ISPRA
Istituto Superiore per la Protezione
e la Ricerca Ambientale

RAPPORTI

Quality Assurance/Quality Control Plan for the Italian Emission Inventory. Year 2013

180 / 2013

ISPRA
Istituto Superiore per la Protezione
e la Ricerca Ambientale

Quality Assurance/Quality Control Plan for the Italian Emission Inventory. Year 2013

Rapporti 180/2013

Legal Disclaimer

The Institute for Environmental Protection and Research, or person acting on its behalf, are not responsible for the use that may be made of the information contained in this report.

ISPRA – Istituto Superiore per la Protezione e la Ricerca Ambientale
(Institute for Environmental Protection and Research)
Via Vitaliano Brancati, 48 – 00144 Rome
www.isprambiente.gov.it

ISPRA is the Institute for Environmental Protection and Research established by Italian Law 133/2008, as published in the Official Journal n. 195, August 21 2008. The Institute performs the functions of three former institutions: APAT (Agency for Environmental Protection and Technical Services), ICRAM (Central Institute for Applied Marine Research), INFS (National Institute for Wildlife).

ISBN 978-88-448-0612-5

Cover design
Franco Iozzoli

Typographic coordination
Daria Mazzella
ISPRA - Section for Publishing

Text available on ISPRA website at www.isprambiente.gov.it

CONTENTS

QA/QC GENERAL
2012 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Daniela Romano, Riccardo De Lauretis

April, 2013

NATIONAL AIR EMISSION INVENTORY: GENERAL OVERVIEW

I. Objective

This document summarizes the specific Quality Assurance (QA) Quality Control (QC) activities and different verification procedures which are applied thoroughly the current inventory compilation as part of the estimation process.

In addition to a description of the current activities applied and the documentation, archiving and reporting processes, a specific section illustrates the main findings of the latest review process together with the actions undertaken by the inventory team.

Further improvements and planned QA activities identified during the preparation of the National Inventory and National Inventory Report 2013 are also presented.

A summary of previous QA/QC procedures which helped to understand the improvement of the inventory over the years concludes the general part of the report.

Sector specific QA/QC and verification documentation are explained in the relevant chapters.

II. QA/QC activities and verification

Quality control checks and quality assurance procedures together with some verification activities are applied both to the national inventory as a whole and at sectoral level.

Specific QA/QC procedures are described in the manual 'Quality Assurance/Quality Control Plan for the Italian Inventory' (APAT, 2006). Verification activities are also part of the overall QA/QC program. These activities have the ultimate objective of increasing the confidence and reliability of the inventory estimates.

Feedbacks for the Italian inventory derive from communication of data to different institutions and/or at local level. 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.

In addition to these annual reviews, an agreement to conduct a bilateral independent review between Italy and Spain was established last year, with a focus on the revision of the GHG inventories of both the Parties. Two in-country visits were already held, in September and October 2012; the Italian team revised part of the energy sector of Spain, specifically the categories public power plants, petroleum refining plants, road transport and off-road, whereas the Spanish team revised the Industrial processes and solvent and other product use, and the LULUCF sectors of Italy. Results of these analyses are not finalized yet but a report will be published as soon as possible. Aim of the review was to carry out a general quality assurance analysis of the inventories in terms of the methodologies, the EFs and the references used, as well as analysing critical cross cutting issues such as details of the national energy balances and comparison with international data (Eurostat and IEA), use of plant specific information. Revisions of the other inventory sectors are planned during the year 2013.

Also, a call for tender to carry out an official independent technical review of the entire Italian national greenhouse gas inventory has been launched this year and will be finalized in the next few months.

However, the review process is carried out and has feedbacks once the inventory, the inventory related publications and the national inventory reports are posted on the website, specifically http://www.isprambiente.gov.it. Comments also derive from the communication of data to different institutions and/or at local level.

The inventory is presented every year to a Technical Committee on Emissions (CTE), coordinated by the Ministry for the Environment, Land and Sea, where all the relevant Ministries and local authorities are represented. Emission figures and results are shared and discussed among experts.

Expert peer reviews of the national inventory also occur annually within the UNFCCC process; results and suggestions can provide valuable feedback on areas where the inventory should be improved. Specifically, the Italian GHG inventory was subjected to in-country reviews by the UNFCC Secretariat in September 2005 and in June 2007. From 2009, the Italian inventory was subjected to centralised reviews; results and recommendations of the reviews are available on the UNFCCC website at http://unfccc.int/national_reports/annex_i_ghg_inventories/inventory_review_reports/items/6616.php.

Responses and actions to the review processes are described in details in section IV.

An official review, apart from reviews from the UNFCCC, was performed by Ecofys, in 2000, in order to verify of the effectiveness of policies and measures undertaken by Italy to reduce greenhouse gas emissions to the levels established by the Kyoto Protocol. In this framework, an independent review and checks on emission levels were carried out as well as controls on the transparency and consistency of methodological approaches (Ecofys, 2001). More recently, VITO, Öko-Institut and the Institute for European Environmental Policy, for DG Environment, undertook a review on the methodologies and EU Member States best practices used for GHG projections to identify possible ways to improve GHG projections and ensure consistency across the EU. The results were presented in 2008 at the Workshop 'Assessing and improving methodologies for GHG projections'. Further analyses were presented in the Workshop on 'Quantification of the effects on greenhouse gas emissions of policies and measures'.

The preparation of environmental reports, where data are needed at different aggregation levels or refer to different contexts, such as environmental and economic accountings, is also a verification for emission trends. At national level, for instance, emission time series are reported in the Environmental Data Yearbook published by the Institute. Emission data are also published by the Ministry of Environment in the Reports on the State of the Environment, the National Communications as well as in the Demonstrable Progress report. Moreover, figures are communicated to the National Institute of Statistics to be published in the relevant Environmental Statistics Yearbooks as well as used in the framework of the EUROSTAT NAMEA accounting.

Comparisons between national activity data and data from international databases are usually carried out in order to find out the main differences and an explanation to them. Emission intensity indicators among countries (e.g. emissions per capita, industrial emissions per unit of added value, transport emissions per car, emissions from power generation per kWh of electricity produced, emissions from dairy ruminants 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 is 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.

Additional comparisons between emission estimates from industrial sectors and those published by the industry in the relevant Environmental reports are carried out annually in order to assess the quality and the uncertainty of the estimates.

The quality of the inventory has also improved by the organization and participation in sector specific workshops. Follow-up processes are also set up in the framework of the WGI under the EC Monitoring Mechanism, which address to the improvement of different inventory sectors. In 2008, a workshop was held, on the implications of the implementation of the 2006 IPCC Guidelines for national GHG inventories. Previous workshops addressed: the use of European emissions trading scheme data in the national greenhouse gas inventories, management of uncertainty in national inventories, methodologies to estimate emissions from the agriculture and LULUCF sectors, involving the Joint Research Centre, from the waste sector, involving the European Topic Center on Resource and Waste Management, as well as from international bunkers, involving the International Energy Agency and EUROCONTROL. Presentations and documentation of the workshops are available at the address: http://air-climate.eionet.europa.eu/meetings/past_html.

A national conference on the Italian emission inventory was organized by APAT in October 2006. Methodologies used to carry out national figures and results of time series from 1990 to 2004 were presented

detailing explanations for each sector. More than one hundred participants from national and local authorities, Ministries, Industry, Universities and Research organizations attended the two days meeting.

In 2007, in the framework of the National Conference on Climate Change, an event previous to the Conference presented the National GHG emission Inventory and specifically the time series of emission estimates from 1990 to 2005; besides a specific session of the Conference was dedicated to the National and local Inventories focusing on methodological issues and policies and measures to be adopted to reduce GHG emissions. In 2010, the time series 1990-2008 was presented in a specific national Kyoto Protocol event.

A specific procedure undertaken for improving the inventory regards the establishment of national expert panels (specifically, in the sectors of road transport, land use change and forestry and energy) which involve, on a voluntary basis, different institutions, local agencies and industrial associations cooperating for improving activity data and emission factors accuracy. Specifically, for the LULUCF sector, following the election of the 3.3 and 3.4 activities and on account of an in-depth analysis on the information needed to report LULUCF under the Kyoto Protocol, a Scientific Committee, constituted by the relevant national experts has been established by the Ministry for the Environment, Land and Sea in cooperation with the Ministry of Agriculture, Food and Forest Policies.

In addition to these expert panels, ISPRA participates in technical working groups within the National Statistical System (Sistan). These groups, named *Circoli di qualità*, coordinated by the National Institute of Statistics, are constituted by both producers and users of statistical information with the aim of improving and monitoring statistical information in specific sectors such as transport, industry, agriculture, forest and fishing. These activities improve the quality and details of basic data, as well as enable a more organized and timely communication.

