

# The Arizona Border Study

*An Extension of the  
Arizona National Human Exposure Assessment Survey (NHEXAS) Study  
Sponsored by the Environmental Health Workgroup of the Border XXI Program*

## Quality Systems and Implementation Plan for Human Exposure Assessment

The University of Arizona  
Tucson, Arizona 85721

Cooperative Agreement CR 824719

**Standard Operating Procedure**

**SOP-BCO-L-23.0**

**Title:** Calibration, Maintenance, and Operation of Electronic Balances

**Source:** The University of Arizona

U.S. Environmental Protection Agency  
Office of Research and Development  
Human Exposure & Atmospheric Sciences Division  
Exposure & Dose Research Branch

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# APPROVALS

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## **Calibration, Maintenance, and Operation of Electronic Balances**

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### **1.0 Purpose and Applicability**

This standard operating procedure (SOP) describes the general procedures to be followed for the operation, calibration and maintenance of electronic balances.

### **2.0 Definitions**

- 2.1 Class S weights - a set of NIST-traceable standardized weights used for calibration. The Battelle Instrument Lab personnel calibrate Class S weights annually by comparing them with NIST-traceable weights provided by Rice Lake, an external consultant.
- 2.2 Weight set ID - the BCO property and serial number, and the date of the last calibration for the set of Class S weights used for external calibration.
- 2.3 Balance ID - the BCO property and Mettler serial number of the balance, and the date the balance was last serviced by a Mettler field technician.
- 2.4 Laboratory Record Book (LRB) - a bound, uniquely-identified book with numbered pages in which daily laboratory experiments are recorded.
- 2.5 Instrument Log Book (ILB) - a bound book dedicated to a single instrument, in which descriptions of instrument maintenance, repair, and configuration alterations are recorded.

### **3.0 References**

- 3.1 "Mettler PC4400," Operator's Manual, Mettler Co.,1981.
- 3.2 "Mettler AE160," Operator's Manual, Mettler Co.,1983.
- 3.3 "Mettler AM/PM Balances," Operating Instructions, Mettler-Toledo,1993.

#### **4.0 Discussion**

None

#### **5.0 Responsibilities**

- 5.1 It is the responsibility of the user to ensure that the balance is functioning properly. This includes performing internal and external calibration procedures.
- 5.2 The user must record all calibration parameters associated with the preliminary weighing out of samples in the NHEXAS Sample Preparation LRB.
- 5.3 The user must discontinue use of a balance that does not meet specifications, and notify a Project Laboratory Director for further instruction.
- 5.4 The Project Laboratory Director will determine whether a service call by a Battelle Instrument Laboratory technician or a Mettler Field Technician is necessary.

#### **6.0 Materials and Reagents**

##### **6.1 Materials**

- 6.1.1 2-place balance - Mettler PC4400, and Mettler PM600
- 6.1.2 Class S weights, includes weights from 1 mg to 50 g.
- 6.1.3 4-place balance - Mettler AE160
- 6.1.4 Kimwipes
- 6.1.5 Beakers, assorted sizes
- 6.1.6 Centrifuge tubes, 15 mL
- 6.1.7 Teflon spatula
- 6.1.8 Small brush

## **6.2 Reagents**

Methanol, reagent grade

## **7.0 Procedure**

### **7.1 Operation of 2-Place Balance (Mettler PC4400, PM600)**

- 7.1.1 Wipe the weighing pan with a Kimwipe moistened with methanol. Allow pan to dry (ca 30 s) before proceeding.
- 7.1.2 Turn on the balance display, wait approximately 30 s, then zero the balance by pressing the front control bar.
- 7.1.3 Check the accuracy of the balance by using at least two different Class S weights which approximate the material to be weighed.
- 7.1.4 Record balance ID, the weight set ID, the two weights used, and their corresponding balance readings in the appropriate LRB.
- 7.1.5 Check the zero reading after removing the weights, and re-zero if necessary.
- 7.1.6 Place the appropriate container on the balance pan.
- 7.1.7 Tare the balance by pressing the bar, or record the tare weight of the container if performing percent solids determinations.
- 7.1.8 Transfer the sample into the container using a clean, Teflon spatula.
- 7.1.9 Record the weight obtained in the appropriate LRB.
- 7.1.10 Repeat Steps 7.1.5 - 7.1.9 for multiple samples.
- 7.1.11 The following samples will be prepared from aliquots weighed out (into the specified glassware) on the 2-place balance:
  - 7.1.11.1 Soil and dust samples to be analyzed for pesticides (15 mL centrifuge tube, held upright in a beaker).

