







INTRODUCTION



The GPC does not require that cities verify their inventory results, but recommends that cities choose the level and type of verification that meets their needs and capacity. This chapter outlines how cities can establish inventory management plans to ensure data quality improvements over time and preparation for verification procedures.

MANAGING INVENTORY QUALITY OVER TIME

To manage inventory quality over time, cities should establish a management plan for the inventory process. The design of an inventory management plan should provide for the selection, application, and updating of inventory methodologies as new research becomes available, or the importance of inventory reporting is elevated.

The GPC focuses on the following institutional, managerial, and technical components of an inventory. It includes data, methods, systems, capacity, and documentation to ensure quality control and quality assurance throughout the process:

METHODS

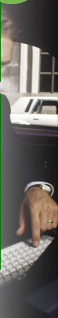
✓ These are the technical aspects of inventory preparation. Cities should select or develop methodologies for estimating emissions that accurately represent the characteristics of their source categories.

✓ The GPC provides many default methods and calculation tools to help with this effort. The design of an inventory program and quality management system should provide for the selection, application, and updating of inventory methodologies as new research becomes available. Cities should create a methodology report to accompany their inventory to detail the methods and assumptions used in estimation.

DATA

✓ This is the basic information on activity levels and emission factors. Although methodologies need to be appropriately rigorous and detailed, data quality is more important.

✓ No methodology can compensate for poor quality input data. Input data may be obtained by downscaling national/ regional/ state data in case city level data is unavailable, for example the Data Portal for Cities87 (developed by GCOM with technical support from WRI) provides estimates of previously unavailable data drawn from national and regional sources to fill critical information gaps.



DATA+

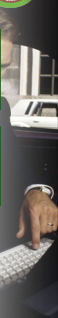
✓ The design of a city inventory program should facilitate the collection of high- quality inventory data and the maintenance and improvement of collection procedures. Data providers should also include metadata or accompanying information where feasible so as to gain a better understanding of the input data.



INVENTORY PROCESSES AND SYSTEMS

✓ These are the institutional, managerial, and technical procedures for preparing CHG inventories. They include the team and processes charged with the goal of producing a high quality inventory.

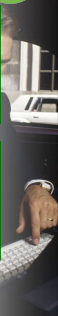
✓ To streamline CHG inventory quality management, these processes and systems may be integrated, where appropriate, with other city-wide processes related to quality.



CAPACITY

✓ This includes the technical understanding and skills to develop/update inventories, manage IT equipment and applications to maintain and process data, as well as availability of managerial and institutional resources to coordinate and lead the process.

✓ Adequate training on the GPC standard and inventory arrangements should be provided and refreshed for those involved in the inventory development process, especially where there is a high staff turnover, or the inventory development work has been outsourced.

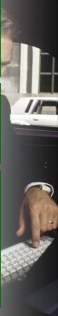


DOCUMENTATION

✓ This is the record of methods, data, processes, systems, assumptions, and estimates used to prepare an inventory, as well as identified areas for improvement.

✓ Documentation is generally done in the form of methodology reports that may contain sections such as data sources, data processing/adjustments, calculations, and assumptions.

✓ Since estimating GHG emissions is inherently technical (involving engineering and science), high quality, transparent documentation is particularly important to credibility. If information is not credible, or fails to be effectively communicated to either internal or external stakeholders, it will not have value.



QUALITY CONTROL

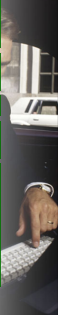
Quality control (QC) is a set of technical activities, which measure and control the quality of the inventory as it is being developed. They are designed to:

✓ 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

QC activities include accuracy checks on data acquisition and calculations, and the use of approved standardized procedures for emission calculations, measurements, estimating uncertainties, archiving information and reporting. Higher tier QC activities include technical reviews of source categories, activity and emission factor data, and methods.