QC procedures are also undertaken on the calculations of uncertainties in order to confirm the correctness of the estimates and that there is sufficient documentation to duplicate the analysis.

The assumptions, which uncertainty estimations are based on, are documented for each category. Figures to draw up uncertainty analysis are checked with the relevant analyst experts and literature references and they are consistent with the IPCC Good Practice Guidance and IPCC Guidelines (IPCC, 2000; IPCC, 2006).

Quantitative estimates of the uncertainties for the Italian GHG inventory are calculated using Approach 1 as defined in the IPCC 2006 Guidelines (IPCC, 2006), which provides a calculation based on the error propagation equations. In addition, Approach 2, corresponding to the application of Monte Carlo analysis, has been applied to specific categories of the inventory but the results show that, with the information available at present, applying methods higher than Approach 1 does not make a significant difference in figures. The results of the study, 'Evaluating uncertainty in the Italian GHG inventory', were presented at an EU workshop on Uncertainties in Greenhouse Gas Inventories, held in Finland in September 2005, and they are also available on website at the address: http://air-climate.eionet.europa.eu/docs/meetings/050905_EU_GHG_Uncert_WS/meeting050905.html.

A further research on uncertainty, specifically on the comparison of different methodologies to evaluate emissions uncertainty, was also carried out (Romano et al., 2004).

In the last two years, Monte Carlo analysis has been applied to some key categories of the Italian inventory and it is planned to extend progressively the study to other inventory categories.

III. Documentation, archiving and reporting

All the material and documents used for the inventory preparation are stored at the Institute.

Information relating to the planning, preparation, and management of inventory activities are documented and archived. The archive is organised so that any skilled analyst could obtain relevant data sources and spreadsheets, reproduce the inventory and review all decisions about assumptions and methodologies undertaken. A master documentation catalogue is generated for each inventory year and it is possible to track changes in data and methodologies over time. Specifically, the documentation includes:

- electronic copies of each of the draft and final inventory report, 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);
- results of the reviews and, in general, all documentation related to the corresponding inventory year submission.

After each reporting cycle, all database files, spreadsheets and electronic documents are archived as 'read-only' mode.

A 'reference' database is also compiled every year to increase the transparency of the inventory. This database consists of a number of records that references all documentation used during the inventory compilation, for each sector and submission year, the link to electronically available documents and the place where they are stored as well as internal documentation on QA/QC procedures.

IV. Review process recommendations

In 2012, the Italian inventory was submitted to a centralised review; the main critical points raised during the review process were addressed in the current inventory compilation and different improvements have been carried out. Specific issues are described in the relevant sectoral chapters and there were no important problems concerning the general and cross cutting activities.

V. Planned improvements and QA activities

The main institutional and legal arrangements required under the Kyoto Protocol have been finalized. Some problems still regard the implementation of national registry for forest carbon sinks to identify areas of land and land-use change in accordance with paragraph 20 of the annex to decision 16/CMP.1, and to provide information, including estimates of emissions/removals, on activities under Article 3, paragraphs 3 and 4, of the Kyoto Protocol. However, actions to solve the question have been undertaken by the institutions involved. In 2009, a technical group, formed by experts from different institutions (ISPRA, Ministry of the Environment, Land and Sea, Ministry of Agriculture, Food and Forest Policies and University of Tuscia), set up the methodological plan of the activities necessary to implement the registry and defined the relative funding. Some of these activities (in particular IUTI, inventory of land use) have been completed, resulting in land use classification, for all national territory, for the years 1990, 2000 and 2008. A process of validation and verification of IUTI data is currently on going and will supply data useful to update and improve the estimations

Other sector specific improvements are identified in the relevant chapters; they can be summarized in the following.

For the energy and industrial sectors, the database where information collected in the framework of different EU legislation, Large Combustion Plant, E-PRTR and Emissions Trading, is annually updated. The database has helped highlighting the main discrepancies in information and detecting potential errors leading to a better use of these data in the national inventory.

For the agriculture and waste sectors, improvements will be related to the availability of new information on emission factors, activity data as well as parameters necessary to carry out the estimates; specifically, improvements are expected for the review of nitrous oxide emission factors in the agricultural soil emissions and availability of additional information on waste composition and other parameters following the entering into force of the European landfill directive.

For the LULUCF, activities planned in the framework of the National Registry for Forest Carbon Sinks should provide data to improve estimate of emissions by biomass burning and the final results from the Inventory of forests and carbon pools related to the soil surveys will definitely constitute a robust database for forest fires, allowing for refined estimates and lower related uncertainty.

Additional studies will regard the comparison between local inventories and national inventory and exchange of information with the 'local inventories' national expert group. In fact, ISPRA has also finalised the provincial inventory at local scale for the year 2010 in the context of the Protocol on Long-term Financing of the Cooperative Programme for Monitoring and Evaluation of the Long-range Transmission of Air Pollutants in Europe (EMEP) under the Convention on Long-range Transboundary Air Pollution (CLTRAP). Results are checked out by regional and local environmental agencies and authorities; data are available at ISPRA web address http://www.sinanet.isprambiente.it/it/sia-ispra/inventaria.

Further analyses will concern the collection of statistical data and information to estimate uncertainty in specific sectors by implementing Approach 2 of the IPCC guidelines.

VI. Major QA/QC activities over the past years

- *Energy Balance Verification.* A task force made up of energy and inventory experts (Ministry of Production Activities, ENEA and APAT) established to examine differences in basic data between the CRF and the joint EUROSTAT/IEA/UNECE questionnaire submissions and to improve the details of the National Energy Balance finalised its study and reported the results in the document "Energy data harmonization for CO_2 emission calculations: the Italian case" (ENEA/MAP/APAT, 2004).
- *Carbon Emission Factors Review.* A sampling and measurement campaign was carried out jointly with the Stazione Sperimentale Combustibili in order to check the CO_2 emission factors used for emission estimation in the energy sector, specifically the road transport and residential and commercial sector. Representative samples of Italian fuels, specifically gasoline, diesel oil and LPG, were collected and analysed from September 2000 - August 2001. Measurements were compared with default CO_2 emission factors proposed by the IPCC in the 1996 Revised Guidelines and those proposed by the EEA and used in COPERT III methodology. Values of national emission factors resulted higher than the default ones for gasoline and LPG, while those of diesel were lower. Emission factors have been substituted for the years 2000 onwards. The study and the results are described in detail in the APAT report (Contaldi, Ilacqua, 2003).
- *Road Transport Emissions Review.* The Italian Expert Panel on Transport, which comprises experts from Research Institutes, Universities, Industrial Associations, Local Authorities, Ministries and Public Authorities, continues its work on the improvement and assessment of emission estimations from road transport. There has been a considerable improvement on the details of basic data to be used within the COPERT model, both in terms of availability and timeliness. Studies of the expert panel group as well as presentations held in different meetings can be found on the website http://groupware.sinanet.isprambiente.it/expert_panel.
- *F-gases Review.* A review with industrial associations and the electrical company ENEL was undertaken in order to improve the quality of estimates by implementing the use of the Tier2 methodology. SF_6 estimates improved with the cooperation of the national electrical company ENEL and the main electrical associations. Specifically, for PFC emissions from aluminium production, the estimates were carried out jointly with the only national producer. The Tier 1 method was applied for the time series from 1990-1999, whereas from 2000, the Tier 2 method has been followed using national site specific values. A revision has also concerned HFC emissions on account of major information on the leakages made available by the European Association of Responsible Use of HFCs in Fire Fighting.
- *MeditAIRaneo Project*. A three years project involving the Inventory Reference Centres of the European Mediterranean Countries (Italy, Spain, France, Greece, Portugal) started at the end of the year 2000. The aim was to examine in details emissions that are specific and/or typical of the Mediterranean

Countries. Four different studies on air emissions from vegetation, agriculture, solvent use and urban road transport in Mediterranean areas were funded by APAT. Common objectives are analysis of methodologies and emission factors used by Mediterranean countries for estimating emissions, individuation of Mediterranean peculiarities, in comparison with other European countries, such as climate, technologies, industrial management, identification of methodological points which need in-depth examination and uncertainty assessment. An Italian case study has been developed for each of the four projects. In 2006, all the projects were concluded and the results have been used in the national inventory to improve country-specific emission factors.

