Technical Procedure for Balances

1.0 Purpose - This procedure specifies the required elements for the calibration and use of individual, analytical, and bulk balances.

2.0 Scope - This procedure applies to all electronic balances in the Drug Chemistry Section of the Raleigh location of the State Crime Laboratory (Laboratory).

3.0 Definitions

- **Calibration -** Checking or adjusting (by comparison with a standard) the accuracy of a measuring instrument. Calibrations are performed by approved service contractors for all balances in the State Crime Laboratory Drug Chemistry Section.
- **Performance verification** - The initial confirmation of the reliability of a previously or externally validated method or instrument.
- **Quality control (QC) Check -** Periodic confirmation of the reliability of equipment, instrumentation, and/or reagents
- **Reference Standard –** Measurement standard designated for the calibration of other measurement standards (reference standards or equipment)

4.0 Equipment, Materials and Reagents

4.1 Equipment

- Mettler Models: Toledo PG5002-S, Toledo XS6002-S (Forensic Scientist Assigned)
- Mettler Model PM4600 (Forensic Scientist Assigned and Toxicology)
- OHAUS Champ II Scale (OHAUS Bulk Balance)
- Mettler Model AE163 (Analytical Balance)

4.2 Materials and Reagents

- Weighing boats
- Paper, boxes, plastic bags or other weighing vessels
- Reference standard weights

5.0 Procedure

5.1 Standards and Controls

5.1.1 New balances

5.1.1.1 New balances shall be installed and leveled according to manufacturer's specifications.

5.1.1.2 Prior to being used for casework, all new balances in the Drug Chemistry Section shall undergo the procedure for the yearly balance study (see Drug Chemistry Technical Procedure for Measurement Assurance).

5.1.1.2.1 This procedure shall be performed by the Balance Key Operator (or designee) and documented as the Performance Verification.

5.1.2 QC Check

5.1.2.1 Balances Assigned to Forensic Scientists

5.1.2.1.1 The Forensic Scientist shall perform a monthly QC check on the balance assigned to him/her using a 0.10, 1.00, 10.00, 100.00, and 1000.00 gram reference standard weights.

5.1.2.1.2 Results of the QC check shall be documented in the Resource Manager section of FA.

5.1.2.1.3 Acceptable ranges for reference standard weights used for QC checks shall be calculated by adding and subtracting the values for Highest Expanded Uncertainty at 99.7 % Confidence Level for each model. See the Drug Chemistry Measurement Assurance Yearly Report for current values.

5.1.2.1.4 The Forensic Scientist shall ensure the balance is clean, level, and properly functioning before use each day it is used for casework.

5.1.2.2 Bulk Balances

5.1.2.2.1 Bulk balance(s) shall have a monthly QC check performed by the Balances Key Operator (or designee) using two reference standard weights.

5.1.2.2.2 Results of the QC check shall be recorded in the Resource Manager section of FA.

5.1.2.2.3 Prior to each use for casework, bulk balance(s) shall have a QC Check performed by the Forensic Scientist using one reference standard weight.

5.1.2.2.4 A 5.00 kilogram or 10.00 kilogram reference standard weight may be used for the one point QC check.

5.1.2.2.5 Results of the one point check shall be recorded in the case file.

5.1.2.2.6 Acceptable ranges for reference standard weights used for QC checks shall be calculated by adding and subtracting the values for Highest Expanded Uncertainty at 99.7 % Confidence Level for each model. See the Drug Chemistry Measurement Assurance Yearly Report for current values.

5.1.2.3 Analytical Balances

5.1.2.3.1 Analytical balance(s) shall have a monthly QC check performed by the Balances Key Operator (or designee) using three reference standard weights.

5.1.2.3.2 Results of the QC check shall be recorded in the Resource Manager section of FA.

5.1.2.3.3 Prior to each use for casework, analytical balance(s) shall have a QC Check performed by the Forensic Scientist using one reference standard weight.

5.1.2.3.4 Results of the one point check shall be recorded in the case file.

5.1.2.3.5 Acceptable ranges for reference standard weights used for QC checks shall be calculated by adding and subtracting the values for Highest Expanded Uncertainty at 99.7 % Confidence Level for each model. See the Drug Chemistry Measurement Assurance Yearly Report for current values.

5.1.2.4 QC Checks are to be performed for all balances as follows:

5.1.2.4.1 Turn on the balance.

5.1.2.4.2 Follow manufacturer's recommendations for leveling.

5.1.2.4.3 For the analytical balance(s) only:

- Using the control bar, set the balance to the desired range (30 g or 160 g).
- Using the control bar, set the Integration Time (Int) to the desired level (1 – shortest, 2, 3 - longest). Integration Time of 3 is recommended.
- Using the control bar, set the Stability Detector (ASd) to the desired value (1 – greatest sensitivity, 2 - OFF). Stability Detector of 1 is recommended.

