Quality Assurance and Quality Control Manual (for Government Officials) for the Zimbabwe National GHG Inventory Process

Initiative for Climate Action Transparency

Initiative for Climate Action Transparency – ICAT

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1. Introduction

Climate change is one of the main developmental challenges of the Twenty-first century. To tackle the challenge the international community can up with the 1992 United Nations Framework Convention on Climate Change. Article 2 of the Convention states that 'The ultimate objective of this Convention and any related legal instruments that the Conference of the Parties may adopt is to achieve, in accordance with the relevant provisions of the Convention, stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.' This firmly places greenhouse gas emissions reduction at the centre of the fight against climate change.

As part of the implementation measures under the convention, Article 4 states that 'All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall: Develop, periodically update, publish and make available to the Conference of the Parties, in accordance with Article 12, national inventories of anthropogenic emissions by sources and removals by sinks of all greenhouse gases not controlled by the Montreal Protocol, using comparable methodologies to be agreed upon by the Conference of the Parties; …' This means that its mandatory for all Parties to the Convention to have National Greenhouse Gas Inventory.

a. Background

Zimbabwe become party to the UNFCCC in 1994 is therefore expected to periodically update and publish its national inventory of anthropogenic greenhouse gas emissions. 'Greenhouse Gases' are gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation that include but are not limited to:

i. carbon dioxide (CO_2);

ii. methane (CH_4);

iii. nitrous oxide (N_2O);

iv. hydrofluorocarbons (HFCs);

v. perfluorocarbons (PFCs);

vi. sulphur hexafluoride (SF6);

vii. Nitrogen trifluoride (NF3).

The 2015 Paris Agreement seeks to enhance the implementation of the 1992 UNFCCC. The Agreement mandates all Parties to report on a more regular basis – after every two years through Biennial Transparency Reports (BTRs) from December 2024. This means that there is need to have more robust and near real systems and institutional arrangements that are geared towards frequent reporting. The quality of the reports and the actions taken thereafter is highly dependent of the quality of data that is contained within a country's national GHG inventory. Zimbabwe ratified and became Party to the Paris Agreement in 2017 and is therefore expected improve its reporting arrangements and submit its BTR by December 2024.

The classification of GHG emission sectors (Waste Sector; Energy Sector – including transport; Industrial Processes and Product Use; and Agriculture, Forestry and Other Land Use) and the methodologies for calculating the emissions is work undertaken by the Intergovernmental Panel on Climate Change (IPCC). Parties expected to ensure that they national experts that are trained and capable of using these methodologies. Parties are responsible for compiling there GHG Inventories and maintenance of the quality of the data uploaded.

b. Purpose of this Manual

A comprehensive quality assurance and quality control (QA/QC) system that is well documented, helps improve transparency, accuracy, consistency, comparability, and completeness in national GHG inventories. Furthermore, it inspires confidence in the GHG inventory process. Ideally, the QA/QC system should have the core components that include a QA/QC plan, roles and responsibilities, QC procedures that should be carried against a checklist, verification/review procedures, documentation, archiving and reporting.

This manual is meant to sensitize and guide government officials in Zimbabwe to assist inventory compilers in the implement the QA/QC process according to recommended good practice. The defined QA/QC procedures are carried out on the national GHG database that has been designed in a way that would make the QA/QC process relatively easy. In order to help with the archiving of the information on the QA/QC process, the database system design has been extended to store details on the QA/QC activities that would be carried out in a particular inventory cycle.

c. Defining QA, QC and Verification

The terms 'quality control' and 'quality assurance' are often used interchangeably or interpreted to mean different things.

Quality Control is a system of routine technical activities, to measure and control the quality of the inventory. The QC system is designed to:

- Provide routine and consistent checks and documentation points in the inventory development process to verify data integrity, correctness, and completeness;
- Identify and reduce errors and omissions;
- Maximize consistency within the inventory preparation and documentation process, and
- Facilitate internal and external inventory review processes.

QC activities include technical reviews, accuracy checks, and the use of approved standardized procedures for emission calculations and measurements.

Quality Assurance activities include a planned system of review and audit procedures conducted by personnel not actively involved in the inventory development process. The review should be performed by an independent, objective third party to assess the effectiveness of the internal QC programme development, to verify that data quality objectives were met, and to reduce or eliminate any inherent bias in the inventory processes.

Verification refers to the collection of activities and procedures conducted during the planning and development, or after completion of an inventory that can help to establish its reliability for the intended applications of the inventory. It refers to those methods that are external to the inventory and apply independent data, including comparisons with inventory estimates made by other bodies or through alternative methods. Verification activities may be constituents of both QA and QC, depending on the methods used and the stage at which independent information is used.

This means that quality control is part on the inventory compilers day-to-day work. In contrast external staff not involved in the inventory compilation perform QA as an additional quality check. Verification activities may be constituents of both QA and QC, depending on the methods used and the stage at which independent information is used.

