



Global BTR Dialogue

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Brussels



**Partnership on Transparency
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Greenhouse Gas Inventory
and Research Center



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Department
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REPUBLIC OF SOUTH AFRICA

on the basis of a decision
by the German Bundestag

QA/QC session

Day 2

30/04/2024



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Objectives

- The purpose of this breakout session is to discuss the reporting on quality assurance and quality control in the national inventory document.
- The aim is to go through the following reporting aspects:
 - Functions related to inventory planning, preparation and management (paragraph 19 of the annex to decision 18/CMA.1)
 - Reporting on the QA/QC plan (paragraph 34 of the annex to decision 18/CMA.1)
 - Inventory QC procedures (paragraph 35 of the annex to decision 18/CMA.1)
 - Comparison with the reference approach (paragraph 36 of the annex to decision 18/CMA.1)
 - At which level of detail should information on quality assurance and quality control be provided?

→ For discussion:

- What challenges are facing and how you plan to address these challenges ?
- Peer to peer exchange on national experiences
- Example QA/QC plan from a National Inventory Report (NIR) submitted under the UNFCCC.



Definitions

Quality Control is a system of routine technical activities, implemented by inventory development personnel 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 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.

This includes technical reviews, accuracy checks, and the use of approved standardized procedures for emission calculations and measurements



Definitions

- **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.



