

UCD IMPROVE Technical Information #251R

General Laboratory Procedures

*Interagency Monitoring of Protected Visual Environments
Air Quality Research Center
University of California, Davis*

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DOCUMENT HISTORY

Date Modified	Initials	Section/s Modified	Brief Description of Modifications
03/04/2022	SRS	All	Previously anthologized versions were separated into individual TIs.
4/15/2022	GRM	All	Updating wording to accommodate new procedures. Removed section 5.11. Added new section 5.11.
6/30/2022	TAK	5.12, 5.13	Added SOPs to "Recertifying Metal Test Weights" and "Recertifying Automated Weighing Chamber Environmental Probe"

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1. PURPOSE AND APPLICABILITY

The purpose of this TI is to detail sample handling lab procedures lab assistants must perform, but do not fit in a specific category. They are general tasks performed on a regular basis to keep operations running smoothly in the lab.

2. SUMMARY OF THE METHOD

Many small tasks must be performed on regularly to ensure lab operations run smoothly. These include making new and replacement flashcards, archiving old and disposing of broken flashcards, creating myriad stickers, creating purchase orders, validating and updating weights, entering status adjustments, handling bad field blanks, and closing the quarter after all samples have been collected.

3. CAUTIONS

When making changes to weights in the web application, pay very close attention to make sure the weight is entered correctly.

When making new flashcards, be sure to choose numbers that have not been used before, especially when making replacement cards.

4. EQUIPMENT AND SUPPLIES

Due to the number of different tasks described in this TI, supplies are described in each individual procedure.

5. PROCEDURAL STEPS

5.1 Creating New, Archiving Old and Disposing of Broken Flashcards

Each IMPROVE site has designated flashcards that are only used for that site. The number of designated cards per site depends on the box cycle rotation for that site. Sites that have two blue boxes also have two designated flashcards, and 3-box cycle sites have three designated flashcards. Sometimes a card is lost or damaged and a new card must be assigned.

Other flashcards, called replacement cards, are sent out to sites when the designated cards are late returning to the lab. Flashcards that no longer function properly are noted and discarded.

5.1.1 Site Flashcards

When making a new flashcard, identify the next flashcard ID number to use. The simplest way to do this is to access the web application, navigate to “Sample Boxes”, select the appropriate site name, and press **Search**. Scroll to

the right to the column called “Flashcard#.” Check to see what other flashcard numbers are in use for that site (excluding the one that is being retired). This will provide a better picture of which flashcards have been used.

Some ID numbers will end in “01,” Or “02”. IDs ending in “01” should be used for new Compact Flash cards. “02” are SD cards used for Controller V4.

The first four digits of the flashcard ID will always remain the same, as that is the site’s UC CODE. The 6th number is typically the one that changes. For example, if the flashcards in use are [UC CODE].04.01 and [UC CODE].05.01 and the -04.01 card needs to be retired, the next card should have an ID of [UC CODE].06.01 If the sixth number will exceed 9, change the fifth number to 1 and the sixth number back to “0.”

Once a new ID number has been decided upon, create, and apply two new labels for the front and back of the flashcard, using another IMPROVE network card for reference.

5.2 Replacement Boxes

Sometimes a box does not arrive in the lab in time to be processed and prepared for another cycle. When this happens, a replacement box is sent out.

To prepare a replacement box, start by pulling one of the replacement bins from the bottom of the bin rack in the SHOP or cartridge preparation rack. Replacement bins are not labeled and have 3 weeks’ worth of cartridges. Make sure the configuration is correct for the box cycle. Retrieve the Velcro label for the site and place it on the bin. Collect the cassette and week bag stickers for the site from the file cabinet and place them in the bin. Place the bin at the Cartridge Preparation station. If a replacement flashcard is necessary, locate the binder that contains all the flashcards. Select any flashcard labeled as **IMPROVE Replacement**. Place the flashcard inside the plastic container and place it inside the bin.

Ensure to flag the late incoming box as “Download only – Replacement being sent out” through the web app under the “Sample Boxes” tab.

5.3 Updating Weights

Sometimes during the Quality Control check, a filter is found with a hole in it or particles that will not come off. When things like this happen, the student assistant or laboratory technician changes out the filter for a new one and notes the new weight. The filter barcode is given to a lead lab assistant, as the new barcode and weight needs to be entered into the Filter Mass table.

