Methods and Data Documentation

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

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Ricardo Energy & Environment, on behalf of the U.S. Environmental Protection Agency

October 8th, 2024

Housekeeping

Chat and Q&A

- Please feel free to introduce yourselves in the Chat channel - **Name, Country, Organization and Role**
- Please place questions in the chat channel or wait to ask them in the Q&A

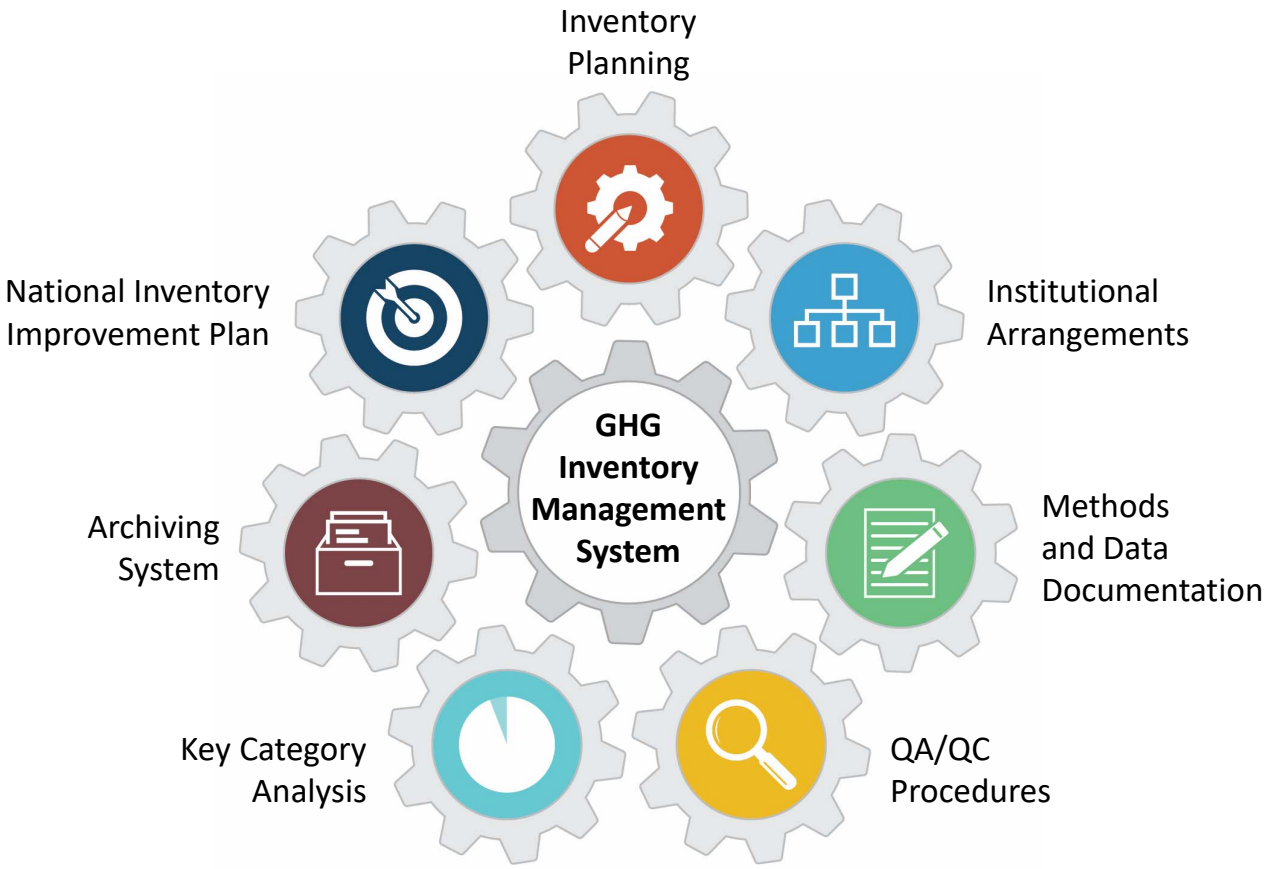
Recording

- Today's session will be recorded, so you can view it again later

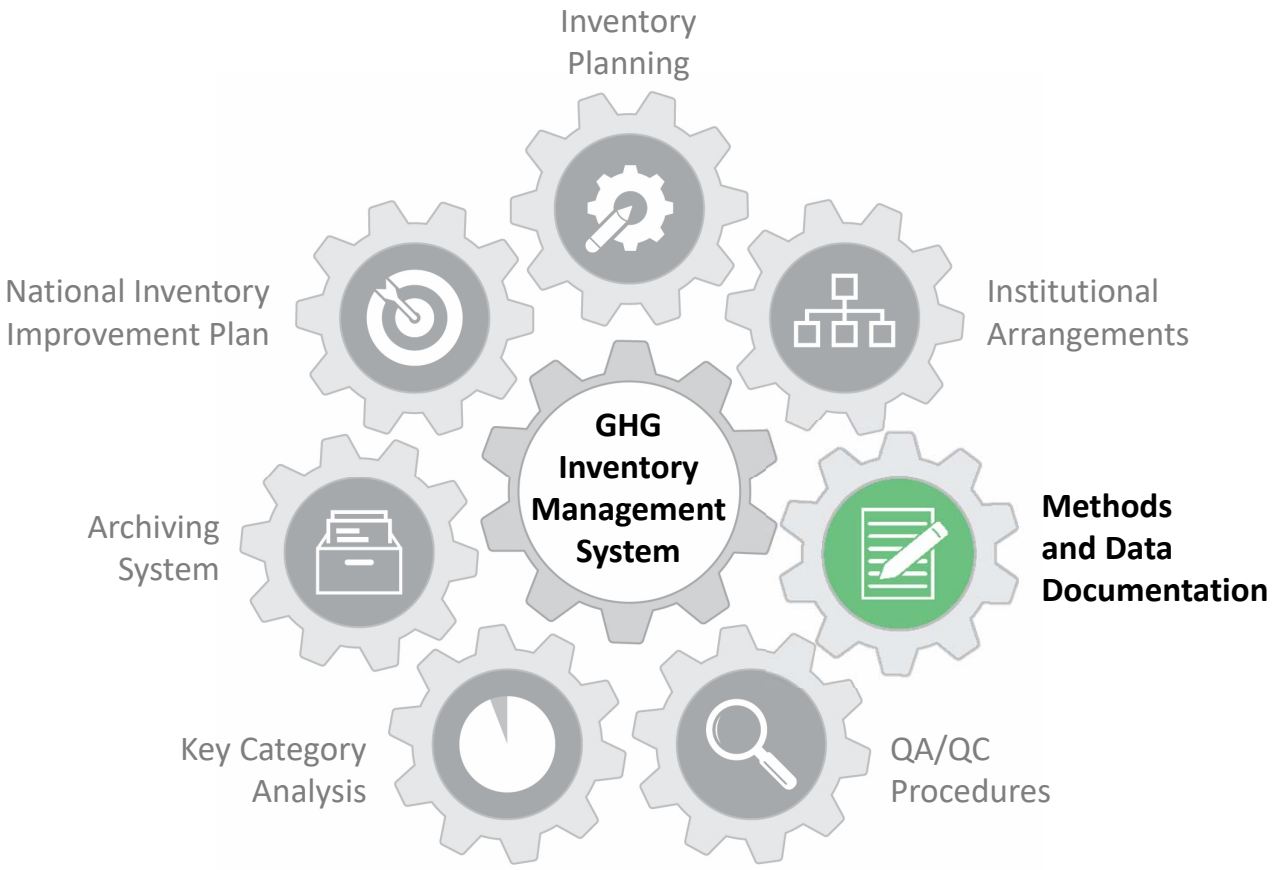
Agenda

5 min	Welcome and Introduction	Ross Hunter
35 min	Part 1: Methods and Data Documentation	Sina Watmann
5 min	Mentimeter poll on Documentation	Serena Churchill
10 min	Q&A	Sina Watmann
10 min	Break	
25 min	Part 2: Methods and Data Documentation	Ross Hunter
5 min	Mentimeter poll on Documentation	Serena Churchill
10 min	Q&A	Ross Hunter
5 min	Conclusions and Next Webinairs	

