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ACTIVITY/PROJECT SPECIFIC PROCEDURE

SP 12-1
USE OF LABORATORY BALANCES AND SCALES
Revision 4

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1.0 Purpose and Scope

This document describes the Sandia National Laboratories (SNL) Waste Isolation Pilot Plant (WIPP) procedure for use of laboratory balances and scales. Calibration and operation guidelines are included in the procedure. This SP is in support of activities described in several WIPP Test Plans (TPs). Both SNL and contractor personnel will use this SP.

Acronyms and definitions for terms used in this procedure may be found in the Glossary located at the Sandia National Laboratories (SNL) WIPP Online Documents web site.

2.0 Implementation Actions

Several different models and brands of balances and scales will be used for the experimental work in support of the WIPP-related studies. These include, but are not limited to, Mettler-Toledo AT261 DeltaRange analytical balances, Sartorious Basic balances, and Mettler AE 163 balance. The general operating procedure given here is appropriate for all balances and scales—detailed procedures are given in the respective instrument user manuals, and will be referred to when appropriate. Guidelines for implementing and documenting quality assurance (QA) procedures are presented in this document, and follow the general guidelines given in Nuclear Waste Management Procedure (NP) 12-1 "Control of Measuring and Test Equipment."

This document is not meant to substitute for the manufacturer's instruction manuals for the balances. The user is responsible for reading and understanding the manuals, which are available in the laboratory.

2.1 Safety and Training

The activities described in this SP shall conform with SNL Environmental Safety and Health programs (ES&H). This document does not address ES&H issues. Laboratory ES&H procedures and specific instrument hazards are described in laboratory-specific TWDs and JSAs, which can be found at the Sandia National Laboratories (SNL) WIPP Online Documents web site.

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2.2 Responsibility

The Principal Investigator (PI), or designee, whose activities warrant the use of this procedure is responsible for implementing the requirements of this procedure.

The PI or designee is responsible for performing the measurements, following the requirements of this procedure, documenting the results, and assuring that the use of the latest revision of this document is followed.

2.3 Balance Operation

Weighing procedures for all of the balances and scales follow a similar format. There are four basic steps in performing the procedure: 1) pre-use check; 2) calibration check; 3) calibration (if necessary); and 4) sample weighing.

2.3.1 Pre-use Check

Prior to using a balance, the instrument should be inspected to ensure that it is properly installed. See the balance user manual for detailed installation guidelines. The instrument should be located in a draft-free area on a stable surface, preferably a “balance table” with a heavy, vibration-isolated top. Clean the balance if necessary, using a soft brush to gently remove chemicals, dust or debris. Gently apply a Kimwipe™ dampened with water or alcohol to remove dried deposits on the tray (if the balance has a removable platform, take it off before cleaning it). Inspect the leveling bubble on the balance, and re-adjust the feet if necessary to level the instrument. Turn the balance on, and allow 20 minutes for the electronics to warm up and stabilize (during high-use periods, the balances should be left on continuously). If the balance has programmable variables (e.g., variable sensitivity to vibration, variable units of measurement), select the proper parameters for the intended procedure as described in the manufacturers manual.

2.3.2 Instrument Calibration Check

Instrument calibration checks shall be done daily or upon each use, whichever is *less* frequent. Calibration check shall be performed using weights that are traceable to the National Institute of Standards and Technology (NIST). The serial numbers and expiration dates of the certifications of the weights used shall be recorded in the balance calibration logbook. Use at least three NIST-traceable weights, covering the range of the expected sample mass.

When handling calibration weights, always use tweezers or dust-free gloves. Never touch the weights with your hands. Always weigh calibration weights on weighing paper or in an appropriate container. To prevent weight-set mix-ups, remove only one weight at a time from its box. Weights must be kept clean--minimize dust accumulation on the weights by keeping them in their container with the lid closed when not in use, and delicately remove chemicals, dust, and debris from the balance pan prior to using the calibration weights.

Gravimetric analysis is extremely precise relative to other analytical methods--it is often possible to measure weights accurately to 0.01% or better. Such accuracy is rarely necessary, however. Performance criteria for the instrument calibration check will vary from instrument to instrument, and may also vary with the goals of the experiment. Unless otherwise stated in the balance calibration logbook, the deviation from the certified weight is ≤ 0.5 mg for each calibration weight that is < 1g, or an accuracy of ≤ 0.1% for each calibration weight that is ≥ 1g, shall constitute a successful performance check. Under some circumstances (e.g., when weighing very small particles, or very

small changes in sample weight), this accuracy might not be necessary or achievable, and modified performance criteria should be listed in the balance calibration logbook prior to performing the calibration check.