- *Emissions Trading Scheme*. Analyses of sectoral industrial data from the Italian Emission Trading Scheme database are used to develop country-specific emission factors and check activity data levels.
- *European Pollutant Release and Transfer Register (E-PRTR).* Data from the Italian Pollutant Emission Register from some industrial sectors are used in the inventory compilation or as a check with the estimates carried out at national level. In particular, this regards the production of non-ferrous metals, chemical productions, cement and lime productions and the production of iron and steel.
- *Database of industrial emissions.* The databases of industrial emissions and basic information from the European Directives on the Emission Trading Scheme, Large Combustion Plant and EPER-E-PRTR Registry, are examined jointly and compared in order to check all the relevant information included.
- *Local inventories*. A study on the top-down approach to the preparation of local inventories was conducted and Italian emissions for different local areas were derived for the years 1990, 1995, 2000 and 2005. The results were checked out by regional and local environmental agencies and authorities in order to find out the main weak points and contribute with information available to characterise the local environment, this contributing as well as a feedback to the improvement of the national inventory. Final estimates and the detailed methodologies followed for each SNAP sector to carry out emission figures are published in technical reports (Liburdi et al., 2004; ISPRA, 2009).

QA/QC ENERGY
2012 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Riccardo De Lauretis

April, 2013

NATIONAL AIR EMISSION INVENTORY: ENERGY

I. Objective

The improvements carried out during the preparation of the 2013 national inventory submission for the energy sector and those expected for the next future are summarised in the following.

II. Review process recommendations

In the following table, the list of improvements implemented during the compilation of the inventory as follows the exchange of information related to the energy sector with the expert review team of the last review process is presented.

Further improvements and planned QA activities identified during the preparation of the National Inventory and National Inventory Report 2013 are also presented.

Subject	Improvement
Energy – Sector overview	Additional information on AD and EFs of biomass fuel consumed has been reported in the NIR, in the relevant paragraphs, §3.3.3.1, §3.4.3, §3.6.2, §3.6.3
Energy – Sector overview	QA/QC activities have been enhanced and description of trend have been better detailed in the NIR, in §3.1, §3.3.3.3, §3.4.2
Energy – Reference and sectoral approaches – Comparison and international statistics	Waste production data have been included in the reference approach in the category other and differences have been updated (see §3.8.5 of the NIR)
Energy –Reference and sectoral approaches – Comparison and international statistics	Refinery feedstocks exports have been properly included in the reference approach updating exports figure of other relevant liquid fuels (see §3.8.5 of the NIR)
Energy –Reference and sectoral approaches – International bunker fuels	Additional information have been included in the NIR (§3.5.4.2). Investigation on differences with IEA data are planned for the future
Energy –Reference and sectoral approaches – Feedstocks and non-energy use of fuels	Fractions of carbon stored based on gross fuel amount input have been calculated and reported in the CRF table 1.A.(d) (see §3.8.5 of the NIR)
Energy – Key categories – Stationary combustion: liquid fuels – CO_2	Additional information on the drivers behind the increasing trend of the CO_2 IEF for consumption of liquid fuels in petroleum refining has been included in §3.3.2.2 of the NIR
Energy – Key categories – Stationary combustion: solid fuels –CH_4	The decreasing trend in the CH_4 IEF in manufacture of solid fuels and other energy industries has been better explained in the NIR, §3.3.3.3

Energy – Key categories – Stationary combustion: solid fuels –CH_4	Additional information on the relatively high CH_4 IEF for solid fuels in the iron and steel subcategory has been included in the NIR, §3.4.3
Energy – Key categories – Stationary combustion: other fuels – CO_2, CH_4 and N_2O	Additional information on other fuels has been included in the NIR, §3.3.1.1, §3.4.3, §3.6.2
Energy – Key categories - Oil and natural gas: natural gas – CO_2, CH_4 and N_2O	Oil and natural gas exploration and production, and oil transport and refining/storage have been disaggregated. Additional information has been included in the NIR, §3.9.2
Energy – Key categories - Oil and natural gas: natural gas – CO_2, CH_4 and N_2O	The notation key in the NIR, §3.9.2, has been corrected
Energy – Non-key categories -Fugitive emissions from solid fuels – CO_2	CO_2 emissions from mines have been estimated (§3.9.2 of the NIR)

III. Planned improvements and QA activities

Documentation collected in the framework of the different European Directives, and Regulations (E-PRTR, Large Combustion plants and the Emissions Trading scheme) has been completely integrated in a unique informative system, with the aim to verify emissions and activity data reported for the same year under different reporting obligations and identify possible improvements in emission estimations. A further use of this database has regarded the calculation at plant level of emission estimates of other pollutants than greenhouse gases. This activity has been implemented also in view of this year submission of national emission figures of other pollutants which have been communicated in the framework of the EMEP-CLRTAP Convention at 50*50 grid scale. Emissions at point source level have been therefore derived for the energy and industrial sectors, refining figures previously attributed at local level by a top-down approach.

Agreements have been established with ISTAT for aviation and maritime data provision which should allow a yearly availability of basic data and the application of more advanced Tiers for the estimation of these sectors. Specifically, for aviation, data by aircraft type and origin destination matrix are under investigation and relevant emission factors will be updated consequently. For the maritime sector, a verification of activity data on ship movements and emission estimates is in progress together with regional environmental agencies.

Generally, off-road basic activity data are planned to be checked and updated especially concerning technological information.

Other improvements will consider the verification of figures reported in the energy balance for some sector. In particular, data on energy consumption communicated to ISPRA by the relevant industries in the framework of the ETS are provided to the Ministry of Economic Development Activities for a comparison and verification with the final consumption reported in the BEN for the Industry sector; the aim is to make full use of the ETS data in the compilation of the final fuel consumption of the energy balance. An additional verification will regard the comparison of ETS data with figures of energy consumption for electricity production reported by the Italian Independent System Operator (TERNA) to the Ministry of Economic Development Activities for publication in the BEN. The previous activities will improve the robustness and accuracy of data reported in the national balance thus of the emission inventory estimates.

QA/QC INDUSTRIAL PROCESSES
2012 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Andrea Gagna, Barbara Gonella, Ernesto Taurino

April, 2013

NATIONAL AIR EMISSION INVENTORY: INDUSTRIAL PROCESSES

I. Objective

The improvements carried out during the preparation of the 2013 national inventory submission for the industrial processes sector and those expected for the next future are summarised in the following.

II. Review process recommendations

In the following table, issues raised during the review process and related to the industrial processes sector are reported; improvements implemented for each subject are also included.

Further improvements and planned QA activities identified during the preparation of the National Inventory and National Inventory Report 2013 are summarised in the following table.

Subject	Improvement
Industrial processes - Cement production – CO_2 - Transparency	Additional information about CO_2 IEF fluctuations has been provided in the NIR in §4.2.2.
Industrial processes – Iron and steel production – CO_2	More explanation has been included in §4.4.2.
Industrial processes - Production of halocarbons and SF6 – PFCs	Detailed information are provided in order to increase the transparency (§4.6.2).
Industrial processes - Consumption of halocarbons and SF6 – SF6	Detailed information are provided in order to increase the transparency and demonstrate the consistency of the time series (§4.7.2).

Other improvements not identified during the review process have been carried out.

CO_2 emissions have been checked with the relevant industrial associations.

Activity data and emissions reported under EU-ETS and EPER/EPRTR are compared with the information provided by the industrial associations. In particular, comparisons have been carried out for cement, lime, limestone and dolomite, and glass sectors.

The outcome of further investigations concerning the production of soda ash and chlorine at facility level has been accounted for in this submission.

III. Planned improvements and QA activities

Planned improvements mainly focus on the improvement of EFs and AD by means of a detailed sectoral analysis of the national E-PRTR and Emissions Trading data for all the industrial sectors. The inventory team integrates the documentation collected in the framework of the different pieces of European legislation (EPER-E PRTR, Large Combustion Plants and Emission Trading Scheme) with the aim to verify emissions and activity data reported for the same year under different reporting obligations and identify possible improvements in emission estimations.

In the framework of EU-ETS, CO_2 emissions have been checked with the relevant industrial associations at national level.

Both activity data and average emission factors are also compared every year with data reported in the national EPER/E-PRTR registry and in the European emissions trading scheme.

Under the EU-ETS, operators are requested to report activity data and CO_2 emissions as information verified and certified by auditors who check for consistency to the reporting criteria.

Activity data and emissions reported under EU-ETS and EPER/EPRTR are compared to the information provided by the industrial associations. The general outcome of this verification step shows consistency among the information collected under different pieces of legislations and the information provided by the relevant industrial associations.

Further investigations regarding completeness of CO_2 emissions sources from the activities of this sector are planned.

Further additional checks regarding emissions for 2005-2009 will be carried out on account of information from new entrance installations that will be included in the ETS from 2013.

