Quality Assurance/Quality Control (QA/QC) Plan and Procedures

Country Specific Examples

Remote Training on the Building of Sustainable National Greenhouse Gas Inventory Management Systems

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On behalf of U.S. Environmental Protection Agency

June 30th, 2022

Some examples of QA/QC systems procedures from countries

- Chile (BUR, NIR)
- UK (NIR)
- Ghana (NIR)

- Let us now look at these examples …
- We do not have time for a “very deep dive”, but I have highlighted important points and features

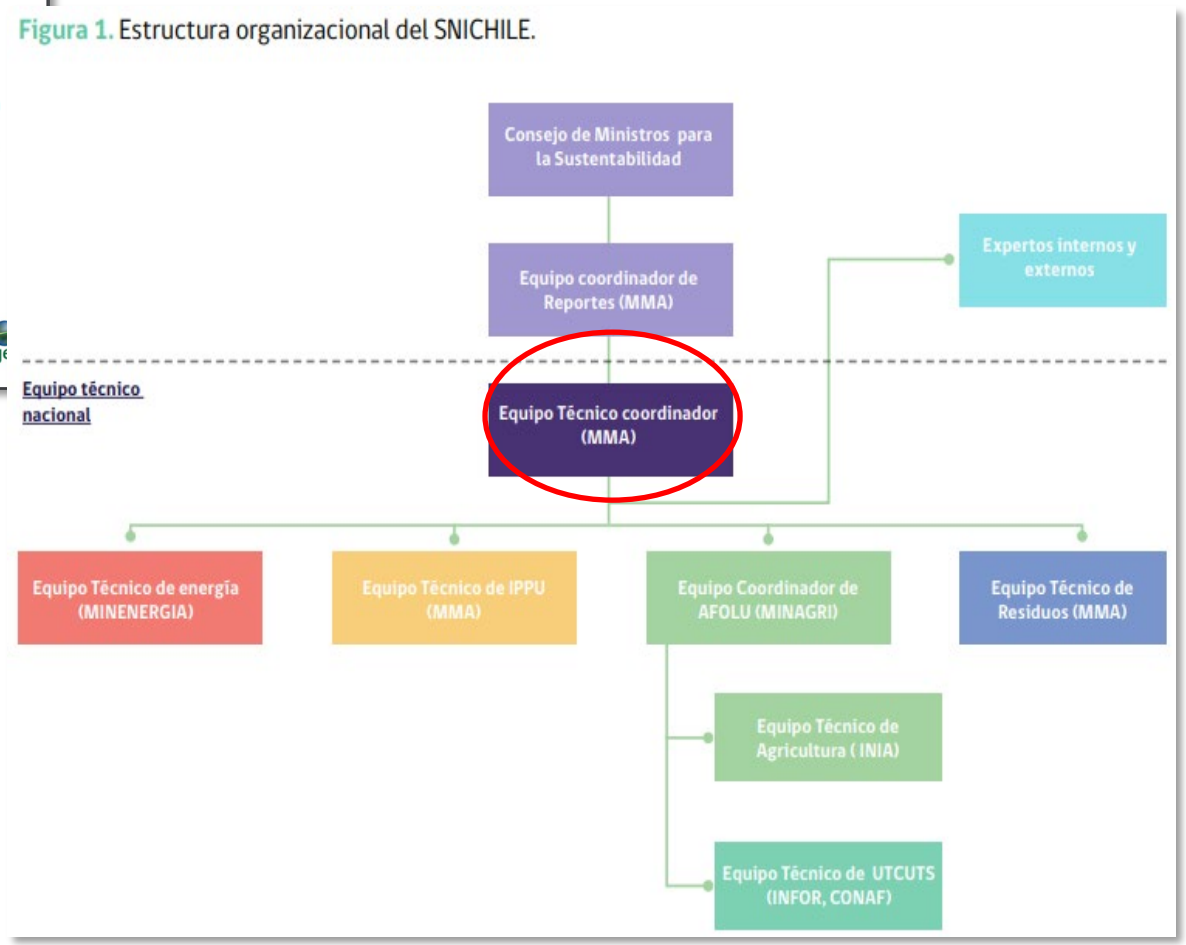
BUR = Biennial Update Report
NIR = National Inventory Report

Chile BUR4 2021

- Information about QA/QC presented in the BUR4 and the NIR4
- NIR4 contains a detailed table in an Annex with general and specific QA/QC procedures

- BUR4 https://unfccc.int/documents/267936
- NIR4 https://unfccc.int/documents/268469

Chile BUR4 2021



- Quality Control = “control de calidad”

- “Since 2012, the GHG Inventories Area of the Office of Climate Change of the Ministry of the Environment (OCC of the MMA) designed, implemented and has maintained the National System of Greenhouse Gas Inventories Greenhouse of Chile (SNICHILE), which contains the institutional, legal and procedural measures established for the biennial update of the INGEI of Chile, thus guaranteeing the sustainability of the preparation of GHG inventories in the country, the consistency of reported GHG flows and quality.”

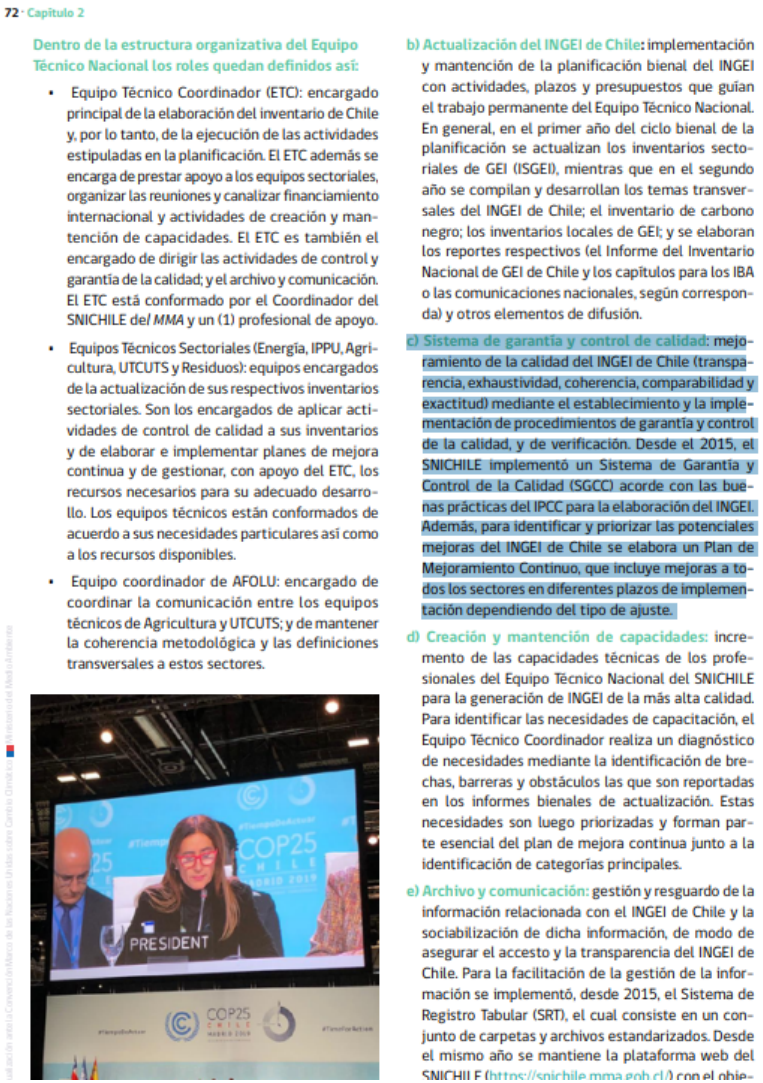
Chile BUR4 2021

SGCC Sistema de Garantía y Control de la Calidad - SGCC Quality Assurance and Control System

- “The main categories of the INGEI of Chile for 1990 and 2018 were identified according to the level and trend criteria (N, TD), applying Method 1, which considers emissions and removals of absolute form and Method 2, which also considers uncertainty. The main categories of the INGEI of Chile are also the subject of documentation more detailed and a more exhaustive quality control”

- “Sectoral Technical Teams (Energy, IPPU, Agriculture, LULUCF and Waste): teams in charge of updating their respective inventories sectoral. They are in charge of applying quality control activities to their inventories and to develop and implement improvement plans and to manage, with the support of the ETC, the resources necessary for its adequate development. The technical teams are made up of according to your particular needs as well as to the available resources.”