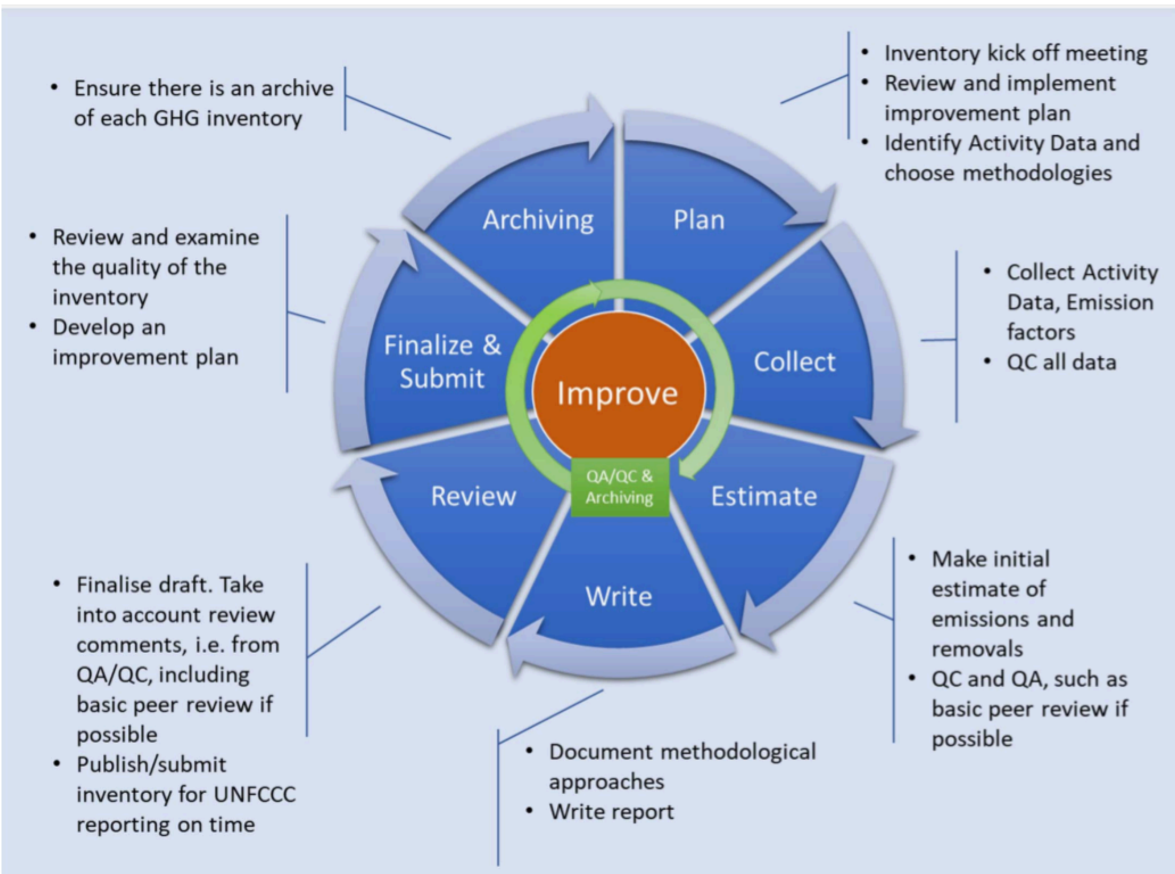

Fig 1: Understanding the National GHG Inventory Cycle (Source: EPA, 2020)

2. Roles and Responsibilities of different actors

The successful implementation of the QA/QC process will depend to a large extent on clearly defined roles and responsibilities for the various tasks in the overall GHG compilation process. These tasks include data collection, selection of methods, emission factors, activity data and other estimation parameters, estimation of emissions and removals, uncertainty assessment, QA/QC and verification activities, documentation and archiving. It is good practice to have a QA/QC coordinator though the national inventory coordinator could take up this role depending on the specific circumstances. Sector leads would ideally have the QA/QC responsibility for their individual sectors.

a. Inventory compilers

GHG Inventory Compilers are highly specialised experts with in-depth knowledge of UNFCCC and IPCC methodologies. They have the task of collecting activity data and analysing it before coming up with the GHG estimates for the different sectors. They work in teams as each sector also has specialised subsectors. In Zimbabwe, this work is contracted to a team of national expert consultants. Overtime, government institutions should have the ability the compile GHG emissions in their respective sectors.

b. Government focal points

The National Statistical Agency and other government entities often collect data on variety of parameters and activity data that can be used in estimating GHG emissions in the different sectors. This national level data is prioritised in coming up with the countries GHG estimates. After compilers conclude their work, it is expected that focal persons within the different government entities verify the product before its finalised and published. Using internal knowledge of the policy and economic dynamics within their sectors they should be able to provide explanations in historical changes and differences with regional or international databases.

c. The Climate Change Management Department and the QA/QC Plan

The GHG inventory coordinator domiciled in the Climate Change Management Department should ensure that a QA/QC plan is developed and implemented. In general, the QA/QC plan should outline the specific QA/QC activities that are supposed to be carried and the associated institutional arrangements and responsibilities. It is also important to have a schedule and checklist for the various QA/QC activities to be carried out at different stages of the GHG inventory cycle. Once the QA/QC plan is developed, it can be used in subsequent inventory cycle. However, the QA/QC plan can be modified particularly if inventory processes change or on the recommendation of reviewers.

3. The TACC Principles

The objectives for the Quality Management as formulated by IPCC Good Practice Guidance are to improve elements of transparency, consistency, comparability, completeness and confidence.

a. Transparency

Transparency means that 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 the inventories is fundamental to the success of the process for the communication and consideration.

b. Accuracy

Accuracy is a relative measure of the exactness of an emission or removal estimate. Emission figures shall not systematically neither overestimate nor underestimate the true emissions, as far as it can be judged, and uncertainties have to be reduced as far as practicable. Appropriate methodologies should be used in accordance with the IPCC good practice guidance, to promote accuracy in inventories.

d. Comparability

Comparability means that estimates of emission and removals reported by Parties in inventories should be comparable. For this purpose, Parties should use the methodologies and formats agreed upon by the COP for estimating and reporting inventories. The allocation of different source/sink categories should follow the IPCC Guidelines for national Greenhouse Gas Inventories at the level of its summary and sectoral tables.

d. Completeness

Completeness means that an inventory covers all sources and sinks as well as all gases included in the IPCC Guidelines, as well as other existing relevant source/sink categories, which are specific to individual Parties and, therefore, may not be included in the IPCC Guidelines. Completeness also means full geographic coverage of sources and sinks of a Party.

e. Consistency

Consistency means that an inventory should be internally consistent in all its elements with inventories of other years. An inventory is consistent if the same methodologies are used for the base and subsequent years and if consistent data sets are used to estimate emissions or removals from sources or sinks. Under certain circumstances an 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 Intergovernmental Panel on Climate Change (IPCC).

