ISPRA
Istituto Superiore per la Protezione
e la Ricerca Ambientale

MANUALI E LINEE GUIDA

Quality Assurance/Quality Control Plan for the Italian Emission Inventory

Procedures Manual 2014

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1 Introduction

The Institute for Environmental Protection and Research (ISPRA) prepares the Italian air emission inventory and is responsible for coordinating the institutional and procedural arrangements for inventory activities. Specifically, the planning, preparation and management of the inventory includes data collection, selection of methods, activity data and other estimation parameters, emission factors, estimation of emissions and removals, uncertainty assessment, QA/QC and verification activities, documentation and archiving.

One of the primary goals of the work programme related to the inventory is the continuous improvement of emission estimates. To this end and in response to the IPCC Good Practice Guidance (IPCC, 2000) and the UNFCCC Guidelines for National Systems under the Kyoto Protocol (FCCC/CP/2001/13/Add.3), a comprehensive description of the procedures followed by the expert analysts involved in inventory preparation is included in this document.
The quality assurance/quality control programme for the annual emission inventory of Italy including the quality objectives and an inventory quality assurance and quality control plan is illustrated as well as the feedback on uncertainty estimates and the verification activities.

2 Objectives of the QA/QC plan

A QA/QC and verification programme contributes to the objectives of good practice in inventory development, namely to improve transparency, consistency, comparability, completeness and accuracy of national emission inventories and to assure the timeliness of submission. As reported in the IPCC Good Practice Guidance (IPCC, 2000), the QA/QC and verification activities are best developed as integral parts of the inventory process, which lead to regular updates of uncertainty estimates and inventory improvements.
ISPRA is responsible for the quality of the Italian inventory, specifically for the selection and choice of activity data, emission factors and other parameters used for the inventory compilation as well as for following methodologies provided in the IPCC Guidelines for National Greenhouse Gas Inventories, the IPCC Good Practice Guidance and the IPCC Good Practice Guidance for Land Use, Land-Use Change and Forestry (IPCC, 1997; IPCC, 2000; IPCC, 2003; IPCC, 2006). The Institute is also responsible for establishing a QA/QC programme for the inventory as part of the national inventory system.
Specifically, the quality objectives of the QA/QC programme should be met in terms of transparency in the methodology used to carry out emission estimates and information provided in the National Inventory Report, completeness in reporting all sources and sinks and all gases included in the IPCC guidelines, consistency in the time series assuring that recalculations of emissions and removals affect the whole time series, comparability among different countries which should follow the IPCC Guidelines and Good Practice Guidance, accuracy in the estimates and timeliness in the submission. The completed inventory should be submitted by the 15th of January to the European Community and by the due date of 15 April to the UNFCCC.

3 Quality control procedures

Quality control (QC), as defined in the IPCC Good Practice Guidance, is a system of routine technical activities, which measure and control the quality of the inventory as it is being developed. A basic QC system provides routine and consistent checks to ensure data integrity, correctness, and completeness, in order to identify and address errors and omissions. It also provides procedures for documenting and archiving inventory material and recording all QC activities.
First, Tier 1 is presented, concerning formal procedures and checklists to be completed annually. In the second place, Tier 2 is illustrated, with regard to source specific category procedures and tests to be applied on a case by case basis. Then a checklist for national inventory document is presented, to be completed annually. At the end, checks to perform with regard to common reporting formats are illustrated, to be compiled for each CRF year.

3.1 Tier 1 - General procedures

General QC procedures include generic quality checks related to calculations, data processing, completeness and documentation that are applicable to all inventory sources and sink categories.
Procedure for maintaining data quality should be followed at any times.
General procedures include data and documentation gathering.

With regard to data gathering, input and handling, a number of common sense procedures govern the collection, maintenance and use of electronic and transcribed data for all activity data, emission factors and other primary data elements. For instance, electronic data are used where possible to minimize transcription errors and, if identical data are used by different source categories, the same electronic files are used by the source categories.

Documentation of the inventory should be sufficiently detailed and clear as to allow an independent but knowledgeable analyst to obtain and review the references used and reproduce the emission estimates. Complete and accessible documentation of methods, data and data sources, spreadsheets, phone numbers and other contacts is important.
The inventory analyst for a source category maintains a complete and separate project file for that source category. These files include all the materials needed to develop the inventory for that year and are maintained in a transparent manner.
The files contain:

- a list of the names and location of all working spreadsheets for the source category with explanations of links among them;
- contact reports for telephone conversations or meetings, copies of written communications (letters, e-mails or fax);
- copies of reference materials or data that are new to that year of inventory.

In the calculation spreadsheets, every primary data elements (activity data, emission factor, carbon coefficient etc.) have a reference, published or unpublished, for the source of the data.
Citations to reference sources are attached by comments to the data, or by another system of notation.
A database of references identified by identification number, location and link to the numeric format, where applicable, is available for all the sectors: Energy, Industrial Processes, Solvent and other product use, Agriculture, Waste and LULUCF.

Every reference has a paper copy in the existing archives. References to unwritten personal communications are supported by a 'contact' note providing information on the phone conversation or meeting.