Chile BUR4 2021



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Dentro de la estructura organizativa del Equipo Técnico Nacional los roles quedan definidos así:

- Equipo Técnico Coordinador (ETC): encargado principal de la elaboración del inventario de Chile y, por lo tanto, de la ejecución de las actividades estipuladas en la planificación. El ETC además se encarga de prestar apoyo a los equipos sectoriales, organizar las reuniones y canalizar financiamiento internacional y actividades de creación y mantención de capacidades. El ETC es también el encargado de dirigir las actividades de control y garantía de la calidad; y el archivo y comunicación. El ETC está conformado por el Coordinador del SNICHILE del *MMA* y un (1) profesional de apoyo.
- Equipos Técnicos Sectoriales (Energía, IPPU, Agricultura, UTCUTS y Residuos): equipos encargados de la actualización de sus respectivos inventarios sectoriales. Son los encargados de aplicar actividades de control de calidad a sus inventarios y de elaborar e implementar planes de mejora continua y de gestionar, con apoyo del ETC, los recursos necesarios para su adecuado desarrollo. Los equipos técnicos están conformados de acuerdo a sus necesidades particulares así como a los recursos disponibles.
- Equipo coordinador de AFOLU: encargado de coordinar la comunicación entre los equipos técnicos de Agricultura y UTCUTS; y de mantener la coherencia metodológica y las definiciones transversales a estos sectores.

b) Actualización del INGEI de Chile: implementación y mantención de la planificación bienal del INGEI con actividades, plazos y presupuestos que guían el trabajo permanente del Equipo Técnico Nacional. En general, en el primer año del ciclo bienal de la planificación se actualizan los inventarios sectoriales de GEI (ISGEI), mientras que en el segundo año se compilan y desarrollan los temas transversales del INGEI de Chile; el inventario de carbono negro; los inventarios locales de GEI; y se elaboran los reportes respectivos (el Informe del Inventario Nacional de GEI de Chile y los capítulos para los IBA o las comunicaciones nacionales, según corresponda) y otros elementos de difusión.

c) Sistema de garantía y control de calidad: mejoramiento de la calidad del INGEI de Chile (transparencia, exhaustividad, coherencia, comparabilidad y exactitud) mediante el establecimiento y la implementación de procedimientos de garantía y control de la calidad, y de verificación. Desde el 2015, el SNICHILE implementó un Sistema de Garantía y Control de la Calidad (SGCC) acorde con las buenas prácticas del IPCC para la elaboración del INGEI. Además, para identificar y priorizar las potenciales mejoras del INGEI de Chile se elabora un Plan de Mejoramiento Continuo, que incluye mejoras a todos los sectores en diferentes plazos de implementación dependiendo del tipo de ajuste.

d) Creación y mantención de capacidades: incremento de las capacidades técnicas de los profesionales del Equipo Técnico Nacional del SNICHILE para la generación de INGEI de la más alta calidad. Para identificar las necesidades de capacitación, el Equipo Técnico Coordinador realiza un diagnóstico de necesidades mediante la identificación de brechas, barreras y obstáculos las que son reportadas en los informes bienales de actualización. Estas necesidades son luego priorizadas y forman parte esencial del plan de mejora continua junto a la identificación de categorías principales.

e) Archivo y comunicación: gestión y resguardo de la información relacionada con el INGEI de Chile y la sociabilización de dicha información, de modo de asegurar el accesto y la transparencia del INGEI de Chile. Para la facilitación de la gestión de la información se implementó, desde 2015, el Sistema de Registro Tabular (SRT), el cual consiste en un conjunto de carpetas y archivos estandarizados. Desde el mismo año se mantiene la plataforma web del SNICHILE (https://snichile.mma.gob.cl/) con el obje-

- c) Quality assurance and control system: improvement of the quality of the INGEI of Chile (transparency, exhaustiveness, coherence, comparability and accuracy) by establishing and implementing assurance and control procedures of quality, and verification. Since 2015, the SNICHILE implemented a Guarantee System and Quality Control (SGCC) in accordance with the good practices of the IPCC for the preparation of the INGEI.
- In addition, to identify and prioritize potential improvements of the INGEI of Chile, a Plan of Continuous Improvement, which includes improvements to all sectors in different implementation periods depending on the type of adjustment.

Chile NIR4 2021

ANEXO 11.01. Actividades de control de calidad del SNICHILE

ET-Coordinador: lista de verificación general de la garantía y control de la calidad

Actividades
Aclarar y comunicar las responsabilidades de GCC a los miembros del equipo de inventario.
Desarrollar y hacer listas de verificación de GCC adecuadas a las funciones en el equipo de inventario.
Distribuir la lista de verificación de GCC a los miembros apropiados del equipo de inventario y establecer la fecha límite para su finalización.
Asegurar el cumplimiento oportuno y exacto de las listas de verificación de GCC y las actividades relacionadas mediante la verificación con los miembros del equipo.
Recolectar las listas de verificación y formularios de GCC completos.
Revisar las listas de verificación y formularios de GCC completos para corroborar su exhaustividad y exactitud.
Entregar documentación de las actividades de GCC para el líder de inventario y el coordinador de archivo.
Coordinar revisiones externas del inventario y asegurar que los comentarios sean incorporados al mismo. Los pasos para coordinar con los revisores externos incluyen:
(1) Identificar los revisores externos (p. ej., a través de los líderes de cada categoría).
(2) Establecer una programación de revisión.
(3) Establecer el formato de revisión (p. ej., soporte digital ya sea en Word o Excel).
(4) Ponerse en contacto con los revisores externos para informarles sobre la programación y las expectativas.
(5) Distribuir el borrador del inventario para su revisión.
(6) Recoger y recopilar los comentarios de revisión.
(7) Entregar los comentarios obtenidos al coordinador de archivo/documento e inventario.
(8) Actualizar el inventario, con base en los comentarios según sea el caso.

Fuente: Equipo Técnico Coordinador del MMA con base en planillas de EPA

ET-Coordinador: revisiones transversales para la visión general de la calidad del inventario

Actividades
Cálculos de emisión de las categorías de emisión/absorción de GEI
Identificar los parámetros que son comunes en las categorías (p. ej., los factores de conversión, los coeficientes de contenido de carbono, etc.) y verificar la coherencia.

- ET-Coordinator: Cross-sectional reviews for inventory quality overview
- Items checked include
  - Text written
  - Table and figures
  - Equations
  - References
  - General formatting

Chile NIR4 2021

ET-Sectoriales: lista de actividades generales de control de la calidad (Nivel 1)

Actividad de CC	Procedimientos
Listas de Verificación de Manejo, Entrada y Recopilación de Datos	
Desarrollar y hacer listas de verificación de GCCC adecuadas a las funciones en el equipo de inventario.	Realizar verificaciones cruzadas de las descripciones de datos de actividad y factores de emisión con información sobre las categorías y asegurar que estos estén debidamente registrados y archivados.
Verificar si existen errores de transcripción en los datos de entrada y la referencia.	Confirmar que las referencias de datos bibliográficos estén debidamente citadas en la documentación interna (informe de la plantilla de MDD).
	Efectuar verificaciones en muestras de datos de entrada de cada categoría (ya sean medidas o parámetros utilizados en las estimaciones) para detectar posibles errores de transcripción. Chequeo de la importación de datos desde los BNE a la planilla anual consolidada y luego desde la planilla al formato requerido por el software del IPCC.
	Revisión detallada de cada archivo anual del BNE, con el fin de contar con las especificaciones correctas de cada información.
	Generación de una planilla consolidada de datos de actividad que traduce mediante vínculos automatizados los valores del BNE al formato requerido por el software IPCC para la entrada de datos. Evitando la transcripción manual de datos y posibles errores asociados.
	Utilizar datos electrónicos siempre que sea posible para minimizar los errores de transcripción.
	Comprobar que las funciones de las hojas de cálculo se utilicen para minimizar los errores de entrada/usuario:
	o Evitar la programación de factores como fórmulas.
	o Crear tablas de referencia automáticas para los valores comunes que se utilizan en los cálculos.
	o Usar la protección de celdas para que los datos fijos no sean modificados de manera accidental.