f. Other aspects to consider

i. Robustness

Robustness implies arrangement of inventory work as regards e.g. inventory experts and data sources in order to minimise the consequences of any unexpected disturbance due to external and internal conditions. A change in an external condition could be interruption of access to an external data source and an internal change could be a sudden reduction in qualified staff, where a skilled person suddenly leaves the inventory work.

ii. Correctness

The correctness is not stated in the guidelines explicitly, as it may be considered part of the accuracy. Correctness has to be secured in order to avoid uncontrollable occurrence of uncertainty directly due to errors in the calculations. Correct data transmission from one level of the inventory to the next level is an important part of the correctness.

g. Critical Control Points

The above-named elements are also called critical control points (CCPs). These are elements or actions, which needs to be taken into account in order to fulfil the quality objective. The different CCP's are not independent and represent different degrees of generality. E.g. deviation from comparability may be accepted if a high degree of transparency is applied. Furthermore, there may even be a conflict between the different CCP´s. E.g. new knowledge may suggest improvements in calculation methods for better completeness, but the same improvements may partly violate the consistency and comparability with regard to former year's inventories and the reporting from other Parties. It is therefore a multicriteria problem of optimisation to apply the set of CCPs in the activity for good quality.

4. General QC Procedures

These are the general QC checks that are applicable to all sectors e.g. on aspects such as units, calculations and documentation. These checks are also referred to as Tier 1 QC checks. Table 1 below shows the specific QC checks that shall be carried out at various stages on the inventory compilation process.

Table 1: Tier 1 QC Checks Template

QC Category	QC Activity	QC Procedure
Data Gathering, Input, and Handling Checks	Check that assumptions and criteria for the selection of activity data and emission factors are documented.	• Cross-check descriptions of activity data and emission factors with information on categories and ensure that these are properly recorded and archived.
	Check for transcription errors in data input and reference.	• Confirm that bibliographical data references are properly cited in the internal documentation • Cross-check a sample of input data from each category (either measurements or parameters used in calculations) for transcription errors. • Utilize electronic data where possible to minimize transcription errors. • Check that spreadsheet features are use d to minimize user/entry error: • Avoid hardwiring factors into formulas. • Create automatic look-up tables for common values used throughout calculations. • Use cell protection so fixed data cannot accidentally be changed. • Build in automated checks, such as computational checks for calculations, or range checks for input data.
	Check that emissions/removals are calculated correctly.	• Reproduce a representative sample of emissions/removals calculations. • If models are used, selectively mimic complex model calculations with abbreviated calculations to judge relative accuracy.
	Check that parameter and emission/removal units are correctly recorded and that appropriate conversion factors are used.	• Check that units are properly labelled • Check that units are correctly carried through from beginning to end of calculations. • Check that conversion factors are correct. • Check that temporal and spatial adjustment factors are used correctly.
	Check the integrity of database files.	• Confirm that the appropriate data processing steps are correctly represented in the database. • Confirm that data relationships are correctly represented in the database. • Ensure that data fields are properly labelled and have the correct design specifications. • Ensure that adequate documentation of database and model structure and operation are archived.

	Check for consistency in data between categories.	• Identify parameters (e.g., activity data, constants) that are common to multiple categories and confirm that there is consistency in the values used for these parameters in the emissions/removals calculations.
	Check that the movement of inventory data among processing steps is correct.	• Check that emissions/removals data are correctly aggregated from lower reporting levels to higher reporting levels when preparing summaries. • Check that emissions/removals data are correctly transcribed between different intermediate products.
Data Documentation	Review of internal documentation and archiving.	• Check that there is detailed internal documentation to support the estimates and enable duplication of calculations. • Check that every primary data element has a reference for the source of the data (via cell comments or another system of notation). • Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review. • Check that the archive is closed and retained in secure place following completion of the inventory • Check integrity of any data archiving arrangements of outside organizations involved in inventory preparation.
Calculation Checks	Check methodological and data changes resulting in recalculations.	• Check for temporal consistency in time series input data for each category. • Check for consistency in the algorithm/method used for calculations throughout the time series. • Reproduce a representative sample of emission calculations to ensure mathematical correctness.
	Check time series consistency	• Check for temporal consistency in time series input data for each category. • Check for consistency in the algorithm/method used for calculations throughout the time series. • Check methodological and data changes resulting in recalculations. • Check that the effects of mitigation activities have been appropriately reflected in time series calculations.
	Check completeness	• Confirm that estimates are reported for all categories and for all years from the appropriate base year over the period of the current inventory. • For subcategories, confirm that the entire category is being covered. • Proved clear definition of 'Other' type categories. • Check that known data gaps that result in incomplete category emissions/removals estimates are documented, including qualitative evaluation of the importance of the estimate in relation to total net emissions (e.g. subcategories classified as 'not estimated').
	Trend checks	• For each category, compare current inventory estimates to previous estimates, if available. If there are significant changes or departures from expected trends, re- check estimates and explain any difference. Significant changes in emissions or removals from previous years may indicate possible input or calculation errors. • Check value of implied emission factors (aggregate emissions/removals divided by activity data) across time series. Are changes in emissions or removals being captured? • Check if there any unusual or unexplained trends noticed for activity data or other parameters across the time series.

Category specific QC procedures or Tier 2 QC checks are directed at specific types of data used in methods for individual source or sink categories. These checks complement the general Tier 1 QC checks. Table 2 below, contains the Tier 2 QC checks.

