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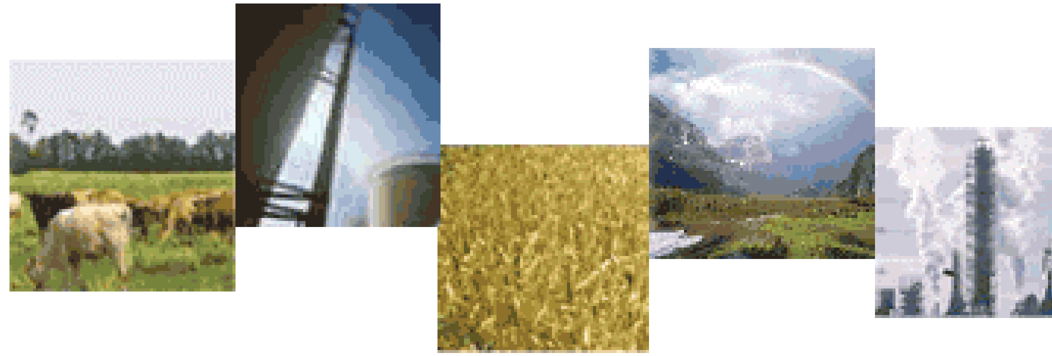


# Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories

# Role of Good Practice

**Good Practice aims to assist in transparent, consistent and comparable inventory estimation by the parties by providing guidance on:**

- **Choice of estimation method within the context of the IPCC Guidelines**
- **Quality Assurance and quality control procedures to provide cross-checks during inventory compilation**
- **Data and information to be documented, archived and reported to facilitate review and assessment of emission estimates**
- **Quantification of uncertainties at the source category level and for the inventory as a whole, so that the resources available for research can be directed toward reducing uncertainties over time, and the improvement can be traced.**

# Methodological Choice and Recalculation

- Identification of key source categories in the national inventory
- Systematic management of methodological changes over time
- Consistency in estimation of trends in national emissions

# Key source category

A Key Source category is the one that is prioritized within the national inventory system because its estimate has a significant influence on the national inventory of direct greenhouse gases in terms of the-

- absolute emission (% contribution)
- trends in emission (growth rates)
- or both

re-calculation using same methodology for all years required to ensure reliability in reported emission trends.

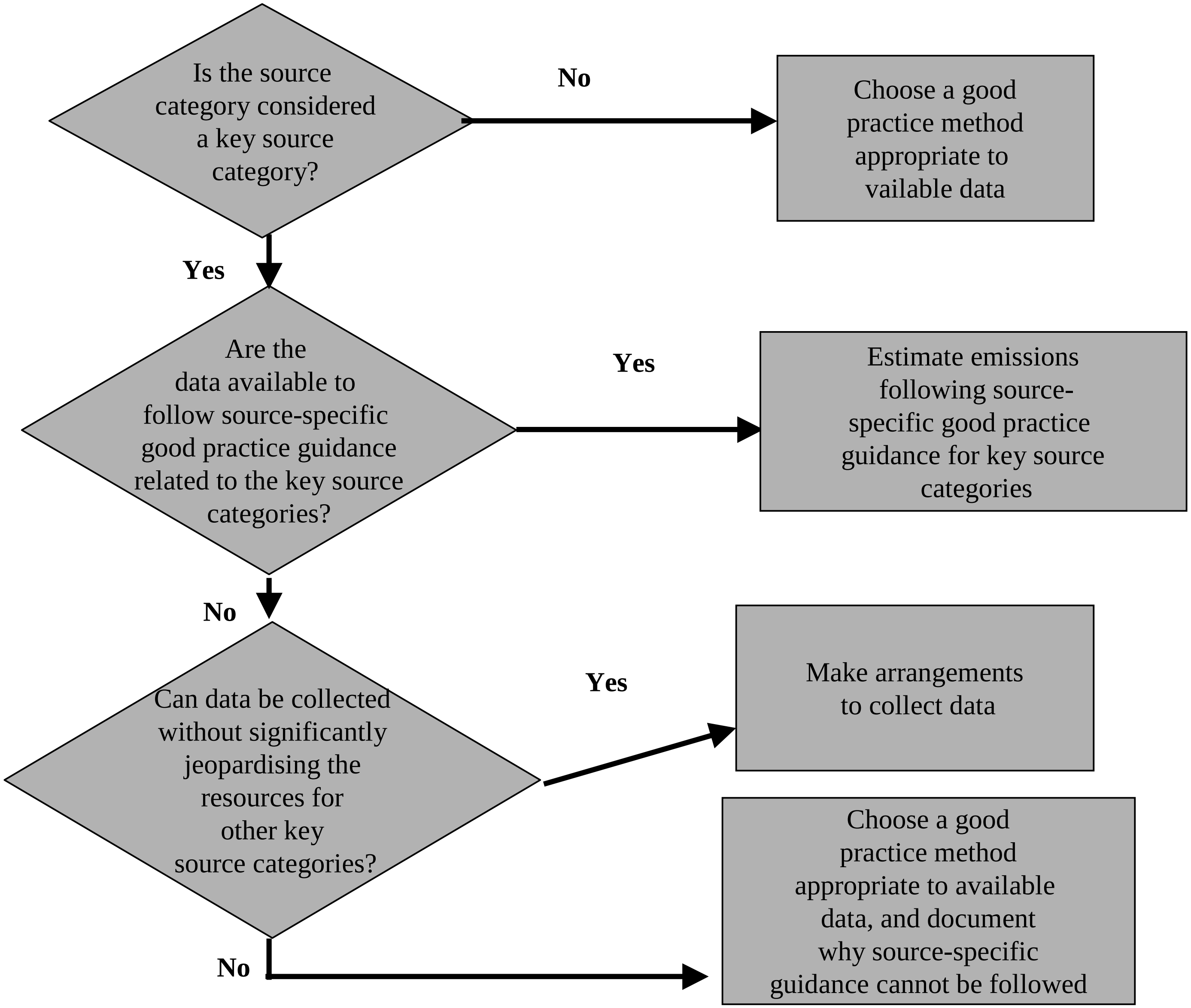
# Why identification of key source category

