming |
| 4A1 LULUCF / Forest land remaining forest land |
| 4A2 LULUCF / Land converted to forest land |
| 4B1 LULUCF / Cropland remaining cropland |
| 4B2 LULUCF / Land converted to cropland |
| 4C1 LULUCF / Grassland remaining grassland |
| 4E2 LULUCF / Land converted to settlements |
| 5A Solid waste disposal |
| 5C1 Waste Incineration / non-biogenic |
| 5D Wastewater treatment and discharge |

# Annex 3b : QC Tier 1 template

| **Checklist for Tier 1:**<br><br>**Individual Source Category :**<br>**Gas :** | | | | | | |
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| **1.3.1 Item** | **Check Completed** | | | **Corrective Action** | | **Supporting documents (including file name and location)** |
| | **Date** | **Responsible** | **Errors (Y/N)** | **Date** | **Responsible** | |
| • Cross-check descriptions of activity data and emission factors with information on source categories and ensure that these are properly recorded and archived.<br>• Check that any quality control (ISO, verified emissions, accredited laboratory,…) is properly recorded<br>• Check that changes in data or methodology are documented<br>• Check for consistency with IPCC inventory guidelines and good practices, particularly if changes occur | | | | | | |

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| • Cross-check a sample of input data from each source category (either measurements or parameters used in calculations) for transcription errors.<br>• Confirm that bibliographical data references are included (in spreadsheet or paper file) for every primary data element<br>• Randomly check bibliographical citations for transcription errors | | | | | | |
| • Reproduce a representative sample of emissions calculations.<br>• Selectively mimic complex model calculations with abbreviated calculations to judge relative accuracy.<br>• Review spreadsheets with computerized checks and/or quality check reports | | | | | | |
| • Check that units are properly labelled in calculation sheets.<br>• Check that units are correctly carried through from beginning to end of calculations.<br>• Check that conversion factors are correct.<br>• Check that temporal and spatial adjustment factors are used correctly. | | | | | | |
| • Confirm that the appropriate data processing | | | | | | |

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| steps are correctly represented in the database.<br>• Confirm that data relationships are correctly represented in the database.<br>• Ensure that data fields are properly labelled and have the correct design specifications.<br>• Ensure that adequate documentation of database and model structure and operation are archived. | | | | | | |
| • Identify parameters (e.g. activity data, constants) that are common to multiple source categories and confirm that there is consistency in the values used for these parameters in the emissions calculations. | | | | | | |
| • Check that emissions data are correctly aggregated from lower reporting levels to higher reporting levels when preparing summaries.<br>• Check that emissions data are correctly transcribed between different intermediate products.<br>• Check a representative sample of calculations, by hand or electronically | | | | | | |
| • Check that qualifications of individuals providing expert judgement for uncertainty estimates are appropriate.<br>• Check that qualifications, assumptions and expert judgements are recorded. Check that calculated | | | | | | |

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| uncertainties are complete and calculated correctly.<br>• If necessary, duplicate error calculations or a small sample of the probability distributions used by Monte Carlo analyses. | | | | | | |
| • Check that there is detailed internal documentation to support the estimates and enable duplication of the emission and uncertainty estimates.<br>• Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review.<br>• Check integrity of any data archiving arrangements of outside organisations involved in inventory preparation. | | | | | | |
| • Check for temporal consistency in time series input data for each source category.<br>• Check for consistency in the algorithm/method used for calculations throughout the time series.<br>• When methods or data have changed, check consistency of time series inputs and calculations | | | | | | |
| • Confirm that estimates are reported for all source categories and for all years from the appropriate base year to the period of the current inventory.<br>• Check that known data gaps that result in | | | | | | |