The reference, or brief rationale, for assumptions and criteria for the selection of activity data and emission factors is documented, if needed, in an identified section of the spreadsheet or in the comment cells.
Changes from the previous year in the assumptions, the methodology, or data sources are noted on a separate sheet, named 'modification', in the spreadsheet.

After each reporting cycle, all database files, spreadsheets and electronic documents are archived and documentation and estimates could be consulted during the next year inventory compilation.

Two checklists are presented for Tier 1: the first one refers to overall inventory quality, the second one refers to individual source categories.
Each checklist consists of a registration of the checks and the adjustments performed. If appropriate corrective actions are not immediately evident, the QC examiner should discuss the results with the institute inventory coordinator. Once completed, the forms should be appropriately archived with the QA/QC documentation.
The examiner has discretion over the implementation of the checks; in fact, as not all checks are applicable to every source category, checks/rows that are not relevant should be indicated with "n/r" and those not available with "n/a". Additional checks, if relevant to the source category, can be added to the list.
The requirements concerning each check are explained. The presence of errors, the name of the compiler and the date when the test was completed should be indicated. In case of corrective actions, the name of the resource employed and the date when the errors were corrected should be reported as well.
Moreover, a section for comments, if necessary, is preset.

3.1.1 Overall Inventory Quality
This section focuses on overall inventory quality.
Two checklists are presented, to be completed annually.

The following form is a master tracking sheet for inventory; it documents the source responsibilities during the annual process of developing and updating the inventory. It can be also applied to inventory spreadsheets or documents. Each row represents a sector or source category.

Sector	Ispra staff	Due Date (date when first draft was due)	Delivery date (date of most recent draft)	Expected modifica-tions (Y/N - whether modifications to latest draft are expected)	Current owner (who currently has the original spreadsheet or text)	Comments (any other important information)

The following checklist aims at the control of overall inventory quality.

It consists of a registration of controls and corrective actions and it should include information about checked variables and sub-variables, the comparisons, the conclusions, the outcome and the respective explanations, the information sources.
The first section consists of the verification about the emission calculations across source categories; the second section focuses on documentation; the third one is centred on completeness and the latter focuses on master inventory file.

TIER 1 – Overall Inventory Quality and Cross-Source Categories							
Item		**Check completed**			**Corrective action**		**Comments**
		Date	**Name**	**Errors (Y/N)**	**Date**	**Name**	
Part A - Checking emission calculations across source categories							
T1-INV-A-1 Check that emissions and removals are calculated correctly	Reproduce a set of emissions and removals calculations						
	Use a simple approximation method that gives similar results to the original and more complex calculation to ensure that there is no data input error or calculation error						
T1-INV-A-2 Check that sources using same data inputs report comparable values (i.e. analogous in magnitude)							
T1-INV-A-3 Check across source categories that same electronic data set is used for common data							
T1-INV-A-4 Check for consistency in data between categories	Identify parameters (e.g. activity data, constants) that are common to multiple categories of sources or sinks and confirm that there is consistency in the values used for these parameters in the emission/removal calculations						
T1-INV-A-5 Check time series consistency	Check for temporal consistency in time series input data for each category						
	Check for consistency in the algorithm/method used for calculations throughout the time series						
	Check methodological and data changes resulting in recalculations						
	Check that the effects of mitigation activities have been appropriately reflected in time series calculations						
T1-INV-A-6 Check that the number of significant digits or decimal places for common parameters, conversion factors, emission factors, or activity data is consistent across source categories							

TIER 1 – Overall Inventory Quality and Cross-Source Categories								
Item		**Check completed**			**Corrective action**		**Comments**
		Date	**Name**	**Errors (Y/N)**	**Date**	**Name**	
T1-INV-A-7 Check that total emissions are reported consistently (in terms of significant digits or decimal places) across source categories							
T1-INV-A-8 Check that the movement of inventory data among processing steps is correct	Check that emissions and removals data are correctly aggregated from lower to higher reporting levels when preparing summaries						
	Check that emissions and removals data are correctly transcribed between different intermediate products						
T1-INV-A-9 Other (specify)							
Part B - Documentation							
T1-INV-A-10 Check if internal documentation practices are consistent across source categories							
T1-INV-A-11 Check that assumptions and criteria for the selection of activity data, emission factors, and other estimation parameters are documented	Cross-check descriptions of activity data, emission factors and other estimation parameters with information on source and sink categories						
	Ensure that these are properly recorded and archived						
T1-INV-A-12 Check for transcription errors in data input and references	Crosscheck a sample of input data from each category (either measurements or parameters used in calculations) for transcription errors						
	Confirm that bibliographical data references are properly cited in the internal documentation						
T1-INV-A-13 Check that parameters and units are correctly recorded and that appropriate conversion factors are used	Check that units are properly labelled in calculation sheets						
	Check that units are correctly carried through from beginning to end of calculations						
	Check that conversion factors are correct						
	Check that temporal and spatial adjustment factors are used correctly						
T1-INV-A-14 Check the integrity of excel files	Confirm that the appropriate data processing steps are correctly represented in the files						
	Confirm that data relationships are correctly represented in the files						