- **Resources available for inventory preparation are finite and their use should be prioritized**

- **It is good practice to carry out detailed quality control and quality assurance on key source categories**

- **Inventory agencies are encouraged to use source category-specific good practice methods for their *key source categories*, unless resources are available. So, there is use of good practices decision tree for improving estimates (Fig. A)**

# Fig. A- Decision Tree to choose a Good Practice Method



# Identification of national key source categories

**The results of key source category determination will be most useful if the analysis is done at the appropriate level of detail.**

**Determination of appropriate level of analysis to identify key source categories:**

- **The analysis should be performed at the level of the IPCC source categories.eg.Agriculture - Rice, enteric, manure, Agriculture residues, Soils etc.**

- **Each GHG emitting from single source category should be considered separately, unless there are specific methodological reasons for treating gases collectively. eg. $CO_2$, $CH_4$ and $N_2O$ are emitted from mobile sources.**

- **Source categories that use the same emission factors based on common assumption should be aggregated before analysis**

- **For each key source category, certain sub-source categories should be identified. eg. Emissions from particular species (cattle, buffalo or sheep) represent the major share of $CH_4$ emissions from enteric fermentation**

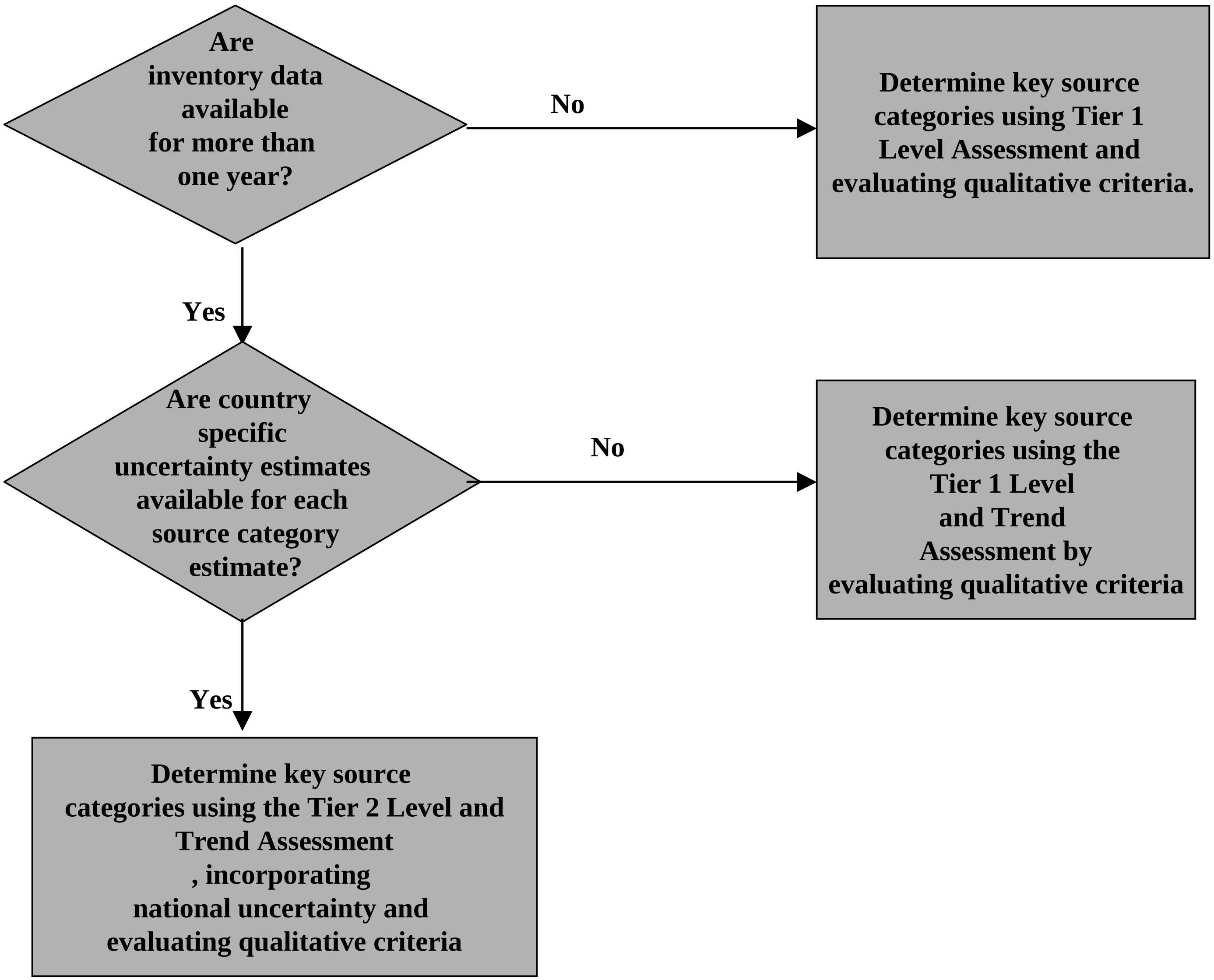
# Quantitative approaches to identify key source categories- Tier I

