Quality Assurance and Quality Control Plan for the Icelandic Greenhouse Gas Inventory

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Abbreviations

AUI	Agricultural University of Iceland
AFOLU	2006 IPCC Guidelines for National Greenhouse gas Inventory, vol. 4: Agriculture, Forestry and Other Land Use
CRF	Common reporting format
COP/MOP	Conference of the Parties serving as Meeting of the Parties
EFA	Environment and Food Agency
ERT	Expert review team
GHG	Greenhouse gases
IPCC	Intergovernmental Panel on Climate Change
IPCC-GPG	Intergovernmental Panel on Climate Change Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories
IPCC GPG for LULUCF	IPCC Good Practice
LULUCF	Land Use, Land-Use Change and Forestry
NIR	National inventory report
QA	Quality assurance
QC	Quality control
UNFCCC	United Nations Framework Convention on Climate Change

1. Introduction

Iceland has signed and ratified the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol to the Convention. One of the requirements under the Protocol is that each Party included in Annex I to the Convention must have in place, no later than one year prior to the start of the first commitment period, a national system for the estimation of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol. Article 7 of the Kyoto Protocol and Decision 19/CMP.1 stipulates the reporting of "supplementary information" including details of the National System and QA/QC plans and procedures.

Iceland prepares an inventory consistent with the methods described in the 'Revised 1996 Intergovernmental Panel on Climate Change (IPCC) Guidelines for National Greenhouse Gas Inventories' (1996) as elaborated by the 'Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories' (2000), Good Practice Guidance for Land Use, Land-Use Change and Forestry (2003) and the UNFCCC reporting guidelines (FCCC/SBSTA/2004/8).

The greenhouse gases included in the national inventory are the following: carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). Emissions of the precursors NOx, NMVOC and CO as well as SO_2 are also included, in compliance with the reporting guidelines.

This document describes the quality assurence and quality control programme for the annual greenhouse gas inventory of Iceland. It includes the quality objectives and an inventory quality assurance and quality control plan. It also describes the responsiblilites and the time schedule for the performance of QA/QC procedures. This manual is an integral part of Iceland's National System.

2. Definitions

Definitions of quality assurance, quality control and related terms are those provided in the IPCC Good Practice Guidance and Guidelines for National Systems under the Kyoto Protocol.

Audits - For the purpose of good practice in inventory preparation, audits may be used to evaluate how effectively the inventory agency complies with the minimum QC specifications outlined in the QC plan. It is important that the auditor be independent of the inventory agency as much as possible as to be able to provide an objective assessment of the processes and data evaluated. Audits may be conducted during the preparation of an inventory, following inventory preparation, or on a previous inventory.

Expert peer review - consists of a review of calculations or assumptions by experts in relevant technical fields. The objective of the expert peer review is to ensure that the inventory's results, assumptions, and methods are reasonable as judged by those knowledgable in the specific field. Expert review processes may involve technical experts and, where a country has formal stakeholder and public review mechanism in place, these reviews can supplement but not replace expert peer review.

Good practice – is a set of procedures intended to ensure that GHG inventories are accurate in the sense that they are systematically neither over- nor underestimated as far as can be judged, and that uncertainties are reduced as far as possible. Good practice covers choice of estimation methods appropriate to national circumstances, quality assurance and quality control at the national level, quantification of uncertainties and data archiving and reporting to promote transparency.

Key source category - is one that is prioritized within the national inventory system because its estimate has a significant influence on a country's total inventory of direct GHG in terms of the absolute level of emissions, the trend in emissions, or both.

National system - includes all institutional, legal and procedural arrangements made within a Party for estimating anthropogenic emissions by sources and removals by sinks of all GHGs not controlled by the Montreal Protocol, and for reporting and archiving inventory information.

QA/QC plan – is an internal document to organise, plan and implement QA/QC activities. The plan should, in general, outline QA/QC activities that will be implemented, and include a scheduled time frame that follows inventory preparation from its initial development through to final reporting in any year.

QA/QC system - the major elements of a QA/QC system are:

- An inventory agency responsible for coordinating QA/QC activities;
- A QA/QC Plan;
- General QC procedures (Tier1);
- Source category-specific QC procedures (Tier 2);
- QA review procedures;
- Reporting, documentation and archiving procedures.

Quality assurance (QA) - activities include a planned system of review procedures conducted by personnel not directly involved in the inventory compilation/development process to verify that data quality objectives were met, ensure that the inventory represents the best possible estimates of emissions and sinks given the current state of scientific knowledge and data available, and support the effectiveness of the quality control (QC) programme. QA activities include audits and expert peer reviews.