TIER 1 – Overall Inventory Quality and Cross-Source Categories							
Item		**Check completed**			**Corrective action**		**Comments**
		Date	**Name**	**Errors (Y/N)**	**Date**	**Name**	
	Ensure that data fields are properly labelled						
	Ensure that adequate documentation of files and model structure and operation are archived						
T1-INV-A-15 Review of internal documentation and archiving	Check that there is detailed internal documentation to support the estimates and enable reproduction of the emission, removal and uncertainty estimates						
	Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review						
	Check methodological and data changes resulting in recalculations						
	Check that the archive is closed and retained in secure place following completion of the inventory						
	Check integrity of any data archiving arrangements of outside organisations involved in inventory preparation						
T1-INV-A-16 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						
	Check that qualifications, assumptions and expert judgements are recorded						
	Check that calculated uncertainties are complete and calculated correctly						
	If necessary, duplicate uncertainty calculations on a small sample of the probability distributions used by Monte Carlo analyses						
T1-INV-A-17 Other (specify)							
Part C – Completeness							
T1-INV-A-18 Check completeness	Confirm that estimates are reported for all categories of sources and sinks and for all years						
	For sub-categories, confirm that entire category is being covered						

TIER 1 – Overall Inventory Quality and Cross-Source Categories							
Item		**Check completed**			**Corrective action**		**Comments**
		Date	**Name**	**Errors (Y/N)**	**Date**	**Name**	
	Check that, in the case of linked calculation spreadsheets, any new sources introduced to the compilation sheets have been fully added throughout the data pathways (for example, it is essential that any calculations added to a spreadsheet estimating emissions from a source/sector are also included in the finalised formatted data block for pasting into the CRF tables)						
	Provide clear definition of "Other" type categories						
	Check that known data gaps (e.g. sub-categories classified as "not estimated") that result in incomplete estimates are documented						
T1-INV-A-19 Trend checks	For each category, compare current inventory estimates to previous estimates. If there are significant changes from expected trends, re-check estimates and explain any differences						
	Check value of implied emission/removal factors across time series. Explain outliers or unusual trends if any						
T1-INV-A-20 Other (specify)							
Part D - Maintaining master inventory file: spreadsheets and inventory document							
T1-INV-A-21 Have file control procedures been followed?							
T1-INV-A-22 Other (specify)							

3.1.2 Individual source category quality

The following table provides a checklist for quality control, to be completed annually for each source category.

The checklist is divided into three sections:

- Stage 1, concerning data gathering, input, and handling activities;
- Stage 2, concerning data documentation;
- Stage 3, concerning emissions and calculations.

TIER 1 – INDIVIDUAL SOURCE CATEGORY: _____						
ITEM	**CHECK COMPLETED**			**CORRECTIVE ACTION**		**COMMENTS**
	DATE	**NAME**	**ERRORS (Y/N)**	**DATE**	**NAME**	
STAGE 1 - Data gathering, input, and handling activities						
T1-1 Check a sample of input data for transcription errors						
T1-2 Review spreadsheets with computerized checks and/or quality check reports						
T1-3 Other (specify)						
STAGE 2 - Data documentation						
T1-4 Check master file for completeness						
T1-5 Confirm that bibliographical data references are included (in spreadsheet) for every primary data element						
T1-6 Check that all citations in spreadsheets and Inventory are complete (i.e. include all relevant information)						
T1-7 Randomly check bibliographical citations for transcriptions errors						
T1-8 Check that citations are properly referenced in the update spreadsheets						
T1-9 Randomly check that the citations contain the material & content referenced						
T1-10 Check that assumptions and criteria for selection of activity data and emission factors are documented						
T1-11 Check that changes in data or methodology are documented						
T1-12 Other (specify)						
STAGE 3 - Emissions and calculations						
T1-13 Check that all emission calculations are transparent						
T1-14 Check whether emission units, parameters, and conversion factors are appropriate						
T1-15 Check if units are properly labelled ad correctly carried through from beginning to end of calculation						
T1-16 Check that temporal and spatial adjustment factors are used correctly						
T1-17 Check that spreadsheet input data and calculated data are clearly differentiated						
T1-18 Check a representative sample of calculations, by hand or electronically						
T1-19 Check the aggregation of data within a source category						
T1-20 When methods or data have changed, check consistency of time series inputs and calculations						
T1-21 Check for consistency with IPCC inventory guidelines and good practices, particularly if changes occur						
T1-22 Other (specify)						

3.2 Tier 2 - Source-specific category procedures

In addition to the general QC checks, category-specific QC activities are performed. The category-specific measures are applied on a case-by-case basis focusing on key categories and on categories

where significant methodological and data revisions have taken place.
Tier 2 focuses on specific source categories; the respective checklist is not to be compiled annually, but according to the peculiarity of key categories.
The first part is oriented to identify potential problems in estimates, emission factors and activity data. The second one focuses on the quality of secondary data and direct measured emissions. Analogously to Tier 1, the analyst has discretion over the implementation of the controls, checks/rows that are not relevant should be indicated with "n/r" and those not available with "n/a" and additional checks, if relevant to the source category, can be added to the list. Once completed, the form should be appropriately archived with the QA/QC documentation.