Developing a Sustainable National GHG Inventory System



Methods and Data Documentation



National GHG Inventory Compilation Cycle

- Save all compilation files and references to create an inventory archive
- Backup the archive

- Inventory inception meeting
- Start with previous inventory, if available
- Review and implement improvement plan
- Identify Activity Data and choose methodologies

- Finalize inventory report, including reporting tables
- Develop improvement plan
- Publish/submit inventory for UNFCCC reporting on time

- Collect Activity Data, Emission Factors
- QC all data

- Conduct & document QA/QC procedures, such as basic peer review
- Address QA/QC findings

- Estimate emissions & removals
- Implement QC procedures
- Revise estimates, based on new data and QA/QC findings
- Ensure time series consistency
- Conduct uncertainty & key category analyses

- Document methodological approaches, recalculations, and references
- Write inventory report, prepare draft reporting tables

6

Overview

Introduction to Methods and Data Documentation

What to Document

Review of the Template

Why document methods and data?

Good documentation of methods and data helps to:

- Improve consistency and efficiency of GHG inventory compilation
- Train new team members
- Serve as starting point for future inventories
- Instill transparency and comparability in the inventory

- Improve reproducibility for yourself and inquiries (e.g., government, expert, peer reviews, or public inquiry)
- Satisfy documentation good practice set out in IPCC Guidelines and required under UNFCCC reporting requirements

Method and data documentation continues to be an important part of Inventory Guidelines

From Volume 1, Chapter 1. Introduction of the 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Transparency: There is sufficient and clear documentation such that individuals or groups other than the inventory compilers can understand how the inventory was compiled and can assure themselves it meets the *good practice* requirements for national greenhouse gas emissions inventories. Documentation and reporting guidance is provided in Chapter 8, Reporting Guidance and Tables, of Volume 1 and in the respective chapters of Volume 2-6 (see also Volume 1, Chapter 6, QA/QC and Verification).

Consistency: Estimates for different inventory years, gases and categories are made in such a way that differences in the results between years and categories reflect real differences in emissions. Inventory annual trends, as far as possible, should be calculated using the same method and data sources in all years and should aim to reflect the real annual fluctuations in emissions or removals and not be subject to changes resulting from methodological differences. (See Chapter 2: Approaches to Data Collection, Chapter 4: Methodological Choice and Identification of Key Categories, and Chapter5: Time Series Consistency in Volume 1.)

Method and data documentation supports compliance with the good reporting practice set out in the 2006 IPCC Guidelines

From Volume 1, Chapter 8. Reporting Guidance and Tables

8.2.7 Time series

It is good practice to complete all the reporting tables (summary, sectoral, cross-sectoral) for each year in which an inventory is available

8.4 Other Reporting

[…]

Additional documentation is needed to ensure the transparency of inventories as part of an inventory report document. An inventory report should clearly explain the assumptions and methodologies used to facilitate replication and assessment of the inventory by users and third parties. Transparency can be ensured through following the guidance on documentation of each category described in the sectoral Volumes 2-5, and for Tier 1 methods by completing the worksheets. Countries using higher tier methods should provide additional documentation in addition to, or instead of the worksheets. Such explanatory information should include cross references to the tables.

The documentation should include a description of the basis for methodological choice, emission factors, activity data and other estimation parameters, including appropriate references and documentation of expert judgements.

[…]

What Should Be Documented?

Method Choice
Equation, reference, justification for selecting method

Activity Data
Type of activity data, values, units, year (s) of data, references, QA/QC procedures performed on data

Emission Factors
Sources/references, values, reasoning for emission factor choice, spreadsheets, models, justification for factor

Uncertainty
Category, relative lower and upper bound, and lower and upper emission estimate

Document All Methods and Data by Inventory Year for Easy Retrieval and Use

Barriers to Obtaining Available Data

- Lack of awareness of what data might be available
- Lack of structured data sharing processes
- Timeliness – key datasets are not available when needed
- Sharing data may be viewed as losing ownership/expertise/power by individuals, departments, or organisations
- Restrictions on statistics data prior to official release
- Commercially sensitive data – e.g., from individual companies or installations
- Keeping up with the policy cycle – new measures and targets can be developed and implemented very quickly, sometimes without consulting data and technical experts

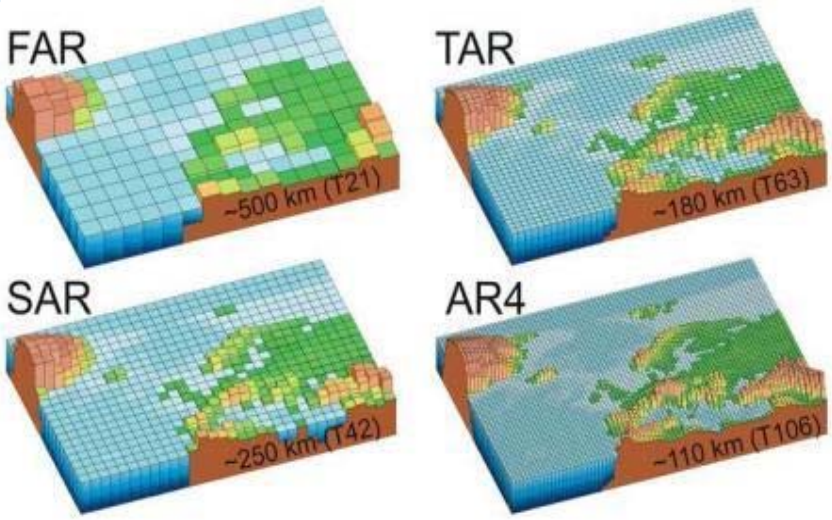
Examples of Overcoming Data Barriers

- Start by undertaking a **systematic review of available data** to establish who may hold the data that you require
- Establish a **working group of key data providers**, where data, its availability, data provision processes, and any other issues can be discussed
- Consider implementing **agreements** (e.g., memorandum of cooperation/ understanding, data supply agreement) with key data providers outlining what they will share and when
- **Aggregate data** to a level where it is no longer deemed commercially sensitive – e.g. grouping data in order that individual sites and companies can no longer be identified
- Try to use the data you have before you decide to start collecting new data to help **prioritize resources**
- Review **available data sources from other entities**, e.g., the Food and Agriculture Organization of the United Nations (FAO)

Making the Most of Limited Data

- Availability of suitable data WILL be an issue
- Do not be afraid to use data that has gaps, is new, or does not provide total coverage – *as long as you understand these issues*
- In many cases, data will provide an indication of direction of travel rather than a definitive answer for whether a target has been met or the exact mitigation effect of a policy
- In the absence of comprehensive data, limited data is better than nothing
- Try using the data you have before you decide to start collecting new data

FAR. Making a start – but resolution poor…

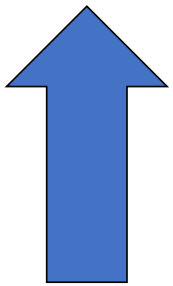


AR4. Improvements made over time. Much better data and modelling. Resolution much better

Source: World Meteorological Association
https://www.wmo.int/pages/themes/climate/climate_models.php

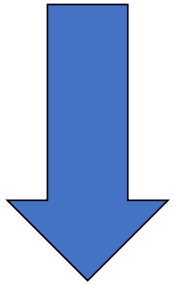
What mechanisms can be used to secure data collection?

