

**TI 251A** Box Cycles and Cartridge Orientation

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## 1. PURPOSE AND APPLICABILITY

The purpose of this SOP is to describe the different box cycles used for IMPROVE sites, to detail the proper cartridge orientation and configuration, and to explain the quarter naming system used to organize filters for analysis.

## 2. SUMMARY OF THE METHOD

IMPROVE sites run on one of two box cycles, which are referred to as “dot” (or 2-3-2’) and “non-dot” (or 3-2’-2). Cycles are differentiated by cartridge configuration and box labels. Each cycle is three weeks long, with loaded cartridges for each week. Cartridges are configured according to the week and cycle to which they belong. After the filters have been sampled and returned to the sample handling laboratory, they are organized for analysis and separated into four different quarters based on the months in which they were sampled.

## 3. PROCEDURE

### 3.1 Types of Boxes

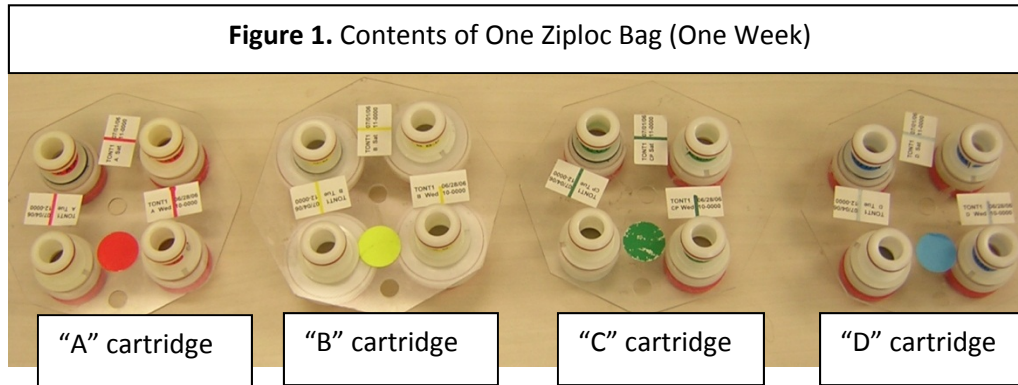
There should be boxes with several different types of labels found on the shelves above the “B/C Download” station. Some boxes have green labels with the site code listed on them, while others have yellow labels with the site code listed on them and an orange dot sticker next to the label. Priority boxes of either box type have PINK site stickers, but dot boxes with pink site stickers will also have an orange dot. All boxes with pink stickers receive priority at all stations. Most of the boxes are blue, and those boxes are shipped by Federal Express (FedEx). Some boxes are white, and these boxes are shipped through the United States Postal Service (USPS) instead of FedEx. White boxes receive the same priority as pink label boxes because it takes longer for USPS sites to be delivered. Priority boxes should be downloaded before normal boxes.

All regularly sized boxes, or “main” boxes, have a five-character site code that ends in a number (usually 1). In addition to the main boxes, some sites have an additional small box for their X module. These small boxes are named the same as their corresponding main box, but with an “X” at the end instead of a “1.” X-boxes are downloaded/uploaded/leak checked immediately after their corresponding main boxes.

### 3.2 Box Contents

#### 3.2.1 Primary Filters

Each box should contain three Ziploc bags labeled Week 1, Week 2, and Week 3. Each Ziploc bag should contain four cartridges. There are four types of cartridges: “A” (red), “B” (yellow), “C” (green), and “D” (blue) (Fig.1). Each bag should have one of each type of cartridge. Cartridges contain three to four cassettes. The cassettes in “A” and “D” cartridges contain Teflon® filters. The cassettes in “B” cartridges contain nylon filters, and the cassettes in “C” cartridges contain quartz filters.



### 3.2.2 X-Mod Filters

“X”-module boxes contain only one type of cartridge. They can be any of the four types (A, B, C, or D). Each box contains three week-bags for the “X” filters (Week 1, Week 2, and Week 3), with only one cartridge present in each bag. “X” cartridges are color-coded orange.