- The Tier I method to identify key source categories assesses the impacts of various source categories on the level and the trend of national emissions inventory

- In case of national inventory estimates for several years, assess the contribution of each source category to both the level, and the trend

- In case of single year's inventory, only a Level Assessment can be performed

# Decision Tree to Identify Key Source Categories



# Level Assessment

**The contribution of each source category to the total national inventory level is calculated according to:**

$$\text{Level } (L_{x,t}) = \frac{\text{Source category estimate } (E_{x,t})}{\text{Total Estimate } (E_t)} \quad \ldots\ldots\ldots(1)$$

*where* $L_{x,t}$ = *Level Assessment for source x in year t*

$E_{x,t}$ = *Emission estimate of source category x in year t*

$E_t$ = total inventory estimate in year t

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# Spread Sheet for Tier I Analysis- Level Assessment

| A | B | C | D | E | F |
|---|---|---|---|---|---|
| IPCC Source Categories | Direct Greenhouse Gas | Base year Estimate | Current Year Estimate | Level Assessment | Cumulative Total of Col. E |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| Total | | | | | |

# Spread Sheet for Level Assessment (contd.)

**Tier I method to identify key source categories can be readily completed using a spreadsheet analysis**

**A. IPCC source categories**

**B. Direct greenhouse gases**

**C. Base year of estimate…………..in $CO_2$ equivalent units**

**D. Current year of estimate………in $CO_2$ equivalent units**

**E. Level Assessment……according to previous eq. (1)**

**F: Cumulative Total of E**

***Any source category that meets the 95% threshold in any year, is identified as a key source category***

# Trend Assessment of more than one source category

**Contribution of Source category trend to overall inventory**
**= (Source category Level assessment) x**
**{(Source category trend - Total trend)}**

$$T_{x,t} = L_{x,t} * \quad \{[(E_{x,t} - E_{x,o}) / E_{x,t}] - [(E_t - E_o) / E_t]\} \quad \ldots\ldots(2)$$

**Where**

$T_{x,t}$ = ***contribution of each source category trend to the overall inventory trend, called the Trend Assessment***

$E_{x,t}$ & $E_{x,o}$ = ***emission estimates for source category x in year t &0***

$E_t$ & $E_o$ = ***total inventory estimates in the years t and 0***

**Therefore key source category is the one which diverges significantly from the total trend weighted by the emission level of the source category.**

# Spread sheet for Tier I Analysis- Trend Assessment

| A | B | C | D | E | F | G |
|---|---|---|---|---|---|---|
| IPCC Source Categories | Direct Greenhouse Gas | Base year Estimate | Current Year Estimate | Trend Assessment | % Contribution to Trend | Cumulative Total of Col. F |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| | | | | | | |
| Total | | | | | | |

**Key source categories are the ones that when added in descending order of magnitude add up to more than 95% of column G**

# Spread sheet for Tier I Analysis- Trend Assessment(contd.)

where Columns:

A. IPCC source categories

B. Direct greenhouse gases

C. Base year of estimate…………..in $CO_2$ equivalent units

D. Current year emissions estimates……in $CO_2$ equivalent units

E. Trend Assessment……according to previous eq. (2)

F: Percentage contribution to the total trend of the national inventory

G: Cumulative Total of F

**Any source category that meets the 95% threshold in any year, is identified as a key source category.**

# Determining the 95% threshold

**The proposed threshold of 95% for both the Level assessment and the Trend Assessment was developed from a review of emissions estimates and uncertainty for several national inventories.**

**Two analysis were performed:**

- **relationship between percentage of emissions and percentage of uncertainty in inventory was compared for national GHG inventories of 35 Parties included in Annex I to the UNFCCC**

**(The results for three inventories are shown in fig. 1 in the next slide) Cumulative Fraction of uncertainty by Cumulative Fraction of Total Emissions indicate:**

- **Threshold of 90% of emissions account for 55-85% of uncertainty**
- **Threshold of 95% of emissions account for 75-92% of uncertainty**
- **Threshold of 97% of emissions account for 85-95% of uncertainty**