Increasing ease



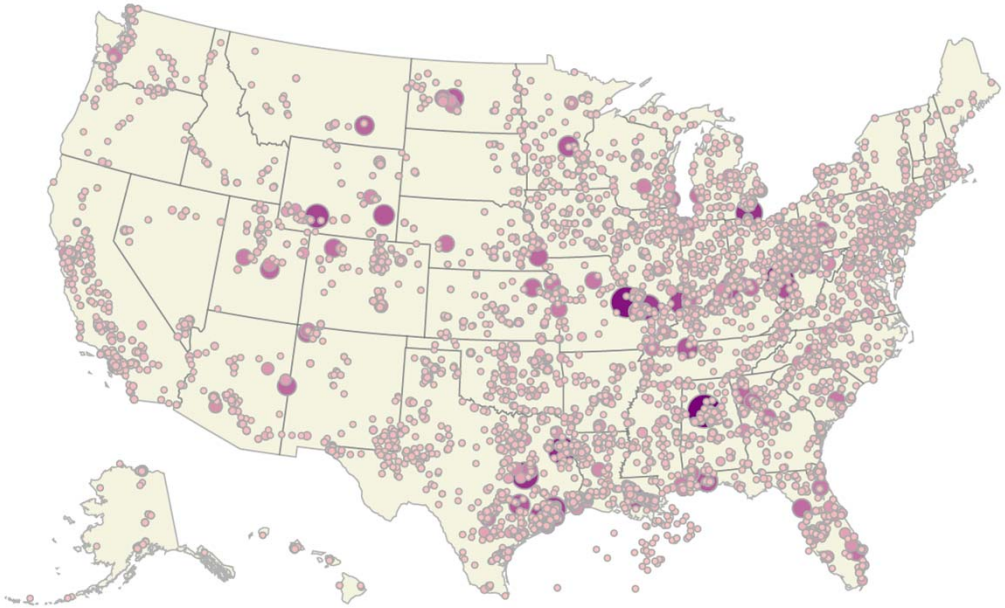
- Informal agreements
- Agreements for data supply (DSA)
- Regulation

Increasing formality



US Example: Greenhouse Gas Reporting Program (GHGRP)

- Annual facility-level data is used across several Inventory sectors (Energy, IPPU, and Waste)
  - Transparent, verified data starting in 2010 and 2011 to current reporting year (e.g., 2023)



Learn more at epa.gov/ghgreporting

US Example: Greenhouse Gas Reporting Program (GHGRP)

- GHGRP data facilitates a range of improvements to the Inventory
  - More timely annual activity data (e.g., cement clinker production)
  - Country-, technology-, process-specific emission and other activity factors (e.g., petrochemicals and industrial gas subsectors)
  - Emissions data (i.e., direct use of net emissions from municipal landfills)
  - QA/QC and uncertainty
  - Better understanding of industry trends and emission reduction efforts (e.g., use of lower-emitting technologies at oil and gas wells, landfills, nitric acid, aluminum production)

Learn more at epa.gov/ghgreporting

Making the most of limited data

- Availability of suitable data will be an issue
- In many cases, data will provide an indication of direction of travel rather than a definitive answer for whether a target has been met or the exact mitigation effect of a policy.
- In the absence of comprehensive data, limited data is better than nothing.
- Try using the data you have before you decide to start collecting new data

Bison data from the U.S. Census of Agriculture, latest reporting year 2017

Bison						
state	2017	2018	2019	2020	2021	2022
AK	1518	1502.2	1486.4	1470.6	1454.8	1439
AL	153	133.2	113.4	93.6	73.8	54
AR	206	180.6	155.2	129.8	104.4	79
AZ	88.33333	91.2	94.06667	96.93333	99.8	102.6667
CA	1396	1382.2	1368.4	1354.6	1340.8	1327
CO	11119	11196.6	11274.2	11351.8	11429.4	11507
CT	342	386	430	474	518	562
DE	148	158.8	169.6	180.4	191.2	202
FL	60	60	60	60	60	60
GA	147	120.8	94.6	68.4	42.2	16

Extrapolate the data over the time series to estimate 2018-2022.

Fuente: BORRADOR. EPA (2024) Datos del censo sobre gestión del estiércol

Filling data gaps using expert judgment

TABLE 2A.1
EXAMPLE OF DOCUMENTATION OF EXPERT JUDGEMENT

Documentation Element	Documentation Example
Reference number for judgement	*EJIPPU2005-001*
Date	*14th January 2005*
Name of expert(s) involved	*Dr Anne N Other*
Experts' background (references, roles, etc.)	*Nitric Acid Process emissions and abatement industrial expert*
The quantity being judged	*National emission factor for emissions of N_2O from Nitric Acid Plant*
The logical basis for judgement, including any data taken into consideration. This should include the rationale for the high end, low end, and central tendency of any uncertainty distribution	*An absence of measurement data for 9 out of the 10 Nitric Acid plant. The single plant estimate has been recommended as the basis for a national factor to be applied to national nitric acid production.*

2006 IPCC Guidelines Vol. 1 Chap. 2: Approaches to Data Collection

Filling data gaps using expert judgment

TABLE 2A.1
EXAMPLE OF DOCUMENTATION OF EXPERT JUDGEMENT

Documentation Element	Documentation Example
The result: e.g., activity value, emission factor or for uncertainty the probability distribution, or the range and most likely value and the probability distribution subsequently inferred	*8.5 kgN_2O/tonne nitric acid produced for 1990 – 2003*
Identification of any ***external reviewers***	*Nitric Acid Trade Association*
Results of any external review	*See document: e:/2003/ExpertJudgement/ EJIPPU2005-001.doc*
Approval by inventory compiler specifying date and person	*25th January 2005, Dr S.B Else*

2006 IPCC Guidelines Vol. 1 Chap. 2: Approaches to Data Collection

Poll Questions #1-#3

Go to

www.menti.com

Enter the code

43 25 57 4

Or use QR code

Example: Methodology table in Mexico's NIR

Sector/ categoría / subcategoría/ fuente de emisión (IPCC 2006)	CO_2		CH_4		N_2O		HFC		PFC		SF_6	
	Tier applied	Emisison Factor	Método aplicado	FE	Método aplicado	FE	Método aplicado	FE	Método aplicado	FE	Método aplicado	FE
[1] Energía	T1, T2, IE, NA	D, CS, IE, NA	T1, IE, NA, NE	D, IE, NE	T1, IE1, IE2, NA, NE	D, NE, IE1, IE2, NA, NE	NA	NA	NA	NA	NA	NA
[1A] Actividades de quema de combustible	T2, IE, NA	CS, IE, NA	T1, IE, NA	D	T1	D	NA	NA	NA	NA	NA	NA
[1A1] Industrias de la energía	T2	CS	T1	D	T1	D	NA	NA	NA	NA	NA	NA
[1A1a] Actividad principal producción de electricidad y calor	T2	CS	T1	D	T1	D	NA	NA	NA	NA	NA	NA

