Global Soil Laboratory Network

Basic guidelines for preparing a sample for internal quality control
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by

Charles Gowing
British Geological Survey, United Kingdom

Rob de Hayr
Department of Environment and Science, Australia
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Basic guidelines for preparing a sample for internal quality control

This document provides basic guidelines to laboratories on preparing a sample for internal quality control (QC). It specifies the adequacy of resource requirements, the importance of documentation, the requirements for preparation of samples, the need for assessment of homogeneity and stability, and the need for defined methods of labeling and packaging.

Uses for internal quality control samples

The principal reason to utilize QC samples in the laboratory is to provide a cost effective means of monitoring the performance of routine procedures for precision each time it is performed.

While QC samples may be used to establish estimates of precision and total measurement of method uncertainty, they cannot be used to establish metrological traceability as there is no requirement to assign metrological values.

The use of QC samples include:

- preparation of QC charts for monitoring and demonstrating that the test is in control or confirm the laboratory's QC processes are effective over time;
- comparing results between batches;
- validation of method development;
- repeatability and reproducibility studies through use over time including changes in operators and instruments;
- inter-laboratory checking;
- impacts of changes in environmental conditions in the laboratory.

Personnel requirements

Staff employed at each stage should be suitably qualified and trained to carry out the task at hand.

Facility requirements

At each stage, use equipment suitable for the purpose. Check the suitability of equipment if it will impact the quality of the final product.

Control the environmental conditions for specific stages to eliminate potential contamination and maintain integrity of the sample.

Sourcing and selecting bulk material

The reference soil selected for internal QC should as much as practical be representative of the soils most commonly analysed by the laboratory. It is considered best practice to select soil that also reflects the range of commonly expected values for the test being performed. (i.e. selecting a reference soil with a concentration towards the low end and another towards the higher end of
normally expected values). For convenience and efficiency, it would be advantageous to select soils that will be useful in this regard for a number of different analyses.

Sample identification
Use of a specific sample shall be authorized by the local manager or by another person that has the authority to ensure all resources (staff and facilities) are suitable and available. Identify the sample in unique and unambiguous terms.

Identify and record any potential health and safety considerations.

Provide the analyst with pertinent information in the description of the sample.

Documentation
At each stage in the process, record and store pertinent information in a system that allows for retrieval.

Submit to the central scheme coordinator records of the preparation along with the prepared samples.

Physical preparation process
Plan all stages in the process.

- Sample collection
  Record the method of sample collection. Include information about the sampling site (location, vegetation cover, etc.) and its proximity to urban and industrial centers. This information is used to identify potential contamination of the soil and assess suitability for use.

- Pre-preparation of material
  Screen the sample prior to processing. For example, remove foreign objects from the sample before packaging for transport to preparation facility.

  The field sample should be free of organic matter that was on the surface of the soil (i.e., organic residue not incorporated into the mineral soil) and free of contaminating material.

  Record specific steps of pre-preparation.

- Initial drying
  Dry the sample before processing. Record the method of drying.

  Methods of drying may include air drying if the ambient temperature is warm enough and the humidity is suitable, oven drying to a maximum of 40°C, or freeze drying to a maximum of 40°C in a well ventilated area. Other methods also may be used.

- Disaggregation
  After the initial drying, gently break down hard clumps using a method that prevents crushing of individual grains.

  Record the method of disaggregation, target endpoint, and apparatus used, including its material. For example, wooden pestle and mortar, ceramic pestle and mortar, hardened steel mallet, or fly press.

- Screening/sieving
  Remove foreign objects that are not part of the actual soil sample.
Record foreign objects and other unnecessary components, if any, that were removed. Record the method of particle-size standardization (e.g., sieving to 2 mm with a nylon or stainless steel sieve mesh).

- **Secondary drying of screened fraction**
  Optional use of a secondary drying stage should be recorded, e.g. if the screened material is discernably moist.

- **Milling**
  Milling is often required to reduce and ensure uniformity of particle size to improve homogeneity and therefore the method used should provide a consistent for the entire sample.

Record the processes for milling. Include the type of mill used, material of the milling vessel (e.g., agate, stainless steel, wood), maximum final particle size, and procedures for controlling dust and preventing contamination.

**N.B. If the internal reference soil is to be used to determine the performance characteristics of the method (method validation or use of QC charts to estimate method uncertainty) it must be processed in such a way as to be representative of samples on which analytical tests are carried out. i.e. if the method is normally performed on a <2 mm sample then the reference material should be <2 mm. If an internal reference sample with a different grain size is used then the control charts cannot be used to determine the performance of the method.**

**Homogenization**
Homogenize the entire bulk volume of the sample at one time.

Record the process and duration of homogenization (e.g., V-blender, rotating barrel, or roller blender for two, eight, or 24 hours.)

**Sub dividing**
Subdivide the bulk soil sample so that each portion is representative and variation among portions is minimized.

Record the process for subdividing (e.g., riffle splitter or rotary divider).

**Assessment of homogeneity and stability**
The analytical and statistical methods used to assess the homogeneity of a sample must be suitable for the purpose and should be recorded. Specify the elements or parameters that have been monitored, the statistical procedures used, and the criteria for acceptance.

Use the following procedure to assess the homogeneity of a sample:

*At least ten containers of each sample are selected at random, batched and analysed in duplicate for the parameters for which the reference material is to be used to monitor according to the principles described by Thompson et. al. (2006). Samples for homogeneity testing shall be taken from prepared samples in final form. All homogeneity testing shall provide sufficient precision for which the QC material is to be used. Assess the homogeneity of the sample initially by calculating the standard deviation. If the standard deviation is less than five percent, the sample is suitable as QC material.*
Typically, soil samples that are dried and prepared are considered stable for at least five years. Some material may be stable longer; therefore, the usable life of QC material may be extended if its stability is verified.

Packaging
Store the prepared material in inert, leak-proof containers that are sufficient to withstand routine handling in the laboratory.

Record the portion sizes and type of packaging (e.g., plastic sachet, plastic jar, glass jar).

Labelling
Identify the samples with clear and unambiguous labels. Labelling should include:

- the name and description of the material (e.g., silty soil);
- date of preparation and expiry date if appropriate;
- reference or batch number;
- unit size and unit number (may assist in determining bottle trends if unexpected results are obtained).

Record the method used to identify the samples (i.e., information provided on labels).

Storage
Record the storage conditions at the preparation facility and the duration of storage. Preferably, store samples at a temperature of 5 to 30°C.

Prolonged storage of soil may result in settling and separation of soil particles. It is most important that soil aliquots are thoroughly mixed before use and bulk samples are also thoroughly mixed prior to a new subsample being taken.

References


The Global Soil Partnership (GSP) is a globally recognized mechanism established in 2012. Our mission is to position soils in the Global Agenda through collective action. Our key objectives are to promote Sustainable Soil Management (SSM) and improve soil governance to guarantee healthy and productive soils, and support the provision of essential ecosystem services towards food security and improved nutrition, climate change adaptation and mitigation, and sustainable development.

GLOSOLAN is a Global Soil Laboratory Network which aims to harmonize soil analysis methods and data so that soil information is comparable and interpretable across laboratories, countries and regions. Established in 2017, it facilitates networking and capacity development through cooperation and information sharing between soil laboratories with different levels of experience. Joining GLOSOLAN is a unique opportunity to invest in quality soil laboratory data for a sustainable and food secure world.

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