Table 2: Tier 2 QC Check Template

Type of QA/QC Activity	Procedures
Assess the applicability of IPCC default factors	• Evaluate whether national conditions are similar to those used to develop the IPCC default factors • Compare default factors to site or plant-level factors • Consider options for obtaining country-specific factors • Document results of this assessment
Review country-specific factors	• QC the data used to develop the country-specific factor • Assess whether secondary studies used to develop country-specific factors used (at a minimum) Tier 1 QC activities • Compare country-specific factors to site or plant-level factors • Compare to factors from other countries (using IPCC Emission Factor Database) • Document results of this assessment • Compare country-specific factors to IPCC defaults; document any significant discrepancies
Review measurements	• Determine if national or international (e.g., ISO) standards were used in measurements • Ensure measurement equipment is calibrated and maintained properly • Compare direct measurements with estimates using a factor; document any significant discrepancies
Evaluate time series consistency	• Review significant (> 10%) changes in year-over-year estimates for categories and subcategories • Compare top-down and bottom-up estimates for similar orders of magnitude • Conduct reference calculations that use stoichiometric ratios and conservation of mass and land
Review national level activity data	• Determine the level of QC performed by the data collection agency. If inadequate, consider alternative data sources such as IPCC defaults and international data sets. Adjust the relevant uncertainty accordingly. • Evaluate time series consistency • Compare activity data from multiple references if possible
Review site-specific activity data	• Determine if national or international (e.g., ISO) standards were used in estimates • Compare aggregated site-specific data (e.g. production) to national statistics/data 🎬 Compare data across similar sites • Compare top-down and bottom-up estimates for similar orders of magnitude
QC uncertainty estimates	• Apply QC techniques to uncertainty estimates • Review uncertainty calculations • Document uncertainty assumptions and qualifications of any experts consulted
Verify GHG estimates	• Compare estimates to other national or international estimates at the national gas sector, or sub-sector level as available

5. QA/QC Uncertainty Estimates

Uncertainty analysis gives an indication of the reliability or quality of data in a national GHG inventory. The uncertainty analysis can provide insights into weaknesses in the estimate, the sensitivity of the estimate to different variables, and the greatest contributors to uncertainty, all of which can assist in setting priorities for improving data sources or methodologies. It is good practice to apply QC procedures to uncertainty estimation to confirm that calculations are correct, and data and calculations are well documented. The assumptions on which uncertainty estimation has been based should be documented for each category.

6. Verification and Review

Verification activities are essential for improving the quality of national GHG inventories. They therefore form an integral part of the overall QA/QC system. Verification activities include comparisons with emission or removal estimates prepared by other institutions or organizations and comparisons with estimates derived from independent assessments, for example actual measurements that would have been carried out.

A review as carried out on a national inventory that has already been compiled. The process includes quality checks carried out by an external inventory expert who has not taken part in the inventory compilation process. This exercise is essential for assessing the quality of the national GHG inventory but it is not necessary to conduct it on a very frequent basis.

7. Storage of QC Activities, Archiving and Reporting

It is essential to record details on the carrying out of QC procedures. For the Zimbabwe GHG inventory, the proposed approach is to store the information in a database table. In this way, the database takes care of the archiving. Backups will also be fairly straightforward to make using inbuilt backup features of the underlying database management system. By querying the database table, it would be easy to check the QC activities that would have been carried out and generate QC related reports that may be required. The data shall be entered into the database table via a Windows e-entry form whose screenshot is shown in Fig 1 below.

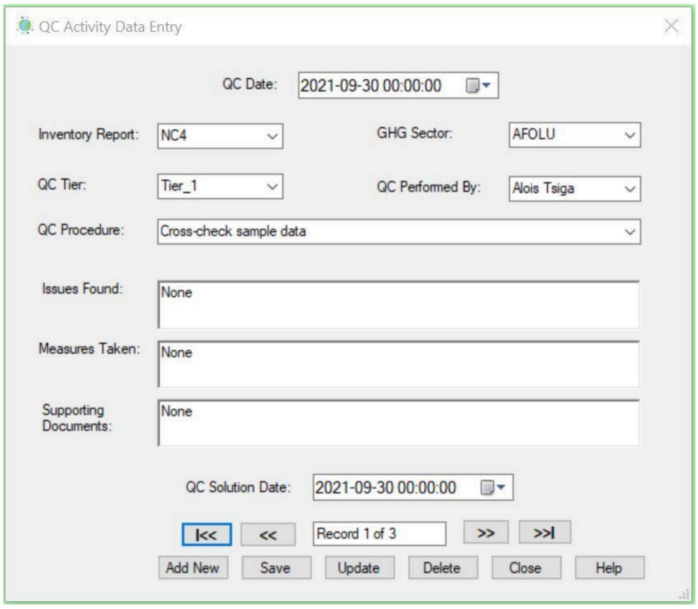

Fig 2. Form for entering data on QC activities carried out on GHG inventory

The data entry form has a date and time picker for specifying when a QC operation was carried out and another one for recording the date when identified issues were resolved. The use of the date and time picker eliminates the possibility of entering invalid date. Furthermore, the form has a number of dropdown lists for selecting values for a number of required parameters e.g. GHG sector, QC procedure etc. This again reduces to a minimum, the chances of entering invalid values.

It is anticipated that the use of the database for QC operations and recording of those operations, will minimize the occurrence of human error and simplify the documentation.

8. Carrying out QC Operations on GHG Inventory Database

The GHG database has been designed in a way that makes it relatively easy to carry out QC operations by querying the database using standard Structured Query Language (SQL). According to the design, activity data is entered into different database tables according to GHG sector and disaggregated source categories. In order to facilitate the process of generating reports and querying the database for QC, activity data and the associated emissions, data from the different key-entry tables is combined into a single table which has been designed to accommodate all types of activity data and emissions. The table has the following attributes or columns: source_category, inventory_year, item_name, item_value, item_units and source_data_table. The same table can be used as the destination table for importing external inventory data if the column structure of the data corresponds to the structure given above. Fig 3 below, shows in datasheet view, the layout of the table for combined source categories for all GHG sectors.

