OPERATING PROCEDURE

Title: **Calibration of the Denver XL5K Top-Loading Balance**
(Note: This SOP is for demonstration purposes, and has numerous problems)

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1 General Information

1.1 Purpose

The purpose of this document is to establish uniform procedures for the calibration, maintenance and associated record keeping for Denver balances of the Laboratory Branch.

1.2 Scope/Application

This SOP will be followed by the P&TSB Analytical Section staff member designated to monitor the laboratory's refrigerators and freezers, plus any other staff member who notices potential problems with these units. The refrigerator / freezer monitor will be designated by the Section Chief.

Any deviations from this procedure will be authorized by the lab technician.

This procedure contains direction developed solely to provide internal guidance to employees. The procedure set forth does not create any rights, substantive or procedural, enforceable at law by a party to litigation with the U.S. Environmental Protection Agency or the United States.

1.3 Documentation/Verification

This procedure has been tested and validated in practice and reviewed in print by a subject matter expert. A master copy of this procedure is kept in a central file by the QA Staff.

1.4 Definitions

1.4.1 Calibration: Comparing one standard instrument or item with another of higher accuracy in order to detect and quantify inaccuracies and report or minimize those inaccuracies. Or, adapting the balance to a reference weight.

1.4.2 Verification: Checking or testing to assure conformance with the specifications.

1.4.3 Accuracy: The extent to which the measured value of a quantity agrees with the accepted value for that quantity.

1.4.4 Linearity: The degree to which a graph of the weight values indicated by a balance vs. the true values of the calibration weights approximates a straight line.

1.5 References

1.5.1 Manufacturer's balance instruction/operation manuals

1.5.2 *Calibration or Verification? A Balanced Approach for Science*, Christine T. Meyers and David M. Kennedy, Qual. Assur., 5: 293-301, 1998

1.5.3 American National Standard ANSI/ASQC M1-1996, *Calibration Systems*

1.5.4 ASTM E898-88 *Standard Method of Testing Top-Loading, Direct-Reading Laboratory Scales and Balances*

1.5.5 *Quality Assurance in Weighing*, Alen S Kenyon, J. C. Black, and Thomas P Layloff, . AOAC Intl., 78 (4): 1109-1111, 1995

1.5.6 *Balances in quality management*, Mettler-Toledo, 1998

1.5.7 *Weighing the right way with Mettler Toledo*, Mettler-Toledo, 1998

1.6 Precautions

1.6.1 Safety

Proper safety precautions must always be observed when calibrating or maintaining the balances in a laboratory environment

1.6.2 Specific Precautions

Required Warm-up

The balances require 3 hours warm-up time before use. If a balance has been unplugged, moved or turned off, allow for the recommended warm-up time before verifying or calibrating. The balance will be turned off after each use.

Leveling

Check and adjust the level of each balance if the balance has been moved, and before calibration or verification. Most of the balances are equipped with a "bubble-type" level indicator, that can be centered by rotating the leveling discs at the base of the balance.

Chemical Spills

Remove any spilled materials from the balance and balance pan. Particles may be swept off with a brush, and spills may be wiped up with a moist cloth, mild soapy water, or methanol.

2 Methodology

2.1 Summary of Method : Routine Maintenance and Calibration

The balances are calibrated periodically based on historical QC data and recent performance activity. They are calibrated at least quarterly for weighing accuracy and linearity and additionally if needed. The specific verification/calibration schedule for each balance may be noted in the balance logbook or at the discretion of the user. Refer to Denver balance Operation Manuals for additional routine maintenance schedules.

2.2 Apparatus, Materials, Chemicals

2.2.1 Weights

Calibration weights covering the required ranges will be used and they will be certified once a year by an organization whose metrology practices and procedures comply with national and/or international standards (e.g., ISO/EIC 17025).

Note: *Calibration weights are not to be touched with fingers, but should be handled with forceps, cotton gloves or laboratory tissues (Kimwipes), and always returned to their storage box. Avoid setting forceps or the weights on lab benches where they may get contaminated.*

2.2.2 Operation Manuals and Logbooks

A manufacturer's operating instructions and a bound logbook for each balance are located in a labeled file folder close to the balance. Denver balance Operation Manuals are kept in locked storage at corporate headquarters located in Baghdad, Iraq.

2.3 Personnel Responsibilities/Training

The primary person and several alternates designated to be responsible for using this procedure will demonstrate competence in the maintenance and calibration of balances and record keeping under the supervision of a qualified individual. However, it is the responsibility of the analyst to assure that these instruments are working properly at time of use.

2.4 Procedure for Verification

2.4.1 Preliminary Steps

The preliminary steps include checking for all of the Specific Precautions (section 1.6.2): balance plugged in, balance level, any chemical spills cleaned up.

2.4.2 Verification of Calibration

- Select three calibration weights covering the commonly used range of the balance. (Consult the balance's Operation Manual for specific operating instructions).

- Zero the balance; then place the first weight in the center of the weighing pan.

  Most balances are equipped with a stability indicator. The weight reading that is displayed after stability is indicated is recorded in the balance logbook. Continue with the second and third weights, zeroing the balance before each weighing.

  If a balance displays weight readings that differ from the calibration weight by more than the tolerance range for that weight, the balance must be calibrated.

2.4.3 Tolerance Ranges

The tolerance range is the permitted deviation between the assigned value of a calibration weight and the value displayed by the balance. A chart of the established tolerance ranges can be found in the balance folders.

2.5 Procedure for Calibration

The calibration methods used are those recommended by the manufacturer and located in the balance's Operation Manual. Preliminary steps and logbook entries are the same as for Procedure for Verification of Calibration, (section 2.4).

When a balance does not meet specifications after calibration, a dated, signed notice "**OUT OF SERVICE**" is attached to the faulty balance. "Out of Service" labels are stored in the logbook for each balance. This occurrence will be reported to the Laboratory QA Representative or Branch supervisor so that recent users of the balance can be contacted. The QA Representative must be contacted so that arrangements can be made for repair of the balance by a qualified repair technician. Once the balance is repaired and calibrated, it can be returned to service. Out of service incidents should also be recorded in the balance logbook.

OUT OF SERVICE
DO NOT USE

Name_____ Date_____

2.6 Quality Control

2.6.1 Annual Servicing and Calibration of Balances

Once a year the balances are serviced by a qualified technician from an organization whose practices and procedures comply with national and international standards (e.g., ISO/IEC 17025). This annual servicing includes preventive and corrective maintenance and a calibration. Each balance has a label showing the date of the last annual servicing and also a dated entry in the balance logbook. Service records for the balances are kept in a binder, *Laboratory Branch Balances*, located in the QA area.

2.6.2 Annual Certification of Calibration Weights

Once a year all weights used for calibrating the balances are recertified by an organization whose practices and procedures comply with national and/or international standards (e.g., ISO/IEC 17025). A copy of the latest certificates are kept in the storage boxes with the calibration weights. The original certificates are kept in a binder, *Calibration Weights*, located in the QA area.

2.7 Reporting Results

Balance calibration/verification information obtained will be entered in appropriate balance logbooks in accordance with Laboratory Branch records management procedures. The balance logbooks are located in folders near their respective balances. These entries must be recorded when calibrations and verifications are performed and will include the information shown in this example.

Date:		Name or initials of person making entry	
50g 10g 1.0g	(Test weights)	(Balance reading, e.g.)	50.001g 10.000g 0.999g

Additional logbook entries should also record "out of service" malfunctions and annual servicing and repairs by a qualified repair technician.

2.8 Data Review and Documentation

QA Representative or designee will review, date, and sign logbook entries quarterly.