GLP 1

Good Laboratory Practice for the Quality Assurance of the Measurement Process[1]

Quality Assurance of the Measurement Process means establishing, documenting, implementing, and maintaining a quality system appropriate to the laboratory's scope of activities. Having such a system in place will allow the laboratory to know, within the limits of a measurement process, that a measurement is valid with respect to its traceability, accuracy, and precision.

The validity of tests and calibrations should be monitored with quality control procedures. Statistical techniques are used to record and monitor charted measurement results to permit the detection of trends. The metrologists and laboratory management should plan and review the results from quality assurance monitoring.

Other steps taken to ensure the quality of the measurement process may include, but are not limited to:

- the regular use of Standard Reference Materials (SRMs) and /or internal quality control using secondary reference materials;
- participation in interlaboratory comparisons (round robins);
- test replications with same and/or different methods;
- recalibration of retained items;
- correlation of different characteristics of an item; and
- proper calibration intervals.

Each measurement parameter in the laboratory's scope of activities must be reviewed and analyzed to determine the validity of the measurement process.

The standards and the measurement process for each parameter must be in a state of statistical control. Statistical control means that the variability of the measurement process is known and stable; when a process is in statistical control, we can assume that the reported measurement uncertainties are valid. The National Institute of Standards and Technology provides technical guidance and support to laboratories to develop suitable measurement control programs that provide measurement assurance. The objective of these programs is to evaluate the entire measurement process including:

- procedures;
- standards;
- equipment;
- personnel; and
- environment.

[1] See also Section 5.9 of ISO/IEC 17025:2005 (reviewed 2010) General Requirements for the Competence of Testing and Calibration Laboratories.

While other quality assurance programs could meet these objectives, the control programs developed for measurement assurance greatly increase the comprehensiveness of the program.

State weights and measures laboratories typically provide measurement services in the disciplines of mass, volume, and length. Some of the weights and measures laboratories provide services in other measurement areas. Approximately 89 % of their workload is in mass standards calibration.[2] Mass calibration is the first discipline for which a measurement assurance program was developed in the 1960's and was implemented in State laboratories in the 1980's. Nevertheless, all measurement disciplines must have a measurement assurance system in place.

The most recent improvement in assuring the quality of each measurement parameter in the State Laboratories is the incorporation of a Process Measurement Assurance Program (PMAP).[3]

The PMAP system consists of duplicating the measurement process by including a check/control standard as surrogate for the test item. Measurements made over an extended period of time, typically at least a year, will show all the conditions that are likely to affect the measurement process and their combined effects. Controlled duplication of the measurement process provides for the realistic evaluation of the measurement variability as one of the primary components in the estimation of the measurement uncertainty.

Measurement results that are collected over several years may be statistically evaluated with current results being compared to results from previous years. Any observed problems or changes in the measurement results are investigated and if necessary, corrective action can be taken. Ongoing monitoring establishes a continuous, comprehensive, internal measurement assurance program in the laboratory.

Data from internal measurement assurance programs may be compared to the results of inter-laboratory comparisons (round robins) or proficiency tests in which the laboratory participates.

The strength of the measurement assurance approach lies in its applicability to a wide variety of measurements with sufficient flexibility to permit each measurement control program to be tailored to the particular needs of a given measurement area. The sophistication of the control program depends on the criticality of the measurement.

[2] State Laboratory Program Workload Survey, 2011, NIST/OWM and NCSLI Legal Metrology Committee.
[3] See NISTIR 6176 (1998) and NISTIR 6969, SOP 30 (2014).