Navigate to the WebApp > Analysis Data > Mass. Enter the information for the filter in the search criteria. Select Edit Pre-Weight or Edit Post-Weight. Assign an Analysis QC code of 0-Invalid to the current entry. Select **Okay**. Select **View records details**. Select **(+) New** and populate the table with the correct information. Ensure that the Analysis

QC Code is 1-Valid. Select + **Add analysis comment**. Enter a comment explaining why the mass was updated.

The Mass table will now have multiple entries for a single sample indicating that the mass was changed. This same method can be used for Post Weight adjustments, or Pre-Weight adjustments needed after a swap.

5.4 Monitoring Field Blanks

Field blank quotas are monitored at the Cartridge Preparation station in the lab application. If too many field blanks are loaded, they are removed by applying an XX status and comment. If a field blank is listed in the database, but is not physically loaded, an appropriate comment must be attached, and the status must be updated to XX.

5.5 Status Adjustments

Status adjustments are performed whenever the status of a filter changes after its information has been entered into SQL database. This is done by changing the status in SQL table adding a comment to explain why the status was changed, and noting the source in which the status was altered. An issue detailing the change is also added to the JIRA project, if applicable, in case any mistake is made making changes in SQL.

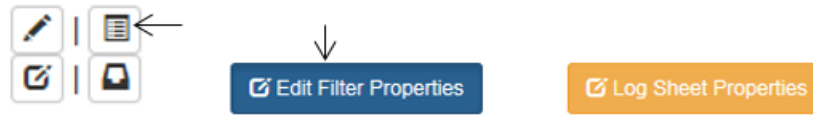
There are two important points to remember when making status adjustments:

1. When a change in SQL is made using the Web Application, be very careful to make changes to the correct site, date, module, and ordinal position.
2. It is important to follow a standardized way of commenting in SQL and creating a JIRA issue so searches for information can be done efficiently. Use templates whenever possible.

The following steps describe how to change the status in SQL:

1. Open the file named "2018 Comment Database.xls." It is located in U:\IMPROVE\LOGS\StatusFlags.
2. If applicable, log in to <https://improve.atlassian.net/jira/projects> Navigate to the correct site project and create a new JIRA issue template. The Issue type should be a Sample Related Problem. The Priority can be changed to Minor.
3. Next open the Sample Comments document and find the "Status Adjustment" comment. Make pertinent changes to the comment using examples from the "2018 Comment Database". Update the first relevant sample date, problem with the filter, channel, sample date, and old and new status. If more than one filter is being adjusted, change the number in the upper left corner in the parentheses to match the number of filters being modified. Copy the first line to the JIRA issue's Summary line, and the rest to the Description field. Create the issue.
4. Log in to the web application: <http://improve.aqrc.ucdavis.edu/Filters> Navigate to the site, data and module for the filter. Select the "View Filter Details" button

on the upper right side. Then select edit filter properties.



5. Update the appropriate filter status.
6. Click on **Okay** to finalize changes.
7. Click Add new Comment to insert the comment into the Filter Comments. If the scenario differs from the “2018 Comment Database.xls” sheet enter a detailed comment explain the series of events.
8. Select SHL as the source if a comment was made not in relation to the weight. Select Weighing Lab if the comment was made in relation to the weight.
9. Navigate back to the JIRA issue created previously and close it after confirming the status change.

5.6 Printing the Stickers

5.6.1 Cassette Stickers

Open the U:\IMPROVE_Lab\Lab Gravimetric\Stickers. For cassette stickers, choose the correct cassette label file depending on cycle (2-3-2' or 3-2'-2). Press **Enable Content** if needed. Open the correct tab (ABCD for normal sites, ABCDX, or Single Mod). Type in the site name(s) that need stickers and sample date for the first filter. For 5X module sites, also remember to fill in the 5X module with 5A, 5B, 5C or 5D.

Verify the stickers are correct, then click on **File** and press **Print**. In the **Print** menu, make sure the IMPROVE lab printer is selected. The file will automatically attempt to print ten sheets, so modify the number of pages printed so only the active sheets will print. Click **Printer Properties** and change the paper source to **Manual Feed**. Press **Print** and feed the printer blank cassette sticker sheets. After printing, color the sticker sheets by drawing a line down the middle of the 1A column with a red marker, down the middle of the 2B column with a yellow marker or highlighter, 3C column with a green marker or highlighter, and 4D column with a blue marker or highlighter. The 5X module stickers are colored orange highlighter line down the middle of the column, only highlighter should be used as orange marker looks too similar to red marker.