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| incomplete source category emissions estimates are documented. | | | | | | |
| • Check the consistency of type of input data and units between the inventories<br>• Check the consistency in allocation of source categories<br>• Cross-check the national aggregated data with the sum of input inventories, by hand or electronically, to ensure that emissions are correctly aggregated from lower reporting levels to higher reporting levels.<br>• Check that the average values for emission factors or other parameters are properly calculated. | | | | | | |
| • For each source category, current inventory estimates should be compared to previous estimates. If there are significant changes or departures from expected trends, recheck estimates and explain any difference. | | | | | | |

# Annex 4: Implementation of the QC checks on the regional level

| Implementation of Table 8.1 IPCC GPG for the Belgian GHG Inventory | | | | |
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| **Due to the specificity of the Belgian National Inventory System, some QC checks are mainly performed at the level of the regional inventory agencies. For each check, the Working Group Emissions of the CCPIE has to verify that comparable checks have been conducted in the three regions and reproduce them on a sample before assessing that the check has been performed at the national level.** | | | | |
| **QC activity** | **Procedure** | **Responsible** | | |
| | | **Flemish region (Flemish Environment Agency, FEA)** | **Walloon region (DGRNE)** | **Brussels region (IBGE/BIM)** |
| 1. Check that assumptions and criteria for the selection of activity data and emission factors are documented. | · Cross-check descriptions of activity data and emission factors with information on source categories and ensure that these are properly recorded and archived. | Descriptions of AD and EF for all source categories involved in GHG inventory are written down in the procedure of the main process (Setting up the GHG emission inventory) of the QM system and are actualized on a yearly basis. This information is cross-checked with 1)all information published in the yearly report on Air Emissions [1990-(X-1)] in the FEA and 2) all information given in the NIR. All this information is archived on a central server. Backups of all information are performed on a daily basis by the department responsible for IT. | Descriptions of AD and EF for all source categories involved in GHG inventory are written down and archived and are actualized on a yearly basis. | AD and EF for all sources categories involved in GHG inventory are described in the spreadsheets used for setting up the inventory. A more complete description is given in the handbook. These two sources are compared each year with the information coming from the Energy Balance and from other updated data. |

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| | · Check that any quality control (ISO, verified emissions, accredited laboratory,…) is properly recorded | Quality control on GHG data is mainly performed through the registration on forms for the different sectors involved. These forms are part of the QM system of the GHG inventory . These forms register 1)input data: which, date claimed, received, controlled, remarks, 2) emission calculations: how, when, remarks and 3) trend analysis: when, remarks. Remarks on and problems with the data are recorded and followed up by the experts on the forms . Also trends are checked and registered to look for any outlier data. | $CO_2$ country-specific emission factors used in the inventories are determined from fuels analyses from EU ETS plants. The analyses (frequency, laboratories,..) are described in a Monitoring Plans following the Commission Regulation 601/2012 on the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council.<br><br>The verification must be carried out by an independent auditor accredited according to ISO14065 and according to the European Accreditation and Verification Regulation.<br>All the monitoring plans are in the ETSWAP platform.<br>Air emission measurements, performed by laboratories which must be agreed by the official institute ISSEP. The agreement covers a review of material and methodologies used and checks the compliance with the requirements of a legal decree . The updated list of agreed laboratories is published on the website of DGO3, the responsible Institute in Wallonia. | Has to be implemented |