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- ET-Sectoral: list of general quality control activities (Level 1)

Chile NIR4 2021

ET-Sectorial: lista de procedimientos de control de la calidad de categoría específica (Nivel 2)

Actividad de CC	Procedimientos
Evaluar la pertinencia de los factores por defecto del IPCC.	Evaluar si las condiciones nacionales son similares a las utilizadas para desarrollar los factores por defecto del IPCC.
	Comparar los factores por defecto con los factores a nivel de planta o de sitio.
	Considerar las opciones para obtener factores específicos del país.
	Documentar los resultados de esta evaluación.
Revisar los factores específicos del país.	Controlar la calidad de los datos utilizados para desarrollar el factor específico del país.
	Evaluar si los estudios secundarios utilizados para desarrollar los factores específicos del país utilizaron (como mínimo) las actividades de CC de Nivel 1.
	Comparar los factores específicos del país con los valores por defecto del IPCC; documentar alguna discrepancia significativa.
	Comparar los factores específicos del país con los factores a nivel de planta o de sitio.
	Comparar los factores de los otros países (utilizando la Base de datos de factores de emisión del IPCC).
	Documentar los resultados de esta evaluación.
	Documentar los factores de emisiones país específico en la Base de datos de factores de emisión del IPCC (ver archivo específico para ello)
Revisar las mediciones.	Determinar si los estándares nacionales o internacionales (p. ej., ISO) fueron utilizados en las mediciones.
	Asegurar que el equipo de medición comprenda y se mantenga apropiadamente.
	Comparar las mediciones directas con las estimaciones utilizando un factor; documentar alguna discrepancia significativa.
Evaluar la coherencia de la serie temporal.	Revisar cambios significativos (> 10%) en las estimaciones anuales para categorías y subcategorías.
	Comparar estimaciones realizadas con enfoques "top-down" y "bottom-up" para verificar que sean de similares órdenes de magnitudes.
	Realizar cálculos de referencia que utilizan las relaciones estequiométricas y la conservación de la masa y tierra.
Revisar los datos de actividad a nivel nacional.	Determinar el nivel de CC obtenido por la agencia de recolección de datos. Si no fuera apropiado, considerar las fuentes de datos alternativas, tales como los conjuntos de datos internacionales o factores por defecto del IPCC. Ajustar la incertidumbre relevante de manera apropiada.
	Evaluar la coherencia de la serie temporal.
	Comparar los datos de actividad de múltiples referencias si es posible.
[illegible]	Determinar si los estándares nacionales o internacionales (p. ej., ISO) fueron utilizados en las estimaciones.
	Comparar los datos específicos de sitio en conjunto con (p. ej., producción) los datos/estadísticas

- ET-Sectoral: list of category-specific quality control procedures (Level 2)
- Detailed checklist for the sector inventory report

UK

- NIR 2022 https://unfccc.int/documents/461922

UK NIR 2022

978-0-9933975-8-5

UK Greenhouse Gas Inventory, 1990 to 2020

Annual Report for Submission under the Framework Convention on Climate Change

Main authors Brown P, Cardenas L, Choudrie S, Del Vento S, Karagianni E, MacCarthy J, Mullen P, Passant N, Richmond B, Thistlethwaite G, Thomson A, Wakeling D

With contributions from Anthony S, Blannin L, Broomfield M, Buys G, Carnell E, Clilverd H, Dragosits U, Gibbs, M, Gilhespy S, Glendining M, Gluckman R, Gorji S, Henshall P, Hobson M, Lambert N, Levy P, Malcolm H, Manning A, Matthews R, Milne A, Misra A, Misselbrook T, Murrells T, Nickerson R, Pang Y, Pearson B, Quinn P, Raine B, Raoult J, Richardson J, Sandars D, Skirvin D, Stewart R, Thomas H, Tomlinson S, Walker C, Watterson J, Williams A, Wong J

April 2022

This work forms part of the Science Research Programme of the Department for Business, Energy & Industrial Strategy.

- Cropland Management, Cropland remaining Cropland, CO_2;
- Grazing Land Management, Grassland remaining Grassland, CO_2;
- Grazing Land Management, Grassland remaining Grassland, CH_4;
- Wetland Drainage and Rewetting, Wetland remaining Wetland, CH_4.

1.6 QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC)

This section presents the QA/QC system for the UK greenhouse gas inventory (GHGI), including the approaches used for verification and treatment of confidentiality issues. QA/QC activities comprise:

- ***Quality Control*** (e.g. raw data checks, calculation checks, output checks) to minimise the risk of errors within the available resources to deliver the inventory;
- ***Quality Assurance*** (e.g. peer reviews, bilateral reviews, expert reviews) whereby independent experts periodically review all or part of the inventory to identify potential areas for improvement;
- ***Verification*** where alternate independent datasets are available to compare against inventory data and trends.

The current system complies with the Tier 1 procedures outlined in the IPCC Good Practice Guidance (IPCC, 2006) and also includes a range of bespoke sector specific QA/QC activities that comply with Tier 2. Ricardo Energy & Environment, the Inventory Agency, is also fully accredited to ISO 9001:2015 and ISO 14001: 2015 (see **Box 1.1**). This accreditation provides additional institutional standards which the Inventory Agency is required to apply to all projects and ensures that the wider company conforms to good practice in project management and quality assurance.

1.6.1 Description of the current QA/QC system

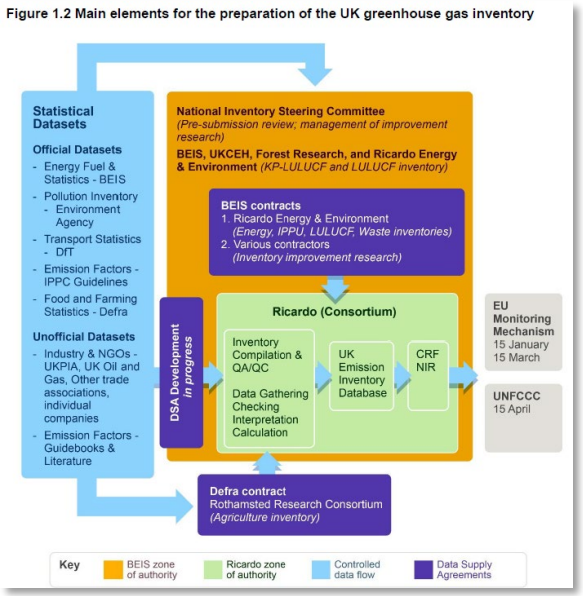
The NAEI and the UK Greenhouse Gas Inventory are compiled and maintained together by Ricardo Energy & Environment (the Inventory Agency), on behalf of the UK Department for Business, Energy & Industrial Strategy (BEIS) and the Department for Environment, Food and Rural Affairs (Defra). Ricardo Energy & Environment prepares the GHG submissions to the EC under the MMR and to the UNFCCC. The data compilation for some source sectors of the UK inventory are performed by other contractors:

- Rothamsted Research manages the compilation of emission estimates for the agriculture sector under contract to Defra, working with a team of contractors that are agriculture sector experts from several other organisations: ADAS, Cranfield University, the Centre for Ecology and Hydrology (UKCEH) and Scotland's Rural College (SRUC).
- The Centre for Ecology and Hydrology (UKCEH) and Forest Research (FR) together compile the Land Use, Land-Use Change and Forestry (LULUCF) sector, both under sub-contract to Ricardo Energy & Environment.