# Cumulative Fraction of Uncertainty by Cumulative Fraction of Total Emissions

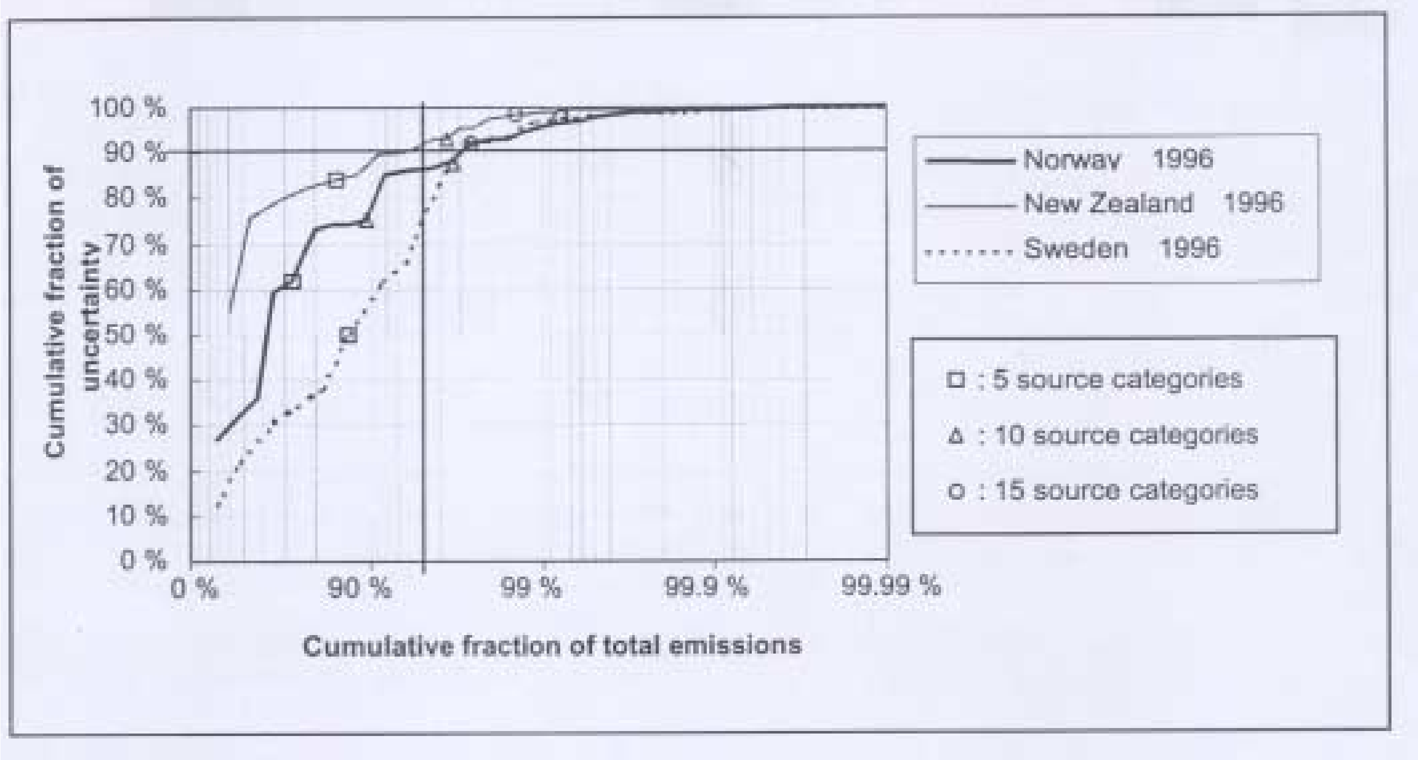


**Fig 1.**

**90% of the uncertainty is generally covered by 10-15 key source categories**

# Determining the 95% threshold (contd.)

- Second Aspect of the analysis compared the results of the trend assessment with the cumulative uncertainty in the inventory. (Fig. 2)

In this case:

- threshold of 90% of the total trend assessment account for 75-85% of uncertainty
- threshold of 95% of total trend assessment account for 90-95% of uncertainty
- threshold of 97% of total trend assessment account for 92-98% of uncertainty

