National Human Exposure Assessment Survey (NHEXAS)

Maryland Study

Quality Systems and Implementation Plan for Human Exposure Assessment

Emory University
Atlanta, GA 30322

Cooperative Agreement CR 822038

Standard Operating Procedure **NHX/SOP-L04**

Title: Balance Operation

Source: Harvard University/Johns Hopkins University

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

Notice: *The U.S. Environmental Protection Agency (EPA), through its Office of Research and Development (ORD), partially funded and collaborated in the research described here. This protocol is part of the Quality Systems Implementation Plan (QSIP) that was reviewed by the EPA and approved for use in this demonstration/scoping study. Mention of trade names or commercial products does not constitute endorsement or recommendation by EPA for use.*

1. Title of Standard Operating Procedure

   Harvard University/Johns Hopkins University Standard Operating Procedure:
   L04 Balance Operation, Rev. 1.0

2. Overview and Purpose

   For the analysis of NHEXAS samples at HSPH, many standards and standard solutions will be based upon obtaining an accurate weight of a standard reagent, a pure or neat reagent, and a NIST or equivalent standard reference material. In turn, these standard solutions will be used to calibrate instrumentation as well as serve as a basis for recovery studies and sample comparisons. The balance(s) used for this purpose must be documented to be accurate and reproducible.

3. Discussion

   HSPH maintains several balances ranging from a coarse two decimal point balance with large capacity to a microbalance with seven decimal point readability and relatively small capacity. Also, some of these balances are permanently located in an environmentally-controlled room at 70 °F. and 40% RH.

   The balance most frequently used for NHEXAS has a precision of ±0.001 g. It is used to weigh dust and soil samples for extraction and is located in the laboratory.

   All balances are routinely serviced every year by Mettler and/or Cahn. They are cleaned, checked for accuracy, precision, and linearity, then certified. Any balance that cannot perform within the prescribed limits is taken out of service, sent for repair, and not placed back into service until it has been demonstrated that it meets the strict requirements of both the manufacturer and participating studies.

   Because one balance is software-controlled, there are additional documented procedures to be followed when using this unit.

4. Personnel Responsibilities

   All appropriate personnel are thoroughly trained to operate the balances and are responsible for ensuring that the balance being used is working properly. If a problem is observed, the user is directed to contact the laboratory supervisor whose duty it is to initiate whatever corrective action is necessary. Every user is responsible for proper usage including cleanliness, care, and cleanup. The laboratory supervisor is responsible for the generation and maintenance of balance control charts.

5. Required Equipment and Reagents

   Mettler or Cahn electronically operated balance
   Sets of standard weights, Class S-1 or better
   Scoops, weighing paper, boats, tweezers
   Camel-hair brushes
   Static Eliminators

6. Procedure

6.1 Preparation for Weighing

Prior to any weighing operation, the balance area must be checked for cleanliness, and cleaned if necessary. In addition, the user must ensure that all necessary tools, calibration weights, and clean apparatus are on hand. If the balance room is being used, then the temperature and humidity must be checked and documented as being within the prescribed limits.

6.2 Calibration Procedures

Every balance has at least one calibration weight associated with it. There are also detailed SOPs for verifying the accuracy of the balance for a given range. These simple procedures are executed each time the balance is used. Generally, the zero is checked for stability and reproducibility, then the calibration weight is similarly checked; alternately, each is adjusted as needed, until the balance is under control. In the case of filter weighing, blank filters and standard previously exposed filters are used to ensure long term stability as well as to allow minor corrections to be made ad hoc.

6.3 Balance Operation

1 Ensure that power is on, doors are closed, the pans are clean and stationary and the reading is stable, then adjust the zero with the appropriate control following the manufacturer's instructions. Use only a soft camel-hair brush to brush the balance pan.

2 Place a calibration weight on the balance pan.

3 Record the weight. Remove the weight, readjust the zero if necessary, then replace the weight on the pan. It should read within 5 digits of the last significant figure of the target value. Adjust as needed.

4 Repeat steps 2 and 3 until the readings are stable and reproducible. If not within specifications, contact the lab manager for corrective action.

5 Remove any weight from the pan and reset the zero.

6 Place the object to be weighed on the balance pan. Use the static eliminator most of time: it is needed particularly for filter materials.

7 When the display is stable, record the weight.

8 Remove the object and recheck the zero.

9 If it is not within 3 digits of 0 at the last significant figure, repeat steps 5 through 7.

10 Continue with further weighings. Follow the appropriate protocol when weighing many

of the same kind of object. Usually one in seven is routinely reweighed. If the reweight is not within seven digits of the last significant figure of the first weight, then corrective action must be taken to determine if a problem exists, what the problem is, and what must be done to fix it.

6.4 Cleanup

The balance area must be cleaned immediately after usage; this particularly means washing away any spills that may have occurred.

7. Quality Assurance Procedures

Quality assurance procedures are built into the specific protocols for each type of material being weighed. For 37 mm Teflon filters, the procedures are thorough and complete and fully documented in a very large manual (see under References below). Balance control charts are updated monthly.

8. References

HSPH SOP: Weighing Particulate Mass Filters on the Cahn 41 Microbalance

HSPH SOP: Balance Control Chart Procedures

Manufacturer's Manual

Cahn: Filter Weighing Protocol