Example: Activity data table in Mexico's NIR

Año	Fuel consumption for power generation by the Federal Energy Commission			
	Coal (ton)	Fuel Oil (m^3)	Diésel (m^3)	Natural Gas (m^3)
1990	3,497,055	15,622,968	397,399	3,758,143,934
1991	3,608,526	15,774,062	437,806	4,416,882,891
1992	3,742,715	15,553,522	313,301	4,095,960,795
1993	4,750,467	15,770,768	298,584	3,527,452,861
1994	5,898,340	18,815,088	338,584	4,269,119,594
1995	6,443,741	16,503,635	265,943	4,532,356,028
1996	7,842,563	17,033,637	242,747	4,522,899,875
1997	7,888,872	19,502,937	337,820	4,928,758,184
1998	8,098,801	21,412,925	492,955	5,860,699,029

Example: Category description tables in Germany‘s NIR

3.2.10.3.1 Category description (1.A.3.c)

KC	Category	Activity	EM of	1990 (kt CO_2-eq.)	(fraction)	2020 (kt CO_2-eq.)	(fraction)	Trend 1990-2020
L/T	**1 A 3 c, Railways**	**fossil fuels**	**CO_2**	**3,122.1**	**0.2%**	**783.1**	**0.1%**	**-74.9%**
-/-	1 A 3 c, Railways		CH_4	17.6	0.0%	0.3	0.0%	-98.5%
-/-	1 A 3 c, Railways		N_2O	7.7	0.0%	2.0	0.0%	-74.3%

Gas	Method used	Source for the activity data	Emission factors used
CO_2	Tier 1 [a], CS (Tier 2)	NS	D [a], CS
CH_4	CS (Tier 2)	NS	D [b, c, d]
N_2O	CS (Tier 2)	NS	D [d], CS
NO_x, CO, NMVOC, SO_2	CS (Tier 2)	NS	CS

Source: Federal Environment Agency (2022), **National Inventory Report for the German Greenhouse Gas Inventory 1990 – 2020**

Methods and Data Documentation in the National Inventory Compilation Cycle

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- Inventory inception meeting
- Start with previous inventory, if available
- Review and implement improvement plan
- Identify Activity Data and choose methodologies

- Finalize inventory
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- Collect Activity Data, Emission Factors
- QC all data

- Conduct & document QA/QC procedures, such as basic peer review
- Address QA/QC findings

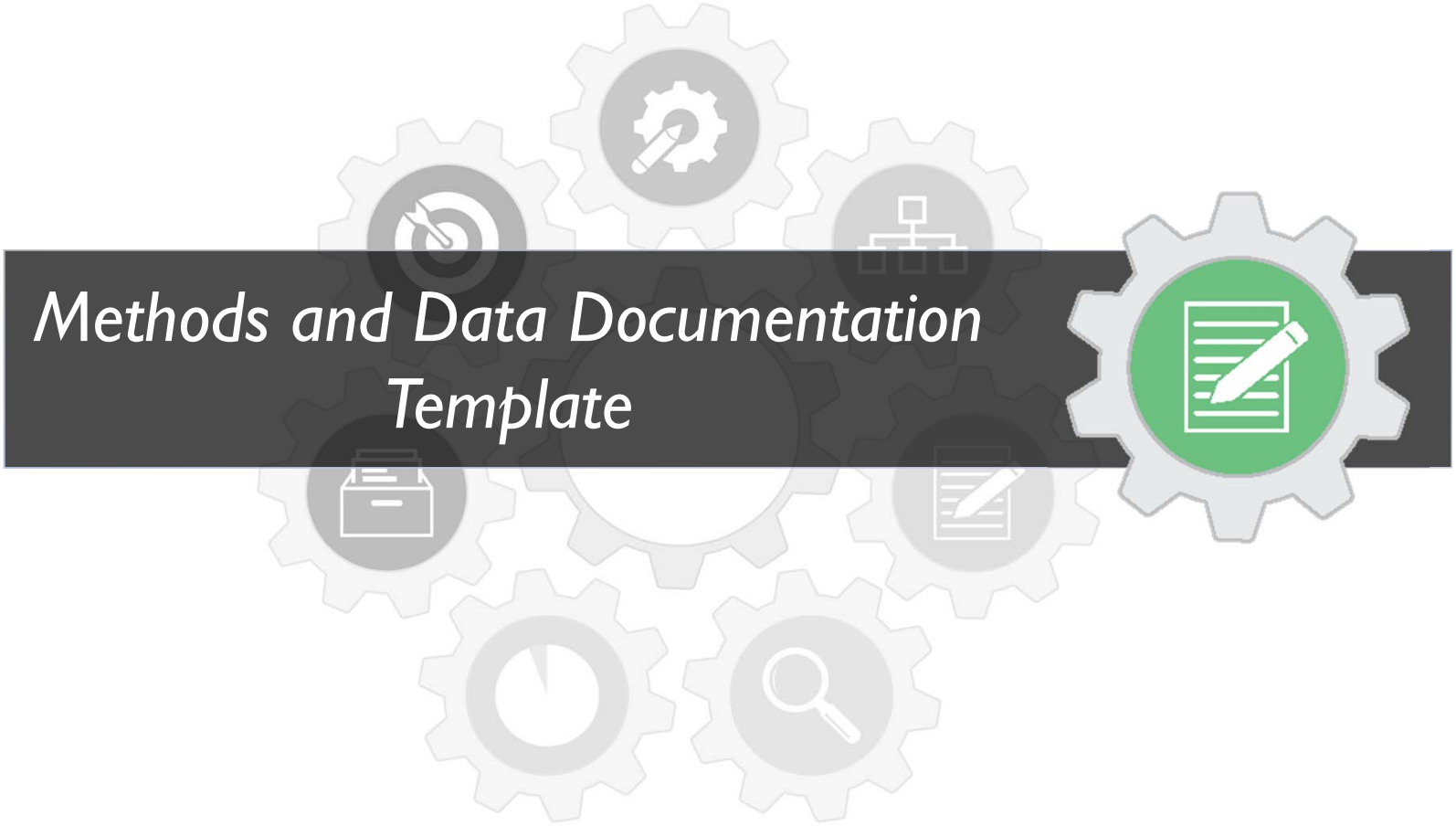
- Estimate emissions & removals
- Implement QC procedures
- Revise estimates, based on new data and QA/QC findings
- Ensure time series consistency
- Conduct uncertainty & key category analyses

- Document methodological approaches, recalculations, and references
- Write inventory report

Questions?

INTERMISSION

Methods and Data Documentation Template



How This Template Will Help

The Methods and Data Documentation Template will help the inventory team:

- Document general information about each source/sink
- Identify method choice and provide descriptions
- Document activity data
- Document emission factors
- Identify improvements

Who completes this template: Sector/Category Leads
How to use this template if using the IPCC Inventory Software?: Export activity data and emission factors from the IPCC software and copy them into the template

Case study: How to document this information?