QA/QC plan process

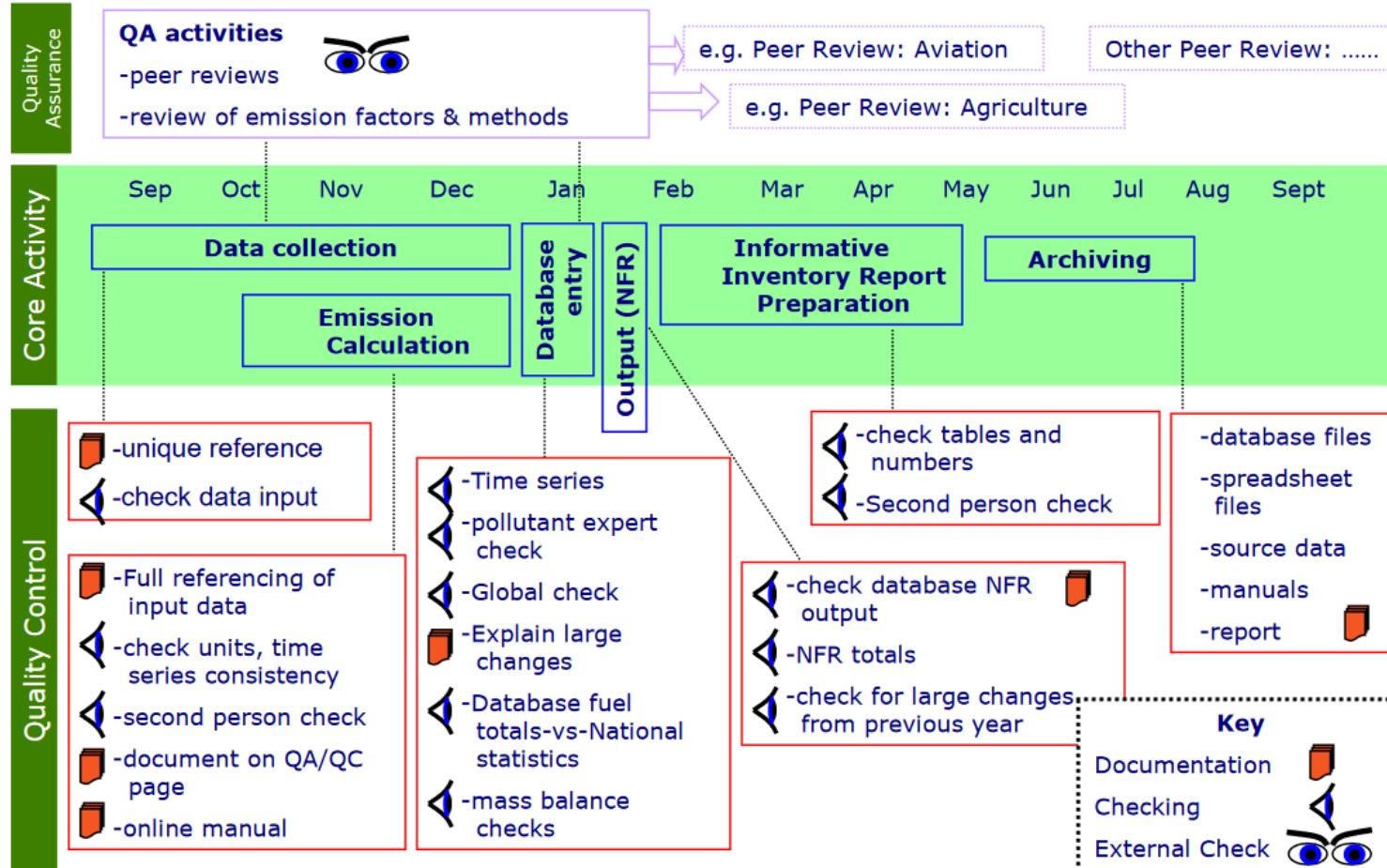


Figure 4-2 QA/QC plan process



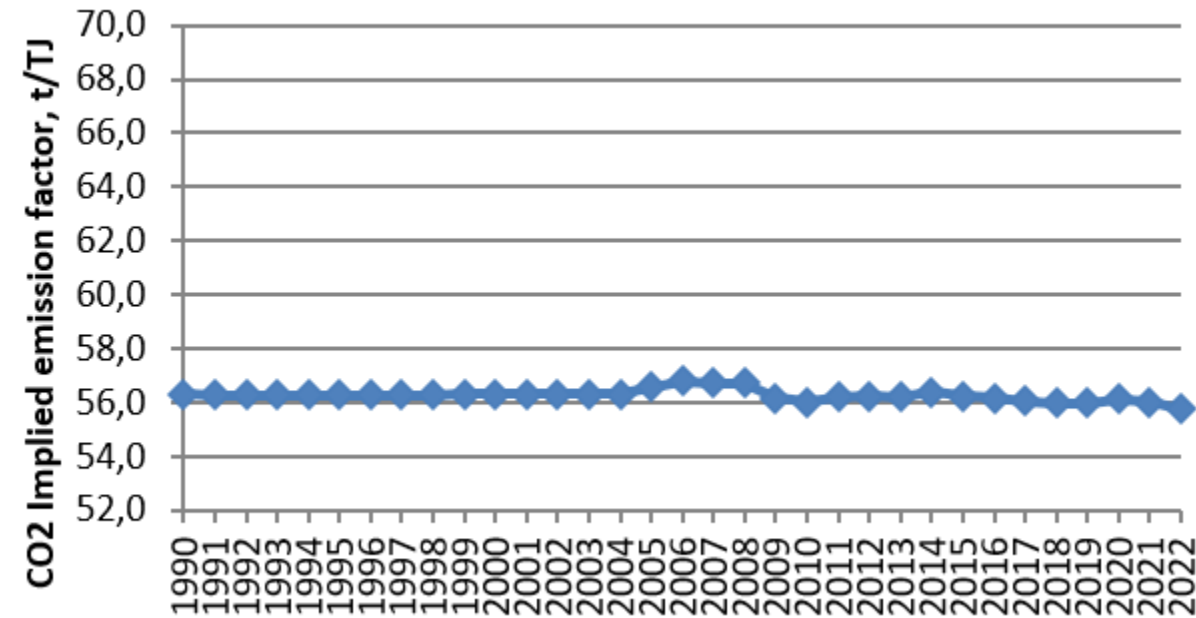
TABLE 6.1
GENERAL INVENTORY QC PROCEDURES

QC Activity	Procedures
Check that assumptions and criteria for the selection of activity data, emission factors, and other estimation parameters are documented.	<ul style="list-style-type: none"> • Cross-check descriptions of activity data, emission factors and other estimation parameters with information on categories and ensure that these are properly recorded and archived.
Check for transcription errors in data input and references.	<ul style="list-style-type: none"> • 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.
Check that emissions and removals are calculated correctly.	<ul style="list-style-type: none"> • Reproduce a set of emissions and removals calculations. • Use a simple approximation method that gives similar results to the original and more complex calculation to ensure that there is no data input error or calculation error.
Check that parameters and units are correctly recorded and that appropriate conversion factors are used.	<ul style="list-style-type: none"> • Check that units are properly labelled in calculation sheets. • Check that units are correctly carried through from beginning to end of calculations. • Check that conversion factors are correct. • Check that temporal and spatial adjustment factors are used correctly.
Check the integrity of database files.	<ul style="list-style-type: none"> • Examine the included intrinsic documentation (see also Box 6.4) to: <ul style="list-style-type: none"> - 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.	<ul style="list-style-type: none"> • 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 emission/removal calculations.