File the colored stickers away into their respective folders in the file cabinet.

5.6.2 Week Bag Labels

Open the Stickers directory to U:\IMPROVE_Lab\Lab Gravimetric\Stickers. To print labels that go on the week bags, choose the “Bag - Labels” Excel file that

corresponds to the correct cycle for the box in question (2-3-2' or 3-2'-2). If more than one site needs week stickers, use the "Batch Site" tab. Enter in the sites and the first installment date. If only one site needs printing, use the "Single Site" printing. Use yellow stickers for 2-3-2' boxes and green stickers for 3-2'-2. The stickers are 2-5/8" x 1". Print following the same steps as the cassette stickers in section 5.6.1.

5.6.3 Box Top Stickers

Open U:\IMPROVE_Lab\Lab Gravimetric\Stickers . For the box stickers that go on the top left of the box, choose the "Box – Top Labels" file that is correct for the box cycle (2-3-2' or 3-2'-2). For labels for multiple sites, use the "Batch site" tab. If printing labels for only one site, use the "Single Site" tab. Print following the same steps as the cassette stickers in section 5.6.1. Use the same labels as the Week Bag labels. Use yellow stickers for 2-3-2' boxes and green ones for 3-2'-2 boxes.

5.6.4 Box Side Stickers

Open U:\IMPROVE_Lab\Lab Gravimetric\Stickers. For the large stickers that are placed on the sides of the blue boxes, choose either "Box - Side Stickers 2-3-2'" or "Box - Side Stickers 3-2'-2" depending on the cycle. Find the page containing the needed site stickers or create a new site label at the bottom of the document (editing Site and UC Code as necessary). Print the page, making sure to use manual feed. In general, use yellow 4 in. X 2 in. yellow labels for 2-3-2' boxes and green 4 in. X 2 in. labels for 3-2'-2 boxes. If the labels being replaced on a box are pink for multi-box sites, make sure to print on pink stickers.

5.6.5 Bin Labels

Open the U:\IMPROVE_Lab\Lab Gravimetric\Stickers. Find the "Bin – Velcro Tags" file. Click on the "Batch Site" tab and enter the site names for sites that need labels. Print using manual feed. Use the appropriate color sticker as designated in the box to the right in the file. To print barcodes only labels, navigate to the "Barcodes Only" tab. Laminate the sheets and place a Velcro adhesive to the backside of the label.

5.7 Adding New Sites

The sample handling laboratory has several responsibilities when a new site is created. After lab personnel have been informed of the new site code, associated UCCODE, and cycle, blue boxes and a bin are assigned to the site. In order to be able to prepare the first box for the site, lab personnel must notify a database manager to set up the site in SQL. A check list of things to be done can be found in JIRA under Lab Ops, LO-69. Next the first

filter and sampling information must be entered into the lab application's Cartridge Preparation station.

5.8 Mass Validation

The lab application's Post-Sample weighing station gives automated weigh validation message, as described in *UCD TI #251H*, section 5.4: Troubleshooting. A Lead Lab assistant will review the message and will check if the recorded measurements are valid. Possible steps include:

1. Reweighing filters to confirm Post Weights.
2. Reviewing flow data to confirm flow data corresponds with high or low mass-loading.
3. Reviewing weights for a given week or box for possible swaps, double-sampling, or incorrect installation.
4. Comparing A-to-D mass-difference ratios for relative consistency. These will vary from site to site and between seasons. The "Mass Review" tab of the Improve Data web page (<https://shiny.aqrc.ucdavis.edu/ImproveData/>) provides helpful mass-differences for all filters, A/D mass-difference ratios for all sampling days, as well as seasonal average for each. The "Early Review" tab is also useful for a zoomed in view on PM2.5/PM10 mass ratio relationship.
5. Changing the filter status to Questionable Data (QD) if filter needs to be reviewed once analysis results are available.
6. Reviewing a month's worth of gravimetric data available in: http://aqrc-sql/Reports/report/Improve_2.1%20Reports/Filter%20Processing%20Lab/Filter%20Mass%20Data%20Validation. Filtering to samples weighing less than 0.005mg and greater than 2.00 mg. In addition, reviewing weights that are ± 0.005 mg for all field blank samples.

5.9 Reviewing Lab Application Pop-ups at Post Weigh

The lab application's Post-Sample weighing station will automatically generate a pop-up message whenever a weight does not meet the criteria below. Balance operators are to write a detailed note that a lead lab assistant will review.