inventory_ad_combined_items_and_emissions — Enter a SQL expression to filter results (use Ctrl+Space)

	source_category	inventory_year	item_name	item_value	item_units	source_data_table
1	1.A.3 - Transport	1990	AD_biomass	0	TJ	[NULL]
2	1.A.3 - Transport	1990	AD_liquid_fuel	18735.8	TJ	[NULL]
3	1.A.3 - Transport	1990	AD_solid_fuel	0	TJ	[NULL]
4	1.A.3 - Transport	1991	AD_biomass	0	TJ	[NULL]
5	1.A.3 - Transport	1991	AD_liquid_fuel	16994.7	TJ	[NULL]
6	1.A.3 - Transport	1991	AD_solid_fuel	0	TJ	[NULL]
7	1.A.3 - Transport	1992	AD_biomass	0	TJ	[NULL]
8	1.A.3 - Transport	1992	AD_liquid_fuel	21310.4	TJ	[NULL]
9	1.A.3 - Transport	1992	AD_solid_fuel	0	TJ	[NULL]
10	1.A.3 - Transport	1993	AD_biomass	0	TJ	[NULL]
11	1.A.3 - Transport	1993	AD_liquid_fuel	21204.9	TJ	[NULL]
12	1.A.3 - Transport	1993	AD_solid_fuel	0	TJ	[NULL]
13	1.A.3 - Transport	1994	AD_biomass	0	TJ	[NULL]
14	1.A.3 - Transport	1994	AD_liquid_fuel	22668.2	TJ	[NULL]
15	1.A.3 - Transport	1994	AD_solid_fuel	0	TJ	[NULL]
16	1.A.3 - Transport	2007	AD_biomass	0	TJ	[NULL]
17	1.A.3 - Transport	2007	AD_liquid_fuel	16633.458	TJ	[NULL]
18	1.A.3 - Transport	2007	AD_solid_fuel	309.6	TJ	[NULL]
19	1.A.3 - Transport	2008	AD_biomass	0	TJ	[NULL]
20	1.A.3 - Transport	2008	AD_liquid_fuel	13704.964	TJ	[NULL]
21	1.A.3 - Transport	2008	AD_solid_fuel	258	TJ	[NULL]
22	1.A.3 - Transport	2009	AD_biomass	0	TJ	[NULL]
23	1.A.3 - Transport	2009	AD_liquid_fuel	14546.058	TJ	[NULL]
24	1.A.3 - Transport	2009	AD_solid_fuel	283.8	TJ	[NULL]

Fig 3. Datasheet view of table for combined source categories and emissions

In the table, the column "source_category" is for storing the IPCC 2006 source category. The column "inventory_year", as the name implies, is for the year of inventory. “item_name” is a generalized name of a variable for storing any type of activity data or emissions, while “item_value” is for the quantity of the activity data or emissions. The next column is for the item units. Lastly, there is a column for the source table from which an item was derived. This is useful particularly for tracing back how the value or quantity of a given item was arrived at. That source table will have information on the value of the emission factor and other factors used in estimating the value of an item.

Since all values are in one column, it is relatively easy to select data, aggregate the data or carry out other data manipulation operations.

The top part of the screenshot in Fig 4 shows the query for extracting liquid fuel consumed for domestic aviation between 2001 and 2010, while the bottom part of the screenshot shows the corresponding output.

```sql
select source_category,inventory_year,item_name,item_value
from ghg_emissions_db.inventory_ad_combined_items_and_emissions
where source_category like '%1.A.3.a.ii%'
and (inventory_year between 2001 and 2010) and item_name like '%liquid_fuel%';
```

inventory_ad_combined_items_and_emissions 1

select source_category,inventory_year,item_na | Enter a SQL expression to filter results (use Ctrl+Space)

	source_category	inventory_year	item_name	item_value
1	1.A.3.a.ii - Domestic Aviation	2007	AD_liquid_fuel	104.958
2	1.A.3.a.ii - Domestic Aviation	2008	AD_liquid_fuel	89.964
3	1.A.3.a.ii - Domestic Aviation	2009	AD_liquid_fuel	104.958
4	1.A.3.a.ii - Domestic Aviation	2010	AD_liquid_fuel	119.952

Fig 4. Querying database for domestic aviation fuel consumption

From the above, it is therefore necessary to have basic knowledge of structured query language (SQL), in order to be able to query the database for QC or other intended purposes.

9. Automated QC During Data Entry into GHG Inventory Database

Development of routines for automated QC during data entry is in progress. Some of those routines have been completed on the form used for entering data on stationary combustion under the Energy sector. The automated QC checks are triggered on pressing the ENTER key. Fig 5 shows the error message that comes up when a non-numeric value is entered for the inventory year.