7.1.11.2 Soil and dust samples to be analyzed for metals (appropriately-sized beaker).

7.1.11.3 Soil and dust samples for the percent solids determination (50 mL beaker).

## **7.2 Operation of 4-Place Balance (Mettler AE160)**

7.2.1 Check to see that the balance is level, by verifying that the bubble is inside the circle of the balancing level, located on the front of the balance. If not, level the balance by turning the leveling knobs, located on the rear feet of the balance.

7.2.2 Clean off any apparent residue on the balance pan with a small brush. Make sure that all the sliding doors to the balance are closed.

7.2.3 Switch the display on, by briefly pressing the single control bar. All display segments will light up after a few seconds, ("8.8.8.8.8.8.8"). Afterwards, the display automatically sets itself to "0.0000".

7.2.4 To perform an internal calibration, press and hold the control bar until "-CAL-" appears in the display; then release the control bar. The display changes to "CAL----", followed by a blinking "CAL 100".

7.2.5 Move calibration lever, located on the bottom, right of the balance, all the way to the rear position. Wait for the display to change to "CAL----", followed by "100.0000", and finally to a blinking "CAL 0".

7.2.6 Move calibration lever all the way to the front position, and wait for the display to change from "----", followed by "0.0000".

7.2.7 Record in the appropriate LRB that an internal calibration was performed.

7.2.8 To perform an external calibration, weigh at least two Class S weights that approximate the anticipated weight of the materials you will be weighing. Slide open the side glass door to the balance, place weight on the balance pan, close the door, and record the weight displayed when the green dot at the left of the display disappears. The green dot is an instability indicator.

- 7.2.9 Record the weight set ID, the balance ID, and the two weights used alongside the reading obtained in the appropriate LRB.
- 7.2.10 Re-zero the balance, as necessary, after removing any weights from the balance pan.
- 7.2.11 To weigh out a sample, place the appropriate container on the balance pan. To tare the weight of the container, make sure all the sliding doors to the balance are closed. Press the control bar briefly; the display should read: "0.0000".
- 7.2.12 Open any of the sliding doors in order to transfer the sample to the container. Close all the sliding doors, and record the weight in the appropriate LRB when the green instability dot disappears from the display.
- 7.2.13 The following standards will be prepared from aliquots of neat material weighed out (into the specified glassware) on the 4-place balance:

Primary standards (4 dram vials).

### **7.3 Calculations**

None.

### **7.4 Maintenance**

- 7.4.1 If the balance display does not operate, replace the microfuse only after unplugging the balance.
- 7.4.2 Any liquid spills must be cleaned up immediately with a Kimwipe.
- 7.4.3 Any granular spills must be cleaned up immediately with a small brush.

### **7.5 Quality Control**

- 7.5.1 All Mettler balances within the ASAT, BCO department are serviced and calibrated annually by Mettler field technicians. A Weight Traceability Certificate indicating the date of calibration, and NIST Test Weight

identification numbers is filed in each ILB. A sticker is affixed to the balance indicating the date the balance was last serviced.

- 7.5.2 For the 2-place balance, external calibration is performed at least once with each day's use. Expected precision on the 2-place balance is  $\pm 0.02$  g.
- 7.5.3 For the 4-place balance, internal and external calibrations will both be performed with each day's use. Expected precision on the 4-place balance is  $\pm 0.0002$  g.
- 7.5.4 If the expected precision is not met, the balance is not used, and the Project Laboratory Director is notified.

## **8.0 Records**

- 8.1 All accuracy checking procedures prior to daily use of a balance, as delineated in Sections 7.1.3 and 7.1.4, are recorded in ink in the LRB in which the experiments are being recorded.
- 8.2 All maintenance, service, and repair activities are recorded in the ILB designated for a given balance.