The checklist is based on two parts: Part A, concerning data gathering and selection and Part B, concerning secondary data and direct emission measurement.

The first part is divided into four sections:

- Stage 1, concerning emission data;
- Stage 2, concerning emission factor;
- Stage 3, concerning national level activity data;
- Stage 4, concerning site specific activity data.

The second part is divided into two sections:

- Stage 1, concerning sample questions regarding the quality of input data;
- Stage 2, concerning direct emission measurement.

For each item, if necessary, the section for comments can be compiled.

TIER 2 – Individual source category: _____						
Item	**Check completed**			**Corrective action**		**Comments**
	Date	**Name**	**Errors (Y/N)**	**Date**	**Name**	
Part A - Data gathering and selection						
STAGE 1 - Emission data						
T2-A-1 Emission comparisons: historical data for source, significant subsource categories						
T2-A-2 Order of magnitude checks						
T2-A-3 Comparison of different reference sources						
T2-A-4 Completeness checks (see overall inventory checklist, as well)						
T2-A-5 Other (detailed checks)						
STAGE 2 - Emission factor						
T2-A-6 Assess representativeness of emission factors, given national circumstances and analogous emissions data						
T2-A-7 Search for options for more representative data?						

TIER 2 – Individual source category: _____						
Item	**Check completed**			**Corrective action**		**Comments**
	Date	**Name**	**Errors (Y/N)**	**Date**	**Name**	
T2-A-8 Other (detailed checks)						
STAGE 3 - National level activity data						
T2-A-9 Check historical trends						
T2-A-10 Compare multiple reference sources						
T2-A-11 Check methodology for filling in time series for data that are not available annually						
T2-A-12 Other (detailed checks)						
STAGE 4 - Site specific activity data						
T2-A-13 Inconsistencies across sites						
T2-A-14 Compare aggregated and national data						
T2-A-15 Other (detailed checks)						
Part B: Secondary data and direct emission measurement						
STAGE 1 - Sample questions regarding the quality of input data						
T2-B-1 Are QC activities conducted during the original preparation of the data (either as reported in published literature or as indicated by personal communications) consistent with and adequate when compared against (as a minimum), Tier 1 QC activities?						
T2-B-2 Does the statistical agency have a QA/QC plan that covers the preparation of the data?						
T2-B-3 For surveys, what sampling protocols were used and how recently were they reviewed?						
T2-B-4 For site-specific activity data, are any national or international standards applicable to the measurement of the data; if so, have they been employed?						
T2-B-5 Have uncertainties in the data been estimated and documented?						
T2-B-6 Have any limitations of the secondary data been identified and documented, such as biases or incomplete estimates? Have errors been found?						
T2-B-7 Have the secondary data undergone peer review and, if so, of what nature?						
T2-B-8 Other (detailed checks)						
STAGE 2 - Direct emission measurement						
T2-B-9 Identify which variables rely on direct emission measurement						

TIER 2 – Individual source category: _____						
Item	**Check completed**			**Corrective action**		**Comments**
	Date	**Name**	**Errors (Y/N)**	**Date**	**Name**	
T2-B-10 Check procedures used to measure emissions, including sampling procedures, equipment calibration and maintenance						
T2-B-11 Identify whether standard procedures have been used, where they exist (such as IPCC methods or ISO standards)						
T2-B-12 Other (detailed checks)						

In the following, two examples of specific source checklists are illustrated, created and adopted for road transport subsector and for agriculture sector of the Italian emission inventory.
The checklists are constructed on the basis of the Italian emission inventory peculiarities, so the controls reported are performed according to the specific sources methodologies, input data, elaboration process, software, output emission data, subsequently reported in NIR and CRF, IIR and NFR tables.

For Road Transport, the first section of checks relates to input data, at first verifying that the elaboration includes at least the fundamental sources useful for the estimation, regarding QA/QC activities and Review Reports, regarding inputs such as fleet, mileage and consumption data; then in order to verify and consult the methodology, in order to consult and check other relevant information (for instance in road transport case study, data and documentation from the national Expert Panel on Transport), in order to control time series and the coordination activities with the inventory team. The second section refers to the software used, in particular Copert (COmputer Programme to calculate Emissions from Road Transport, Emisia SA, http://www.emisia.com/copert/General.html) and it is divided into control sections regarding input data for each year of the time series and run details. Afterwards controls related to output emission data are included, also focusing controls on reporting: CRF and NIR, NFR tables and IIR.