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| | · Check that changes in data or methodology are documented | Changes in data or methodology are documented on different levels: 1) facility level (electronically and in files), 2) sectoral level (electronically registered on the forms of the QM system), 3) all changes of GHG data are yearly described in the report on Air Emissions (electronically and on paper) and 4) reported in the NIR (electronically and on paper). The electronical archiving occurs on the central server in the FEA. Only experts of the emission inventory have access to this part of the central server. Besides logbooks are filled in by the different experts on a daily basis with a description of the daily activities of all experts. | Assessment on rationale for recalculations – in regard with IPCC guidelines- are archived on a yearly basis . Source data used for calculations are referenced on the calculation spreadsheets. | Changes in data or methodology are noted in the same spreadsheets used for setting up the inventory. In complement, changes in method/data occurring from 2008 onwards will be described in the handbook. |
| | · Check for consistency with IPCC inventory guidelines and good practices, particularly if changes occur | Consistency with IPCC 1996 guidelines and GPG was mainly performed in the course of 2003 with all experts of the 3 regions in technical working groups. Whenever questions surface with respect to methodologies used f.i. originating from reviews carried out on the European level (Status & Consistency reports by ETC/ACC, EEA) or by UNFCCC-experts (Synthesis & Assessments reports) or when methodologies change, consistency checks still take place. | Consistency with IPCC 2006 guidelines was mainly performed in the course of 2014 with all experts of the 3 regions in technical working groups. Whenever questions surface with respect to methodologies used f.i. originating from reviews carried out on the European level (Status & Consistency reports by ETC/ACC, EEA) or by UNFCCC-experts (Synthesis & Assessments reports) or when methodologies change, consistency checks still take place. | Consistency with IPCC 1996 guidelines and GPG was mainly performed in the course of 2003 with all experts of the 3 regions in technical working groups. Whenever questions surface with respect to methodologies used f.i. originating from reviews carried out on the European level (Status & Consistency reports by ETC/ACC, EEA) or by UNFCCC-experts (Synthesis & Assessments reports) or when methodologies change, consistency checks still take place. |

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| 2. Check for transcription errors in data input and reference | · Cross-check a sample of input data from each source category (either measurements or parameters used in calculations) for transcription errors. | These cross-checks of input data in the CRF Reporter are yearly performed by the responsible person of the GHG inventory for all sectors except for the agriculture sector which is carried out by the agriculture expert. Before the input in the CRF Reporter these checks are also performed by the individual experts of the different sectors involved. Finally with the compilation of the regional data to the national level a last control of input data is performed by the NIC. | The cross checks are performed a 2 levels : between the calculation sheets and the Wapi database, and between the Wapi database and the Webrep. The checks are conducted on the total emissions and on samples of source categories. | The cross-checks of input data in the CRF Reporter are yearly performed for each source category. |
| | · Confirm that bibliographical data references are included (in spreadsheet or | The bibliographical data references are not included in the inventory for every primary data element but are integrated on a more aggregated level + see here under | Data references are generally included on spreadsheets or in paper files describing the methodology. | The bibliographical data references are included in the source spreadsheet of the inventory. |
| | · Randomly check bibliographical citations for transcription errors | Bibliographical citations are published in the QM system in the procedure of the main process (Setting up the GHG emission inventory), in the yearly report on Air Emissions and in the NIR. Each year with the actualization of the procedures or with the publication of the reports, these citations are checked for transcription errors. | To be performed | Some bibliographical citations are randomly checked during the updating process. |

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| 3. Check that emissions are calculated correctly. | · Reproduce a representative sample of emissions calculations. | Reproduction of emission calculations is performed on a regular basis through the audits of the GHG inventory that is yearly conducted by the responsibles of the QM system within the FEA and from time to time by an external consultant. From the start of the QM system in 2004 so far 3 internal audits and 1 external audit took place. | For all installations reporting under EPER (European Program on Environmental reporting) , this is done during the validation of their environmental reporting. For the ETS sector (half of the Walloon regional emissions) , emissions are verified by verificators, and the verification is later validated by Awac in charge of GHG inventory. | For checking the emission calculations, the method consists to go back from the result to the first input data to check all the methodology. |

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| | · Selectively mimic complex model calculations with abbreviated calculations to judge relative accuracy. | The sectors where an alternative methodology is used to check the reliability of the emission estimates are<br>1) the waste disposal sites: The available (not for all years and all sites) waste gas production figures are put in the model instead of the calculated amounts to judge relative accuracy.<br>2) agriculture: Manure production is calculated in 2 different models on different ways (N2O and NH3). A relative judge accuracy is performed. The emissions of NH3 (as input in the N2O-model) are calculated on 2 geographical levels: the model on municipal level is more complex compared to the model on regional level. The relative judge accuracy is performed on the results of the 2 models.<br>3)Total industrial emissions in the Flemish region are validated by comparing the share of estimated emissions in the collective approach with the industrial reported emissions by the facilities through the yearly integrated environmental report. The latter share of emissions should be 90-95% of total industrial emissions. | For the energy sector, the sum of detailed emissions are compared with the total emissions calculated from the regional energy balance . For the industrial, energy and waste sector, comparison with EPER reporting is done. | The sectors where an alternative methodology is used to check the reliability of the emission estimates are 1) transport sector 2) waste incinerator |