Many of the statistical datasets received by Ricardo Energy & Environment, UKCEH, FR and Rothamsted Research for the UK GHGI compilation come from data provider organisations that are UK government departments, agencies, research establishments or consultants working on behalf of the UK Government or for trade associations. Several of these data provider organisations (e.g. BEIS, the Department for Transport, Defra, the Office of National

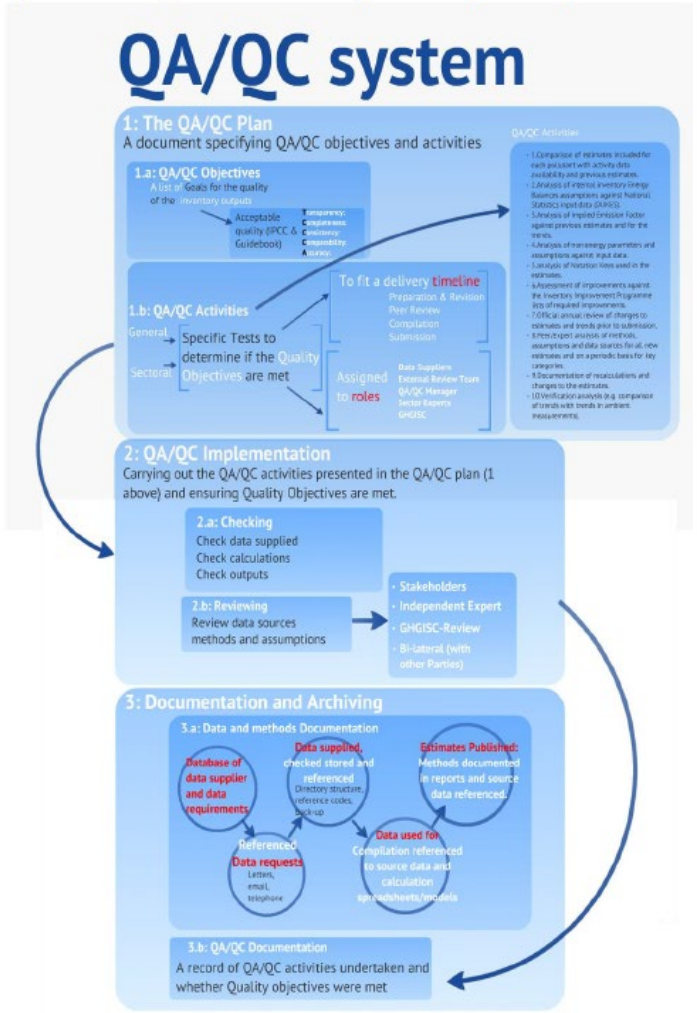
- There is a detailed section on QA/QC, with some of the procedures "visualised"
- You are welcome to use some of the ideas and approaches for your own inventory – you might wish to reference us!

Figure 1.2 Main elements for the preparation of the UK greenhouse gas inventory



UK NIR 2022

Figure 1.3 QA/QC system used within UK greenhouse gas inventory



5 key elements

1. Objectives
2. Activities
3. Implementation
4. Documentation
5. Archiving

1.6.1.2 Scope of the QA/QC plan

The scope of the QA/QC plan includes:

- 1. Calculation of greenhouse gas estimates and reporting to UNFCCC and MMR (including emissions and removals from all sources and gases)
- 2. Calculation of air pollutant estimates and reporting to UNECE (including emissions from all sources and pollutants)
- 3. Calculation of estimates and reporting to UK National Statistics
- 4. Identification and phased implementation of incremental improvements to the QA/QC system.

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- The UK inventory QA/QC system encompasses a wide range of activities to cover:
  - **inventory planning tasks**, including: review of historic data and methods, identification of improvement priorities, data and method selection, inventory team training and development;
  - **inventory compilation and reporting tasks**, including: management and documentation of data flows from raw data through calculation of emission estimates to reporting, input data requests/acquisition, management of compilation processes and quality checking systems, documentation of data, methods and assumptions, assessment of key source categories and uncertainties, reporting of inventory outputs;
  - **inventory checking task**s, including: raw data checks, inventory model / calculation checks, source-specific and cross-cutting output checks, checking reasons for changes compared to previous inventory estimates, emission trend checks, emission factor checks; and,
  - **inventory QA review tasks**, including: pre-submission reviews, post-submission reviews, peer reviews, bilateral reviews, expert reviews.

UK NIR 2022

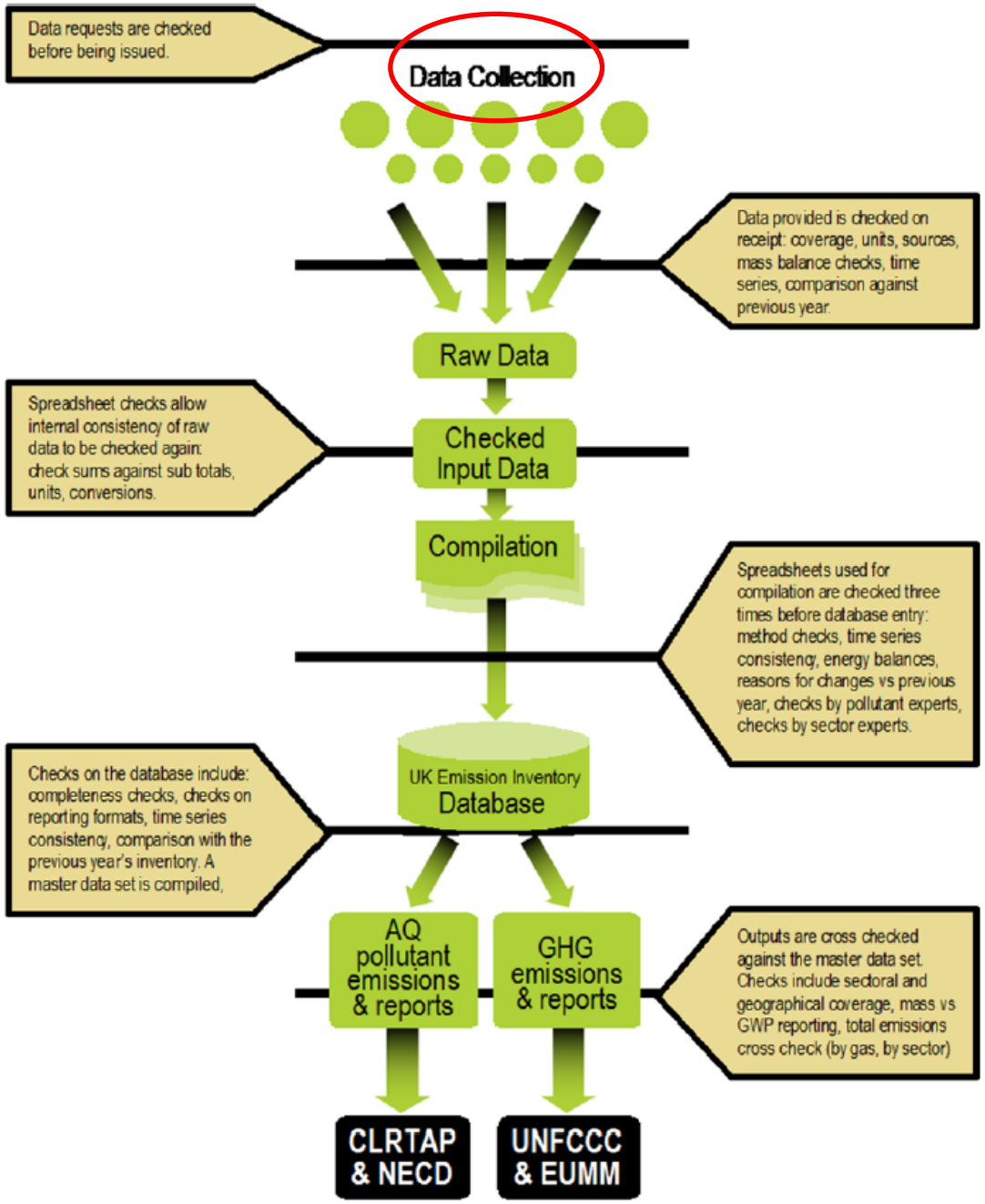
Roles and Responsibilities

- The QA/QC plan sets out specific responsibilities for the different QA (review) and QC (data controls, checking) activities and to different roles within the inventory compilation and reporting team. These are embedded within compilation and processing spreadsheets and databases. Training and project management communication across the Inventory Agency ensures that these responsibilities are clear, with specific tasks and checks signed-off at appropriate stages throughout the inventory process.