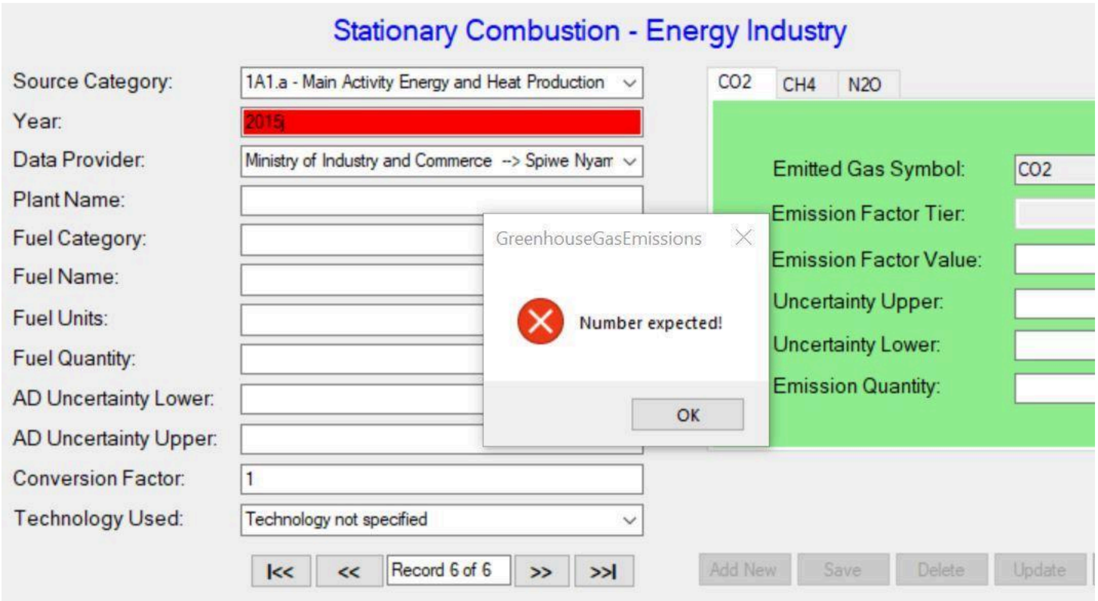

Fig 5. Critical error is highlighted when non-numeric character is entered as part of the year

The same type of error message also appears when a non-numeric value is entered for fuel quantity or activity data uncertainty as shown in Fig 6.

If lower limits and upper limits have been pre-defined for activity data, automatic range checks will be made. For example, lower and upper limits for fuel quantity have been defined for stationary combustion. The screenshot in Fig 7 shows the error message that comes up when a value that is below the lower limit is entered.

Fig 6. Critical error displayed when a non-numeric value is entered for activity data uncertainty

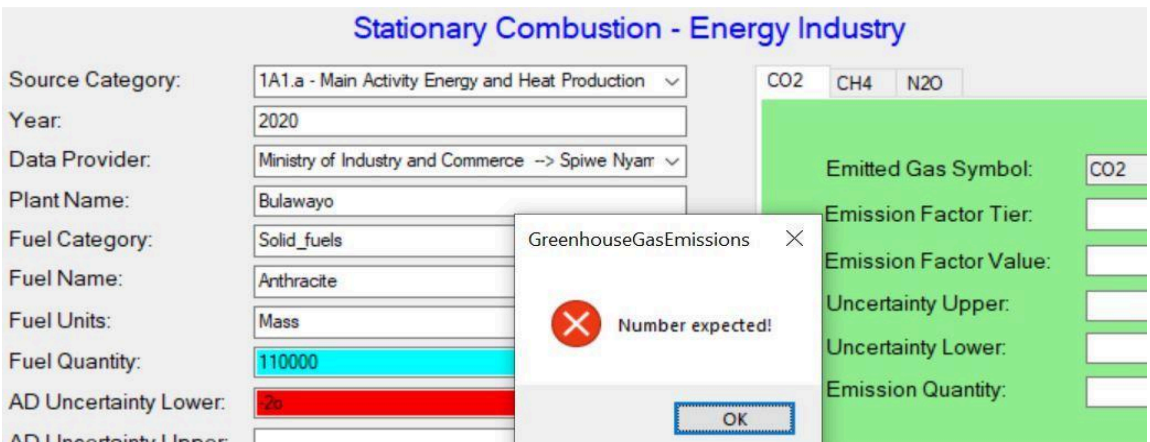

Fig 7. Automated check for lower limit on the stationary combustion key-entry form

On the same form, the warning for a value that is greater than the defined upper limit is shown in Fig 8.

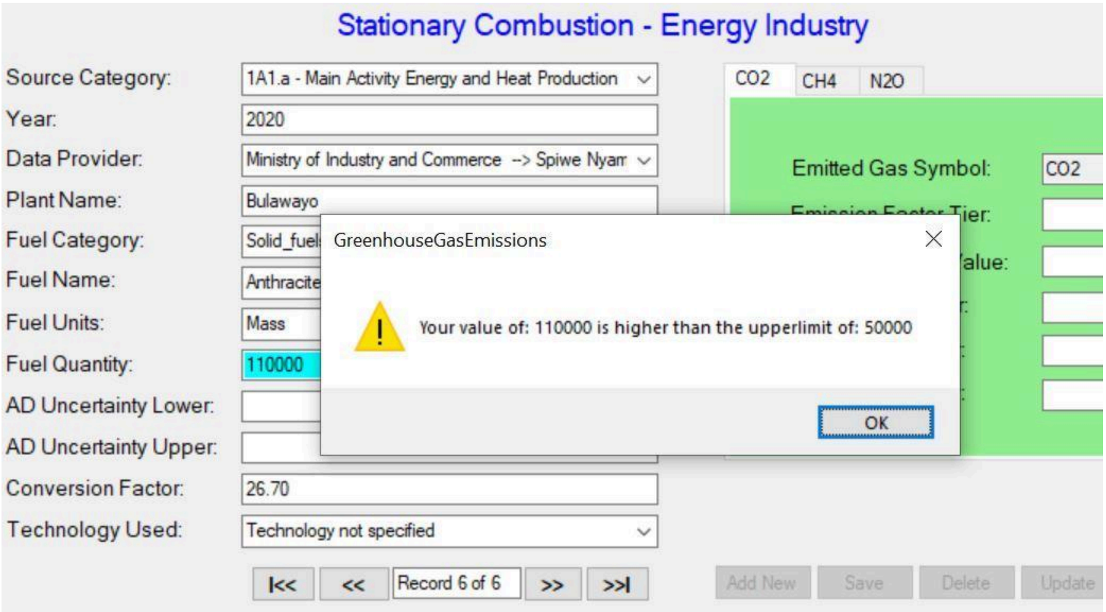

Fig 8. Automated check for upper limit on stationary combustion key-entry form

The automated QC checks that have been implemented on the data entry form for stationary combustion, are being replicated on the rest of the date entry forms for all sectors.

10. Settings of QC Threshold Values

Activity data values entered on data-entry forms are automatically checked against predefined lower and upper thresholds. Ideally these threshold values should be defined by the data provider who is familiar with the quantities of data involved. A facility has now been added for setting these threshold values for a given source category of activity data. Fig 9 shows a screenshot of the dialogue for selecting a required source category and then setting the threshold values and uncertainties for the activity data.