5.1.2.4.4 Zero, or tare, the balance with nothing on the pan.

5.1.2.4.5 Place a reference standard weight on the pan.

5.1.2.4.6 Record the actual weight displayed.

5.1.2.4.7 If results are within the range for the model, the balance may be used for casework.

5.1.2.4.8 If the results are outside these parameters, the balance shall not be used until all necessary steps have been taken to bring the balance into compliance.

- Steps may include cleaning, leveling, re-taring, or contacting the Section Balances Key Operator who can then contact an approved ISO accredited outside vendor.

5.2 Calibrations

5.2.1 Calibration for all Drug Chemistry Section balances shall be done on a yearly basis by an approved ISO accredited outside vendor.

5.2.1.1 Certificates of Calibration issued by the approved ISO accredited outside vendor shall be maintained in Section records by the Balances Key Operator.

5.2.2 Recertification for all reference standard weights used in the Drug Chemistry Section shall be done every three years by an approved ISO accredited outside vendor.

5.2.2.1 Scheduling of re-certification shall be done in such a manner to keep at least one set of reference standard weights in the section at all times.

5.2.2.2 Reference Standard Weights calibration certificates shall be filed, and maintained by the Balances Key Operator.

5.2.3 When a Drug Chemistry Section balance has been placed out of service (e.g., maintenance/calibration, or malfunction), correct operation shall be demonstrated by a performance verification.

5.2.3.1 This evaluation shall be conducted according to the monthly QC Check as outlined above.

5.2.3.2 This evaluation shall be done prior to the balance being used for casework and it shall be documented in the Resource Manager Section of FA.

5.2.3.3 Laboratory personnel shall examine the effect(s), if any, of a malfunction on analysis results and implement the Procedure for Corrective Action as required.

5.3 Sampling - See Drug Chemistry Section Technical Procedure for Sampling.

5.4 Application of Procedure on Evidence

5.4.1 Choose desired units of measure according to balance instructions. (Record weights from bulk balances in kilogram units only. Do not use the pound setting on the balances. See “Calculations” **5.5** below for conversion factors.)

5.4.2 Tare the weighing boat or other weighing vessel that will hold the evidence.

5.4.3 Removed the tared weighing vessel from the balance.

5.4.4 Remove evidence from packaging material, if possible, and place in/on the tared weighing vessel.

5.4.5 Return the tared weighing vessel with evidence to the balance pan and record weight observed from the balance.

5.4.6 Note in the FA case file if gross weights are recorded.

5.4.7 For weights received, record in the FA case files all digits displayed by the balance.

5.4.8 For returned weights, replace the weighing boat or other weighing vessel back on the balance without taring and record all digits displayed by the balance.

5.4.9 Record the weight of material to be returned in the FA case file.

5.5 Calculations

5.5.1 When conversion of kilograms to pounds is needed, the following NIST Conversion factor shall be used:

5.5.1.1 1 pound = 0.45359237 kilograms

5.5.1.2 Round to the same number of significant figures produced by the balance.

5.5.1.3 Example: $56.4 \text{ kg} \times \frac{1 \text{ pound}}{0.45359237 \text{ kg}} = 124.34073 \text{ pounds} = 124.3 \text{ pounds}$

5.6 Reporting

5.6.1 When net weights are reported, the following shall be included on the report:

- All digits displayed on the balance
- The corresponding calculated uncertainty for that measurement
- Example for an individual top-loading balance:
  Cocaine – Schedule II
  Net Weight of Material – 1.25 (+/- 0.0X) grams.
  (See Technical Procedure for Measurement Assurance for current uncertainty.)

5.6.2 Uncertainty of Measurement - The uncertainty of measurement shall be calculated by the following formula:

$U_{final} = \sqrt{(U_{balance})^2 \times N)}$
Which can be simplified to

$U_{final} = \sqrt{N} \times U_{balance}$

Where
U_{final} = Final uncertainty for the measurement process
$U_{balance}$ = Total Expanded Uncertainty
N = number of weighings

(See the Technical Procedure for Measurement Assurance for current Uncertainty values.)

6.0 Limitations - If the balance does not read to the hundredths place due to units chosen (e.g., bulk balances) or due to the quantity of material being weighed, record in the case file all digits displayed on the balance.

7.0 Safety - Make sure balance is plugged in and is not near a source of water.

8.0 References

Operator Manuals for each balance model.

Moffat, A.C., et al., eds. *Clarke's Isolation and Identification of Drugs.* 2nd Edition. London: Pharmaceutical Press, 1986.

Butcher, K.S, et al., ed. *The International System of Units (SI) – Conversion Factors for General Use*. National Institute of Standards and Technology, NIST Special Publication: U.S Department of Commerce, May 2006: 11.

Virginia Department of Forensic Sciences. Controlled Substances Procedure Manual. Document 221-D100 Revision 7, February 6, 2012.

9.0 Records

- Certificates of Calibration for balances
- Certificates of Calibration for reference weights
- QC Check entries in Resource Manager section of FA

10.0 Attachments - N/A

Revision History		
Effective Date	Version Number	Reason
09/17/2012	1	Original Document - Technical Procedures L-01 through L-05 combined for conversion to ISO Standards.