- The following responsibilities are outlined in the QA/QC plan:

    - **QA/QC Manager ("Senior Analyst")**: Coordinates all QA/QC activities
    - **Knowledge Leaders**: Lead the technical development and implementation of the NAEI programme, supporting the QA manager
    - **Project Manager**: Lead all key management activities including management of the project finances, commercial issues, liaison with BEIS
    - **Task Managers/Sector Experts**: Task managers (or sector experts) are responsible for the maintenance of task documentation (e.g. compiler manual, scope documents, quality checking records and correspondence) and task QA Plan specific review and checking activities and report to the QA/QC Manager. Sector Experts also collaborate with data suppliers and other key stakeholders to review data quality (input data and outputs), perform quality checks on supplied information, assess and report on uncertainties associated with NAEI outputs. Identify improvement requirements for their tasks/sectors and promote/implement cross cutting QA/QC improvements by sharing best practice and engaging in team communication activities.
    - **External Review Experts:** Provide expert/peer review of emissions and projections for specific sectors, identify key findings and inventory improvement recommendations, and report to the QA/QC Manager.

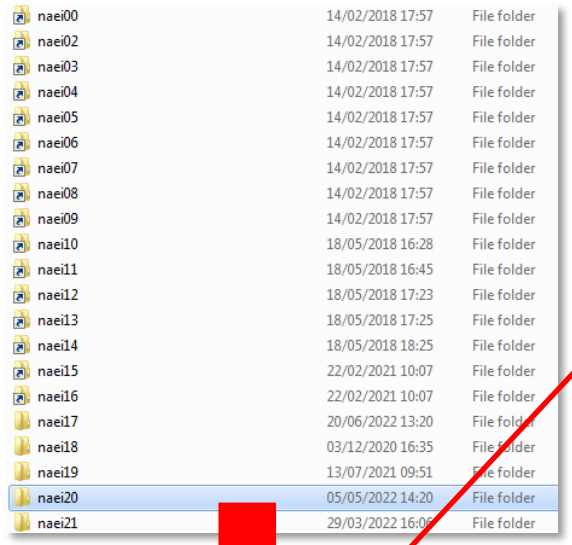
Figure 1.4 Quality Checks throughout the UK inventory compilation process

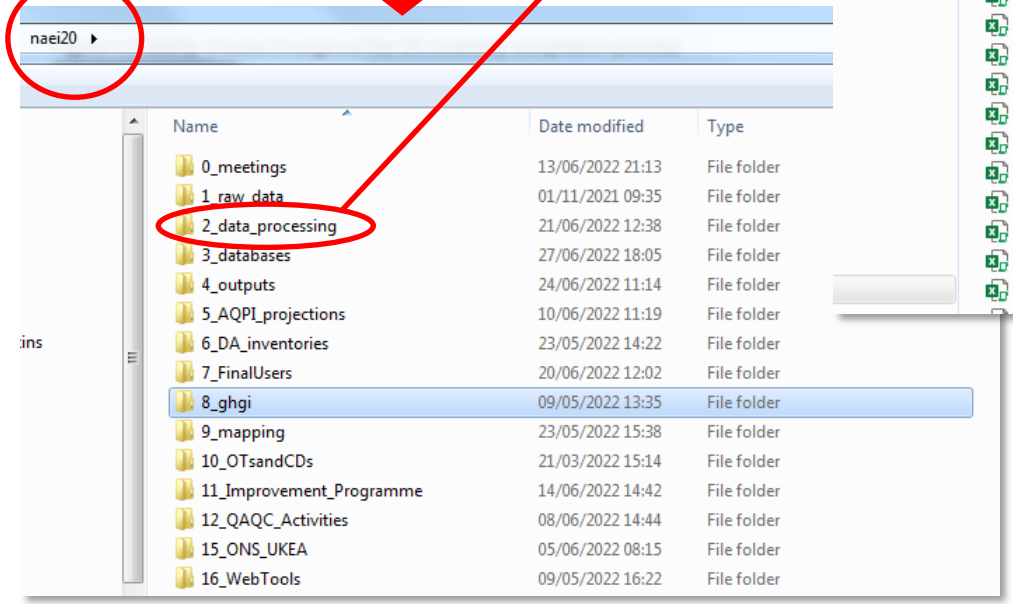


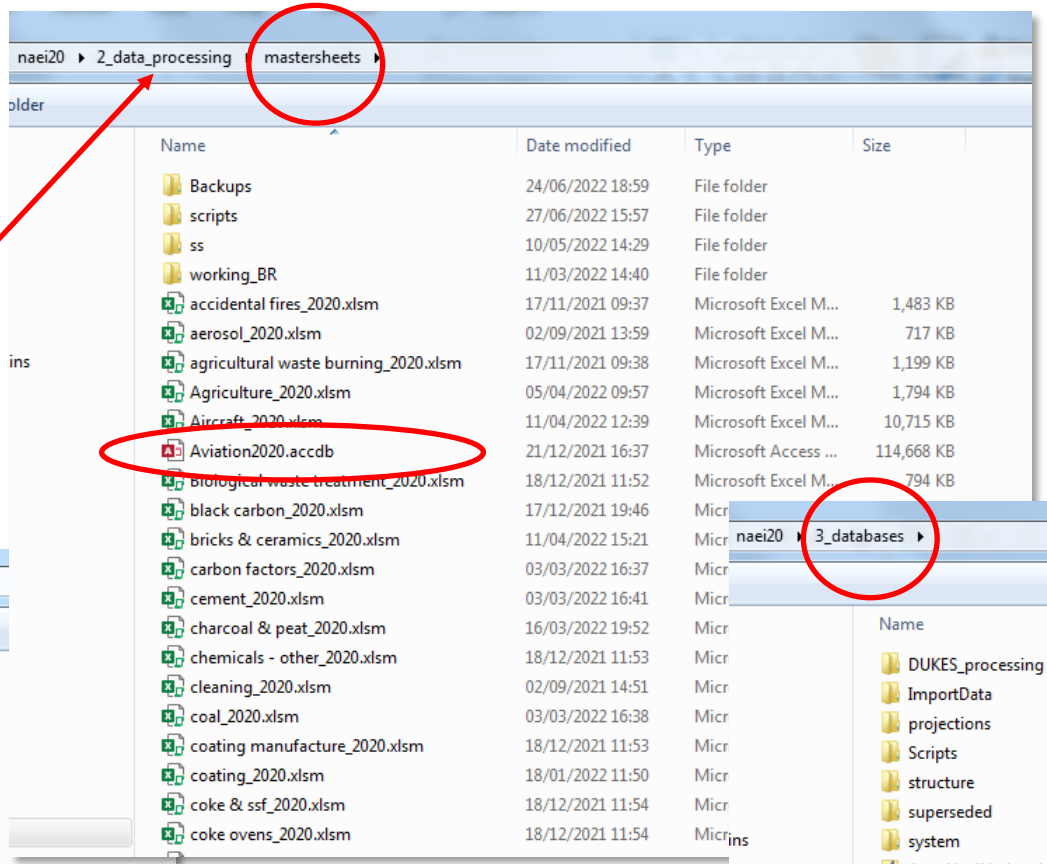
- **"A database of contacts** containing uniquely referenced data on suppliers, data users, detailed data requirement specifications (including requirements for supplier QA/QC and uncertainty information) and data supplied to and delivered from the inventory.