A detailed balance of the natural gas reported in the Energy Balance, as no energy fuel consumption, and the fuel used for the production processes in the petrochemical sector is planned.

The average emission factor of CO_2 from electric arc furnaces will be checked with ETS data communicated in the next years.

Following the encouragement of the ERT in the last review report, the inventory team has begun a survey to collect further information about the emissions due to the consumption of coke and, if possible, to disaggregate the relevant emissions between combustion and process.

In the framework of the Regulation (EC) n. 842/2006 of the European Parliament and of the Council on certain fluorinated greenhouse gases, Italy has established a reporting system in order to collect emission data. For this purpose, ISPRA, and in particular the inventory team, is responsible for the collection of reports by the operators of stationary application for refrigeration and air conditioning heat pumps as well as fire protection systems containing 3 kg or more of fluorinated greenhouse gases. Operators must report within 31 May every year; as for 2013 the information to be collected includes type and numbers of stationary appliances containing 3 kg or more of fluorinated greenhouse gases; from the next year also information about leakages from those stationary appliances will be collected thus contributing to an improvement of the inventory of F-gas emissions.

QA/QC SOLVENT AND OTHER PRODUCT USE
2012 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Eleonora Di Cristofaro

April, 2013

NATIONAL AIR EMISSION INVENTORY: SOLVENT AND OTHER PRODUCT USE

I. Objective

The improvements carried out during the preparation of the 2013 national inventory submission for the solvent sector and those expected for the next future are summarised in the following.

II. Planned improvements and QA activities

In the following table, the specific planned improvements and remarks to be taken into account in future submissions of the national air inventory for the solvent and other product use sector are reported.

The main improvements carried out during the 2013 submission regarded emissions from paint application, specifically considering data communicated from the industries in the framework of the EU Directive 2004/42, implemented by the Italian Legislative Decree 161/2006, on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products. These data refer to the composition of the total amount of paints and varnishes (water and solvent contents) in different subcategories for interior and exterior use and the total amount of products used for vehicle refinishing; available from the year 2007, they have been used as in the estimation process also as a verification of emission estimates.

Additional verifications of the emissions from the sector occurred the last year, on account of the bilateral independent review between Italy and Spain and the revision of national estimates and projections in the context of the National emission ceilings Directive for the EU Member States and the Gothenburg Protocol of the Convention on Long-Range Transboundary Air Pollution (CLRTAP). In the case of the bilateral review, national emissions from the solvent sector were revised by the Spanish team in October 2012.The analysis by category has not highlighted the need of major methodological revisions of the sector; an additional source of emissions has been added affecting only NMVOC emissions. A change of NMVOC emission factors for the last years in two chemical categories was the result of the other review process.

In the actual submission, the main modification involved the chemical products subsector with respect to NMVOC emissions, due to the update of emission factors for polyurethane processing. On the basis of the industrial association communication, the phase out of CFC gases occurred in the second half of nineties and the blowing agent currently used is penthane, which resulted in a strong reduction of emissions. In the same subsector NMVOC emissions from asphalt bowling have been added for the whole time series. Recalculations are also observed in paint application, for NMVOC and CO2, due to the update of emission factors in paint application in wood from 2005 to 2010 and for car repairing in 2010. Minor recalculations occurred in other use of solvents, considering an updating of the activity data in fat, edible and non edible oil extraction and application of glues and adhesives for the whole time series.

	Sub-category	**NMVOC Emission**	**Emission factor**
Degreasing, dry cleaning and electronics	Metal degreasing	4%	Update information, from the national chemical industrial association (Federchimica), on activity data and emission factor.

QA/QC AGRICULTURE
2012 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Eleonora Di Cristofaro and Rocío Dánica Cóndor

April, 2013

NATIONAL EMISSION INVENTORY: AGRICULTURE

I. Objective

This report describes activities and improvements carried out during the preparation of the 2013 national inventory submission for the agriculture sector.

II. Review process recommendations

No recommendation was raised during the last UNFCCC review process (UNFCCC, 2013)[1].

At European level, in the context of the European Effort Sharing Decision (EC, 2009) defining the 2020 emission limit of a Member State in relation to its 2005 emissions, a technical review was carried out, in 2012, to review and verify emission data of each Member State, for the reference years 2005, 2008 and 2009, prior to determining their annual emission allocations. This section provides the list of improvements carried out in consideration of the main findings raised by the technical expert review team (TERT) during the mentioned review process. Information is summarized in the following table.

Subject	Improvement
4.D.1.2. Animal manure applied to soils N_2O	The TERT recommends that Italy corrects the values reported under the parameter $Frac_{GASM}$ by reporting the ratio of N_NH_3-NOx emissions compared to total N recovered and stored instead of N excreted. This issue only concerns the reporting of the parameter $Frac_{GASM}$ and does not affect the calculation of emissions. The values have been calculated and reported in the NIR.
4.D.1.6. Other direct emissions Activity data	In order to improve transparency, the TERT recommends that Italy reports the amount of nitrogen in sewage sludge adjusted by volatilisation in order to report in a harmonised way with manure animal application. This issue only concerns the reporting of the amount of nitrogen in sewage sludge and does not affect the calculation of emissions. The values have been corrected.

Moreover, an issue related to estimates of CH_4 from enteric fermentation from young cattle ('*less than 1 year for the slaughter*' category, including in non-dairy cattle) was identified during the European review. The answer to the TERT has been included in NIR, and relevant parameters for this category, used for estimating N_2O emissions from manure management, have been reported.

Finally, the percentage of animals in temperate zone based on data from the 2000 Agriculture Census, provided by ISTAT, and the average temperature at provincial level are shown in the NIR. This information has been included to support the details on the estimation of the methane emission factors from manure management from other livestock categories.

III. Planned improvements and QA activities

III.1 General aspects

Improvements for the Agriculture sector developed in the last years are described in the following.

[1] UNFCCC, 2013. Report of the individual review of the annual submission of Italy submitted in 2012. FCCC/ARR/2012/ITA. UNFCCC, 12 February 2010. http://unfccc.int/resource/docs/2013/arr/ita.pdf (last access 12/04/13).

An internal report of the "**National Agriculture UNFCCC/CLRTAP emission inventory"** has been updated. This report contains information on the procedures undertaken for preparing the national inventory *2011 submission* and scenario emissions for 2015 and 2020[2].

Since 2006 submission, results from the MeditAIRaneo project have been included in the preparation of the Agriculture emission inventory (GHG/CLRTAP). Besides, results from the convention signed between APAT and the Ministry for the Environment, Land and Sea have been incorporated.

At the end of 2009 another research study related to land spreading estimations and scenario was completed[3].

III.2 National statistics

The Italian National Statistical System (SISTAN) revises every year the National Statistical Plan that covers a three years period. In this framework, the Agriculture, Forestry and Fishing Quality Panel (*Circolo Qualità Agricoltura, Foreste e Pesca*) has been established under the coordination of the Agriculture service of ISTAT. In the last years, through this process different improvements, at activity data level, have been reached. Moreover, ISPRA has established a direct contact with a network of sectoral experts useful for the verification of the time series.

The implementation of an *ad hoc* survey on "Agricultural Production Methods", regulated by the European Commission (EC), will be crucial for improving the preparation of the national agriculture emission inventory (GHG/CLRTAP). This survey was carried out during the 2010 General Agricultural Census in Italy. Detailed data such as animal grazing information, animal housing and storage systems characteristics, and use of manure/slurry for land application information were collected. Already, initial efforts had been oriented to collect these data at provincial level through the incorporation of specific queries in the Farm Structure Survey (FSS) from 2005 and 2007. ISPRA together with CRPA participated to the preparation of the instructions for specific queries (grazing, housing, storage and land spreading) of the Agricultural Census. This exercise will allow obtaining information useful as required by the EC regulation and the improvement of the emission inventory, which will include peculiarities of agricultural production in Italy. We expect to validate results obtained with FSS 2005 with information coming from the Agricultural census; final data from the census have been published by ISTAT at the end of 2012 and data will be analyzed in 2013.

III.3 Estimation improvements

In the following, a list with the different activities developed for the 2013 submission and future improvements are described. Further specific improvements are addressed in this section.

In 2010 data collection and verification of emission factors presented in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories (Volume 4 – Agriculture, Forestry and other land uses, *AFOLU*) was implemented. In particular, emission factors related to nitrous oxide emissions from agricultural soils were compared. Different local and European scientific publications were used for this verification. Different research groups that are working on soil emission measurements were contacted (University of Naples, University of Turin, University of Udine).