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| | · Review spreadsheets with computerized checks and/or quality check reports | Computerized checks for all sectors are performed in the different steps of the calculation process by the responsible experts as much as possible. Besides the new CRF software allows to show trend graphs in an easy way.+ Completeness checks: see point 11 | | The trend graphs are systematically checked. If the trend seems abnormal, a data control is performed. |
| 4. Check that parameter and emission units are correctly recorded and that appropriate conversion factors are used. | · Check that units are properly labelled in calculation sheets. | Units are properly labelled in all calculation sheets. Besides units are checked on different places of registration (spreadsheets and models used for different sectors, yearly report on Air Emissions, CRF Reporter and related output reports, NIR) and by different persons (responsibles for sectors, responsible for GHG inventory and overall responsible for emission inventory). Crosschecks between the different registrations/publications is also performed. Trend analysis carried out each year allows to check correct use of units and conversion factors through all calculation steps in the process. | The cross checks are performed a between the calculation sheets and the Wapi database. The export in the webrep format is already in the adequate emissions units.<br>The checks are conducted on the total emissions and on samples of source categories. | The trend graphs are systematically checked. If the trend seems abnormal, a data control is performed, first on the units and conversion factors. |
| | · Check that units are correctly carried through from beginning to end of calculations. | | | |

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| | · Check that conversion factors are correct. | | | |
| | · Check that temporal and spatial adjustment factors are used correctly. | | | |
| 5. Check the integrity of database files. | • Confirm that the appropriate data processing steps are correctly represented in the database. | All spreadsheets and models used in the different sectors involved are, where relevant, linked with basic (common) files so that all different steps in the calculation process can be checked. All different steps in the process are reported in detail in the QM procedure of the main process (Setting up the GHG emission inventory) with a nomination of all files used and archived on the central server. All adequate documentation of database and model structure is also archived on the central server. An important common database used in different sectors is the Flemish energy balance. | Wapi database is used. Data processing and relationships is checked through cross-checked with the original calculation sheets. | The calculations spreadsheets are linked with data sources. All adequate documentation of database is archived on the central server. |
| | • Confirm that data relationships are correctly represented in the database. | | Data files labels are checked during encoding. | |
| | • Ensure that data fields are properly labelled and have the correct design specifications. | | | |

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| | • Ensure that adequate documentation of database and model structure and operation are archived. | | The database structure is managed by AWAC and all the documentation are on the server. | |
| 6. Check for consistency in data between source categories. | • Identify parameters (e.g. activity data, constants) that are common to multiple source categories and confirm that there is consistency in the values used for these parameters in the emissions calculations. | * The most important common database used in the different sectors involved in the GHG inventory is the Flemish energy balance. This energy balance is located on one single place on the central server, accessible by all experts which use all the same common database.<br>*The industrial activity data are known through the annual integrated environmental reporting obligation by industrial facilities and are also located on one single place on the central server, accessible by the experts.<br>* Other common data (gas distribution, incinerated and composted waste, inhabitants, number of animals) are claimed by one expert and distributed to the other experts to ensure consistency in the data used. | In the Wapi database, there is one single encoding for the EF for fuels for area sources, ensuring consistency. For facilities subject to environmental reporting, the EF can vary according to carbon content, but all references are encoded fuel by fuel and year by year, allowing verification | The most important common database used in the different sectors involved in the GHG inventory is the energy balance. This energy balance is located on one single place on the central server. |