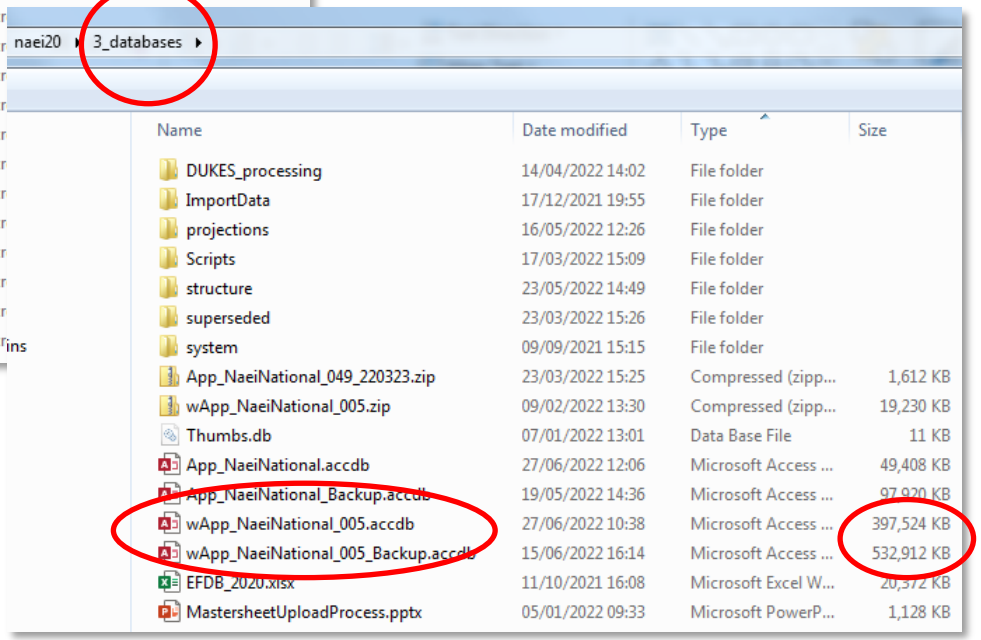
- This database tracks all data sources and suppliers used for the estimation of emissions/removals with unique references that are used to tag datasets through the inventory compilation process. The contacts database also tracks all outputs from the GHGI including formal submissions and data supplied in response to informal and ad-hoc data requests."

UK NIR 2022 – our “filing” system

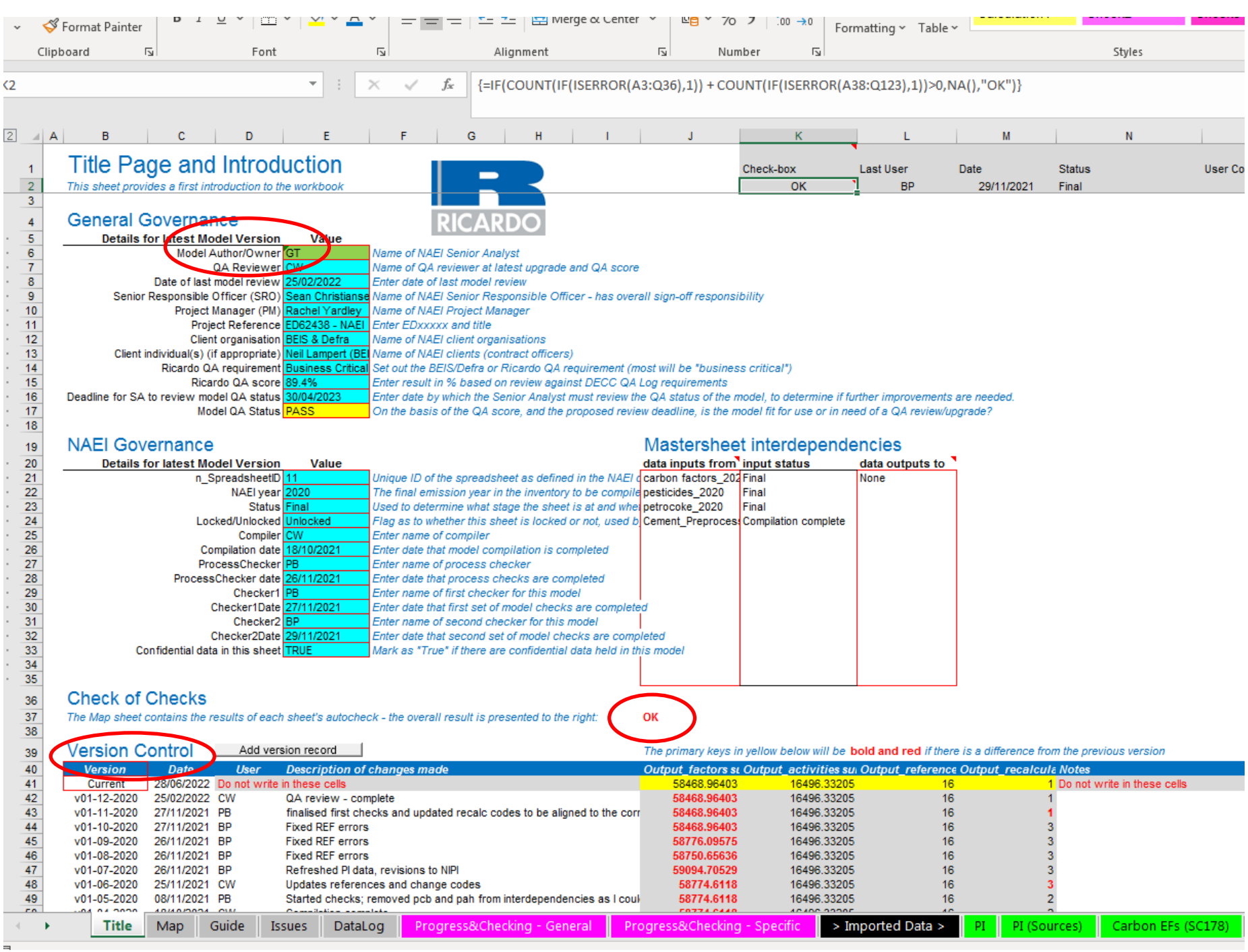








- One folder for each new year. Data from previous year “locked and archived”
- Hierarchy of Folders and Files
- Using combination of Mastersheets and Databases



Format Painter | Clipboard | Font | Alignment | Merge & Center | Number | Formatting | Table | Styles

=IF(COUNT(IF(ISERROR(A3:Q36),1)) + COUNT(IF(ISERROR(A38:Q123),1))>0,NA(),"OK")}

Title Page and Introduction

This sheet provides a first introduction to the workbook

RICARDO

Check-box	Last User	Date	Status	User Co
OK	BP	29/11/2021	Final	

General Governance

Details for latest Model Version	Value	
Model Author/Owner	GT	*Name of NAEI Senior Analyst*
QA Reviewer	CW	*Name of QA reviewer at latest upgrade and QA score*
Date of last model review	25/02/2022	*Enter date of last model review*
Senior Responsible Officer (SRO)	Sean Christianse	*Name of NAEI Senior Responsible Officer - has overall sign-off responsibility*
Project Manager (PM)	Rachel Yardley	*Name of NAEI Project Manager*
Project Reference	ED62438 - NAEI	*Enter EDxxxxx and title*
Client organisation	BEIS & Defra	*Name of NAEI client organisations*
Client individual(s) (if appropriate)	Neil Lampert (BEI	*Name of NAEI clients (contract officers)*
Ricardo QA requirement	Business Critical	*Set out the BEIS/Defra or Ricardo QA requirement (most will be "business critical")*
Ricardo QA score	89.4%	*Enter result in % based on review against DECC QA Log requirements*
Deadline for SA to review model QA status	30/04/2023	*Enter date by which the Senior Analyst must review the QA status of the model, to determine if further improvements are needed.*
Model QA Status	PASS	*On the basis of the QA score, and the proposed review deadline, is the model fit for use or in need of a QA review/upgrade?*