# Cumulative Fraction of Trend Uncertainty by Cumulative Fraction of Total Trend Assessment

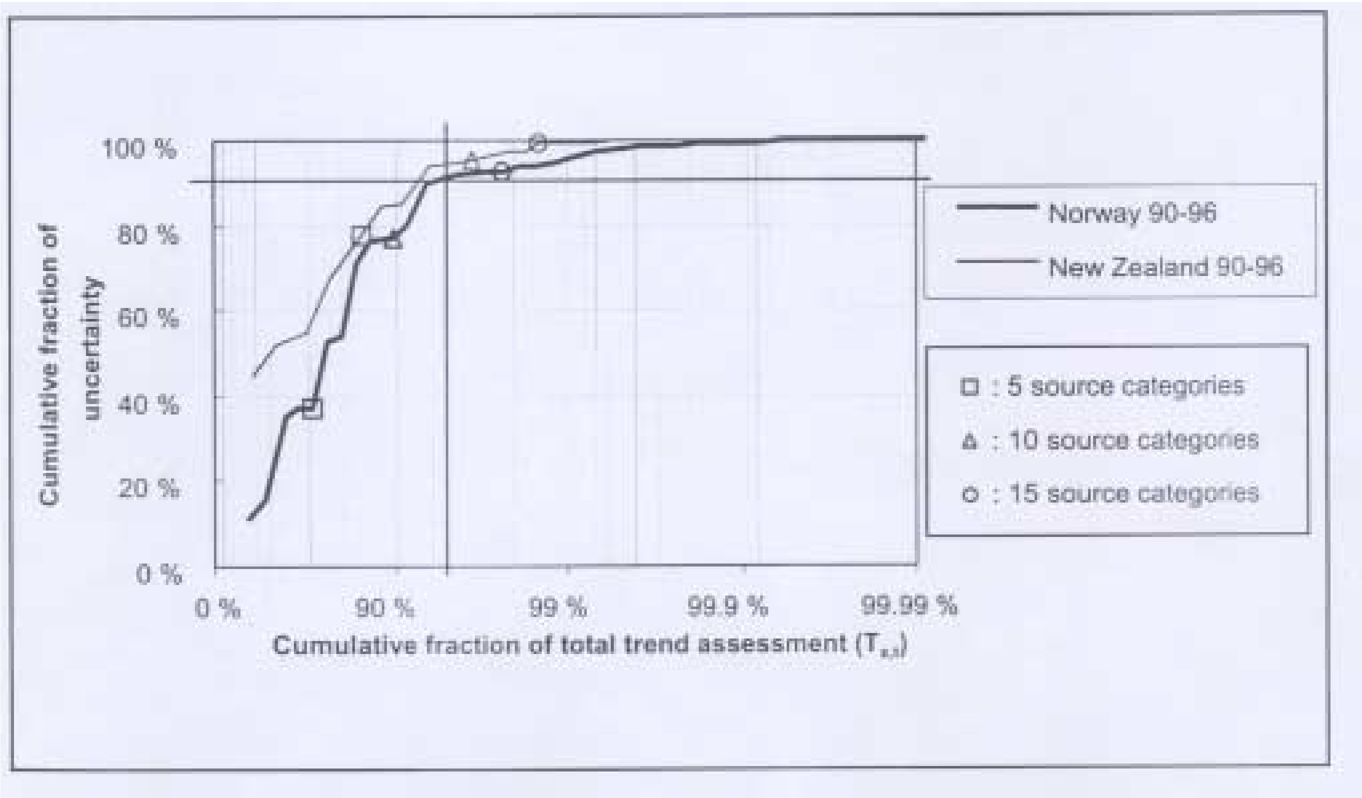


**Fig. 2**

# Quantitative approaches to identify key source categories- Tier II

**This is with respect to uncertainties in**

- **Level assessment of source category &**
- **Trend assessment of source category**

**Uncertainties are associated with:**

- **measured/ or direct determination of emission factors**
- **emission factors derived from published references**
- **activity data**

**Uncertainties can be determined by Table 6.1 or by Monte- Carlo method…..all detailed in Chapter 6 of Good Practice Guidelines report of IPCC**

# Tier-II: Quantitative assessment of Key source category

**Level of assessment with U = Tier 1 $L_{x,t}$ * $U_{x,t}$**

**……………………………(3)**

**Trend assessment with U = Tier 1 $T_{x,t}$ * $U_{x,t}$**

**……………………………(4)**

**Where**

**$L_{x,t}$ & $T_{x,t}$ to be calculated using eqs. 1 and 2**

**Threshold can be determined based on discretion (90% or 95%)**

# Qualitative approach to identify key source categories

- **Mitigation techniques and methodologies:** If emissions from a source category are being reduced significantly through the use of mitigation techniques or technologies, it is good practice to identify these source categories as key.

- **High expected emission growth rates:** If emissions from a source category grow significantly in the future,then these source categories can be identified as key.

# Qualitative approach to identify key source categories

- **High uncertainty:** If uncertainty is not taken explicitly into account by using the Tier 2 method to identify key source categories, then the most uncertain source categories can be identified as key.

- **Unexpectedly low or high emissions:** It is good practice to focus attention on those source categories where unexpected results are observed, to ensure that the results are reliable.

# Reporting and Documentation

- It is good practice to clearly identify the key source categories in the inventory.This information is essential for documenting and explaining the choice of method for each source category.

- In addition, inventory agencies should list the criteria by which each key source category was identified (‘Level’ for Level Assessment,‘Trend' for Trend Assessment, or ‘Qualitative’ for qualitative criteria and the method used to conduct the quantitative analysis.