It is good practice for inventory agencies to conduct a basic expert peer review (Tier 1 QA) prior to inventory submission in order to identify potential problems and make corrections where possible. Inventory agencies may also choose to perform more extensive peer reviews or audits or both as additional (Tier 2 QA) procedures within the available resources.

Quality control (QC) – is a system of routine technical activities, to measure and control the quality of the inventory as it is being developed. The QC system is designed to:

- Provide routine and consistent checks to ensure data integrity, correctness, and completeness;
- Identify and address errors and omissions;
- Document and archive inventory material and record all QC activities.

QC activities - include general methods such as accuracy checks on data acquisition and calculations and the use of approved standardised procedures for emission calculations, measurements, estimating uncertainties, archiving information and reporting. Higher tier QC activities include technical reviews of source categories, activity data and emissions factors, and methods of estimation.

Tier 1 QC procedures

Tier 1 General Inventory Level QC procedures are checks that the inventory agency should use routinely throughout the preparation of the annual inventory. The focus of general QC techniques is on the processing, handling, documenting, archiving and reporting procedures that are common to all the inventory source categories.

Tier 2 QC procedures

Source category-specific QC procedures (Tier 2), are directed at specific types of data used in the methods for individual source categories and require knowledge of the emissions source category, the types of data available and the parameters associated with emissions. The source category specific QC measures are focusing on key source categories and on source categories where significant methodological and data revisions have taken place. Tier 2 QC activities are in addition to the general QC conducted as part of Tier 1.

Quality Objectives - The objectives of QA/QC activities on national greenhouse gas inventories are to improve transparency, consistency, comparability, completeness, accuracy, confidence and timeliness in national inventories.

Transparency - the assumptions and methodologies used for an inventory should be clearly explained to facilitate replication and assessment of the inventory by users of the reported information. The transparency of inventories is fundamental to the success of the process for the communication and consideration of information;

Consistency - an inventory should be internally consistent in all its elements over a period of years. An inventory is consistent if the same methodologies are used for the base year and all subsequent years and if consistent data sets are used to estimate emissions or removals from sources or sinks. The inventory using different methodologies for different years can be considered to be consistent if it has been recalculated in a transparent manner, in accordance with the IPCC GPG;

Comparability - estimates of emissions and removals reported by Parties in inventories should be comparable among Parties. For this purpose, Parties should use the methodologies and formats agreed by the COP for estimating and reporting inventories. The allocation of different source/sink categories should follow the split of the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, and the IPCC GPG for Land Use, Land-Use Change and Forestry, at the level of its summary and sectoral tables;

Completeness - an inventory should cover all sources and sinks, as well as all gases, included in the IPCC Guidelines. Completeness also means full geographic coverage of sources and sinks;

Accuracy – is a relative measure of the exactness of an emission or removal estimate. Estimates should be accurate in the sense that they are systematically neither over nor under true emissions or removals, as far as can be judged, and that uncertainties are reduced as far as practicable;

Timeliness - submission of the complete inventory by the deadlines specified in the relevant decisions or other documents.

Verification – verification processes are intended to help establish an inventory's reliability. These processes may be applied at either national or global levels of aggregation and may provide alternative information on annual emissions and trends. The results of verification processes may:

- Provide inputs to improve inventories;
- Build confidence in emissions estimates and trends;
- Help to improve scientific understanding related to emissions inventories.

3. Elements of the QA/QC system

This QA/QC system was established according to the UNFCCC and Kyoto Protocol's provisions related to GHG inventory preparation and national system establishment and also to 1996 Revised IPCC Methodology and Good Practice Guidance. Therefore, the document comprises information on:

- The inventory agency responsible for coordinating QA/QC activities;
- The objectives of the QA/QC programme;
- The QA/QC plan;
- The QC procedures;
- The QA procedures;
- The reporting, documenting and archiving procedures.

3.1 Responsibilites

Environment and Food Agency of Iceland (EFA)

EFA, an agency under the Ministry for the Environment, has overall responsibility for the national inventory. EFA compiles and maintains the greenhouse gas emission inventory, except agriculture and LULUCF which is compiled by the Agricultural University of Iceland (AUI). The QA/QC elements outlined in this document are the responsibility of the EFA which is the designated Inventory Agency for the Greenhouse Gas National Inventory System. EFA assigns the QA/QC coordinator, who is responsible for ensuring that QA/QC system is implemented and functioning. The EFA is also responsible for designating responsibilities for implementing and documenting these or similar QA/QC procedures to other agencies or organizations who contribute data or advice to the National Inventory.