N excretion in Italy has been evaluated through a N balance inter-regional project "Nitrogen balance in animal farms", funded by the Regional Governments of the most livestock-intensive Italian Regions. The N-balance methodology has been applied in real case farms, monitoring their normal feeding practice, without specific diet adaptation. In the project the most relevant dairy cattle production systems in Italy has been considered. In contrast with what normally found in European milk production systems, poor correlation

[2] Cóndor R.D. 2012. *Procedura per la preparazione, caricamento e reporting dell'inventario nazionale delle emissioni 1990-2010, le emissioni provvisorie del 2010 e gli scenari emissivi del 2015 e 2020: settore agricoltura. Rapporto interno AMB-MPA/ISPRA.* Roma – Italia.

[3] CRPA. 2009. *Valutazione dell'entità delle emissioni ammoniacali derivanti dall'applicazione al suolo dei fertilizzanti, delle loro possibilità di riduzione e individuazione degli elementi per un monitoraggio statistico delle tecniche di applicazione utilizzate*. Rapporto finale. Reggio Emilia – Italia.

between the N excretion and milk production has been found. Probably there are two reasons for explaining the non correlation: a) extreme heterogeneity in the protein content of the forage and in the use of the feed; b) the non optimisation of the protein diet of less productive cattle[4,5]. Still further efforts on theoretical assessment of nitrogen excretion data will be done base on N balance methodology[6]. An ad-hoc agro-environmental indicator group coordinated by the Ministry of Agriculture is working to determine gross nitrogen balances; therefore, N coefficients will be revised.

For the agricultural emission inventory, a new source has been estimated: the use of sewage sludge applied to soils for agriculture (direct and indirect N_2O emissions). Activity data, amount of sewage sludge and % N content, was provided by the Ministry for the Environment, Land and Sea, which is in charge of collecting and reporting data under the EU Sewage Sludge Directive 86/278/EEC.Regarding, uncertainty analysis applied to GHG estimates, Monte Carlo analysis has been extended to other key categories of the sector, the estimation of uncertainties are shown in the NIR.

In the following table, improvements for the Agriculture emission inventory (GHG/CLRTAP) are reported.

Category	Sub-category	Parameter	Gas	Year		Activities
				2014	2015	
Enteric fermentation	Dairy cattle		GHG	√		Information coming from 2010 Agricultural census will be analysed and verified
Manure management	Dairy cattle	N excretion	GHG	√		Still further efforts on theoretical assessment of N excretion data will be done based on N balance methodology (Gruber and Poesch, 2006).
	Livestock categories	Type of housing	NH_3/GHG	√		A query on the type of housing of different livestock categories has been introduced in the Farm and structure survey 2005. Results have been analysed. According to experts from CRPA, information collected from SPA 2005 (housing data) needs to be validated with information from the Agricultural Census (CRPA, 2010).
	Livestock categories	Slurry and solid manure storage facilities	NH_3/GHG	√		We are analysing and verifying information coming from the Farm and Structure Survey 2007, where a query related to storage facilities for slurry and solid manure was incorporated. Validation will be executed with data coming from the 2010 Agricultural census.
	Livestock categories	Production methods	NH_3/GHG	√		Different queries have been incorporated in a specific section of the 2010 Agricultural Census. Grazing, housing, storage systems and land spreading information will be collected.
	Livestock categories	Average temperature	GHG		√	The distribution of animal in the temperate zones will be verified on the basis of animals provincial distribution from the 2010 Agricultural census and updated average temperatures.
Rice cultivation	Activity data	Days of cultivation and cultivars	GHG	√		Information on days of cultivation for new varieties will be collected.
	Rice	Emission factor	GHG	√		We have contacted DG Joint Research Centre Institute for Environment and Sustainability - Climate Change Unit, in charge of measuring rice paddy fields in Italy. New measurements have been done since 2007. The use of updated information on EFs is under evaluation.
Agricultural soils	Activity data	Land spreading	NH_3/GHG	√		Figures on land spreading collected in the framework of the 2010 Agricultural Census will be compared with those used in the inventory.

[4] *De Roest and Speroni, 2005. Il bilancio dell'azoto negli allevamenti di latte. Agricoltura. Marzo 2005. pag 112-114*

[5] CRPA, 2010. *Personal communication - experts Laura Valli and Maria Teresa Pacchioli from Centro Ricerche Produzioni Animali (expert consultation on N excretion and natinal production systems).* Reggio Emilia, Italy.

[6] Gruber, L. & Pötsch, E. M., 2006. Calculation of nitrogen excretion of dairy cows in Austria. Die Bodenkultur, 2006, Vol. 57, Heft 1- 4, Vienna. http://www.boku.ac.at/diebodenkultur/volltexte/band-57/heft-2/gruber.pdf

QA/QC LULUCF
2012 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Marina Vitullo

April, 2013

NATIONAL AIR EMISSION INVENTORY: LULUCF

I. Objective

The report summarizes the improvements and remarks, which have been identified during the preparation of the 2013 inventory submission for the LULUCF sector.

II. Review process recommendations

In Table 1, responses to the main questions raised during the last UNFCCC review process, related to the national inventory submitted in 2012, are described.

Table 1. *Response to the review process recommendations*

Review report para	Subject	Description	Response
68	**LULUCF** - Sector overview	... The ERT recommends that the Party use the new land-use matrix and present any related recalculations in the next annual submission..	As reported in the NIR (§7.1. §7.2.8, §10.3.1.6, Annex 10), the national land-use inventory (IUTI) has been completed for the years 1990, 2000 and 2008. A process of validation and verification of IUTI data is currently ongoing. The new data will be used, in the next submission, to derive land use matrices.
69	**LULUCF** - Sector overview	… Therefore, the ERT agrees that the land use for energy crops should be allocated under cropland. The ERT recommends that Italy provide a clear description of the area plantations that are not for energy crops and that are reported under forest land in its next annual submission.	A detailed description related to energy crops included in cropland category is reported in the NIR (§7.2.2, §7.3.2).
70	**LULUCF** - Forest land remaining forest land - CO_2	... Italy refers in the NIR to the "For-est model", with reference to an article by Federici et al. (2008). ... the ERT recommends that the Party improve the transparency of its reporting and assess whether values taken from the article should be updated or not and report on this assessment in its next annual submission.	Additional information has been reported in the NIR (§7.2.4, §10.3.1.1).
72	**LULUCF** - Forest land remaining forest land - CO_2	Italy reports root-to-shoot ratio in NIR table 7.6, but did not provide documentation on these ratios. ...The ERT recommends that this improved documentation be included in the next annual submission.	Following the ERT's recommendation, the dead wood mass has been estimated using country specific coefficients, calculated from outcomes of a survey conducted by the Italian national forest inventory (NIR, §7.2.4).
74	**LULUCF** -Cropland remaining cropland – CO_2	... The ERT welcomes this correction in the allocation of organic soils and recommends that the Party implements this correction in the next annual submission.	The ERT's recommendation has been addressed and the organic soils have been allocated under annual crops subcategory.
75	**LULUCF** – Land converted to forest land - CO_2	... The ERT recommends that Italy provide transparent documentation on the values used in applying equation 3.2.32 in its next annual submission and reiterates the recommendation in the previous review	A detailed description of the methodology implemented to to assess carbon stock changes in land converted to forest land and the SOCs used have been reported in the NIR (§7.2.4).