The instrument calibration check shall be recorded in the balance calibration logbook. Record the Activity/Project Specific Procedure (SP) being followed (is noted in the introduction of the Logbook), the model and serial number of the balance, the serial number(s) and expiration date(s) of the weights used, and for each weight, the "true" weight and the "indicated" balance reading in the balance calibration logbook. Record the success or failure of the performance test, and initial and date the entry. A typical entry for a balance calibration check might look like this:

Balance calibration check for Mettler AT261 balance, S/N 1118323457, using weight set # 34855, exp. 11/9/13.

Actual wt., g	Measured wt., g
200.0004	*200.0003*
99.9999	*100.0002*
10.0000	*10.0000*
1.0000	*1.0000*
0.1000	*0.1000*
0.0050	*0.0050*

Balance passed calibration check. TW 4/30/12

If the calibration verification fails, check the balance and work area for interferences, correct the problem, if any, and repeat the weighing. If the performance check still fails, calibrate the balance following the procedure in section 2.3.3. If the instrument still fails the calibration check, it shall be tagged and taken out of service until repaired.

2.3.3 Instrument Calibration

Depending upon the balance, calibration can be done with either internal or external calibration weights. Read the operators' manual to see which method is appropriate for the balance in question, and to determine the calibration procedure.

In general, for balances with internal calibration weights, calibration will be carried out by selecting the calibration function from the operating menu, and activating it. The balances move internal calibration weight(s) into position and calibrate themselves. Some balances (e.g., the Mettler AT261) will automatically recalibrate if a change in instrument response is detected.

To calibrate a balance using external weights, consult the operator's manual to determine the proper calibration weight to use. Most instruments will indicate the proper calibration weight on their display, once the "calibration" option has been selected on the operating menu. Instruments using external weights perform a 2-point calibration, taking a reading with the calibration weight on the weighing tray, and then with a blank tray, and assuming a linear response between those two points.

Instrument calibration shall be done upon initial placement of the instrument, and when the instrument fails a calibration check. When the calibration is performed by the user the calibration needs to be verified by calibration check. The balance calibration and calibration check should be documented in

the balance calibration logbook. For high precision analytical balances, it is recommended that calibrations be done daily or prior to weighing out each suite of samples.

2.3.4 Sample Weighing

Sample weights are recorded in the scientific notebook with reference to the location of the balance calibration information (i.e. page number and the name of the balance calibration logbook) plus the balance manufacture name and model. Instrument user manuals provide procedures for use of this equipment under standard conditions, and those will not be reviewed here. General guidelines for accurate gravimetric analysis include the following:

1) Do not attempt to weigh objects heavier than those recommended by the balance manufacturer.
2) Always weigh samples on weighing paper or in an appropriate container. When using weighing paper that overlaps the edge of the weighing pan, care must be taken to insure that the edges of the weighing paper do not contact the balance around the pan, or an inaccurate result will be obtained. This is especially a problem with the Mettler-Toledo AT261 analytical balance, as there is very little clearance between the weighing pan and the raised steel rim surrounding it.
3) Do not weigh hot samples. Heat may affect the electronic response of the balance, and convective air currents around the sample can result in inaccurate readings.
4) Do not weigh samples giving off corrosive fumes (e.g., hot or fuming acids), as these can corrode the balance pan, internal calibration weights, or electronics, resulting in serious damage to the balance.
5) When weighing finely powdered samples into plastic or Teflon™ containers, static electricity can cause the sample to “jump” to surrounding objects, resulting in sample loss or, if weighing chemicals, contamination of the balance or personnel with hazardous materials. Wearing latex gloves intensifies this effect. This problem can be reduced by using an antistatic brush to reduce the static charge on the weighing container. Placing a few ml of water in the container, if possible, can also reduce static effects.
6) Keep weighing pans/platforms clean of debris and spills.

3.0 Records

The following QA records generated through implementation of this procedure shall be prepared and submitted to the WIPP Records Center in accordance with NP 17-1, “Records”.

QA Record

- Weight Calibration Record
- Balance Calibration logbook
- Scientific Notebook

4.0 Appendices

There are no appendices associated with this document.

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