Agriculture University of Iceland (AUI)

The Agriculture University of Iceland is the sectoral expert for agriculture and LULUCF. The AUI is responsible for implementing QA/QC procedures in the agriculture and LULUCF sectors.

Data providers

The main data providers in the Icelandic GHG Inventory are the National Energy Authority, Statistics Iceland, Iceland Forest Service and Soil Conservation of Iceland. A formal agreement has been established with these data providers, emphasizing their responsibility for the collection and timely submission of activity data to EFA/AUI, applying QC procedures according to chapter 8 of the IPCC GPG and AFOLU, as well as evaluation of uncertainties of the initial data.

Coordinating team

The Coordinating Team, with representatives from the Ministry for the Environment, the EFA and the AUI not directly involved in preparing the inventory, has the role to officially review the emission inventory before submission to UNFCCC, as well as to plan the inventory cycle and formulate proposals on further development and improvement of the national inventory system. After the Coordinating Team has reviewed the inventory and the institutions responsible for preparing the inventory responded accordingly, the greenhouse gas inventory and the NIR are submitted to UNFCCC by the Ministry for the Environment.

The Coordinating team is responsible for identification and prioritization of categories for review, based on key category and uncertainty analysis. The team is also responsible for identification of review personnel in cooperation with EFA and the Ministry for the Environment.

Ministry for the environment

The Ministry for the Environment submits the inventory to the UNFCCC secretariat.

Figure 1 shows the flow chart for the inventory system.

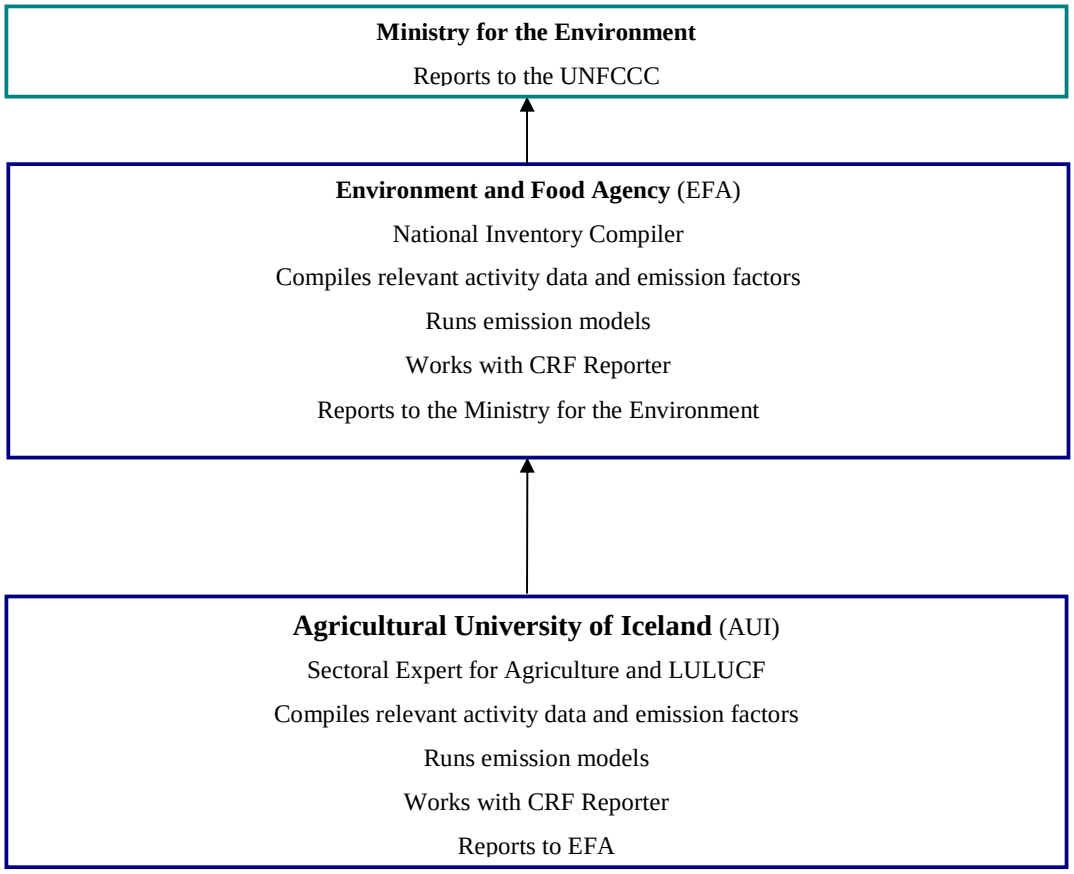

Figure 1

3.2 Quality objectives

The overall aim of the quality system is to maintain and improve the quality in all stages of the inventory work, in accordance with decision 19/CMP.1. The quality objectives of the QA/QC programme and its application are an essential requirement in the GHG inventory and submission processes in order to ensure and improve the inventory principles: transparency, consistency, comparability, completeness, accuracy, timeliness and confidence in the national emissions and removals estimates for the purposes of meeting Iceland's reporting commitments under the UNFCCC and the Kyoto Protocol.