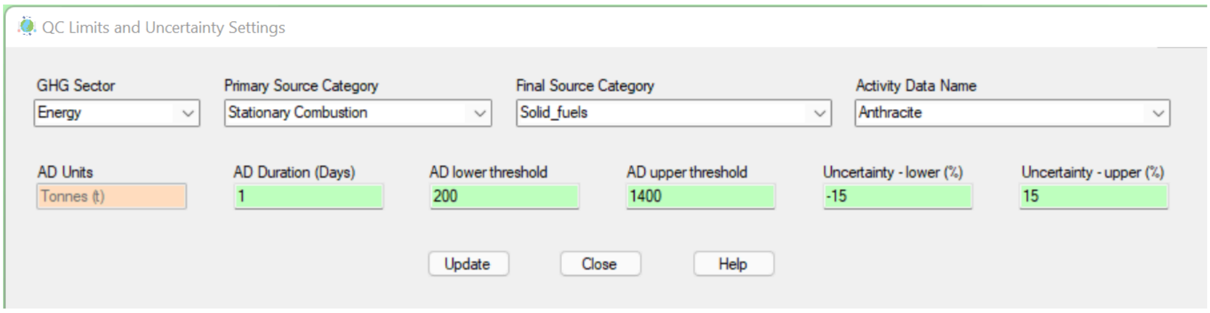

Fig 9. Setting QC lower and upper threshold values for activity data.

Starting from the top left part of the dialogue, the appropriate GHG sector should be selected from the dropdown list. The next dropdown list with then show the primary source categories for the selected sector. When a primary source category has been selected, the next dropdown list will show the corresponding final source categories. The last dropdown list on the top right will display a filtered list of types of activity data that correspond to the final source category. In the example above, the selected GHG sector is Energy, primary source is Stationary Combustion, final source is Solid-fuels and activity data type is Anthracite.

After making the appropriate selection from the dropdown lists, one should then enter the threshold values and uncertainties for the selected activity data. The button "Update" should then be clicked for the settings to be registered in the database.

The dialogue for setting the QC threshold values is accessed by clicking on the "Settings" icon on the main window of the GHG inventory database system.

11. Emission Factor (EF) Settings

The dialogue for emission factor settings is also accessed by clicking on the “Settings” icon on the main form of the GHG inventory database system. Fig 10 below shows the dialogue for selecting a required source category and type of emission factor setting.

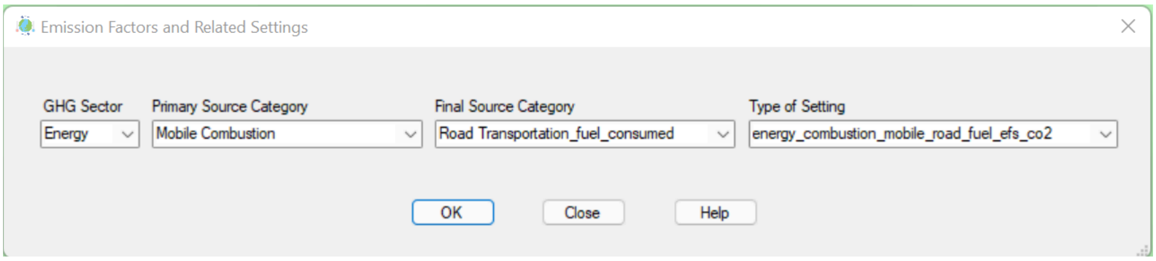

Fig 10. Selection of source category and type of emission factor setting

A selected final source category can have more than one type of settings. For example, as shown in the screenshot above, the final source category of road transport fuel consumption has a setting for CO_2 emission factors, and another type of setting for CH_4 and N_2O emissions factors.

After selecting the required setting and clicking the OK button, the dialogue for viewing or entering the required EF settings will appear as shown in Fig 11.

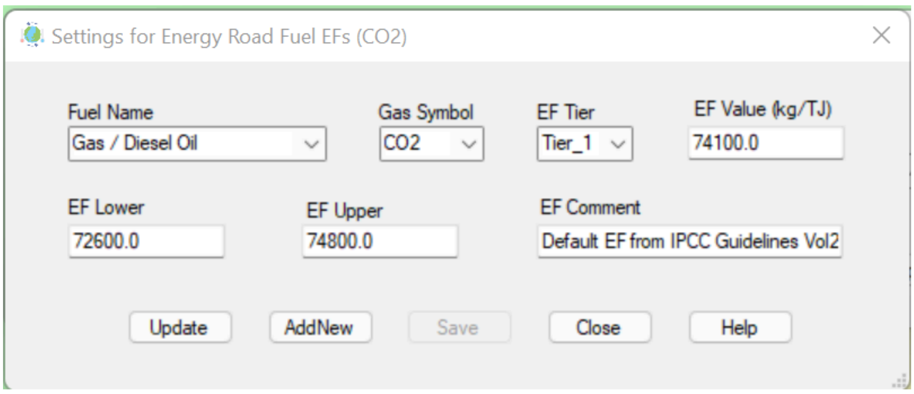

Fig 10. Example of EF settings for mobile combustion

As shown in the screenshot above, the dialogue allows updating an existing emission factor or adding a new emission factor e.g. a new country specific emission factor at Tier 2.

12. Entering GHG Activity Data at sub-Annual Frequency

While the GHG inventory is required to be compiled for a calendar year, in practice, the actual activity data for most source categories is most likely collected on a sub-annual basis, which could be monthly, weekly, or even daily. In order to improve the transparency in coming up with the annual GHG data figures for the inventory, and to make the original data more amenable to quality control, a facility has been developed to allow entry of GHG data at these sub-annual frequencies, right at the source of the data. Presumably, this will also simplify the data processing task for the data provider.

Fig 12 below shows a screenshot for an updated key-entry form with provision for entering the date when activity data was recorded and the duration in terms of days.