TABLE 6.1 (CONTINUED)
GENERAL INVENTORY QC PROCEDURES

QC Activity	Procedures
Check completeness.	<ul style="list-style-type: none"> Confirm that estimates are reported for all categories and for all years from the appropriate base year to the period of the current inventory. For subcategories, confirm that entire category is being covered. Provide clear definition of 'Other' type categories. Check that known data gaps that result in incomplete estimates are documented, including a qualitative evaluation of the importance of the estimate in relation to total emissions (e.g., subcategories classified as 'not estimated', see Chapter 8, Reporting Guidance and Tables).
Trend checks.	<ul style="list-style-type: none"> For each category, current inventory estimates should be compared to previous estimates, if available. If there are significant changes or departures from expected trends, re-check estimates and explain any differences. Significant changes in emissions or removals from previous years may indicate possible input or calculation errors. Check value of implied emission factors (aggregate emissions divided by activity data) across time series. <ul style="list-style-type: none"> Do any years show outliers that are not explained? If they remain static across time series, are changes in emissions or removals being captured? Check if there are any unusual and unexplained trends noticed for activity data or other parameters across the time series.
Review of internal documentation and archiving.	<ul style="list-style-type: none"> Check that there is detailed internal documentation to support the estimates and enable reproduction of the emission, removal and uncertainty estimates. Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review. Check that the archive is closed and retained in secure place following completion of the inventory. Check integrity of any data archiving arrangements of outside organisations involved in inventory preparation.



IPCC 2006



BOX 6.3

EVALUATION OF DATA QUALITY ON EXTERNAL DATA IN THE TRANSPORTATION SECTOR

Countries typically use either fuel usage or kilometer (km) statistics to develop emissions estimates. The national statistics on fuel usage and km travelled by vehicles are usually prepared by a specialised agency. However, it is the responsibility of the inventory compiler to determine which QA/QC activities were implemented by the agency that prepared the original fuel usage and km statistics for vehicles. Questions that may be asked in this context are:

- Does the statistical agency have a QA/QC plan that covers the collection and handling of the data?
- Was an adequate sampling protocol used to collect data on fuel usage or km travelled?
- How recently was the sampling protocol reviewed?
- Has any potential bias in the data been identified by the statistical agency?
- Has the statistical agency identified and documented uncertainties in the data?
- Has the statistical agency identified and documented errors in the data?



Checklist for general QC checks (complete table for each category):

Item	Check completed			Corrective action		Supporting documents (provide reference)
	Date	Individual (first initial, last name)	Errors (Y/N)	Date	Individual (first initial, last name)	
DATA GATHERING, INPUT, AND HANDLING ACTIVITIES: QUALITY CHECKS						
1.	Check a sample of input data for transcription errors					
2.	Review spreadsheets with computerised checks and/or quality check reports					
3.	Identify spreadsheet modifications that could provide additional controls or checks on quality					
4.	Other (specify):					
DATA DOCUMENTATION: QUALITY CHECKS						
5.	Check project file for completeness					
6.	Confirm that bibliographical data references are included (in spreadsheet) for every primary data element					



Quality control and quality assurance

In accordance with IPCC requirements, the national GHG inventory preparation process must include quality control and quality assurance (QC/QA) procedures. The objective of quality checking is to improve the transparency, consistency, comparability, completeness, and accuracy of the national GHG inventory. QC procedures, performed by the compilers, were carried out at various stages throughout the inventory compilation process. **Quality checks were completed at four different levels**, namely (a) inventory data (activity data, EF data, uncertainty, and recalculations), (b) database (data transcriptions and aggregations), (c) metadata (documentation of data, experts and supporting data), and (d) inventory report. For the 2020 inventory quality assurance was completed through a public review process and the inventory was reviewed by the UNFCCC through an in-country QA workshop provided by the GHG support unit. The inventory was finalized once comments from the quality assurance process were addressed.