NAEI Governance

Details for latest Model Version	Value	
n_SpreadsheetID	11	*Unique ID of the spreadsheet as defined in the NAEI*
NAEI year	2020	*The final emission year in the inventory to be compile*
Status	Final	*Used to determine what stage the sheet is at and whe*
Locked/Unlocked	Unlocked	*Flag as to whether this sheet is locked or not, used b*
Compiler	CW	*Enter name of compiler*
Compilation date	18/10/2021	*Enter date that model compilation is completed*
ProcessChecker	PB	*Enter name of process checker*
ProcessChecker date	26/11/2021	*Enter date that process checks are completed*
Checker1	PB	*Enter name of first checker for this model*
Checker1Date	27/11/2021	*Enter date that first set of model checks are completed*
Checker2	BP	*Enter name of second checker for this model*
Checker2Date	29/11/2021	*Enter date that second set of model checks are completed*
Confidential data in this sheet	TRUE	*Mark as "True" if there are confidential data held in this model*

Mastersheet interdependencies

data inputs from	input status	data outputs to
carbon factors_202	Final	None
pesticides_2020	Final	
petrocoke_2020	Final	
Cement_Preproces	Compilation complete	

Check of Checks

The Map sheet contains the results of each sheet's autocheck - the overall result is presented to the right: OK

Version Control

Add version record

The primary keys in yellow below will be **bold and red** *if there is a difference from the previous version*

Version	Date	User	Description of changes made	Output_factors su	Output_activities su	Output_reference	Output_recalcula	Notes
Current	28/06/2022	Do not write in these cells		58468.96403	16496.33205	16	1	Do not write in these cells
v01-12-2020	25/02/2022	CW	QA review - complete	58468.96403	16496.33205	16	1	
v01-11-2020	27/11/2021	PB	finalised first checks and updated recalc codes to be aligned to the corr	58468.96403	16496.33205	16	1	
v01-10-2020	27/11/2021	BP	Fixed REF errors	58468.96403	16496.33205	16	3	
v01-09-2020	26/11/2021	BP	Fixed REF errors	58776.09575	16496.33205	16	3	
v01-08-2020	26/11/2021	BP	Fixed REF errors	58750.65636	16496.33205	16	3	
v01-07-2020	26/11/2021	BP	Refreshed PI data, revisions to NIPI	59094.70529	16496.33205	16	3	
v01-06-2020	25/11/2021	CW	Updates references and change codes	58774.6118	16496.33205	16	3	
v01-05-2020	08/11/2021	PB	Started checks; removed pcb and pah from interdependencies as I coul	58774.6118	16496.33205	16	2	

Title | Map | Guide | Issues | DataLog | Progress&Checking - General | Progress&Checking - Specific | > Imported Data > | PI | PI (Sources) | Carbon EFs (SC178)

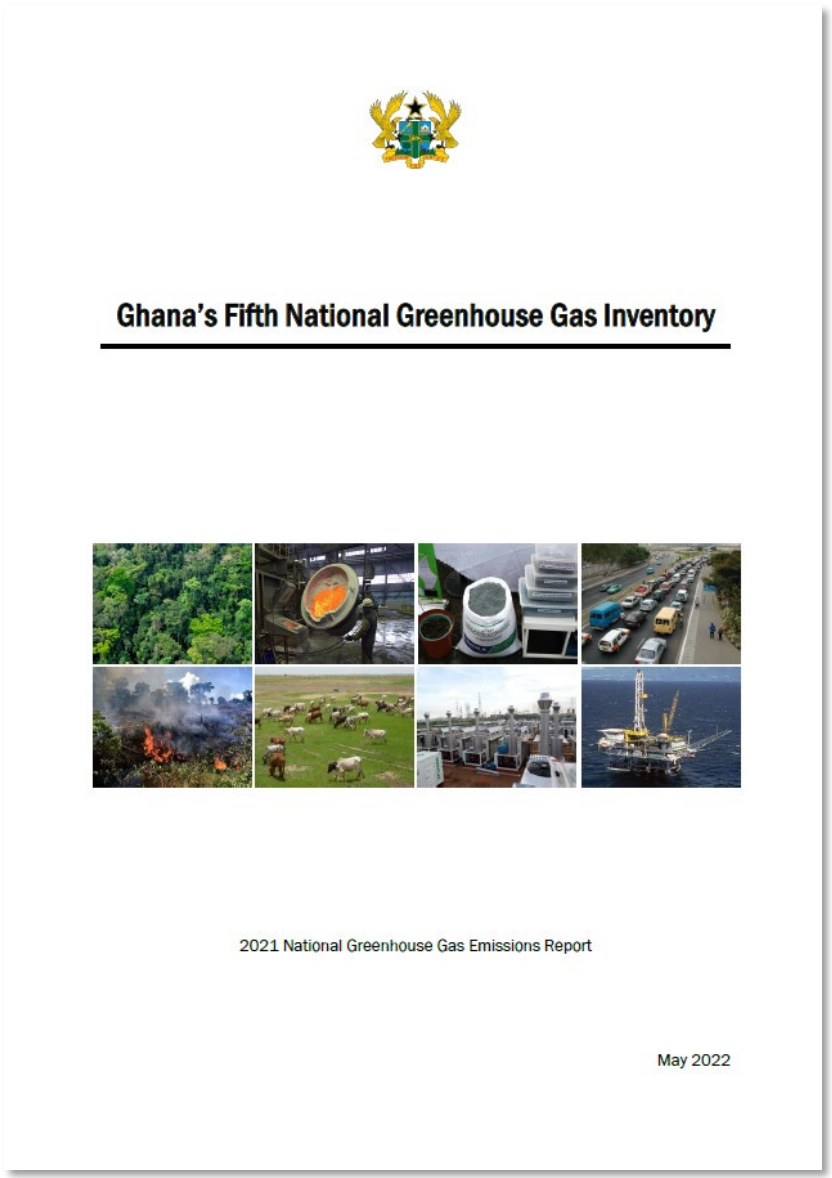
- Every model has an owner
- <**Title**> sheet – with QA/QC details
- The spreadsheet is check twice – Checker 1 and Checker 2
- Check of Checks – one check summarising all other internal checks
- Version Control system to track model changes