- The category 1A3bi "Cars" leads to emissions from CO_2, CH_4, and N_2O from the combustion of diesel and gasoline.
- Emissions from CO_2 was a key category according to both the level and trend analysis in the previous GHG inventory.
- For CO_2, activity data is taken from the national energy balance as well as transport modelling, which allows fuel consumptions into disaggregated by vehicle category.
- For CO_2, country-specific emission factors for diesel and gasoline are used.
- For CH_4 and N_2O, emissions, vehicle population, trip duration, and number of trips from the transport model are used, together with default emission factors per vehicle type from the 2006 IPCC Guidelines.
- The transport model provides accurate data for current vehicle types. For models and trips in the 1990s, data is based on expert judgements.

Step 1: Provide Category Information

Table 3-1. General Information

[Insert sector, IPCC category/subcategory code, and category/subcategory name, e.g., “Energy: 1A3Bi Cars”]			
Key category in the previous GHG inventory: Record “Yes” if the **category** was a key category in the previous inventory, otherwise record “No”.	[Enter Text]		
Greenhouse gases and tiers, as reported in the previous inventory:			
Gases reported	Key category	Activity data Tier	Emission factor Type
Record the GHG emitted/removed. Example: CO_2, CH_4, N_2O	Record “Yes” if emissions/removals of this specific **Gas** documented in this row within the source category/subcategory was a key category in the previous inventory. Otherwise, record “No”.	Record the IPCC methodology tier level used to provide activity data. Best practice, use the key notations used in the CRT to easily translate data. Example: Tier 1, 2, 3 (T1, T2, and T3): country-specific (CS); model (M)	Record the tier level relating to the emission factor. Best practice, use the key notations used in the CRT to easily translate data. Example: IPCC default factor (D), country-specific (CS), plant-specific (PS), Model (M), CORINAIR (CR) and OTH (other)
[Enter Text]			
Category description/definition:		[Enter Text]	
Relevant national circumstances:		[Enter Text]	
Recalculations:		[Enter Text]	

Who completes this table: Sector/Category Leads

Example of Table 3-1

Table 3-1. General Information

Energy: 1A3Bi Cars			
Key category in the previous GHG inventory: Record "Yes" if the **category** was a key category in the previous inventory, otherwise record "No".	Yes		
Greenhouse gases and tiers, as reported in the previous inventory:			
Gases reported	Key category	Activity data Tier	Emission factor Type
CO_2	Yes	Tier 2	Country-specific
CH_4	No	Tier 1	IPCC default, Table 3.2.2
N_2O	No	Tier 1	IPCC defaults, Table 3.2.2
Category description/definition:		Emissions from automobiles categorized using vehicle registration information within a country primarily for transport of persons and normally having a capacity of 12 persons or fewer. (Source: 2006 IPCC Guidelines, Volume 2, Chapter 3, Table 3.1.1)	
Relevant national circumstances:		The direct combustion of fuels for road transport using cars accounts for 11.4% of total national GHG emissions in 2022. At present, no biofuels are used at the national level, but might become of relevance in the coming years.	
Recalculations:		Recalculations were performed for year 2018 based on updated highway use data from the Federal Highway Administration 2022 annual report. Compared to the previous inventory, emissions for 2018 decreased by 3 percent (1,353 kt CO2 Eq.).	

Who completes this table: Sector/Category Leads

Step 2: Describe Method Choice

Table 3-2. Methodology

[Insert sector, IPCC category/subcategory code, and category/subcategory name, e.g., "Energy: 1A3Bi Cars"]	
Greenhouse gas: Record the specific gas or gases to which the below methodology relates.	[Enter Text]
Equation and parameters: Record the equation for the estimation of emissions/removals under this category and describe variables and key parameters. Where several equations apply or equations are complex, adding a reference to the source (e.g., *2006 IPCC Guidelines*) and listing any relevant assumptions about its application will suffice.	[Enter Text]
Reference: List the source of the equation, including full title, chapter, and page number/equation number.	[Enter Text]
How and why this method was chosen: Describe why this methodology is most appropriate for your country and how it was chosen. Appropriateness should be based on the IPCC decision trees, including considerations like data availability and cost-effectiveness. Describe any other institutions/departments involved in the choice.	[Enter Text]
Recalculations: Is this methodology different from the methodology used to estimate emissions for this gas/category in the previous inventory?	[Enter Text]

Who completes this table: Sector/Category Leads

Example (a) of Table 3-2

You would fill an additional table for CO_2, which is calculated using a different methodology

Table 3-2. Methodology

Energy: 1A3Bi Cars	
Greenhouse gas:	CH_4 and N_2O
Equation and parameters:	Equation 3.2.3 from Volume 2, Chapter 3 of the IPCC 2006 Guidelines
Reference:	For the CH_4 and N_2O estimates, car population by vehicle types and number of trips and distances per trips from the national transport model. The national transport model is kept in the Ministry of Transport, in the department of Modelling and Projections. A copy of results of the model (number of vehicles by type and age, number of trips, distances per trip) can be found on our servers under Q:\Climate\GHG inventory data\2019 submission\1.Energy\1A3 MobileCombustion\Transport model
How and why this method was chosen:	The transport modelling data is the most precise data available at the national level. CH_4 and N_2O emissions from this category are not key categories and country –specific emission factors are not available.
Recalculations:	The Tier 1 method used in the previous inventory has been replaced with a more representative Tier 2 factor.

Who completes this table: Sector/Category Leads

Example (b) of Table 3-2

Table 3-2. Methodology

Energy: 1A3Bi Cars	
Greenhouse gas:	CO_2
Equation and parameters:	Equation 3.2.1 from Volume 2, Chapter 3 of the IPCC 2006 GL
Reference:	Activity data: fuel consumption from transport modelling, aligned with real total consumption from the energy balance emission factors (country-specific emission factors for diesel and gasoil)
How and why this method was chosen:	The approach uses the most accurate data currently available with regards to activity data (fuel consumption from transport modelling, aligned with real total consumption from the energy balance) and emission factors (country-specific emission factors for diesel and gasoil)
Recalculations:	No recalculations occurred.

Who completes this table: Sector/Category Leads

Step 3: Document Activity Data (1 of 3)