3.3 Implementation of QA/QC system

The quality system described here is designed according to the PDCA-cycle (Plan – Do – Check – Act) presented in figure 2. This is a generally accepted model for pursuing a systematic quality work according to international standards, in order to ensure the maintenance and development of the quality system. This structure is in accordance with structures described in decision 19/CMP.1 and in the

IPCC GPG. Chapter 8, Quality Assurance and Quality Control, refers to ISO systems which are built upon the PDCA-cycle.

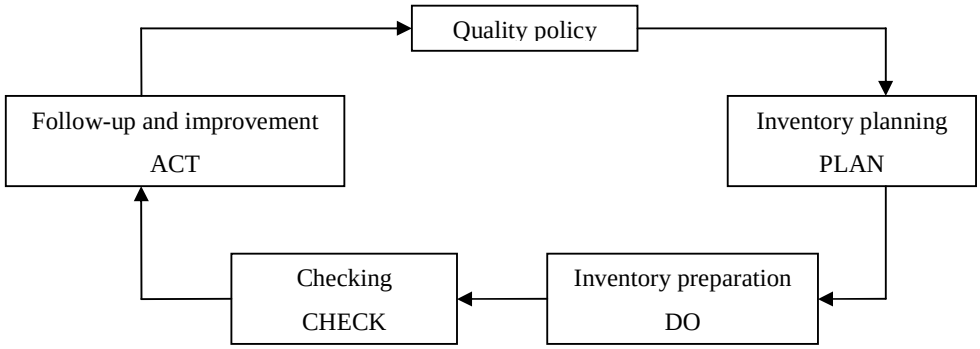

Figure 2

The QA/QC system consists of inventory planning, inventory preparation, inventory quality checking and follow-up improvements which are integrated into the annual cycle and preparation as illustrated in the figure 3.

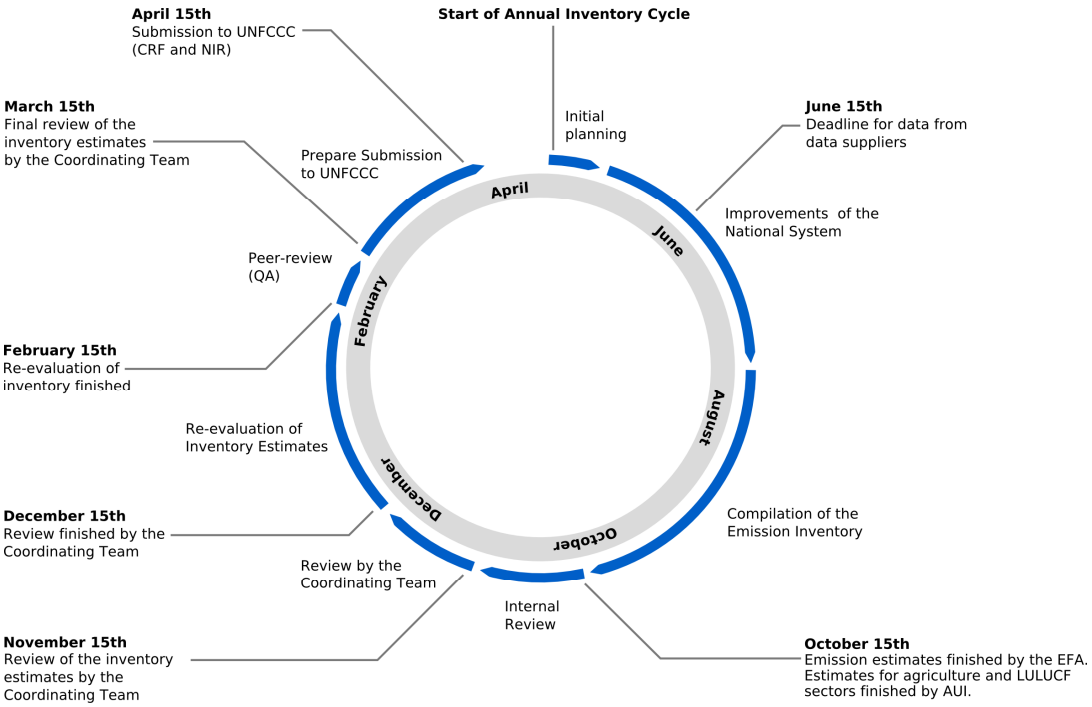

Figure 3

Inventory planning (PLAN)

Each year in May a planning meeting with the Coordinating team is held to plan next inventory's year's work. In the annual planning procedure, suggestions and issues for further consideration are derived from the work with the last inventory, including the audit of work documentation and QC-checklists by the QC-team, as well as from ERT reviews.