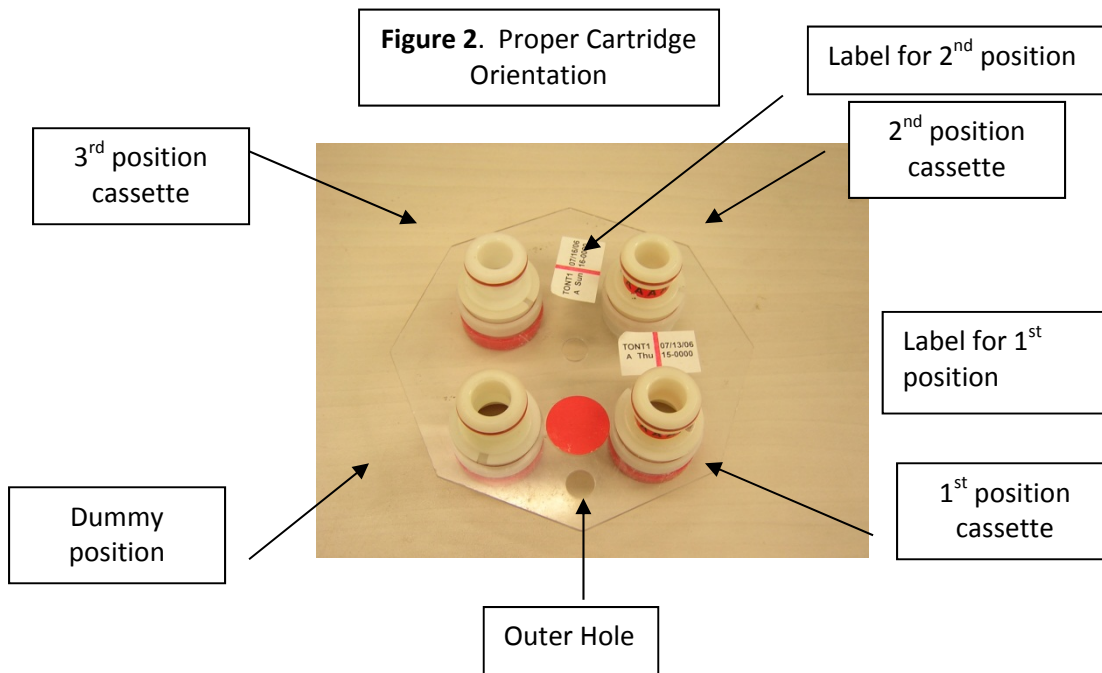
### *3.3 Proper Cartridge Orientation*

The proper orientation of the cartridge is with the labels facing up. There are two holes in each cartridge—one in the middle and one on the outer edge. If looking at the cartridge head-on, orient the cartridge so that the outer hole is facing 6 o’clock. Ensure that the color-coded circular sticker is above the outer hole, as this helps to orient the cartridge.

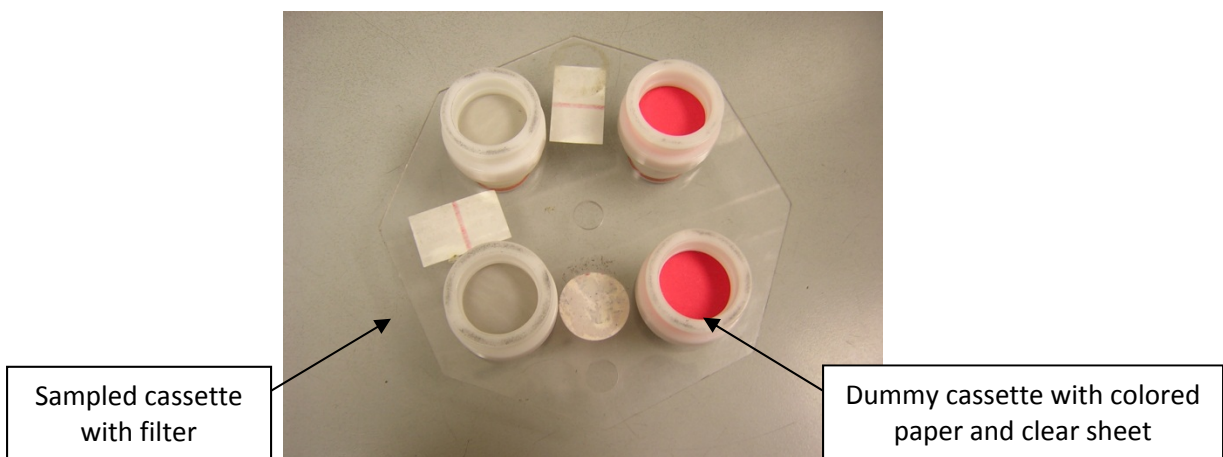
With the cartridge properly oriented, the sampling of the cassettes runs in a counter-clockwise manner. The bottom right cassette or the first position is always the first sampled followed by the top right (the second position) and then sometimes the top left (the third position) (Fig.2), depending on the week.