Check list Road Transport (NFR code: 1A3b)						
Item	***Check completed***			***Corrective action***		***Comments***
	Date	***Name***	***Errors (Y/N)***	***Date***	***Name***	
INPUT DATA						
CHECK THAT THE ELABORATIONS OF INPUT DATA FILES INCLUDE AT LEAST THE SOURCES SHOWN BELOW.						
In order to consider QA/QC activities and Review Reports						
◊ Control which are the activities expected for this submission from the QA/QC report						
◊ Control if any update or modification needs to be done from the methodological point of view						

Check list Road Transport (NFR code: 1A3b)						
Item	***Check completed***			***Corrective action***		***Comments***
	Date	***Name***	***Errors (Y/N)***	***Date***	***Name***	
◊ Control Review reports of the reporting year, if any improvement has been suggested						
In order to estimate the fleet and to estimate and to check mileage data (also on the basis of the fuel balance simulation process):						
◊ ACI - Dati e statistiche						
◊ AISCAT publications						
◊ ANCMA - Statistics						
◊ Istat - Trasporto merci su strada						
◊ Ministero delle Infrastrutture e dei Trasporti - Conto Nazionale delle Infrastrutture e dei Trasporti						
◊ Ministero delle Infrastrutture e dei Trasporti - Vehicles population data						
In order to estimate fuel consumption data:						
◊ MSE – Bilancio Energetico Nazionale						
◊ MSE – Bollettino Petrolifero Trimestrale						
◊ Unione Petrolifera - Statistics						
In order to verify and consult the methodology:						
◊ EMEP/EEA air pollutant emission inventory guidebook 2009						
◊ IPCC Guidelines and Good Practice Guidance						
◊ Manuals and documentation about the software						
In order to consult and check other relevant information:						
◊ Expert Panel on Transport – data and documentation						
In order to control time series and coordination activities with the inventory team						
◊ Coordinating with other staff members an unique collection of data and exchange of information						
◊ Control times series of statistics for consistency reasons						
SOFTWARE						
INPUT DATA						
For every year of the time series:						

Check list Road Transport (NFR code: 1A3b)						
Item	***Check completed***			***Corrective action***		***Comments***
	Date	***Name***	***Errors (Y/N)***	***Date***	***Name***	
◊ In the case that the inventory is updated using a new version of the software Copert: check that in the conversion process of the data-base, the same settings and options are maintained with respect to the previous version (in particular the country specific fuel consumption factors inserted for passenger cars and mopeds in *Calculation Factors>Hot Emission Factors*).						
◊ Test that in *Country> Country Info*, Beta parameters are calculated (at now, other values of this section are default values)						
◊ Test that in *Country> Fuel Info*, the fuel consumptions data and fuel specifications are corresponding to the selected year.						
◊ Test that the fleet is correctly configured (in *Fleet Configuration*).						
◊ Check that to each vehicle category having Population >0, values>0 are associated regarding:						
◊ Mileage, Mean Fleet Mileage in *Activity Data>Input Fleet Data* (the test should be performed according the general rule that mileage is greater for new models than the elder ones and for diesel vehicles than the gasoline ones)						
◊ U, R, H Speed and U, R, H, Driving Share in *Activity Data>Input Circulation Data*						
◊ In *Activity Data>Input Evaporation Data*, default values are maintained except for mopeds, for which specific data were available						
RUN DETAILS						
Test for every year of the time series that in "Run Details" every calculation is performed and that every option is activated (every cell should be clear).						
OUTPUT EMISSION DATA						
Test the whole estimated emissions time series:						

Check list Road Transport (NFR code: 1A3b)						
Item	***Check completed***			***Corrective action***		***Comments***
	Date	***Name***	***Errors (Y/N)***	***Date***	***Name***	
◊ Test the completeness by verifying that, according to the methodology reported in the EMEP/EEA air pollutant emission inventory guidebook 2009, emissions are correctly calculated for every year (by Copert: in Emissions>Total Emissions or, better, in the excel export file that makes easy the control over several years), i. e. test that emissions values per vehicle category are greater than zero when the methodology contemplates it. If a missing emission value is found, then test that calculations factors are correctly set (activity data should have been already tested)						
◊ Verify the coherence and consistency of the emissions time series (the comparison should be performed checking both the consistency between vehicles categories emissions with reference to every single year and between emissions values of several years).						
◊ Test the comparability of data with respect to previous submissions and, if available, with respect to other comparable independent emissions inventories.						
CRF						
Check that all data reported in the CRF (subsector 1.A.3.b) coincide with those reported in the latest updated files (checking also, before uploading estimates, the last version of the CRF Reporter)						
NIR						
Check that all data reported in the NIR (subsector 1.A.3.b) coincide with those reported in the latest update files and all information reported are consistent with the methodology illustrated in the IPCC Guidelines and Good Practice Guidance and in the EMEP/EEA air pollutant emission inventory guidebook						
NFR						
Check that all data reported in the NFR tables (NFR subsector 1.A.3.b) coincide with those reported in the latest updated files						
IIR						
Check that all data reported in the IIR (NFR subsector 1.A.3.b) coincide with those reported in the latest update files and all information reported are consistent with the methodology illustrated in the EMEP/EEA air pollutant emission inventory guidebook and in the IPCC Guidelines and Good Practice Guidance						

As regards the Agriculture sector of the Italian inventory, the following checklist has been structured. The first control section includes checks relating to the elaboration of input data, in particular with reference to QA/QC activities and Review Reports, then as regards agricultural statistics, the control of time series and coordination activities with the inventory team, the uploading of activity data, the consultation of methodology and check of other relevant information (for instance in agriculture case study, data and documentation from the Expert Panel on Agriculture and Nature), the control of estimation files, output emission data and related reporting on CRF and NIR, NFR tables and IIR.