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| 7. Check that the movement of inventory data among processing steps is correct. | • Check that emissions data are correctly aggregated from lower reporting levels to higher reporting levels when preparing summaries. | This aggregation is checked twice: 1) during the preparation of the yearly report on Air Emissions where the data per sector are summarized to the performance of emissions per theme (f.i. photochemical pollution, climate change due to GHG, depletion of the ozone layer) and 2) during the actualization and optimization of the emissions in the CRF Reporter software where the emission inventory is built in a bottom-up way. All emissions are checked and compared within and among these publications on the different levels of aggregation. | The original CRF excel sheet produced by Wapi are compiled on calculation sheets for trends analysis purposes. These results are then cross-checked with the submissions prepared by Webrep, to identify any problem in the data processing | For checking the calculations, the method consists to go back from the result to the first input data to check all the methodology. This aggregation is checked twice: 1) during the preparation of the two-yearly report on the "state of the environment" where the data per sector are summarized to the performance of emissions per theme (f.i. photochemical pollution, climate change due to GHG, depletion of the ozone layer) and 2) during the actualization and optimization of the emissions in the CRF Reporter software where the emission inventory is built in a bottom-up way. |
| | • Check that emissions data are correctly transcribed between different intermediate products. | | | |

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| | Check a representative sample of calculations, by hand or electronically | The emissions of the different sectors are estimated in the most automatized way. To ensure that all automatic calculations are carried out in an accurate way, the experts calculate from time to time the emissions of their sector by hand. Also total emissions per sector are checked electronically and by hand. | | |
| 8. Check that uncertainties in emissions and removals are estimated or calculated correctly. | • Check that qualifications of individuals providing expert judgement for uncertainty estimates are appropriate.<br>• Check that qualifications, assumptions and expert judgements are recorded. Check that calculated uncertainties are complete and calculated correctly. | *Controls on uncertainty calculation in emissions and removals are performed on the national level by IRCEL/CELINE. The experts judgements from the Belgian experts have been compared to the judgements of the DNV experts (uncertainty calculation in Flanders), who also performed a duplication of Tier 1 and Tier 2 calculation for Flanders.* | Controls on uncertainty calculation in emissions and removals are performed on the national level by IRCEL/CELINE. The experts judgements from the Belgian experts have been compared to the judgements of the DNV experts (uncertainty calculation in Flanders), who also performed a duplication of Tier 1 and Tier 2 calculation for Flanders. | *Controls on uncertainty calculation in emissions and removals are performed on the national level by IRCEL/CELINE .The experts judgements from the Belgian experts have been compared to the judgements of the DNV experts (uncertainty calculation in Flanders), who also performed a duplication of Tier 1 and Tier 2 calculation for Flanders.* |

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| | • If necessary, duplicate error calculations or a small sample of the probability distributions used by Monte Carlo analyses. | | | |
| 9. Undertake review of internal documentation. | • Check that there is detailed internal documentation to support the estimates and | | To be performed | The handbook describes in detail the methodology used for each sector. This procedure should enable independent persons to duplicate emission calculations. |
| | • Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review. | All inventory data, supporting data and inventory records are archived and stored on one single place on the central data server of the FEA which is only accessible by the responsible experts of the emission inventory. Backups of all files are made on a daily basis to ensure efficient archiving. These data also include the registration on the forms of the QM system. | All inventory data is archived at one single location (Awac) | All inventory data, supporting data and inventory records are archived and stored on one single place on the central data server of the IBGE/BIM. Backups of all files are made on a daily basis. |