1. Mass difference is less than or equal to 0.005 mg.
 - The Lead Lab assistant will reweigh the filter to confirm the Post Weight, if applicable.
 - Review the Flashcard data and Flow graph data for abnormalities.
 - Using the Web Application, leave the appropriate comment for that sampling date.
 - Use any of the other available tools detailed in section 5.8 to take appropriate action.

2. A-to-D mass difference ratio is not within a preset range, determined by the lab application.
 - Review the weights for the entire box, if either the A or D mass is significantly different from surrounding sampling dates reweigh said filter.
 - Review the flow data and PM_{2.5}/PM₁₀ mass ratio for abnormalities within the box. If needed, compare the mass difference to historical records.
3. Field Blank mass difference is outside ± 0.005 mg.
 - The Lead Lab assistant will reweigh the filter to confirm the Post Weight.
 - Using the web application, leave the appropriate comment for that sampling date.

5.10 Cleaning the MTL AH500 Auto handlers

While the MTL AH500 Autohandler door is closed at most times, the chambers will accumulate dust and other contaminants over a week of use. Every Friday, or last business day of the week, the chamber must be cleaned, and the reference filters and weights air brushed.

1. Schedule fifteen minutes, at least one hour before the MTL AH500 Autohandler is loaded with filters, to clean the chamber.
2. If there are any filters remaining in the weighing silos, they must all be unloaded. Do not remove the filters or weights in the garage positions. Place the clean filters in the appropriate bin and organize the sampled filters in a separate bin.
3. Working from the top down, air brush and or wipe down all surfaces inside the chamber. Only use ethanol and low-lint laboratory wipes to clean. Do not use any household cleaners. Take care when cleaning on and around the middle shelf as not to damage the electronic boxes, wiring, or Mettler Balance display unit.
4. Remove the glass lid on the Mettler Balance weighing chamber and press either the left or right button on the display unit to rotate the weighing chamber to the left or right. Air brush the inside of the weighing chamber, directing dust towards the opening when possible. When done, replace the glass lid, and close the weighing chamber. Take care to not move the faraday cage orientation, doing so could cause damage to the faraday cage once routine weighing is resumed.
5. Air brush around the Mettler Balance chamber and confirm that it is level when done. Special care must be taken not to move the Mettler Balance; its position is critical when operating the MTL AH500 Autohandler.
6. Air brush the y-axis threads on the handler arm.
7. Wipe down the protective aluminum plate that occupies the top garage position in each silo.
8. Before handling any reference filter or reference weight in the garage positions,

note its orientation and location. If handling a filter with a matrix code, the position of the matrix code is critical for it to be recognized by the reader. Airbrush both the top and bottom sides of each reference filter and weight, returning the reference filter or weight to the original orientation. Work one carrier at a time and replace it back to its original garage position before handling another carrier.

9. Clean the bottom of the chamber last. If the polonium strip holder must be moved, make note of its position and orientation relative to the rectangular white sticker placed to the right side.

5.11 Weekly Checks, Tracking and Shipping

Weekly checks are performed by lead lab assistants to ensure timely delivery of boxes, tracking of all filters, and maintenance of equipment. Checks include but are not limited to:

1. Check Field Blank Quota for the month through the Cartridge Preparation station.
2. Track that the multi-box sites have boxes far enough in advance. Reference for the sites is located in U:\IMPROVE_Lab\Lab Gravimetric\Daily Operation files in file "Multi_Box_Sites".
3. Review and contact operators for Late Boxes located in IMPROVE Status Views.
4. Update Network Status located on IMPROVE Status View page. Update 'NetworkStatusUpdate_RHR' workbook located in U:\IMPROVE_Lab\Lab Gravimetric\RHR.
5. Review Outgoing Boxes reports located in IMPROVE status view.
6. Re-inventory Terminal status filters.
7. Schedule UPS pickups for selected sites. Updated list is located in U:\IMPROVE_Lab\Lab Gravimetric\Daily Operation files titles 'Sites_UPS_Pickup'.
8. Checking the continuous status of the MTL Autohandler RH and temperature levels.

5.12 Recertifying Metal Test Weights

All stainless-steel external test weights are certified annually. The effective dates are shown on each respective certificate. This is regardless of the frequency or duration of their implementation.