QUALITY ASSURANCE

- ✓ **Quality assurance (QA) activities include a planned system of review procedures conducted by personnel not directly involved in the inventory compilation/development process.**
- ✓ **Reviews, preferably performed by independent third parties, should take place when an inventory is finalized following the implementation of QC procedures.**
- ✓ **Reviews verify that data quality objectives were met and that the inventory represents the best possible estimates of emissions and sinks given the current state of scientific knowledge and data available.**



EXAMPLE QA/QC PROCEDURES

Data gathering, input, and handling activities

- Check a sample of input data for transcription errors
- Identify spreadsheet modifications that could provide additional controls or checks on quality
- Ensure that adequate version control procedures for electronic files have been implemented
- Others

Data documentation

- Confirm that bibliographical data references are included in spreadsheets for all primary data
- Check that copies of cited references have been archived
- Check that abbreviations and criteria for selection of boundaries, base years, methods, activity data, emission factors, and other parameters are documented
- Check that changes in data or methodology are documented
- Others

Calculating, reviewing, and checking calculations

- Check whether emission units, parameters, and conversion factors are appropriately labeled
- Check if units are properly labeled and correctly carried through from beginning to end of calculations
- Check that conversion factors are correct
- Check the data processing steps (e.g., equations) in the spreadsheets
- Check that spreadsheet input data and calculated data are clearly differentiated
- Check a representative sample of calculations, by hand or electronically
- Check some calculations with alternative calculations (i.e., back of the envelope calculations)
- Check the aggregation of data across sectors, regions, sectors, etc.
- Check consistency of time series inputs and calculations
- Others



VERIFICATION

- ✓ **Cities may choose to verify their GHG emissions inventory to demonstrate that it has been developed in accordance with the requirements of the GPC, and provide assurance to users that it represents a faithful, true, and fair account of their city's GHG emissions.**
- ✓ **This can be used to increase credibility of publicly-reported emissions information with external audiences and increase confidence in the data used to develop climate action plans, set GHG targets and track progress.**
- ✓ **Verification involves an assessment of the completeness, accuracy and reliability of reported data. It seeks to determine if there are any material discrepancies between reported data and data generated from the proper application of the relevant standards and methodologies, by making sure that reporting requirements have been met, estimates are correct and data sourced is reliable.**



PARAMETERS OF VERIFICATION

Verifiers should be selected based on previous experience and competence in undertaking GHG verifications, understanding and familiarity with the GPC, and their objectivity, credibility, and independence. However, before commencing with verification, a city should clearly define its goals and decide whether they are best met by self-verification or third-party verification. Verification criteria for a GHG emissions inventory should include the following:

- ✓ Inventory boundary is clearly and correctly defined
- ✓ All required emission sources are included and notation keys have been used appropriately
- ✓ Calculations are consistent with the requirements of the GPC
- ✓ Data are time- and geographically-specific to the inventory boundary and technology-specific to the activity being measured
- ✓ Data are sourced from reliable and robust sources and referenced appropriately
- ✓ All assumptions are documented

PARAMETERS OF VERIFICATION +

The verification process may also be used to examine more general data management and managerial issues, such as selection and management of GHG data, procedures for collecting and processing GHG data, systems and processes to ensure accuracy of GHG data, managerial awareness, availability of resources, clearly defined responsibilities, and internal review procedures. To enhance transparency and credibility, the objectives and remit of verification should be made publicly available.

VERIFICATION PROCESS

- ✓ Verification will usually be an iterative process, where an initial review—highlighting areas of non-compliance and/or queries relating to the assessment—offers an opportunity to make any necessary updates to the GHG inventory before the verification report is produced and conformity with the GPC is determined.
- ✓ Verification can take place at various points during the development and reporting of GHG inventories. Some cities may establish a semi-permanent internal verification team to ensure that GHG data standards are being met and improved on an on-going basis.
- ✓ Verification that occurs during a reporting period allows for any issues to be addressed before the final report is prepared. This may be particularly useful for cities preparing high-profile public reports.
- ✓ The process of verification should be viewed as a valuable input to a path of continuous improvement. Whether verification is undertaken for the purposes of internal review, public reporting or to certify compliance with the GPC, it will likely contain useful information and guidance on how to improve and enhance a city's GHG accounting and reporting practices.