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The NGHGIS assists in managing and storing the inventory compilation related documents and processes. The NGHGIS, amongst other things, keeps records of the following:

Stakeholder list with full contact details and responsibilities

List of input datasets which are linked to the stakeholder list

QA/QC plan

QA/QC checks

QA/QC logs which will provide details of all QA/QC activities

QC Tools

QC Analysis Tags



Quality assurance, quality control and verification plans and procedures

1.7.1 Quality assurance and quality control procedures

1.7.1.1 QA/QC plan and procedures

As part of the NGHGIS, South Africa developed a **formal quality assurance/quality control plan** (see Appendix 1.A of 2015 NIR (DEA, 2018)). This provides a list of QC procedures that are to be undertaken during the preparation of the inventory. In this inventory the relatively new team was provided with QA/QC training and each team member was assigned to a sector. Each quality controller went through the sector calculation files and provided comments. A programme, QA Analyst, assisted with the process of tracking the comments by keeping a log in the front of each file.



Table 1.8: Quality control checks carried out on South Africa's 2020 GHG inventory.

ID	Type of check	Description	Level
QC001	Activity data source	Is the appropriate data source being used for activity data?	Calculation file
QC002	Correct units	Check that the correct units are being used	Calculation file
QC003	Unit carry through	Are all units correctly carried through calculations to the summary table? This includes activity data and emission factors.	Calculation file
QC004	Method validity	Are the methods used valid and appropriate?	Calculation file
QC005	Uncertainties	Carry out uncertainties analysis	Supporting file
QC006	Double counting – Categories	Check to ensure no double counting is present at category level	Calculation file
QC007	Notation keys	Review the use of notation keys and the associated assumption to ensure they are correct.	Calculation file
QC008	Trend check	Carry out checks on the trend to identify possible errors. Document any stand out data points.	Calculation file
QC009	Emission factor applicability	Where default emission factors are used, are they correct? Is source information provided?	Calculation file



ID	Type of check	Description	Level
QC010	Emission factor applicability	Where country specific emission factors are used, are they correct? Is source information provided?	Calculation file
QC011	Recalculations	Check values against previous submission. Explain any changes in data due to recalculations.	Calculation file
QC012	Sub-category completeness	Is the reporting of each sub-category complete? If not this should be highlighted.	Calculation file
QC013	Time series consistency	Are activity data and emission factor time series consistent?	Calculation file
QC014	Colour coding	Has colour coding been used in a consistent and accurate manner? Are there any significant data gaps or weaknesses?	Calculation file
QC015	Cross check data	Where possible cross check data against alternative data sources. This includes activity data and EF. If CS EF are used they must be compared to IPCC values as well as any other available data sets.	Supporting file
QC016	Spot checks	Complete random spot checks on a data set.	Calculation file
QC017	Transcription checks	Complete checks to ensure data has been transcribed from models to spreadsheet correctly.	Calculation file
QC018	Transcription to document	Complete checks to ensure data has been transcribed from spreadsheets to documents correctly.	Sector report



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QC019	Data source referencing	All source data submitted must be referenced	Calculation file
QC020	Data traceability	Can data be traced back to its original source?	Calculation file
QC021	Links to source data	Where possible, links to the source data must be provided	Calculation file
QC022	Raw primary data	All raw primary data must be present in the workbook	Calculation file
QC023	QA review	Data must be reviewed and checked by a second person	Calculation file
QC024	Verification	Where possible have calculated emissions been checked against other data sets?	Sector report
QC025	Archiving	Are all supporting files and references supplied?	Archive manager
QC026	Data calculations	Can a representative sample of the emission calculations be reproduced?	Calculation file
QC027	Unit conversions	Have the correct conversion factors been used?	Calculation file
QC028	Common factor consistency	Is there consistency in common factor use between sub-categories (such as GWP, Carbon content, Calorific values)?	Calculation file
QC029	Data aggregation	Has the data been correctly aggregated within a sector?	Calculation file
QC030	Trend documentation	Have significant trend changes been adequately explained?	Sector report