# Source Category Analysis Summary

| Quantitative Method Used: ☐ Tier 1 ☐ Tier 2 | | | | |
|---|---|---|---|---|
| A | B | C | D | E |
| IPCC Source Categories | Direct Greenhouse Gas | Key Source Category Flag (Yes or No) | If C is Yes, Criteria for identification | Comments |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| Total | | | | |

# Recalculation - for improving estimates

- It is good practice to recalculate historic emissions when methods are changed or refined, when new source categories are included in the national inventory, or when errors in the estimates are identified and corrected
- A methodological change occurs when an inventory agency uses a different tier to estimate emissions from a source category or when it moves from a tier described in the Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories (IPCC Guidelines) to a national method
- A methodological refinement occurs when an inventory agency uses the same tier to estimate emissions but applies it using a different data source or a different level of aggregation

# Reasons for recalculations

- Available data have changed
- The previously used method not consistence with good practice guidance for that source category
- A source category has become key
- The previously used method is insufficient to reflect mitigation activities in a transparent manner
- The capacity for inventory preparation has increased
- New improved methods become available

# Alternative Re-calculation Techniques

**Alternative approaches for inventory recalculations can be applied at the level of the method (in case of a methodological change) or at the level of the underlying data (in case of a methodological refinement)**

- **Overlap - if relationship between re-calculated & previously calculated emission estimates inconsistent**

- **Surrogate method- emission factors or activity data used in the new method are strongly correlated with other well-known and readily available indicative data**

- **Interpolation- data needed for recalculation using the new method are available only for intermittent years during the time series**

- **Trend extrapolation- data for the new method are not collected annually and are not available at the beginning or end of time series**

# Overlap method

**The overlap method is most commonly used when there is a proportional relationship between the two methods. The emissions associated with the new methods are estimated according to the equation:**

$$y_o = x_o * \{\sum y_i / \sum x_i\}$$

**the summation are over years**

**t = through m and n**

**$y_o$ = recalculated emission estimate computed using the overlap method**

**$x_o$ = estimate developed using the from previously used method**

**Sum of $y_i$ ans $x_i$ are the estimates prepared using the new and previously used methods during the period of overlap, as denoted by years m through n**

# Surrogate method

**The surrogate method relates emissions estimates to underlying activity or other indicative data**

**$Yo = Yi * (So / S_t)$**

**Y - emission in year 0 and t**

**s - statistical parameters in years 0 and t**

# Documentation for recalculation

**The following information is required for recalculation:**

- **Reason for recalculation**
- **Effect of recalculation on the level and trend of estimate**
- **Description of changed/refined method**
- **Rationale for selecting the approach**
- **Approach used to recalculate previously submitted estimates**
- **Justification for the methodological change or refinement in terms of an improvement in accuracy, transparency, or completeness**

# Summary of Approaches to Recalculations

| Approach | Applicability | Comments |
|---|---|---|
| Overlap | Data necessary to apply both the previously used and the new method must be available for at least one year. | • Most reliable when the overlap between two or more sets of annual emissions estimates can be assessed.<br>• If the relationship observed using the two methods is inconsistent, the recalculation should be based on two or more annual emissions estimates.<br>• If the emission trends observed using the previously used and new methods are inconsistent and random, this approach is not *good practice*. |
| Surrogate Method | Emission factors or activity data used in the new method are strongly correlated with other well-known and more readily available indicative data. | • Multiple indicative data sets (singly or in combination) should be tested in order to determine the most strongly correlated.<br>• Should not be done for long periods. |
| Interpolation | Data needed for recalculation using the new method are available for intermittent years during the time series. | • Emissions estimates can be linearly interpolated for the periods when the new method cannot be applied. |
| Trend Extrapolation | Data for the new method are not collected annually and are not available at the beginning or the end of the time series. | • Most reliable if the trend over time is constant.<br>• Should not be used if the trend is changing (in this case, the surrogate method may be more appropriate).<br>• Should not be done for long periods. |

# Quality Control (QC) & Quality Assurance (QA)

- **A QA/QC programme contributes to the objectives of good practice guidance, namely to improve the transparency, consistency, comparability, completeness and confidence in national inventories of emissions estimates**

# Quality Control (QC)

**Quality Control is a system of routine technical activities to measure and control the quality of the inventory as it is being developed**

**The QC system is designed to:**

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

# Quality Assurance (QA)

**A planned system of review procedures conducted by third party upon a finalized inventory to verify that:**

- **Data quality objectives were met**
- **Ensure that the inventory represents the best possible estimates of emissions and sinks given the current state of scientific knowledge and data availability**
- **Support the effectiveness of the QC program**

# QA/QC: Considerations

**Before implementing QA/QC activities, it is necessary to determine the techniques and its applicability. There are technical and practical considerations in making these decisions**

- **Technical (sector specific)**
- **Practical considerations involve:**
  - **Assessing national circumstances such as available resources and particular characteristics of the inventory**
  - **QA/QC level compatible with Inventory estimation methodology (Tier 1/2/3)**
  - **Focus resources on the priority areas such as key source categories**

# Practical Considerations in developing QA/QC systems

**In developing QA/QC system, it is necessary that judgements will need to be made on the following:**

- **Resource allocation**
  - **More for KSC**
  - **More for SC where data and methodological changes have recently occurred**
  - **More for some KSC due to their dynamic nature**
  - **Initial national communication requires more resources**
- **Time allocated for QC and review (QA)**
- **Availability and access to information on activity data and emission factors, including data quality**