Two or three of the cassettes in each cartridge will have labels next to them. The label for each cassette can be found above in the picture. Printed labels contain the site name, the date of the sample, the sample day (Mon-Sun) and the cartridge type. Sometimes handwritten labels will appear in the third position. These are for field blanks, which are filters that are not sampled, but instead are used as controls. Handwritten labels will have the site name, sampling date (which will match that of position 1), and cartridge. Any unlabeled cassettes are considered “dummies” and do not contain any sample. Dummy cassettes contain a colored piece of paper and a clear circular sheet instead of a filter except for the “B” cassettes. For the “A” dummies, a red piece of paper and a clear sheet are used. The same protocol follows for “C” and “D” dummies, except that “C” dummies use a green piece of paper and “D” dummies use blue. The “B” dummies use two white circular sheets with the word “PALL” in blue writing. A dummy cassette can be identified by removing the red cap on the bottom of the cassette (Fig. 3).

All cassettes containing filters (except for the field blanks) should have a neck-tie around the center. Neck-ties are thin stickers that contain both the color and name of the type of cassette they are for. For example, neck-ties for "A" filters are red and have "AAAAAAA" typed on them; neck-ties for "B" filters are yellow and have "BBBBBBB" typed on them, etc. All of the neck-ties should be facing upright except for the "D". This sticker should be put on so that the typed "D"s are upside down.

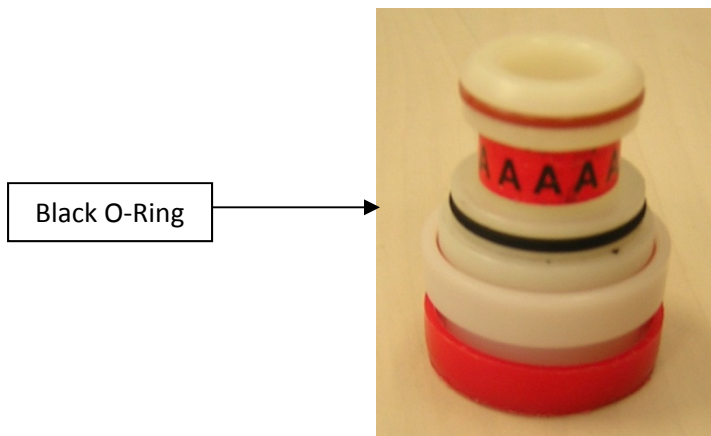


**Figure 3. Identification of Dummy Cassettes**



Some cartridges contain a cassette with a black rubber band, also called an “O-ring,” around its center and label. The black rubber band allows this cassette to be manually moved between cartridges when necessary. The week that this movable position is in is dependent upon the box cycle.

**Figure 4. Movable Cassette (O-Ring)**



### 3.4 Box Cycles

There are two different types of box cycles, which are referred to as the non-dots (3-2'-2) and the dots (2-3-2'). As previously mentioned, cycles can be identified based on the stickers found on the boxes they are shipped in. Non-dots have a green sticker with the site code printed on it on the boxes. Dots have a yellow sticker with the site code printed on it on the boxes. These boxes have an orange circle sticker next to the yellow labels.

#### 3.4.1 Non-Dots (3-2'-2)

Non-dot boxes have three routine filters in the first week, two routine filters in the second week, and two routine filters in the third week. In the first week, the first two cassette positions contain a filter. The third position, which is the top left position, is a movable cassette (the one with the O-ring) containing a filter. A dummy is in the fourth position. Any cassettes that contain a filter will have a neck-tie around the top of the cassette.

In the second week, there are filters in the first two positions. The third position is left empty. When the box is out in the field, operators remove the movable position found in the first week and insert it into this open space in the second week's cartridge. The empty space found in this cartridge is denoted by the apostrophe after the "2" in "3-2'-2." The fourth position is a dummy.

In the third week, there are two cassettes with filters and two dummies. This is the only week in which field blanks can be found for a non-dot. They will be in the third position (top-left) instead of a dummy.