Review report para	Subject	Description	Response
		report that the Party develop a country-specific reference soil carbon content for forest land.	
76	**LULUCF** – Land converted to cropland - CO_2	The ERT recommends that Italy review the 2010 values and provide an explanation for the finalization of the grassland conversion to cropland in 1996.	A detailed description of the land uses and land use changes assessment has reported in the NIR (§7.1).
77	**LULUCF** – Land converted to settlements - CO_2	… The ERT recommends that Italy, in its next annual submission improve the documentation on why there is only conversion from grassland for the period 1990-1995.	A detailed description of the land uses and land use changes assessment has reported in the NIR (§7.1).
78	**LULUCF** -Biomass burning – CH_4 and N_2O	… The ERT recommends that Italy review its reporting on biomass burning for its next annual submission especially as another source indicates that about 40 per cent of wild fires occur on land with an agricultural land cover, 20 per cent on forest and other woody land, 35 per cent on nature land, while fewer than 1 per cent of wild fires occur in settlements.	Emissions from fires occurring in other land use categories (i.e. cropland, grassland and settlements) have estimated (NIR, §7.12.1).
94	**Supplementary information required under Article 7.1 of the KP** – Overview	… the ERT recommends that Italy provide documentation in the NIR on the inclusion of forestry plantations under KP-LULUCF activities and explain why the information reported in the CRF tables is different from that reported to the FAO, as required by paragraph 16 of the annex to decision 16/CMP.1.	A description of the forest definition and its implementation in Italian context has been provided in the NIR (§10.1.1). Additional information is also reported in §7.2.2.
96	**Supplementary information required under Article 7.1 of the KP** - Activities under Article 3.3, of the KP - Afforestation and reforestation - CO_2	The ERT therefore recommends that, in its next annual submission, Italy provide better documentation to prove the areas of natural afforestation and reforestation activities on abandoned agricultural lands that are directly human-induced, or exclude the natural afforestation and reforestation on these lands from its accounting under Article 3, paragraph 3, of the Kyoto Protocol.	A description of legislative Italian context and the consequent implications for the direct human induced afforestation and reforestation activities has been provided in the NIR (§10.4.1).
98	**Supplementary information required under Article 7.1 of the KP** - Activities under Article 3.3, of the KP – Afforestation and reforestation - CO_2	The ERT noted that Italy continues to estimate the carbon stock changes in mineral soils using a linear relationship with the aboveground biomass that is not clearly documented by the Party and has high uncertainty. The ERT reiterates the recommendation in the previous review report that the Party provide transparent documentation in its next annual submission.	In the NIR (§10.3.1.2) a detailed description of the methods and data used to estimate soils carbon stocks (and the consequent carbon stock changes) is reported. These SOCs have been used to assess the carbon stock changes in AR activities. For the next submission, the implementation of INFC data related to the soils survey to estimate litter ad soils pools is foreseen.
99	**Supplementary information required under Article 7.1 of the KP** - Activities under Article 3.3, of the KP – Afforestation and reforestation - CO2	… The ERT therefore recommends that Italy estimate carbon stock changes in dead wood using country-specific methods and parameters, in line with the IPCC good practice guidance for LULUCF, and provide this information in its next annual submission.	The ERT's recommendation has been addressed and the dead wood mass has been estimated using country specific coefficients, calculated from outcomes of a survey conducted by the Italian national forest inventory (NIR, §10.3.1.6, §7.2.4).

Review report para	Subject	Description	Response
100	**Supplementary information required under Article 7.1 of the KP** - Activities under Article 3.4 of the KP – Deforestation - CO_2	The ERT recommends that Italy provide clear documentation on the emissions from deforested plantations that meet the forest definition in its next annual submission.	A description of the forest definition and its implementation in Italian context has been provided in the NIR (§10.1.1). Additional information is also reported in §7.2.2.
102	**Supplementary information required under Article 7.1 of the KP** - Activities under Article 3.4 of the KP – Forest management - CO_2	...the ERT recommends that Italy develop country-specific methods and parameters to estimate carbon stock changes in dead wood in line with the IPCC good practice guidance for LULUCF and provide this information in its next annual submission.	The ERT's recommendation has been addressed and the dead wood mass has been estimated using country specific coefficients, calculated from outcomes of a survey conducted by the Italian national forest inventory (NIR, §10.3.1.6, §7.2.4).
103	**Supplementary information required under Article 7.1 of the KP** - Activities under Article 3.4 of the KP – Forest management - CO_2	... the ERT recommends that Italy provide clear documentation on the inclusion of forestry plantations in the reporting on forest management in its next annual submission.	A description of the forest definition and its implementation in Italian context has been provided in the NIR (§10.1.1). Additional information is also reported in §7.2.2.

III. Planned improvements and QA activities

In the following, specific improvements and remarks to be taken into account in the next submission of the national air inventory for LULUCF sector are reported. The Approach 2 uncertainty analysis has been carried out for 2009 inventory year; Montecarlo has been applied to following LULUCF categories, producing, for most of the results, comparable results for both approaches (Approach 1 and 2). A re-assessment of uncertainty analysis with Montecarlo methodology is planned in order to be included in the 2014 submission.

III.1 Forest land (5A)

In 2011 submission, forest definition adopted by Italy in the framework of application of elected 3.4 activity, under Kyoto Protocol, has been fully implemented also in the LULUCF sector of the inventory under the Convention, in order to maintain coherence and congruity between the two forest-related reporting. The forest definition (and the consequent exclusion of plantations) has been set up, and included in the determination of Italy's assigned amount under Article 7, paragraph 4, of the Kyoto Protocol, and the election of the art. 3.3 and 3.4 activities, by a national expert panel set up under the coordination of Ministry of Environment and in cooperation with the Ministry of Agriculture, Food and Forest Policies. The abovementioned panel involves, on a voluntary basis, the relevant national experts, including the forest inventory experts (http://www.sian.it/inventarioforestale/jsp/home_en.jsp), members of the FAO-FRA Italian panel (http://www.fao.org/docrep/013/al537E/al537E.pdf) and other national researchers. The national expert panel has considered the Kyoto Protocol rules and requirements, related to reporting and accounting of art. 3.3 and 3.4 activities, and agreed the national forest definition. In the same context, national circumstances (e.g. forest composition, forestry management practices, agroforestry practices, etc.) were examined and it was decided to classify plantations, and in particular poplars, in the cropland category and shrubland in the grassland category because they do not fulfil national forest definition while other plantation typologies, as chestnut and cork oak, have been included in forest.

An update of the For-est model has been done, following the 2012 ERT's recommendation; the INFC data related to the dead mass, collected in the framework of INFC surveys, have been implemented in the model. Samples of dead-wood were collected across the country from the plots of the national forest inventory network, and their basic densities measured in order to calculate conversion factors for estimating the dry weight of dead-wood. In addition transparency has been enhanced in description of the method used to derive carbon stock changes from transition of lands from and to forest land category, by reporting, in the National Inventory Report, detailed explanation related to the forest SOCs.
The overall upgrade of the used model has been postponed, in order to implement INFC data related to the soils survey, in order to obtain more accurate estimates of the carbon stored in the litter and soil pools. The upgrading of the model will also allow the use of the INFC biomass data, actually not utilized, as classification system, and consequent categories list, has changed from the first forest inventory to INFC. A transition matrix, between the INFC and the first forest inventory classification systems, has been planned to be elaborated in order to use all the information acquired within the INFC.
Activities planned in the framework of the 'National Registry for Carbon sinks' are expected to be useful to detect the different land uses and land uses changes between 1990 and 2012. Some of these activities (in particular IUTI, inventory of land use) have been completed, resulting in land use classification, for all national territory, for the years 1990, 2000 and 2008. A process of validation and verification of IUTI data is currently ongoing and will supply data useful to update and improve the estimations. Several meetings are scheduled with the relevant experts from Italian National Forest Service and from the CRA-MPF[7] research unit (in charge for the technical and scientific support to the INFC) to finalize the validation process of the IUTI data; outcomes of this process will be available for the 2014 submission.
Activities planned in the framework of the National Registry for Forest Carbon Sinks should also provide data to improve estimate of carbon sequestration due to Afforestation/reforestation activities (with a special focus on soil organic content), and should allow to refine the estimate of forest land category. Specifically, for the LULUCF sector, following the election of 3.4 activities and on account of an in-depth analysis on the information needed to report LULUCF under the Kyoto Protocol, a Scientific Committee, *Comitato di Consultazione Scientifica del Registro dei Serbatoi di Carbonio Forestali*, constituted by the relevant national experts has been established by the Ministry for the Environment, Land and Sea in cooperation with the Ministry of Agriculture, Food and Forest Policies.
In 2013, the joint project "ITALI" (*Integration of Territorial And Land Information*) has started its activities; the project, coordinated by the National Institute of Statistics and promoted by EUROSTAT[8], involves ISPRA, the Ministry of Agriculture, Food and Forest Policies, the National Forestry Service and the SIN (*Sistema Informativo Nazionale per lo sviluppo dell'agricoltura*) and is aimed to supply national statistics related to land use and land cover, harmonising and improving the current informative bases already available in the country. In this framework existing data sources for land cover and land use are under examination, comparing the statistical design (classification system, coverage, statistical unit, reference area, time coverage and statistical process), in order to underline the opportunities of producing coherent and consistent statistics, concerning the whole Italian territory. Furthermore, for some experimental areas, data collected by LUCAS[9] will be compared with data collected by in-situ Italian surveys, administrative data or data collected by photo-interpretation.