Between the two MTL automated weighing systems, there are three sets of test weights in the range of 50 mg, 100 mg, 200 mg, and 400 mg. Each set is labeled by the year of receipt and A (100mg), B (200mg), or C (400mg). For example, the 100 mg test weights received in 2018 is labeled 18A. Each set of test weights is to be recertified by an accredited metrology lab annually. While two sets are in use in each MTL automated weighing system, the third is in the recertification process or in storage. Time the recertification rotation approximately four months apart.

For manual weighing, there are two sets of test weights at 50 mg and 100 mg. Each set is labeled by the mass range and A, B, C, etc. For example, a 50 mg test weight is labeled 50A. A pair of 50 mg and 100 mg manual-weighing test weights are not grouped as sets, but are commonly recertified at the same time. While one set is in use in the lab, the other is in the recertification process or in storage. Time the recertification rotation at least 2 months apart.

1. Recertification is requested through the group or department purchaser.
2. After a set of recertified weights are received back at the Sample Handling Laboratory, all packing and purchasing documentation must be copied for the group or department purchaser.
3. Scans of the certificates are filed in this directory: U:\IMPROVE_Lab\Lab Gravimetric\Balance QA and Testing\Reference Weights\Test Weight Certificates. There is a separate file for each test weight.
4. Original copies of the certificates are filed in a binder in the Sample Handling Lab. There is a separate binder for Sample Handling Lab test weights and Carbon Lab test weights. There is a divider for each test weight.
5. Information from the certificates are entered in the IMPROVE WebApp: <https://improve.aqrc.ucdavis.edu/ReferenceWeights>.
 - a. On the Metal test weight tab, locate the test weight by its Label.
 - b. Click on the Details button.
 - c. In the Certifications section, click the Add button and input data into all required fields based on the information from the certificate, then click on the Create button to finalize the entry.
6. Information from the certificates are entered into the MTL Filter Weighing Software (FWS).
 - a. Under the Administration section, navigate to the Calibration Weights tab.
 - b. On the list to the left, select the test weight name and click on Edit Calibration Weight.
 - c. Input data into all required fields based on the information from the certificate, then click on the Save button to finalize the entry.
7. Generate a report for the Laboratory Manager.
 - a. Weigh the recertified test weights ten times each on each MTL automated weighing system. There is a QC Check procedure set up for this.
 - b. Using another weight's report or a past report as a template, query and copy over the ten replicate measurements for each test weight, calculate averages from each MTL system, and compare the averages between MTL systems. The Report tab covers full instructions and a template for presenting this information to the Laboratory Manager.
8. U:\IMPROVE_Lab\Lab Gravimetric\Balance QA and Testing\Reference Weights\Test Weight Acceptance\
9. Notify the Software Development group and request an update to the certified values on the Sample Handling Lab Daily QC page:

https://shiny.aqrc.ucdavis.edu/balance_daily_ops/. Provide the ID number, certified mass, and upper and lower ranges.

5.13 Recertifying Automated Weighing Chamber Environmental Probe

Every Vaisala environmental monitoring unit is recertified annually. The effective dates are shown on each respective certificate. This is regardless of the frequency or duration of their implementation.

Between the two MTL automated weighing systems, there are three Vaisala environmental monitoring unit. Each is labeled VAIHMT and a number and each is to be recertified by an accredited lab annually. While two are in use in each MTL automated weighing system, the third is in the recertification process or in storage. Time the recertification rotation approximately four months apart.

1. Recertification is requested through the group or department purchaser.
2. After a Vaisala environmental monitoring unit is received back at the Sample Handling Laboratory, all packing and purchasing documentation must be copied for the group or department purchaser.
3. Scans of the certificates are filed in this directory: U:\IMPROVE_Lab\Lab Gravimetric\Balance QA and Testing\Vaisala Environmental Monitoring Unit Certificates. There is a separate file for each test weight.
4. Original copies of the certificates are filed in a binder in the Sample Handling Lab.
5. Replacement of the hardware is done after the MTL system is entirely shut off.
 - a. Close the FWS.
 - b. Close the Environmental Monitoring Software.
 - c. Shut down the computer.
 - d. Turn off the Autohandler and HVAC power using the circular buttons on the front of the unit.
 - e. Flip the cutoff switch on the back of the MTL automated weighing chamber.
 - f. Unscrew and unplug the currently-installed Vaisala environmental monitoring unit, and install the replacement unit.
 - g. Power everything back on in the opposite order as in the instructions listed above.
 - h. Through the Environmental Monitoring Software and FWS, confirm that the temperature and humidity are read.