Table 3-3. Activity data general information, values, and QA/QC

[Insert sector, IPCC category/subcategory code, and category/subcategory name, e.g., "IPPU: 2A1 Cement Production"]	
Type of Activity data (included in the CRT: Yes/No):	Clinker production data by state and county. Included in the CRT.
Reporting unit: This should be the unit in which the data are reported for estimating emissions/removals.	metric tons
Appropriateness to national circumstances: State how these specific activity data were chosen.	The National Cement Association compiles production data from all its members.
Time series covered: Record the years for which the activity data are available.	2015-2022
Activity data reference (if applicable): If the activity data are from a publication, record the full reference. If multiple sources are used to provide activity data for all years in the time series, list all data sources and note the inventory years for which each data source is used in emissions estimates.	National Cement Association, 2022 Annual Report
Source of uncertainty data: Record the source of the uncertainty data/bounds for the activity data for the start year of the inventory (e.g. 1990 or 2020) and the latest year (e.g., 2022). Indicate where these files are located and whom to contact to access them. If relying on expert judgment to assess uncertainty bounds, make sure to document and archive that decision.	Expert judgement from the National Cement Association expert confirmed that clinker production data are estimated from cement production and agreed with the 2006 IPCC Guidelines estimation of +/- 35%. Communicated via email on August 16, 2022. Email available at this file link.
Date of provision: Record the date of receipt of the activity data.	August 29, 2022
Contact details: Record the name, email address, and phone number of the contact person at the entity which provided the data	John Smith, National Cement Association, john.smith@example.com, +12 3456 7890
Basis for data provision: State the basis upon which data are provided (e.g., annual publication, voluntary provision, legal requirement, data sharing agreement, a memorandum of cooperation or understanding). If applicable, cite any agreements formalizing the provision of data with data providers. You may find that a Confidential Business Information (CBI) Agreement, or the Memorandum of Cooperation (MoC) supporting templates can help you formalize your institutional arrangements with data providers.	Voluntary provision, informal data sharing agreement between Geological Survey Office and Climate Change Office, Memorandum of Cooperation between Ministry of Statistics and Ministry of Environment

Who completes this table: Sector/Category Leads

Step 3: Document Activity Data (2 of 3)

Completeness/Coverage: State whether the activity data cover all emissions or removals in the category taking place in your country.	The national cement association claims data collected for its annual report includes n all clinker production taking place in the country.
Adjustments applied to activity data: Explain any adjustments applied to the original activity data received from the data source to make it usable for the calculation (e.g., unit conversion, calculations to fill data gaps).	The data were provided in kg and recalculated to metric tons. Linear interpolation was used to fill data gaps between 2016-2020, per *2006 IPCC Guidelines*, Volume 1, Chapter 5.

Activity data values:

Add or remove years as necessary to reflect your time series. Document at least your base and most recent year, and preferably any additional years for which lower and upper bound has been quantified. Adjust the grey shading to cover any interim years between your base year and most recent year. For example, if your time series is 1990-2023, grey out 1991-2022 and add information only if available.

Year	Activity Data Value	Lower Bound	Upper Bound	Uncertainty Source (indicate where file is located/whom to contact)
1990	1,200	*-35%*	+35%	Expert Judgement
1991				
⋮				
2023	1,500	-30%	+30%	Expert Judgement
[add years as needed]				

The activity data values in the rows above are from these files: List all files from which the activity data values above come. Indicate where these files are located and whom to contact to access them.	[Enter Text]

Step 3: Document Activity Data (3 of 3)

Quality control measures Indicate in the following rows what quality control measures you have applied to the activity data indicated above. Add additional rows as needed to describe additional QC activities. Refer to Template 4. QA/QC Procedures for your inventory's category-specific QC activities. For suggestions about quality control activities, see the *2006 IPCC Guidelines*, Volume 1, Chapter 6. To address data gaps or problems with time series consistency, refer to the *2006 IPCC Guidelines*, Volume 1, Chapter 5.	
Comparison with trend Describe the results of the comparison of the new activity data with the previous trend (e.g., what developments were expected based on projecting the trend of past activity data values, what developments happen in the real activity data).	Trends indicated a further increase of 3% annually between 2018 and 2020.
Comparison with other datasets (e.g., IEA or FAO) Compare both level and trend of your activity data with other datasets, and describe the result of the comparison (e.g., to what extent does your data deviate from the level and trend of the other dataset).	Consistent alignment of trend with the International Energy Agency (IEA) or Food and Agriculture Organization of the United Nations (FAO) database(s).
Are all data entered correctly into models, spreadsheets, etc.? Record "Yes" or "No". If "No", describe the corrective actions taken.	No, the 2013 value contained a typo and has been corrected.
Have these activity factors been recalculated? Record "Yes" or "No". If "Yes", describe the reason for the recalculation.	Yes. Tier 1 defaults for fuel consumption were used in the previous inventory, these are updated with Tier 2 national defaults from 2015 onward.
Have these activity factors been recalculated for the purpose of the CRT? Record "Yes" or "No". If "Yes", describe the reason for the recalculation.	Yes. Subnational data were averaged, weighted by subnational populations, and reported at a national level in accordance with the CRT.

Step 4: Document Emission Factors (1 of 3)

Table 3-4. Emission factors/carbon stock change factors (EF/SCF) general information, values, and QA/QC

[Insert sector, IPCC category/subcategory code, and category/subcategory name, e.g., "IPPU: 2A1 Cement Production"]	
Type of EF/SCF (s) or other parameters: Record a descriptive title for the EF/SCF and/or other parameters (e.g., correction factors)	Use of emission factor for clinker production and cement kiln dust (CKD) in Tier 2 method
Reporting unit: This should be the unit in which the EF/SCF is reported for estimating emissions/removals.	Metric tons of CO_2 per metric ton of clinker produced
Appropriateness to national circumstances: State how this specific EF/SCF was chosen. Note completeness where appropriate.	Expert judgment from the National Geological Survey's minerals expert confirmed that 2006 IPCC Guidelines Tier 1 emission factor assumptions of an average CaO content for clinker of 65 percent, 100 percent of CaO from calcium carbonate material, and a 2 percent correction factor for CKD are reasonable assumptions for national cement production. Communicated via email on September 1, 2022. Email available here at this file link.
Time series covered: Record the years for which the EF/SCF is available.	2015-2022
EF/SCF reference (if applicable): If the EF/SCF is from a publication, record the full reference.	Default value from *2006 IPCC Guidelines*, Volume 3, Chapter 2, Table 2.4.
Source of uncertainty data: Record the source of the uncertainty data/bounds for the EF/SCF for the start year of the inventory (e.g. 1990 or 2020) and the latest year (e.g., 2022). Indicate where these files are located and whom to contact to access them. If relying on expert judgment to assess uncertainty bounds, make sure to document and archive that decision.	Under *2006 IPCC Guidelines* Volume 3 Chapter 2.2 Uncertainty Assessment, for Tier 2, if clinker data is available then the uncertainty arises from determining CaO content of clinker and how much CaO is derived from $CaCO_3$. The *2006 IPCC Guidelines* cites a 3-8% uncertainty in the assumption of 65 percent CaO in clinker, a 1-3% uncertainty in the assumption that 100% of CaO is from $CaCO_3$.
Date of provision: Record the date of receipt of the EF/SCF.	Not applicable, EF taken from *2006 IPCC Guidelines.*
Contact details: Record the name, email address, and phone number of the contact person at the entity which provided the EF/SCF.	Not applicable, EF taken from *2006 IPCC Guidelines.*

Who completes this table: Sector/Category Leads

Step 4: Document Emission Factors (2 of 3)

Table 3-4. Emission factors/carbon stock change factors (EF/SCF) general information, values, and QA/QC

Basis for EF/SCF provision: State the basis upon which EF/SCF and support data is provided (e.g., annual publication, voluntary provision, legal requirement, data sharing agreement, a memorandum of cooperation or understanding). If applicable, cite any agreements formalizing the provision of data with data providers.	EF/SCF adjustments were made on the basis of data provided through a data sharing agreement with manufacturer.

EF/SCF or other parameter values:

Add or remove years as necessary to reflect your time series. Document at least your base and most recent year, and preferably any additional years for which lower and upper bound has been quantified. Adjust the grey shading to cover any interim years between your base year and most recent year. For example, if your time series is 1990-2023, grey out 1991-2022 and add information only if available.