Check list AGRICULTURE (NFR code: 4)						
	Check completed			*Corrective action*		
In order to check list AGRICULTURE (NFR code: 4)	*Date*	*Name*	*Errors (Y/N)*	*Date*	*Name*	*Comments*
INPUT DATA						
CHECK THAT THE ELABORATION OF INPUT DATA FILES INCLUDE THE FOLLOWING ITEMS:						
In order to estimate agricultural emissions the following steps are needed:						
Check QA/QC activities and ERT UNFCCC review report						
* control which are the activities expected for this submission from the QA/QC report						
* control if any update or modification needs to be done from the methodological point of view						
* control ERT UNFCCC review report, if any improvement has been suggested						
In order to Identify and store agricultural statistics						
* identify provisional or final data, and collect final data if possible						
* to be sure final data is collected, contact reference person at ISTAT for agricultural production/surface, milk, animal number and fertilisers						
* collect other sources of data collection are: AIA, UNA, FAO, TERNA, MATTM						
* store collected data on specific files by type and save files with the date (*Dati attività*)						
In order to control of time series and coordination activities with the inventory team						

Check list AGRICULTURE (NFR code: 4)						
	Check completed			*Corrective action*		
In order to check list AGRICULTURE (NFR code: 4)	*Date*	*Name*	*Errors (Y/N)*	*Date*	*Name*	*Comments*
* coordinate with other staff member a unique collection of data and exchange of information (LULUCF - fertilizers; Waste - sludge&biogas; Energy - biogas)						
* control times series of statistics for consistency reasons						
In order to upload activity data						
* Before uploading data control units						
* After uploading data control time series						
* Final control of activity data files with files use for emission estimations						
In order to verify and consult the methodology:						
* EMEP/EEA air pollutant emission inventory guidebook 2009						
* IPCC Guidelines and Good Practice Guidance						
In order to consult and check other relevant information:						
* Expert Panel on Agriculture and Nature						
ESTIMATION FILES						
INPUT DATA						
* Activity data files ready for performing estimations:						
- Parco animali.xls						
- Coltivazioni.xls						
ESTIMATION FILES						
* During estimation insert as note any relevant information (excel cells)						
* Control each estimation and each excel file:						
- Metano 90-00.xls						
- BUFALE ENTERICO.xls						

Check list AGRICULTURE (NFR code: 4)						
	Check completed			*Corrective action*		
In order to check list AGRICULTURE (NFR code: 4)	*Date*	*Name*	*Errors (Y/N)*	*Date*	*Name*	*Comments*
- N20 reflui 90-00.xls						
- N20 suoli 90-00.xls						
- serie storica risaie.xls						
- 1003-007 emiprov.xls						
- Ammoniaca 90-00.xls						
OUTPUT EMISSION DATA						
Test the whole estimated emissions time series:						
* Test the completeness by verifying that all substances and categories are included, according to the methodology reported in the IPCC Guidelines and EMEP/EEA air pollutant emission inventory guidebook 2009						
* Verify the consistency of the emissions time series						
* Test the comparability of data with respect to previous submissions						
Final verification of estimates						
* In order to control total emissions, verify the following file:						
- AGRICOLTURA Trend 1990-2020 ver3						
CRF						
Check that all data reported in the CRF (sector 4) coincide with those reported in the latest updated files (checking also, before uploading estimates, the last version of the CRF Reporter)						
NIR						

Check list AGRICULTURE (NFR code: 4)						
	Check completed			*Corrective action*		
In order to check list AGRICULTURE (NFR code: 4)	*Date*	*Name*	*Errors (Y/N)*	*Date*	*Name*	*Comments*
Check that all data reported in the NIR (sector 4) coincide with those reported in the latest update files and all information reported are consistent with the methodology illustrated in the EMEP/EEA air pollutant emission inventory guidebook and in the IPCC Guidelines and Good Practice Guidance						
NFR						
Check that all data reported in the NFR tables (NFR sector 4) coincide with those reported in the latest up-dated files						
IIR						
Check that all data reported in the IIR (NFR sector 4) coincide with those reported in the latest update files and all information reported are consistent with the methodology illustrated in the EMEP/EEA air pollutant emission inventory guidebook and in the IPCC Guidelines and Good Practice Guidance						

3.3 Inventory document quality

This section presents the quality control about the national inventory document, namely, in this specific case, the "National Inventory Report (NIR)".

The checklist, to be completed annually, consists of a registration of the checks and corrections performed. When the choice of the appropriate corrective action is controversial, the QC examiner should involve in the decision the institute inventory coordinator.

Analogously to previous checklists, the compiler can decide about the implementation of the controls and he should insert in the list additional checks, if relevant.