- If there is time – we could look at a Master sheet in more detail…

Ghana NIR3 2022

- NIR3 https://unfccc.int/documents/476883

Ghana NIR3 2022



Ghana's Fifth National Greenhouse Gas Inventory

2021 National Greenhouse Gas Emissions Report

May 2022

Table of content

- 10 page section on QA/QC

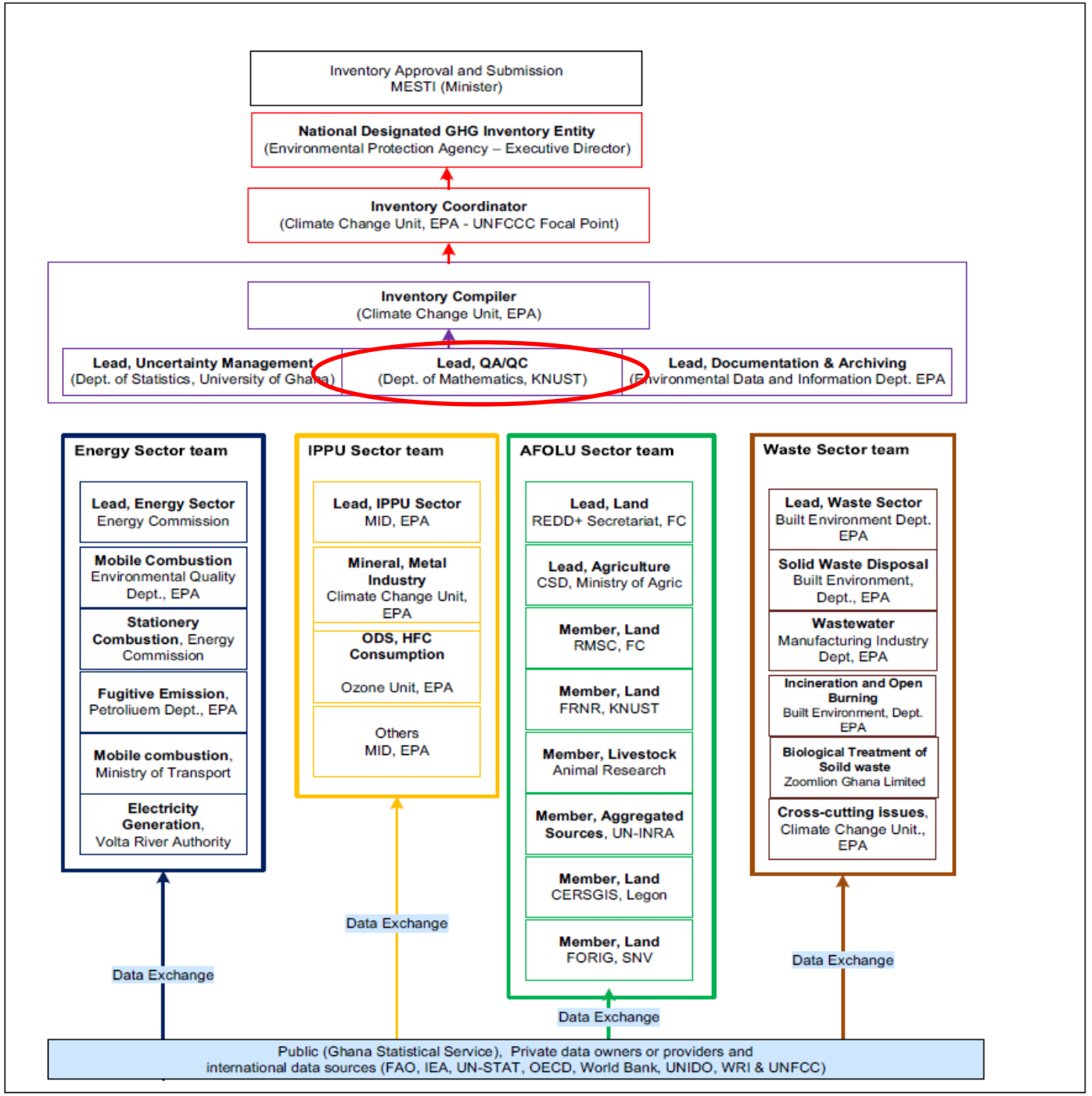


Figure 1: Institutional arrangements for the preparation of national GHG inventory[6]

- A person is nominated to be in overall charge of QA/QC of the inventory – QA/QC "Lead"

Ghana NIR3 2022

1.9.1 Summary of QA/QC procedures

The QA/QC is an integral part of the national system, and the practices are broadly consistent with the good practices in the 2006 IPCC Guidelines. The documentation and the implementation of the QA/QC procedures are reported based on the US template EPA QA/QC measures. Inventory teams used the template to document the QA/QC activities in the inventory. The Forestry Commission has also prepared and adopted 12 Standard Operating Procedures (SOPs) to guide the land category's inventory activities. The SOPs were useful in the planning and designing of the data collection techniques for activity data and emission factors (biomass inventory)[17]. Despite some progress in the improvements of the QA/QC, there were still challenges in the areas relating to:

- insufficient data handling protocols in the treatment of incompatible data formats,
- secondary data without metadata,
- detection of data errors and outliers, and
- data restriction and confidential data.
- non-standardised application of experts' judgement,
- the use of tier 1 or default emission factors for key categories and
- the application of generic approaches to address sector-specific problems.

Ghana has also adopted a country-specific QA/QC plan and GHG inventory manual to address the challenges. The GHG plan clearly articulates the inventory steps, institutional responsibilities and timelines. The plan would also be used to inform the training of existing experts. The QA/QC manual[18] seeks to streamline and formalise existing QA/QC procedures and communicate with a clear set of objectives to the inventory team in line with the 2006 IPCC Guidelines. These procedures ensure that the inventory system and its estimates are more transparent, credible and defensible.

1.9.2 QA/QC institutional roles and responsibilities

According to the QA/QC plan, the EPA was tasked to play a facilitative role in implementing

1.9.3 Tier 1 QC protocols

In the inventory, Ghana implemented tier 1 QC procedures which covered checks, documentation and archiving practices the inventory compilers routinely used throughout the inventory cycle. The list of the QC procedure followed in the inventory is in Table 11.

Table 11: List of QC procedures followed in the inventory

QC Tasks	Details of QC Tasks	Responsibility
Internal consistency	Ensured that the total GHG emissions equal the sum of the individual emissions from the sectors and categories.	EPA
	Confirmed the total GHG emissions equal the sum of the emissions by gas.	EPA
	Ensured that parameters used in multiple categories (e.g., livestock population) were consistent across categories.	EPA
	Confirmed that the emissions data is reported consistently with the calculation tables in the Non-Annex 1 National Communications Reporting Guidelines.	EPA
	Confirmed that the selection and application of the estimation methods were consistent with the 2006 IPCC Guidelines.	EPA
Documentation	Created back-ups of all documentation in hard and soft copies and uploaded files to the central storage facility online.	All sectors Webmaster
	Moved all files and documentation to an "online climate change data hub".	Webmaster
Checks	Checked that assumptions and criteria for the selection of activity data and emission factors are documented	EPA
	Check that parameters and emission/removal units are correctly recorded, and appropriate conversion factors are used.	EPA
	Checked for transcription errors in data input and reference.	EPA
	Checked methodological and data changes that led to recalculations.	EPA
	Checked that emissions/removals are calculated correctly.	EPA
	Compared current inventory estimates to previous estimates, if available. If significant changes or departures from expected trends are significant, re-check estimates and explain any difference. Significant changes in emissions or removals from previous years	EPA

- Ghana have created a separate QA/QC manual
- Roles and responsibilities are defined
- Good list of Tier 1 checks – you could use exactly these for your inventory

Ghana NIR3 2022

Table 14: Issues tracking table for the comments from the QA/QC Workshop in 2018

Review	Sector	Main issues	Description of issue and critical recommendations	Timelines	Actions taken	Status
Technical Analysis	Cross-cutting	Use of notation keys	Include information on other areas such as the control of consistent values, the notation key "NE" (not estimated) and the values of non-CO_2 gas emissions in units of Gg and CO_2e.	BUR2/NIR4	QA/QC has been improved to improve the checking of the use of notation keys.	Resolved in NIR4
		Use of notation keys	The transparency of the information reported could be enhanced if, following decision 17/CP.8, Annex, paragraph 22, notation keys were used where numerical data are not provided.	BUR2/NIR4	All "0" used to denote not applicable has been changed to dash.	Resolved in NIR5
		Uncertainty analysis	Provides a category-specific uncertainty assessment	BUR2/NIR4	The uncertainty assessment for the Land representation system has been provided. Uncertainty in other sectors has not been done due to the lack of requisite meta-data. Due to the lack of requisite data, there was no clear basis to assign a default range of uncertainty in the IPCC software.	Unresolved as in NIR5
		Key category analysis (KCA	Make the threshold for KCA consistent with that of the 2006 IPCC Guidelines (95%).	BUR2/NIR4	The threshold for the KCA calculation has been changed to 95%.	Resolved in NIR5
		Consistency with IPCC	Report estimates of emissions/removals on a gas-by-gas basis and in mass units, as suggested in the	BUR2/NIR4	Emissions/removal has been reported on a gas-by-gas	Resolved in NIR4

- Issue tracking system implemented to track problems identified during QA/QC and remedial actions taken

Suggestions for designing and implementing a QA/QC system

- Make sure QC is “embedded” in all activities – and it not just applied at the end of the inventory compilation process. QA can follow at key milestones in the compilation cycle
- Appointment a person to be in charge the QA/QC overall process
- Start with a simple system – “Level 1” – then refine and improve
- Reserve and protect some time and resource for QA/QC
- Create a simple set of general QC checks
- Tailor some QC activities to the specific needs of each category and sector
- Apply QC to the input activity data – even if the data are “national statistics”
- Visualise the process – draw simple organisation charts showing who “owns” the QA/QC tasks, and, how the process works

- Make a plan to develop and implement QA/QC system – “Get a GANTT” (chart)!