# Practical Considerations in QC (contd.)

- Procedures to ensure confidentiality of inventory and source category information, when required

- Requirements for archiving information

- Frequency of QA/QC checks on different parts of the inventory

- The level of QC appropriate for each source category (SC)

- Whether increased effort on QC will result in improved emissions estimates and reduced uncertainties

- Whether sufficient expertise is available to conduct the checks and reviews

# Elements of a QA/QC system

- **An inventory agency responsible for coordinating QA/QC activities**
- **A QA/QC plan**
- **General QC procedures (Tier 1)**
- **Source category-specific QC procedures (Tier 2)**
- **QA review procedures**
- **Reporting, documentation, and archiving procedures**

Tier 2 QA/QC include Tier 1 approaches

# QA/QC Plan

- **The QA/QC plan should in general:**

  **Outline QA/QC activities that will be implemented**

  - **Include scheduled time frame that follows inventory preparation from its initial development to final reporting**
  - **Outline of the processes and schedule to review all source categories**

- **The QA/QC plan is an internal document, and should be available for external review**
- **In developing QA/QC plan, it is useful to refer to standards and guidelines published by International Organization for Standardization (ISO) series (e.g. UK and the Netherlands)**
- **General QC procedures and peer review**
- **Use combination of manual and automated data checks**

# ISO: Data Quality Management System

**ISO 9004-1:** General quality guidelines to implement a quality system.

**ISO 9004-4:** Guidelines for implementing continuous quality improvement within the organisation, using tools and techniques based on data collection and analysis.

**ISO 10005:** Guidance on how to prepare quality plans for the control of specific projects.

**ISO 10011-1:** Guidelines for auditing a quality system.

**ISO 10011-2:** Guidance on the qualification criteria for quality systems auditors.

**ISO 10011-3:** Guidelines for managing quality system audit programmes.

**ISO 10012:** Guidelines on calibration systems and statistical controls to ensure that measurements are made with the intended accuracy.

**ISO 10013:** Guidelines for developing quality manuals to meet specific needs.

# General QC Procedures (Tier 1)

- **QC Activity 1**

**Check that assumptions and criteria for the selection of activity data and emission factors are documented.**

- **Procedures**

**Cross-check descriptions of activity data and emission factors with information on source categories and ensure that these are properly recorded and archived.**

- **QC Activity 2**

**Check for transcription errors in data input and reference**

- **Procedures**

**Confirm proper bibliographical data referencing Cross-check a sample of input data from each source category (either measurements or parameters used in calculations) for transcription errors.**

# General QC Procedures (Tier 1) Contd.

- **QC Activity 3**

**Check that emissions are calculated correctly.**

- **Procedures**

**Reproduce a representative sample of emissions calculations. Selectively mimic complex model calculations with abbreviated calculations to judge relative accuracy.**

- **QC Activity 4**

- **Check that parameter and emission units are correctly recorded and that appropriate conversion factors are used.**

**Procedures**

**Check that units are properly labelled in calculation sheets.**
**Check that units are correctly carried through from beginning to end**
**Check that conversion factors are correct.**
**Check that temporal and spatial adjustment factors are used correctly**

# General QC Procedures (Tier 1) Contd.

▪ **QC Activity 5**

**Check the integrity of database files**

▪**Procedures**

▪**Confirm that appropriate data processing steps are correctly represented in the database**

▪ **Confirm that data relationships are correctly represented**

▪**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.**

# General QC Procedures (Tier 1) Contd.

- **QC Activity 6**

**Check for consistency in data between source categories**

- **Procedures**

**Identify parameters (e.g. activity data, constants) that are common to multiple source categories and confirm that there is consistency in the values used for these parameters in the emissions calculations.**

- **QC Activity 7**

**Check that inventory data movement among processing steps is correct.**

- **Procedures**

**Check that emissions data are correctly aggregated from lower to higher reporting levels when preparing summaries**

**Check that emissions data are correctly transcribed between different intermediate products.**

# General QC Procedures (Tier 1) Contd.

- **QC Activity 8**

**Check that uncertainties in emissions and removals are estimated or calculated correctly**

- **Procedures**

- **Check that qualifications of individuals providing expert judgement for uncertainty estimates are appropriate.**
- **Check that qualifications, assumptions and expert judgements are recorded. Check that calculated uncertainties are complete and calculated correctly.**
- **If necessary, duplicate error calculations or a small sample of the probability distributions used by Monte Carlo analyses.**

# General QC Procedures (Tier 1) Contd

- **QC Activity 9**

  **Undertake review of internal documentation.**

- **Procedures**

**•Check that there is detailed internal documentation to support the estimates and enable duplication of the emission and uncertainty estimates.**

**• Check that inventory data, supporting data, and inventory records are archived and stored to facilitate detailed review.**

**• Check integrity of any data archiving arrangements of outside organizations involved in inventory preparation.**

# General QC Procedures (Tier 1) Contd.

- **QC Activity 10**
- **Check methodological and data changes resulting in recalculations.**

- **Procedures**
- **Check for temporal consistency in time series input data for each source category.**
- **Check for consistency in the algorithm/method used for**
- **calculations throughout the time series.**