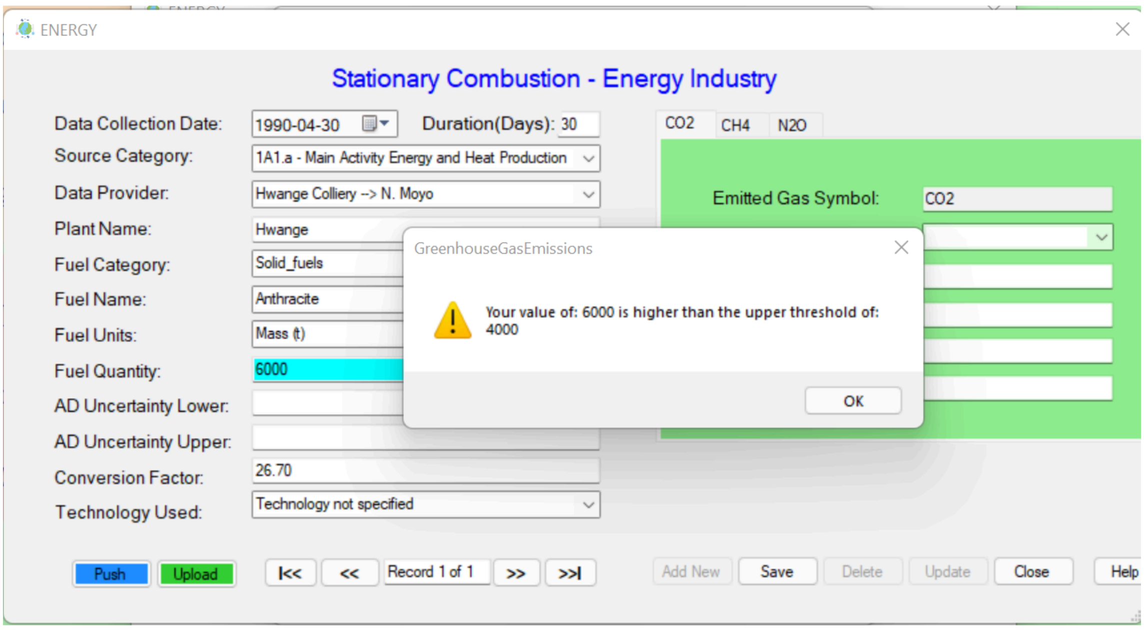

Fig 12. Updated key-entry form with provision for entering the date of data collection and duration covered by the data.

Once the data for any given frequency has been entered it will be straightforward to generate summary data for the year within the database.

13. Pushing Data to Remote Server

As a way to simplify the data collection process from the data providers, it has been proposed to have the new GHG database system installed at the location of the data provider so that they can enter the activity data directly into the system as soon as the data has been collected, at whatever frequency. This will allow the data provider to have their own local GHG inventory database which would enable them to monitor their own carbon footprint directly. In the same vein, it has been further proposed to implement a simplified way for the data provider to share their data with the Lead Agency, namely the Climate Change Management Department. In this regard, the key entry forms in the new GHG inventory database now have a facility for pushing a copy of the data from the local database to a remote central database at the Lead Agency. On closing a data entry form, a data provider will be prompted to push the data to the remote server. At the same time, there is also a button for manually pushing the data to the remote server. See Fig 13 below.

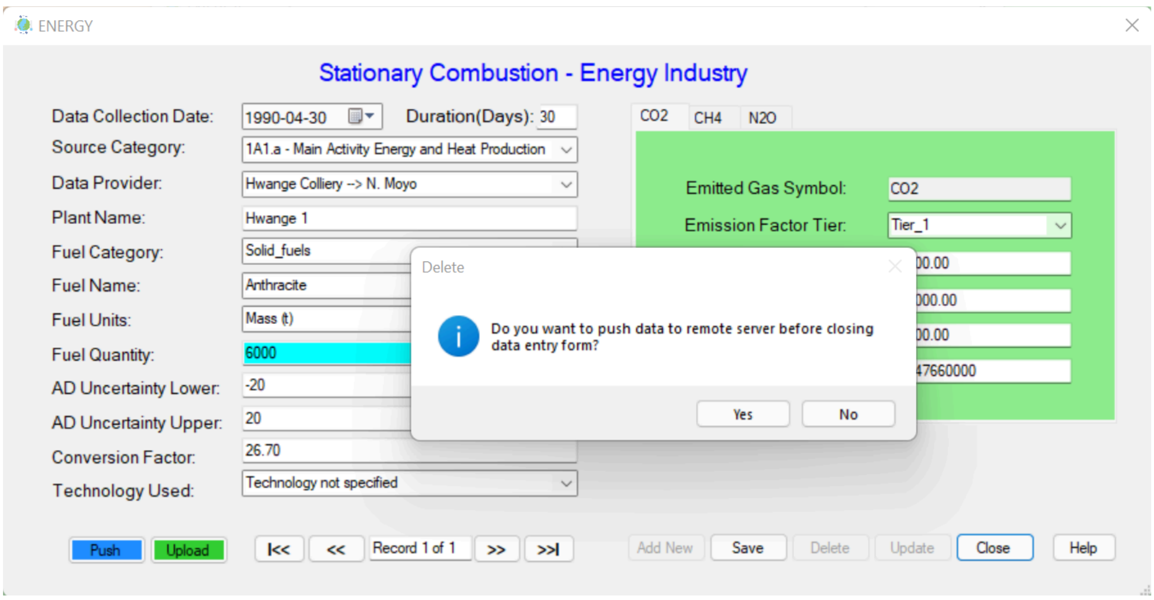

Fig 13. Pushing data from data provider to remote server at Lead Agency

Internet connection is required for pushing data to the remote server. However, the local data entry operation can be done completely off-line. Therefore, there is no disruption of data entry due to issues of unreliable internet connectivity.