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| | • Check integrity of any data archiving arrangements of outside organisations involved in inventory preparation. | Since July 2000 all procedures to prepare the Flemish energy balance are part of a certified ISO9001 system and necessary steps are undertaken within the VITO to ensure efficient archiving of the energy data. The yearly integrated environmental reports of the industrial facilities remain available through 'Alfresco', the reports are archived for 10 years in different formats (PDF, XML en PDFA).The integrity of other data archiving arrangements of external organisations involved, has not been checked so far. It will be difficult in any case because this don't belong to the competence of the FEA. More attention needs to be given to this item in the future. | All the activities of he ICEDD (institute involved in the preparation of the Walloon energy balance) are certified ISO 9001:2000.To be performed for other institutions | All the activities of he ICEDD (institute involved in the preparation of the Brussels energy balance) are certified ISO 9001:2000. |
| 10. Check methodological and data changes resulting in recalculations. | • Check for temporal consistency in time series input data for each source category. | *Time and method consistency is guaranteed in the Flemish GHG inventory because in* general all input data for all source categories originate from the same sources of information (f.i. energy balance, yearly integrated environmental reports, IPCC 1996 guidelines, ...). Whenever methodologies or data change (f.i. because of measures taken, new measurements performed, reorganizations | A check is done at the Belgian and regional (AWAC) level with webrep, on activity data, emission factors and emissions. A complete time-series check is conducted for key sources. For sources where there have been significant changes, experts are required to explain these changes. The Wapi database allows a view of the time series of all data of the inventory (Emissions, activity data, emission factors) | The complete time serie from 1990 is subjected to revision in case of methods or data modification. |

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| | • Check for consistency in the algorithm/method used for calculations throughout the time series.<br>• When methods or data have changed, check consistency of time series inputs and calculations | (privatization of gas- and electricity market) taking place, ...), these changes are discussed in detail with the company or institutions involved and the complete time series from 1990 on is (if possible, depending also on availability of information) subjected to revision to ensure that all emissions are reported in a consistent way. | | |
| 11. Undertake completeness checks. | • Confirm that estimates are reported for all source categories and for all years from the appropriate base year to the period of the current inventory. | Each year complete time series of estimated emissions are published first in the report on Air Emissions (per sector and per theme). These totals are checked for the 2nd time when putting the data in the CRF Reporter. This software allows easy control of completeness for all years. Blanco cells can be detected in an easy and fast way. | The completeness of the source categories through the time series is checked through the trends examination. | Due to the specificity of a city-region, there are a lot of sources not present on the regional territory (no agriculture, few industries). For the industry sector cross checks are performed with the environment permits delivered by IBGE/BIM. |

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| | • Check that known data gaps that result in incomplete source category emissions estimates are documented. | Empty cells are filled with notation keys (NE because of lack of data or because of negligibility, IE, NA or NO). This is a point of attention for the 2009 submission, especially on the national level, where still some notation keys are missing. Notation keys are explained in table 9a and in the NIR.<br>The different reviews of the inventory that were already conducted in the past resulted in a further improvement in completeness of the GHG inventory. | | |
| 12. Specific checks on aggregation of 3 regional inventories | • Check the consistency of type of input data and units between the inventories | | | |
| | • Check the consistency in allocation of source categories | | | |

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| | • Cross-check the national aggregated data with the sum of input inventories, by hand or electronically, to ensure that emissions are correctly aggregated from lower reporting levels to higher reporting levels. | | | |
| | • Check that the average values for emission factors or other parameters are properly calculated. | | | |

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| 13. Compare estimates to previous estimates. | • For each source category, current inventory estimates should be compared to previous estimates. If there are significant changes or departures from expected trends, recheck estimates and explain any difference. | Trend analyses are performed for the different source categories in the inventory by all experts and registered in the forms of the QM system. The emission results in function of time in a graph are checked. This is also done in a very easy way in the CRF Reporter software and as is documented in the NIR (chapter 2). Also in the report on Air Emissions, trend analysis is performed each year. Outliers are discussed with the sector involved and are explained in the NIR on the national and the regional level. | The effects of recalculations are compared with previous estimates and differences are analysed. The main results of these analyses are summarised in chapter 2 (trends) and chapter 9 (recalculations) of the NIR. | Trend analyses are performed with the help of the CRF Reporter graphs. This procedure has to be formalized. |