Year	Factor Value	Lower Bound	Upper Bound	[Uncertainty Source (indicate where file is located/whom to contact)]
	Example: 0.52	*Example: -5%*	*Example: +5%*	*[Example: Default value from 2006 IPCC Guidelines, Volume 3, Chapter 2, Section 2.2.2, Table 2.3.*
1990				
1991				
⋮				
2023				
[add years as needed]				

The EF/SCF or other parameter values in the rows above are sourced from the files listed here: List all files from which the EF/SCF values above come, and indicate where these files are located, and whom to contact to access these files.	Default value from *2006 IPCC Guidelines*, Volume 3, Chapter 2, Table 2.4.

Who completes this table: Sector/Category Leads

Step 4: Document Emission Factors (3 of 3)

Table 3-4. Emission factors/carbon stock change factors (EF/SCF) general information, values, and QA/QC

Quality control measures Indicate in the following rows what quality control measures you have applied to the EF/SCF values indicated above. Add additional rows as needed to describe additional QC activities. Refer to Template 4. QA/QC Procedures for your inventory's category-specific QC activities. For suggestions about quality control activities, see the *2006 IPCC Guidelines*, Volume 1, Chapter 6. To address data gaps or problems with time series consistency, refer to the *2006 IPCC Guidelines*, Volume 1, Chapter 5.	
Comparison to IPCC default factor If not using an IPCC default factor, compare the EF/SCF to the *2006 IPCC Guidelines* default factor, and explain any differences.	We are using the *2006 IPCC Guidelines* default value.
Are all data entered correctly into models, spreadsheets, etc.? Record "Yes" or "No". If "No", describe the corrective actions taken.	No, the calculations referred to the wrong cell in the spreadsheet. Spreadsheet has been corrected.
Have these emission factors been recalculated? Record "Yes" or "No". If "Yes", describe the update.	Yes, the previous inventory used the *2006 IPCC Guidelines* default value for this category and this inventory uses national emission factors.
Have these EF/SCF/other parameters been recalculated for the purpose of the CRT? Record "Yes" or "No". If "Yes", describe the reason for the recalculation.	No calculations or modifications were required to appropriately report data within the CRT.

Who completes this table: Sector/Category Leads

Document Improvement options for methodologies and data

Purpose	To record potential improvements to methodology and data.
When to fill it in	The Sector/Category Leads should update this table as they complete tables 3-1 through 3-4. Completing this table during or soon after completing the rest of this template avoids needing to revisit the template to reconstruct improvement ideas later.
How to use it when done	The NIC may find it useful to consult this table as they construct the National Inventory Improvement Plan to recall known limitations and areas for potential improvement, especially for categories in the key category analysis from the previous inventory.
Instructions	Consider any known limitations to the methodology. If the methodology is known to address only a portion of the activity taking place (e.g., due to data limitations), describe how this methodology addresses the GHG inventory principle of completeness. Consider known limitations to data availability, e.g., if accurate activity data for a source category is not available for specific regions within your country, requiring gap-filling approaches to estimate emissions from this region with relatively high associated uncertainty. Consider the levels of uncertainty for your activity data, EF/SCF, and other parameters for each category and whether improvements can be made to reduce uncertainty, especially for categories identified as key categories in the key category analysis from your previous inventory.
Instructions by column	**Improvement number**: The column is prefilled with ten rows. Add or remove rows as needed.
	Category sector: Record Energy, IPPU, Agriculture, LULUCF, or Waste.
	Category code and name: Record the category code and name (ex: 1A3Bi Cars).
	Key Category in the previous GHG inventory: Record if this category was a key category in the previous GHG inventory.
	Relevant GHG inventory principle: Record which GHG inventory principle(s) the improvement would address: transparency, accuracy, consistency, comparability, or completeness (i.e., TACCC).
	Potential Improvement: Record in detail what the improvement entails (i.e., what will change and what impact this will have). For example: Replace proxy activity data for 2012-2018 with actual activity data collected from a recently completed industrial sector survey covering years 2012-2018.

Who completes this table: Sector/Category Leads

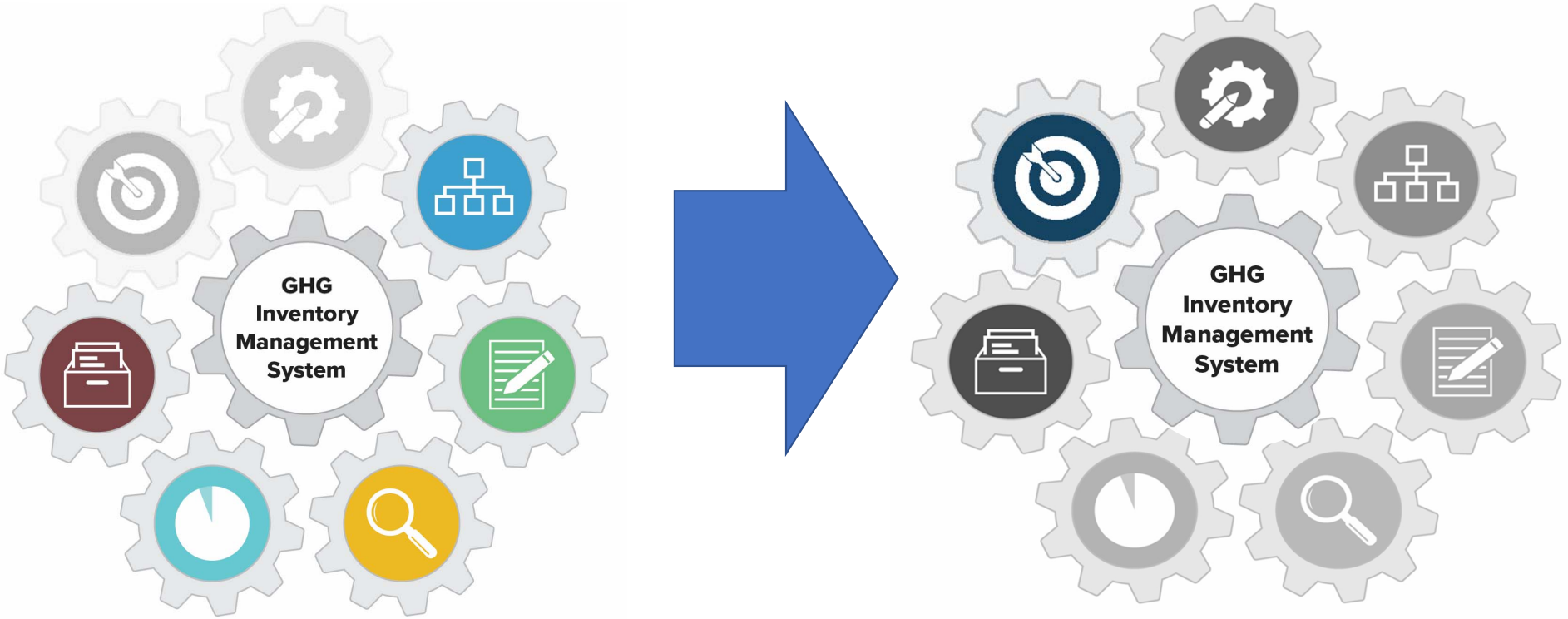
Step 5: Improvement options related to methodologies and data