South Africa, NIR



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ID	Type of check	Description	Level
QC031	Consistency between sectors	Identify parameters that are common across sectors and check for consistency.	Draft NIR
QC032	Data aggregation	Has the data been correctly aggregated across the sectors?	Draft NIR
QC033	Documentation - CRF tables	Check CRF tables are included.	Draft NIR
QC034	Documentation - KCA	Check that key category analyses have been included.	Draft NIR
QC035	Documentation - Uncertainty	Check uncertainty analysis have been included.	Draft NIR
QC036	Documentation - Overall trends	Check overall trends are described both by sector and gas species.	Draft NIR
QC037	Documentation - NIR sections complete	Check all relevant sections are included in the NIR.	Draft NIR
QC038	Documentation - Improvement plan	Check that the improvement plan has been included.	Draft NIR
QC039	Documentation - Completeness	Check for completeness	Draft NIR
QC040	Documentation - Tables and figures	Check numbers in tables match spreadsheet; check for consistent table formatting; check the table and figure numbers are correct.	Draft NIR

South Africa, NIR



QC041	Documentation - References	Check consistency of references.	Draft NIR
QC042	Documentation - General format	Check general NIR format - acronyms, spelling, all notes removed; size, style and indenting of bullets are consistent.	Draft NIR
QC043	Documentation - Updated	Check that each section is updated with current year information.	Draft NIR
QC044	Double counting - Sectors	Check there is no double counting between the sectors.	Draft NIR
QC045	National coverage	Check that activity data is representative of the national territory.	Calculation file
QC046	Review comments implemented	Check that review comments have been implemented.	Calculation file
QC047	Methodology documentation	Are the methods described in sufficient detail?	Sector report
QC048	Recalculation documentation	Are changes due to recalculations explained?	Sector report
QC049	Trend documentation	Are any significant changes in the trend explained?	Sector report
QC050	Documentation - QA/QC	Check the QA/QC procedure is adequately described.	Draft NIR



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ID	Type of check	Description	Level
QC051	Complete uncertainty check	Check that the uncertainty analysis is complete.	Draft NIR
QC052	Consistency in methodology	Check that there is consistency in the methodology across the time series	Calculation file
QC053	Data gaps	Is there sufficient documentation of data gaps?	Sector report
QC054	Steering committee review	Has the draft NIR been approved by the steering committee? Was there public consultation?	Draft NIR
QC055	Check calorific values	Have the correct net calorific values been used? Are they consistent between sectors? Are they documented?	Calculation file
QC056	Check carbon content	Have the correct carbon content values been used? Are they consistent between sectors? Are they documented?	Calculation file
QC057	Supplied emission check	If emissions are supplied by industry have they been calculated using international standards? Have the methods been adequately described?	Sector report
QC058	Livestock population checks	Have the livestock population data been checked against the FAO database?	Calculation file
QC059	Land area consistency	Do the land areas for the land classes add up to the total land area for South Africa?	Calculation file
QC060	Biomass data checks	Have the biomass factors been compared to IPCC default values or the EFDB?	Calculation file
QC061	Fertilizer data checks	Has the fertilizer consumption data been compared to the FAO database?	Calculation file
QC062	Waste water flow checks	Do the wastewater flows to the various treatments add up to 100?	Calculation file
QC063	Reference approach	Has the reference approach been completed for the Energy sector? Have the values been compared to the sector approach? Has sufficient explanation of differences been given?	Calculation file
QC064	Coal production checks	Has the industry-specific coal production been checked against the coal production statistics from Department of Mineral Resources?	Calculation file

South Africa, NIR



3.2.6.4 Category specific QA/QC and verification

Consumption data from refineries was checked against the energy balance data and where there seems to be over-estimation of emissions, the data from refineries was queried and re-submissions were requested.

5.2.4.4 Category specific QA/QC and verification


Activity data verification is provided in section 5.2.1.3. For the emission factor data, a literature search was conducted, and the results are shown in the calculation files.

Data was also compared to the IPCC default data. The dairy cattle emission factor is higher than the default for Africa. The differences are due to the different manure management systems in these regions which impacts the MCF. The situation is similar for the emission factor for swine. The Other cattle emission factor is much lower than that in other countries and is even lower than the default value for Africa. Sheep and goat emission factors are lower than IPCC default values.

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