An expert panel on forest fires has been set up, in order to obtain geographically referenced data on burned area; the overlapping of land use map and georeferenced data should assure the estimates of burned areas in the different land uses. The fraction of CO_2 emissions due to forest fires, currently included in the estimate of the forest land remaining forest land, will be pointed out.
Furthermore ISPRA participates in technical working groups, denominated *Circoli di qualità*, within the National Statistical System (*Sistan*). Concerning the LULUCF sector, this group, coordinated by the National Institute of Statistics, includes both producers and users of statistical information with the aim of improving

[7] Consiglio per la Ricerca e sperimentazione in Agricoltura (CRA) - Unità di ricerca per il Monitoraggio e la Pianificazione Forestale (MPF): http://mpf.entecra.it/; http://sito.entecra.it/portale/index2.php
[8] Eurostat is the statistical office of the European Union: http://epp.eurostat.ec.europa.eu/portal/page/portal/about_eurostat/introduction
[9] LUCAS (Land Use/Cover Area frame statistical Survey) is an European field survey program: http://www.lucas-europa.info/NewsBASE/content_eftas_lucas01/frame_deutsch.php

and monitoring statistical information for the forest sector. These activities should improve the quality and details of basic data, as well as enable a more organized and timely communication.
A specific procedure undertaken for improving the inventory regards the establishment of national expert panels which involve, on a voluntary basis, different institutions, local agencies cooperating for improving activity data and emission factors accuracy. To this aim, an interregional project, named INEMAR[10], developed to carry out atmospheric emission inventories at local scale, has added a module to estimate forest land emission and removals, following the methodology applied, at national level, to estimates removals and emissions by forest land. The module is currently applied, at local scale with local data, in seven of the 20 Italian regions and the results will constitute a good validation of the used methodology. The module has been applied, at local scale with local data, for the different pools in Lombardia region, for the years 1990, 2000, 2005, 2008, in Veneto region for the year 2005 and in Friuli Venezia Giulia region for the year 2007.

III.2 Cropland (5B)

Coherently with forest definition adopted by Italy in the framework of application of elected 3.4 activity, under Kyoto Protocol, plantations, that don't fulfil national forest definition, have been reported into cropland category. which excludes agroforestry systems, predominantly used for agricultural practice; other plantation typologies, such as chestnut and cork oak, have been included in forest land category. Plantations (*eucalyptuses coppices, other broadleaves coppices, poplar stands, other broadleaves stands, and conifers stands*) in Italy are considered an agroforestry system, characterized by short rotation coppice system. Poplar stands, representing 83% of the total plantation areas in Italy, are typically grown in a short rotation coppice system for two to five years. Once harvested, these crops are usually substituted by annual crops like maize or wheat.
In response to 2011 ERT's recommendation, Italy has decided to use the IPCC default land use transition period of 20 years, in the estimation process of carbon stock changes in mineral soils related to land converting to cropland; once a land has converted to a land use category, the annual changes in carbon stocks in mineral soils have been reported for 20 years subsequent the conversion.
The carbon stock change in living biomass has been estimated on the basis of carbon gains and losses, computed applying a value of biomass C stock at maturity. The default factors of aboveground biomass carbon stock at harvest, harvest/maturity cycle, biomass accumulation rate, biomass carbon loss, for the temperate climatic region, are not very representative of the Mediterranean area, where the most common woody crops are crops like olive groves or vineyards that have different harvest/maturity cycles. Therefore, in the absence of country specific values, and following the suggestion of Joint Research Centre (JRC[11]) experts, in the framework of European Union QA/QC checks of the Member States' inventories for the preparation of EU greenhouse gas inventory, an average value of 10t C ha^{-1} (carbon stock at maturity), deduced by the values adopted in Spain, has been chosen. A cycle of 30 years has been considered.
For the "plantations" subcategory, growing stock and the related carbon are assessed by the For-est model, estimating the evolution in time of the different pools and applied at regional scale (NUTS2). Therefore the update of the model, taking into account the INFC data related to the dead mass, affects also the cropland category. To estimate litter carbon amount from the aboveground carbon amount, linear relations were used, on the basis of the results of the European project Biosoil[12] (for litter and soil organic content) and a Life+ project FutMon[13] (Further Development and Implementation of an EU-level Forest Monitoring System), for the aboveground biomass. Dead wood mass has been estimated using coefficients calculated from outcomes of a survey conducted by the Italian national forest inventory. Concerning soils pool, following the ERT recommendation, Italy has decided to apply the IPCC Tier1, assuming that, the carbon stock in soil organic

[10] INEMAR: INventario EMissioni Aria: http://www.inemar.eu/xwiki/bin/view/Inemar/WebHome; http://www.ambiente.regione.lombardia.it/inemar/e_inemarhome.htm
[11] European Commission's Joint Research Centre (JRC) - Institute for Environment and Sustainability (IES): http://ies.jrc.ec.europa.eu/
[12] BioSoil project – http://www3.corpoforestale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/487/UT/systemPrint; http://www.inbo.be/content/page.asp?pid=EN_MON_FSCC_condition_report.
[13] FutMon: Life+ project for the "Further Development and Implementation of an EU-level Forest Monitoring System"; http://www.futmon.org/;

matter, for plantations, does not change. Therefore carbon stock changes in soils pool, for cropland remaining cropland, have been not reported.
CO_2 emissions from urea application have been estimated; it has to be noticed that CRF Reporter doesn't allow inputting such a contribution to overall emissions, and therefore these emissions are not included in the 2013 submission.
Additional researches will be made to collect more country-specific data on woody crops. Improvements will concern the implementation of the estimate of carbon change in cropland biomass at a higher disaggregate level, with the subdivision of the activity data in the main categories of woody cropland (orchards, citrus trees, vineyards, olive groves) and the application of different biomass accumulation rates and harvest/maturity cycles for the various categories.
Further investigation will be made to obtain ancillary information about the final crop types, concerning the areas in transition to cropland, in order to obtain a more precise estimate of the carbon stocks change.
Activities planned in the framework of the National Registry for Forest Carbon Sinks should also provide data to improve estimate of carbon sequestration due to Afforestation/reforestation activities (with a special focus on soil organic content), and should allow to refine the estimate of soil organic content in cropland category.
In addition, in 2013, the joint project "ITALI" (*Integration of Territorial And Land Information*) has started its activities, with the aim to supply national statistics related to land use and land cover, harmonising and improving the current informative bases already available in the country. Further details may be found in the section III.1 Forest land (5A).

III.3 Grassland (5C)

Coherently with forest definition adopted by Italy in the framework of application of elected 3.4 activity, under Kyoto Protocol, shrublands, that don't fulfil national forest definition, have been reported into grassland category. Following 2011 review finding, Italy has decided to use the IPCC default land use transition period of 20 years, in the estimation process of carbon stock changes in mineral soils related to land converting to cropland; once a land has converted to a land use category, the annual changes in carbon stocks in mineral soils have been reported for 20 years subsequent the conversion.
The change in biomass has been estimated only for subcategory "other wooded land", since, for grazing land, the increase in biomass stocks in a single year is assumed equal to biomass losses from harvest and mortality in that same year. For the "other wooded land" subcategory, growing stock and the related carbon are assessed by the For-est model, estimating the evolution in time of the different pools and applied at regional scale (NUTS2). Therefore the update of the model, taking into account the INFC data related to the dead mass, affects also the grassland category. To estimate litter carbon amount from the aboveground carbon amount, linear relations were used, on the basis of the results of the European project Biosoil[14] (for litter and soil organic content) and a Life+ project FutMon[15] (Further Development and Implementation of an EU-level Forest Monitoring System), for the aboveground biomass. Concerning soils pool, following the ERT recommendation, Italy has decided to apply the IPCC Tier1, assuming that, the carbon stock in soil organic matter, for shrubland, does not change. Therefore carbon stock changes in soils pool, for grassland remaining grassland, have been not reported.
Concerning land in transition to grassland, further investigation will be made to obtain additional information about different types of management activities on grassland, and the crop types of land converting to grassland, to obtain a more accurate estimate of the carbon stocks change.
Activities planned in the framework of the National Registry for Forest Carbon Sinks should also provide data to improve estimate of carbon sequestration due to Afforestation/reforestation activities (with a special focus on soil organic content), and should allow to refine the estimate of soil organic content in grassland category. In addition, in 2013, the joint project "ITALI" (*Integration of Territorial And Land Information*)

[14] BioSoil project – http://www3.corpoforestale.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/487/UT/systemPrint; http://www.inbo.be/content/page.asp?pid=EN_MON_FSCC_condition_report.
[15] FutMon: Life+ project for the "Further Development and Implementation of an EU-level Forest Monitoring System"; http://www.futmon.org/; http://www3.corpoforestale.it/flex/cm/pages/ServeAttachment.php/L/IT/D/D.e54313ecaf7ae893e249/P/BLOB%3AID%3D397

has started its activities, with the aim to supply national statistics related to land use and land cover, harmonising and improving the current informative bases already available in the country. Further details may be found in the section III.1 Forest land (5A).