# General QC Procedures (Tier 1) Contd.

- **QC Activity 11**
- **Undertake completeness checks**

- **Procedures**

- **Confirm inventory estimate reporting for all source categories and years**
- **Check that known data gaps that result in incomplete source category emissions estimates are documented.**

- **QC Activity 12**
- **Compare estimates to previous estimates**

- **Procedures**

**For each source category, current inventory estimates should be compared to previous estimates. If there are significant changes or departures from expected trends, recheck estimates and explain any difference.**

# Source Category Specific QC Procedures (Tier 2)

**Source category-specific QC procedures are directed at specific types of data used in the methods for individual source categories and require knowledge of the emission source category, the types of data available and the parameters associated with emissions**

## Source category-specific QC activities include

- **Emissions data QC**
- **Activity data QC**
- **QC of uncertainty estimates**

# Source Category Specific QC Procedures (Tier 2)

- **Emission data QC**

▪IPCC default emission factors (applicability check using  practical considerations)

▪Country specific emission factors developed based on:

▪Primary data (ensure QA/QC in data collection)

▪Secondary data (ascertain adequacy of QA/QC in   base data collection, report it and take appropriate steps)

# Source Category Specific QC Procedures (Tier 2)contd.

- **Direct Emission Measurements in the following ways:**
  - **Sample emissions measurements from a facility may be used to develop a representative emission factor for that individual site, or for the entire category**
  - **Continuous emissions monitoring (CEM) data may be used to compile an annual estimate of emissions for a particular process**

# Source Category Specific QC Procedures (Tier 2)contd.

- **Emission Comparisons/ Reality Checks**

  - **Consistency and completeness check using available historical inventory data for multiple years. Usually within + - 10% in subsequent years**
  - **Check annual increase or decrease of changes in emissions levels in significant sub-source categories of some key source categories**
  - **Supplementary emission comparisons may also be performed, including order-of-magnitude checks and reference calculations (i.e. using empirical formulae for emission calculations)**
  - **Order-of-magnitude checks look for major calculation errors and exclusion of major source or sub-source categories. Source categories and sub-source categories should be ranked according to the percentage difference in emissions from the previous year.**

# Source Category Specific QC Procedures (Tier 2)contd.

- **Activity Data QC:** **Activity data is normally collated at a national level using secondary data sources or from site-specific data prepared by the site or plant personnel from their own measurements**

- **Ascertain the QA/QC practices adopted by the original data source. If minimum activities listed in the QA/QC plan were satisfied, use it giving proper references.**

- **Otherwise attempt to establish QA/QC checks on the secondary data. Verify/compare data from diverse sources.**

- **If that is also not possible, then document the inadequacies associated with the secondary data QC as part of the Summary Report on QA/QC.**

# Checks for Secondary Activity Data QC

- Does the statistical agency have a QA/QC plan that covers the preparation of the data?
- What sampling protocol was used to estimate fuel usage or kms traveled?
- 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?

# QA Procedures

**Good practice for QA procedures requires an objective review to assess the quality of the inventory, and also to identify areas where improvements could be made**

- **QA by third party, not involved with inventory preparation**
- **Inventory may be reviewed as a whole or in parts**
- **Conduct a basic expert peer review (Tier 1 QA) before the inventory is submitted in order to identify potential problems and make corrections where possible. It is a data review and not a data audit.**
- **Give priority for QA for key source categories**
- **Sector specific QA (Tier 2) indicated in chapter 2-5 of Good practice report**

# Verification of Emissions Data

- Verification techniques can be applied during inventory development as well as after the inventory is compiled. Comparisons with other independently compiled,national emissions data (if available) are a quick option to evaluate completeness, approximate emission levels and correct source category allocations.

- The verification process can help evaluate the uncertainty in emissions estimates, taking into account the quality and context of both the original inventory data and data used for verification purposes. The verification techniques should be reflected in the QA/QC plan. Improvements resulting from verification should be documented.

# Documentation, Archiving and Reporting

**Internal documentation and archiving: It is good practice to document and archive all information required to produce the national emissions inventory estimates. This includes:**

- **Assumptions and activity data selection criteria**
- **Adequate information about the activity data to enable tracing it back to the referenced source**
- **Emission factors used, references and QA/QC support**
- **Rationale for choice of methods**
- **Methods used for inventory and uncertainty reduction (UR)**
- **Changes in data inputs or methods from previous years**
- **Identification of experts for UR and their quantification to do so**
- **Worksheets and interim calculations**
- **Final inventory**
- **QA/QC plans and outcome of QA/QC procedures**

# Documentation, Archiving and Reporting (contd.)

**It is good practice to maintain and archive this documentation in such a way that every inventory estimate can be fully documented and reproduced if necessary. Records of QA/QC procedures are important information to enable continuous improvement to inventory estimates. It is good practice for records of QA/QC activities to include the details of checks/audits/reviews.**

- **It is good practice to report a summary of implemented QA/QC activities and key findings as a supplement to each country's national inventory. The summary should describe which activities were performed internally and what external reviews were conducted for each source category and on the entire inventory in accordance with the QA/QC plan.**