As before, the requirements concerning each check are explained; the presence of errors, the name of the compiler and the date when the test was completed should be indicated. In case of corrective actions, the name of the resource employed and the date when the errors were corrected should be reported as well. For each check, a section for comments, if necessary, is preset.

The compiled checklist should be appropriately archived with the QA/QC documentation.

The checklist is divided into three sections: front section, tables and figures and other issues concerning format. The latter is based on the verification of the homogeneity of the structure of the sectoral sections, the homogeneity of the format of equations and the coherence between citations and references.

Checklist for National Inventory Document						
Item	**Check completed**			**Corrective action**		**Comments**
	Date	**Name**	**Errors (Y/N)**	**Date**	**Name**	
STAGE 1 - Front section						
T-NIR-1 Cover page has correct date, title and contact address						
T-NIR-2 Document number listed on title page						
T-NIR-3 Tables of contents/tables/figures are accurate: titles match document, page #s match; numbers run consecutively and have correct punctuation						
T-NIR-4 The Executive Summary and Introduction are updated with appropriate years and discussion of trends						
T-NIR-5 Other (specify)						
STAGE 2 - Tables and Figures						
T-NIR-6 All numbers in tables match numbers in spreadsheets						
T-NIR-7 All numbers in tables match in the Executive Summary						
T-NIR-8 All numbers in tables match in the Introduction						
T-NIR-9 All numbers in tables match in the Trends Chapter						
T-NIR-10 All numbers in tables match in the Energy Chapter						
T-NIR-11 All numbers in tables match in the Industrial Processes Chapter						

Checklist for National Inventory Document						
Item	**Check completed**			**Corrective action**		**Comments**
	Date	**Name**	**Errors (Y/N)**	**Date**	**Name**	
T-NIR-12 All numbers in tables match in the Solvent and other product use Chapter						
T-NIR-13 All numbers in tables match in the Agriculture Chapter						
T-NIR-14 All numbers in tables match in the LULUCF Chapter						
T-NIR-15 All numbers in tables match in the Waste Chapter						
T-NIR-16 All numbers in tables match in the Recalculations and Improvements Chapter						
T-NIR-17 All numbers in tables match in the Annexes						
T-NIR-18 Check that all tables have correct number of signifi-cant digits						
T-NIR-19 Check all symbols in tables						
T-NIR-20 Table formatting is consistent						
T-NIR-21 Check that all figures are updated with new data and referenced in the text						
T-NIR-22 Check table and figure titles for accuracy and consis-tency with content						
T-NIR-23 Other (specify)						
STAGE 3 - Other issues concerning format						
T-NIR-24 Make sure the structure of the sectoral sections follows the same criteria						

Checklist for National Inventory Document						
Item	**Check completed**			**Corrective action**		**Comments**
	Date	**Name**	**Errors (Y/N)**	**Date**	**Name**	
T-NIR-25 Equations (should have the same traits)						
T-NIR-26 Check that in text, citations and references match						
T-NIR-27 Other (specify)						

3.4 Quality of Common Reporting Format Tables

This paragraph presents a formalisation of the checks to perform with regard to common reporting formats (excel files); all checks should be carried out for each CRF year.
Analogously to previous checks, the analyst can decide about the implementation of the controls and he should insert in the list additional checks, if relevant.

Once completed, the following form should be appropriately archived with the QA/QC documentation.

The checklist is divided into three sections: data checks, formatting checks, other checks before printing or submitting.

Checklist for Common Reporting Format Tables						
Item	**Check completed**			**Corrective action**		**Comments**
	Date	**Name**	**Errors (Y/N)**	**Date**	**Name**	
STAGE 1 - Data Checks						
T-CRF-1 Check emissions and consumption from each chapter, each gas, and overall totals. Ensure that CRF data and emissions match totals in summary spreadsheet. Note: if totals are inconsistent, work from broad to specific categories to locate the error						
T-CRF-2 Check all duplicate data is linked to the same source or each other						
T-CRF-3 Check all of the links go to the most recent spreadsheets and the correct year on the Data and Document Coordinator's computer						
T-CRF-4 Ensure all "business sensitive" information is appropriately hidden						
T-CRF-5 Check that IE, NA, NO, and NE are used appropriately						

Checklist for Common Reporting Format Tables						
Item	**Check completed**			**Corrective action**		**Comments**
	Date	**Name**	**Errors (Y/N)**	**Date**	**Name**	
T-CRF-6 Make sure all changes from the previous year's submittal are explained						
T-CRF-7 Check the Reference Approach separately						
T-CRF-8 Check all units are correct within the CRF sheets (they often need to be converted from inventory units)						
T-CRF-9 Make sure no cells are blank unless instructed by the IPCC						
T-CRF-10 Make sure a specific item is given always the same value						
T-CRF-11 Other (specify)						
STAGE 2 - Formatting Checks						
T-CRF-12 Make sure the information for current Inventory year is correct						
T-CRF-13 Check range names to make sure they did not get changed (especially in documentation boxes and areas where rows were inserted)						
T-CRF-14 Other (specify)						
STAGE 3 - Other Checks Before Printing/Submitting						
T-CRF-15 Make sure contact information is current						
T-CRF-16 Cut all links and delete all comments that have been inserted. Check to see if the macro that performs this function changed any formatting, especially in areas where rows were inserted						
T-CRF-17 Other (specify)						

4 Quality assurance procedures

Quality Assurance (QA), as defined by the IPCC Good Practice Guidance, is a planned system of review procedures conducted by personnel not directly involved in the inventory compilation process. Reviews, preferably by independent third parties, are performed upon a finalised inventory following the QC procedures in order to verify that data quality objectives are met, ensure that the inventory represents the best possible estimates of emissions and removals given the current state of scientific knowledge and data availability, and support the effectiveness of the QC programme.
Quality assurance procedures regard some verification activities of the inventory as a whole and at sectoral level.