Inventory preparation (DO)

After data collection, selection of emission factors and calculations of emissions the quality is checked (units, sources, mass balances, methodology, emission factors, etc). Further uncertainties calculations and analysis are performed, CRF tables are filled and the National Inventory Report is prepared.

Checking (CHECK)

The inventory is reviewed by the coordinating team and inventory estimates re-evaluated if needed. The inventory is then subject to final checking, where i.e. data consistency, documenting, processing and archieving are checked.

Follow-up and improvement (ACT)

The final project eveluation takes places at the next year's inventory planning meeting.

3.4 General QC procedures

Quality manual will be prepared as stated in the ISO 9001 4.2.2. In this document references to normative and descriptive documents (procedures) which govern the inventory and reporting, structure and relationships between all participants acting in preparation of the NIR will be made. One of the purposes of the document is to describe how the coordinated quality system works as a whole and how its different parts work together. This objective will be attained by preparation and implementation of appropriate working procedures.

Preparation of general procedures:

- Control of documents (ISO 9001:2000, 4.2.3). Should define preparation, approvement, review, etc. of documents;
- Control of all records, including those made in electronic form (ISO 9001:2000, 4.2.4). A complete and correct archiving of GHG inventory data should also be included;
- Procedure for audits with responsibilities and requirements for planning and conducting audits, and for reporting results and maintaining records (ISO 9001:2000, 8.2.2), that would be QA activities;
- The controls and related responsibilities and authorities for dealing with non-conforming product shall be defined in nonconforming product procedure (ISO 9001:2000, 8.3);
- Procedures for coreective and preventive actions (ISO 9001:2000, 8.5.2, 8.5.3).

3.5 Specific QC procedures

For full implementation of QA/QC plan the following documented procedures will be prepared:

Data collection procedure with requirements for activity data collection and emissions factors selection. It will include:

- selection of appropriate (i.e. complying with IPCC Good Practice Guidance) methods, activity data and emission factors;
- check for correct calculation and/or modelling of data and consistency of time series, compare with previous estimates;
- documentation of quality control activities in a checklist.

Procedure for emissions calculations, which will include checking of:

- consistent use of emission factors;
- correctness of emission parameters, units, conversion factors;
- correct and complete transcription of data from spreadsheets into CRF tables;
- correctness of recalculations;

Procedure for preparation of national inventory report, which will include checking of:

- integrity of data structures in the inventory
- completeness of the inventory
- consistency of the time series;
- comparison of emission estimates to previous estimates
- check for consistency between data tables and text in the NIR;
- checks the completeness of the inventory submission files

Procedure for data archiving, which will include checking of:

- complete and correct archiving of GHG data
- Integrity of archiving arrangements in the organizations involved in the inventory process.

3.6 QA procedures

The most important external reviews of Iceland's GHG inventory have been performed by the UNFCCC ERTs, which perform extensive reviews of each year's submission. Results from these reviews are considered annually and decisions are taken on how the recommendations will be taken forward in the development and improvement of the national system.

The Coordinating team is responsible for identification and prioritization of categories for external review, as well as for identification of review personnel in cooperation with EFA and the Ministry for the Environment. Quality assurance procedures will involve external reviewers conducting an unbiased review of the national inventory or parts of the inventory. The results of the QA activities will be documented and described in the QA/QC sub-chapter of the NIR.

3.7 Reporting, documentation, and archiving procedures

All National System documents are stored electronically on the EFA's computer network. This includes quality system documents, reports, original data from data providers, the CRF Reporter database files, data submitted to the UNFCCC and spreadsheets of the emission inventory. Also decisions reached by the coordinating team, reviews, and results of key category and uncertainty analysis as well as inventory development is documented and archived in the data base. Geographical database used for preparing the LULUCF intventory is stored at the AUI computer network. Resulting digitized maps of land use classification are stored also at EFA. After each submission to UNFCCC a complete copy is archived.

Inventory data as well as background information on activity data and emission factors are archived by the Environment and Food Agency, which will be the single location where archives of GHG submissions and all supporting reference material is stored and maintained. Backups of each year's data and supportive material are kept as a separate CD.