III.4 Wetlands (5D)

Improvements will concern the acquirement of data about flooded lands and the implementation of the GPG method to estimate CO_2, CH_4 and N_2O emissions from flooded lands.

III.5 Settlements (5E)

Settlements time series has been developed through a linear interpolation between the 1990, 2000 and 2006 data, obtained by the Corine Land Cover maps, relatively to the class "Artificial surfaces". By assuming that the defined trend may well represent the near future, it was possible to extrapolate data for the years 2007-2011. The average area of land undergoing a transition from non-settlements to settlements during each year, from 1990 to 2011, has been estimated with the land use change matrices that have also permitted to specify the initial and final land use. Land use changes have been derived, by the way of land use change matrices, smoothing the amount of changes over a 5 year period, harmonizing the whole time series, resulting in a constant amount of C stock change in the 5 year period, following a previous review remark.
Further investigation will be made to obtain additional statistics about settlements, comparing the added information to the time series developed from Corine Land Cover data. More accurate and resolute data will outcome from the activities, in progress, related to the Kyoto reporting system (National registry for carbon sinks). Urban tree formations will be probed for information, in order to estimate carbon stocks. Moreover improvements will concern acquirement of data sufficient to give estimates of carbon stocks changes in dead organic matter for land in transition to settlements. In addition, in 2013, the joint project "ITALI" (*Integration of Territorial And Land Information*) has started its activities, with the aim to supply national statistics related to land use and land cover, harmonising and improving the current informative bases already available in the country. Further details may be found in the section III.1 Forest land (5A).

III.6 Carbon emissions from agricultural lime application (5(IV))

In 2013 submission CO_2 emissions from application of carbonate containing lime and dolomite to agricultural soils have been estimated for the period 1998-2011, since data on agricultural lime application have been became available only for that period; moreover CO_2 emissions from agricultural dolomite application have been included in CO_2 emissions from limestone application, as national statistics on amount of lime applied don't allow to disaggregate the two components (limestone and dolomite). CO_2 emissions from agricultural lime application are reported in the Table5(IV) - CO_2 emissions from agricultural lime application.
Improvements will concern the acquirement of data about annual amount of lime applied in the period 1990-1997; consideration will be focussed onto the acquisition of disaggregated data on calcic limestone and dolomite agricultural application.

III.7 Biomass Burning (5(V))

CH_4 and N_2O emissions from forest fires are estimated, in accordance with the IPCC method, and burned areas for forest land remaining forest land and land converting to forestland subcategories have been reported. CO_2, CH_4 and N_2O emissions have been also estimated for cropland and grassland categories. Areas affected by fires encompassed in settlements category have been reported, but no emissions are estimated, assuming the carbon losses from the settlements areas affected by fires are irrelevant.

The forest fires expert panel plans to obtain geographically reference data on burned area; the overlapping of land use map and geo referenced data should assure the estimates of burned areas in the different land

uses. The fraction of CO_2 emissions due to forest fires, now included in the estimate of the forest land remaining forest land, will be pointed out.
In addition an *ad hoc* expert panel on fires has been constituted by experts from different institutions from ISPRA and Ministry of Agriculture, Food and Forest Policies; the panel is currently working on harmonising the data, related to fires, collected at regional level which are now characterized with different level of disaggregation and details, as:

- burned area, with reference to various land uses
- forest land category, with reference to
    a. different forest typologies
    b. specific parameters related to fire's type (crown or grazing fire)
    c. amount of burned biomass, etc.

The harmonised database will be the informative basis to apply an updated methodology for the emissions estimation from biomass burning, taking into account the real oxised biomass during fires.

QA/QC WASTE
2012 ACTIVITIES AND FUTURE IMPROVEMENTS

Prepared by: Barbara Gonella, Ernesto Taurino

April, 2013

NATIONAL AIR EMISSION INVENTORY: WASTE

I. Objective

This report summarises the improvements, which have been identified during the preparation of the 2013 inventory submission for the waste sector.

II. Review process recommendations

In the following table, issues raised during the review process and related to the waste sector are reported; responses to each subject are also included.

Further improvements and planned QA activities identified during the preparation of the National Inventory and National Inventory Report 2013 are also presented.

Subject	Improvement
Waste – Solid waste disposal on land – CH_4	The amount of waste disposed in unmanaged landfills has been estimated as a percentage of the waste disposed in managed landfills. Different studies provided information about the percentage of waste in unmanaged sites for 1973, 1979, 1991 and data in other years are extrapolated. These studies show that the share of waste disposed of into uncontrolled landfills has gradually decreased, from 72.8%, in 1973, to 53.4 in 1979 and 26.6 in 1991, which is a consequence of the progressive implementation of the national legislation.Since 2000 the percentage of waste in unmanaged landfills is equal to 0% because of legal enforcement
Waste - Solid waste disposal on land – CH_4	The methane generation rate constant k values derive from national and international literature and Italian national experts; those figures are representative of average biogas production conditions with respect to the characteristics of national landfills and waste composition in terms of moisture, density and size. The average k is calculated on the basis of the waste composition, and assumes different values during different periods on account of the waste composition changes.
Waste - Waste incineration – CO_2, CH_4 and N_2O	Additional information has been provided in the NIR (§ 8.2.2 and § 8.4.3).
Waste – Other waste – CH_4	Additional information has been provided in the NIR (§ 8.5.2)

Other improvements not identified during the review process have been carried out.

An in depth analysis of EWC codes of waste disposed of in landfills has been done for the year 2007, thanks to the complete database of Waste Cadastre kindly supplied by ISPRA Waste Office. This accurate analysis has permitted to verify the correctness of waste typology assumptions used for the estimations.

The LCV used for biogas derives from national experts and it has been verified with energy and quantitative data about biogas production from waste supplied by TERNA (National Independent System Operator).

Where information is available, wastewater flows and COD concentrations are checked with those reported yearly by the industrial sectoral reports or technical documentation developed in the framework of the Integrated Pollution and Prevention Control (IPPC) Directive of the European Union (http://eippcb.jrc.es).

A thesis on GHG emissions from wastewater handling has been carried out at Environmental, Hydraulic, Infrastructures and Surveying Engineering Department (DIIAR) of Politecnico di Milano, where national methodology has been compared with that reported in 2006 IPCC Guidelines and with a methodology

developed in the framework of a previous thesis for the estimation of emissions from wastewater treatment plants located in Regione Lombardia.

As planned in the previous submission a rearrangement of incinerators database has been made. During this process an in depth analysis about all incineration plants has been carried out with the target to eliminate double counting and to add eventual no counted plants. Once the list of plants was updated, a new and unique database has been developed to manage activity data, emissions of greenhouse gases and other pollutants, and spatial disaggregation, supporting QA / QC processes.

Moreover, mortal remains have been added to cremation of corpses.

III. Planned improvements and QA activities

III.1 Solid waste disposal on land

More recent data on the fraction of CH_4 in landfill gas and on the amount of landfill gas collected and treated are under investigation.

Investigation on industrial sludge disposed into landfills is ongoing, the information about the amount of sludge disposed in managed landfills has already been collected and must be processed and checked.

Regarding the energy conversion efficiency of biogas engine, actually assumed equal to 0.3, as the technological evolution is probably leading to increase efficiency to around 40%, further investigations are planned.

The National Waste cadastre is managed by ISPRA and is formed by a national branch hosted by ISPRA and regional and provincial branches hosted respectively by the Regional Agencies for the Protection of the Environment. So the system requires continuous and systematic knowledge exchange and QA/QC checks in order to ensure homogeneity of information concerning waste production and management throughout the entire Italian territory.

Moreover, ISPRA was involved in an in depth environmental study of Malagrotta area, where the biggest European non hazardous waste landfill is located. The study was assigned to the Institute by the Minister of the Environment, Land and Sea, in order to verify the real status of the environment, afterwards several complaints from local inhabitants. The results of this study improved the national inventory and were used as quality control procedure.

III.2 Wastewater handling

Possible improvements in future submissions could come from the share of information with the Office of the Ministry of the Environment, Territory and Sea who is responsible for water activities.

Some improvements could also come from the analysis of E-PRTR data.

Methane conversion factor from domestic and commercial wastewater will be investigated in the future. Moreover the served population equivalent figures supplied by the National Institute of Statistics will be verified with the results of the last national survey.

III.3 Waste incineration

As reported for solid waste disposal on land, the waste composition is very important to improve CO_2 emission factor on the basis of carbon content. In order to update the government's strategy to achieve Italy's emissions reduction target under the Kyoto Protocol, the GHG emission projections for 2020, specific to waste management, have been updated with a focus on how this could influence the waste composition. The new information on waste composition will improve also waste incineration emission estimates.