Feedbacks for the Italian inventory should derive from communication of data to different institutions and/or at local level and from information publicly available. For instance, the communication of the inventory to the European Community result in a pre-check of the GHG values before the submission to the UNFCCC and relevant inconsistencies may be highlighted.
Results and suggestions from expert peer reviews of the national inventory within the UNFCCC process can provide valuable feedback on areas where the inventories can be improved.
A specific procedure for improving the inventory should regard the establishment of national expert panels involving different institutions, local agencies and industrial associations which cooperate for the improvement of activity data and accuracy of emission factors and may serve as review of sectoral estimates.
The quality of the inventory may improve through the organization and participation in sector specific workshops.

Independent reviews and public reviews should be implemented in order to check emission levels and make controls on the transparency and consistency of methodological approaches performed. Nevertheless, the process of review has feedbacks also once the inventory, the inventory related publications and the national inventory reports are posted on the website, specifically http://www.isprambiente.gov.it/, or by diffusion and publication of emission data in Environmental and Statistical yearbooks.

5 QA/QC and uncertainty estimates

The QA/QC process and uncertainty analyses provide valuable feedback to one another. Critical components of the inventory estimations and data sources that contribute to both the uncertainty level and inventory quality and which should therefore be a primary focus of inventory improvement efforts should be identified by the QA/QC and uncertainty analyses.
QC procedures should be also undertaken on the calculations of uncertainty associated with estimates to confirm that calculations are correct and that there is sufficient documentation to duplicate them. The assumptions on which uncertainty estimations have been based should be documented for each category.
Figures to draw up uncertainty analysis should be checked with the relevant analyst experts and literature references and it should be verified that they are consistent with the IPCC Good Practice Guidance.

6 Verification

Verification activities should be part of the overall QA/QC program. These activities have the ultimate objective of increasing the confidence and reliability of the inventory estimates.
Additional comparisons of emission estimates from industrial sectors with figures published by the industry itself in the environmental reports should be carried out annually in order to assess the quality and the uncertainty of the estimates.
A comparison of emission intensity indicators between countries (e.g. emissions per capita, industrial emissions per unit of value added, transport emissions per car, emissions from power generation per kWh of electricity produced, and emissions from dairy cattle per tonne of milk

produced) can also be useful to provide a preliminary check and verification of the order of magnitude of the emissions. This should be carried out at European and international level by considering the annual reports compiled by the EC and the UNFCCC as well as related documentation available from international databases and outcome of relevant workshops.
For processes where different tiers could result in different emission figures, lower and higher tier methods should be applied and compared and differences should be analysed.

7 Documentation, archiving and reporting

All the material and documents used for the inventory preparation should be stored at the Institute for Environmental Protection and Research.
All information relating to the planning, preparation, and management of inventory activities should be documented and archived. The archive should be organised so that an informed analyst could obtain relevant data sources and spreadsheets, reproduce the inventory and review all decisions about assumptions and methodologies that were made. A documentation catalogue should be generated for each inventory year and it should be possible to track changes in data and methodologies over time. Specifically, the documentation should include:

- an electronic copy of the list of the full content of the documentation catalogue for that year;
- electronic copies of each of the draft and final inventory report, paper and electronic copies of the draft and final CRF tables;
- electronic copies of all the final, linked source category spreadsheets for the inventory estimates (including all spreadsheets that feed the emission spreadsheets), as well as any important printouts;
- for the overall inventory and for individual source categories, the documentation containing adequate explanation of the linkages among the spreadsheets and the inventory document;
- the results of the reviews and, in general, all documentation related to the corresponding inventory year submission.

With regard to excel files containing all documentation and references used and the places where they are stored, the following table should be used and appropriately archived by ISPRA with the QA/QC documentation; it presents an example of form to be updated annually, for each sector.

SECTOR	ID	N	Author	Year	Title	Editor	Numeric format	Position	Link	Notes

8 Inventory improvement plan

The synthesised findings of the reviews as well as feedbacks from inventory compilers and users should provide a basis for the planned progressive development of inventories. Priorities should be established for the changes that are required on account of the importance of the source category out of the total inventory; key source categories should estimated by more advanced tiers.
Quality objectives should be set and reviewed annually. Prioritisation of improvements should be established.
Generally, improvements are related to the availability of new and updated information on emission factors, activity data as well as parameters necessary to carry out the estimates.