Table 3-5. Improvement options related to methodologies and data

Improvement No.	Category sector *Example: Energy, AFOLU, IPPU, or Waste*	Category code and name *Example: 1A3Bi Cars*	Key category in the previous GHG inventory: *Record Yes or No*	Relevant GHG inventory principle *Example: Transparency, Accuracy, Completeness, Consistency, or Comparability*	Potential Improvement *Record in detail what the improvement entails, i.e. what will be changed and what impact this will have.*
1	Cars	1.A.3.b.i	Yes (CO_2), No (CH_4, N_2O)	Accuracy	CH_4 and N_2O emissions: Data on vehicle models and trips in the transport related to 1990-1999 data is based on expert judgements. In order to increase accuracy, these expert judgements should at least be validated in some form. Suggest discussing options for relevant studies with the Ministry of Transport
2					
3					
4					
5					
6					
7					
8					
9					

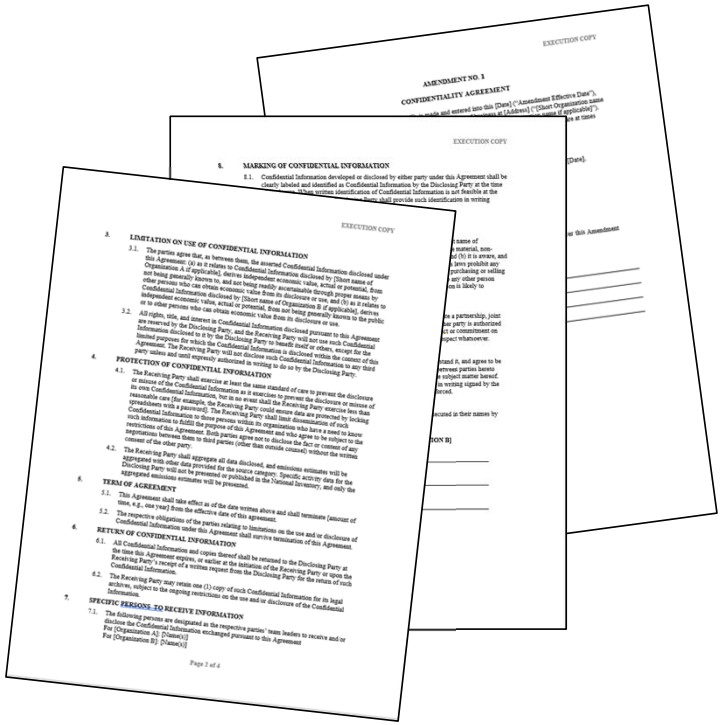
Who completes this table: Sector/Category Leads

Improvements Tie Into National Inventory Improvement Plan Template (Template 7)



Supporting Template: Confidentiality Agreement and Amendment Template

- A confidentiality agreement or contract can be useful when working with a data provider that is supplying confidential information for the inventory.
- Customize the template to the specific agreement you would like to develop and to allow for your country-specific circumstances related to the use of confidential business information.



Action Plan for Methods and Data Documentation

1. Gather general information about the categories in your sector.
2. As you identify the method choice for each category, document it.
3. As you collect activity data and emission factors, methodically document information about that data.
   - Document QC measures as you review the data.
4. Identify potential improvements to methodologies and data.

Poll Questions #4

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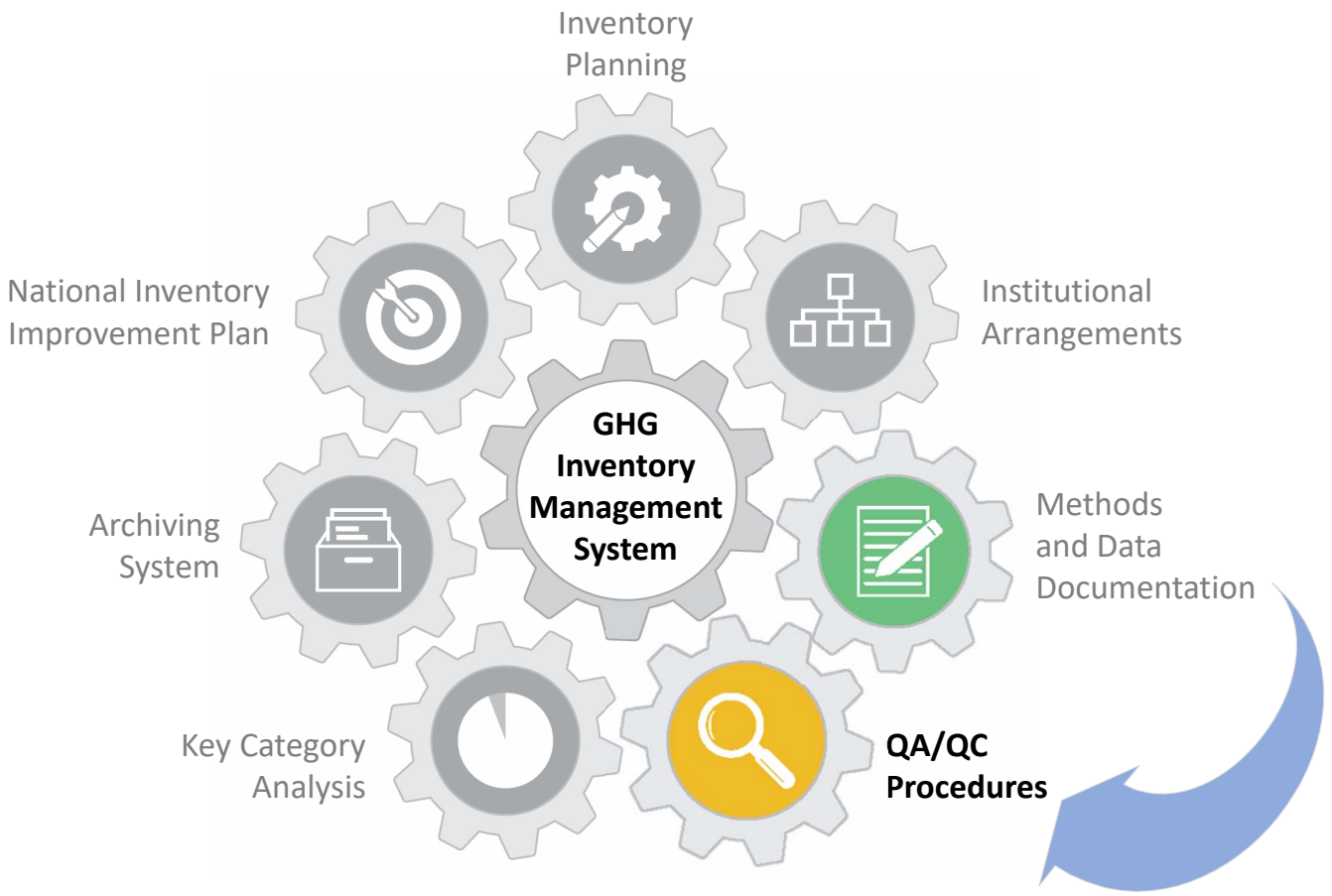
Or use QR code

Questions?

Next template…



Thank You For Your Attention!

For questions & more information, email:

ghgi.transparency@epa.gov

Toolkit for Building National GHG Inventory Systems

https://www.epa.gov/ghgemissions/toolkit-building-national-ghg-inventory-systems