#### 3.4.2 Dots (2-3-2')

Dot boxes have two filters in the first week, three filters in the second week, and two filters in the third week. In the first week, there are two cassettes with filters and two dummies. This is the only week in which field blanks can be found for a dot box. They will be in the third position (top-left) instead of a dummy. Any cassettes that contain a filter will have a neck-tie around the top of the cassette.

In the second week, the first two cassette positions contain a filter. The third position (top-left) is a movable cassette, which also contains a filter. Operators in the field will remove the movable position and place it into the third week during their sample change. The fourth position is a dummy.

In the third week, the first two positions contain cassettes with filters, and the 3rd position is left empty. The movable cassette will be inserted into this space when it is out in the field. The empty space found in this cartridge is denoted by the apostrophe after the "2" in "2-3-2'." The fourth position is a dummy.

### *3.5 The Quarter Naming System*

When filters are organized for analysis, they are separated into four different quarters based on the months in which they were sampled. Every quarter is given a three character code for identification purposes. The quarter is identified by the month and the year. March through May are identified as "A" months, June through August are "B" months, September through November are "C" months, and December through February are "D" months. Therefore, there are four quarters in a year each labeled A, B, C or D. The last two digits of the year in which the quarter began are found after the quarter letter. For example, December of 2006 through February of 2007 would be D06, while March through May of 2007 would be A07.

**TI 251B** Balance Calibrations and Control Filters

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## 1. PURPOSE AND APPLICABILITY

The purpose of this SOP is to describe the procedures used to weigh calibration weights and control filters in the sample handling laboratory. Metal weights are used to calibrate the Cahn balances and to test the balance measurements. Control filters are because they provide a practical approach to monitoring balance performance and artifact collection on the filters. The exact same media is used for control filters as is used for those that go out into the field, so the behavior of these filters should be comparable to network filters. Also, the 32 business days in between re-weighing each control filter mimics the approximate timing between pre-weighing and post-weighing IMPROVE filters. The results of controls confirm that the balance equations remain relatively constant over time, as control filter post weights are usually very close to their pre-weights.

## 2. SUMMARY OF THE METHOD

The balances are calibrated twice a day, once in the morning and once in the afternoon. A pair of control filters is weighed after balance calibrations are complete. One of the control filters is a clean filter that is prepared before morning calibrations, and the other control filter has been pre-weighed and stored for 32 days.

## 3. CAUTIONS

Be careful when handling the metallic weights. Dropping and/or damaging these can change their weight measurements significantly, creating a discontinuity in the data.

It is important not to damage or contaminate the control filters in any way. Dropping a filter on a work surface or tearing a hole in the membrane may cause the Teflon<sup>®</sup> filter to weigh significantly more or less than it otherwise would; thus, it would not be a true representation of balance performance. Any incidents that occur must be noted in the comments field of controls.dbf.

## 4. INTERFERENCES

A change in the gauss will affect the balance reading. If a change in the gauss occurs during controls, wait for the gauss to stabilize, recalibrate, and then re-weigh the filter to ensure that an accurate value is recorded.

## 5. EQUIPMENT AND SUPPLIES

### *Calibration*

- Metal calibration weights (200mg and 50mg)
- Microbalances
- Plastic forceps
- Computers attached to each balance, with FoxPro<sup>®</sup> and TeraTerm programs installed
- Polonium strips

### *Control Filters*

- 32 filter cassettes (with small red caps to cover the tops) in black controls tray



- 2 Petri slide dishes
- Yellow circular stickers
- 36 red caps for cassette bottoms
- Metal forceps
- Microbalances
- Computers attached to each balance, with FoxPro® and TeraTerm programs installed
- Polonium strips
- Pen
- Controls box with archived filters
- Current-lot Teflon® filters

## 6. PERSONNEL QUALIFICATIONS

Staff members calibrate the balances and weigh control filters in the morning before box work can begin. Trained student lab assistants may perform balance calibrations and weigh control filters in the afternoon under staff research associate supervision.

## 7. PROCEDURES

### 7.1 Background Information for Calibrations

The balances in the sample handling lab are to be calibrated twice every day, once in the morning between 8 a.m. and 9 a.m. and once in the afternoon between 1 p.m. and 2:30 p.m. (see Figure 1). All machines may be calibrated at the same time. Morning calibrations and controls must be completed before any of the weighing for the day can begin.

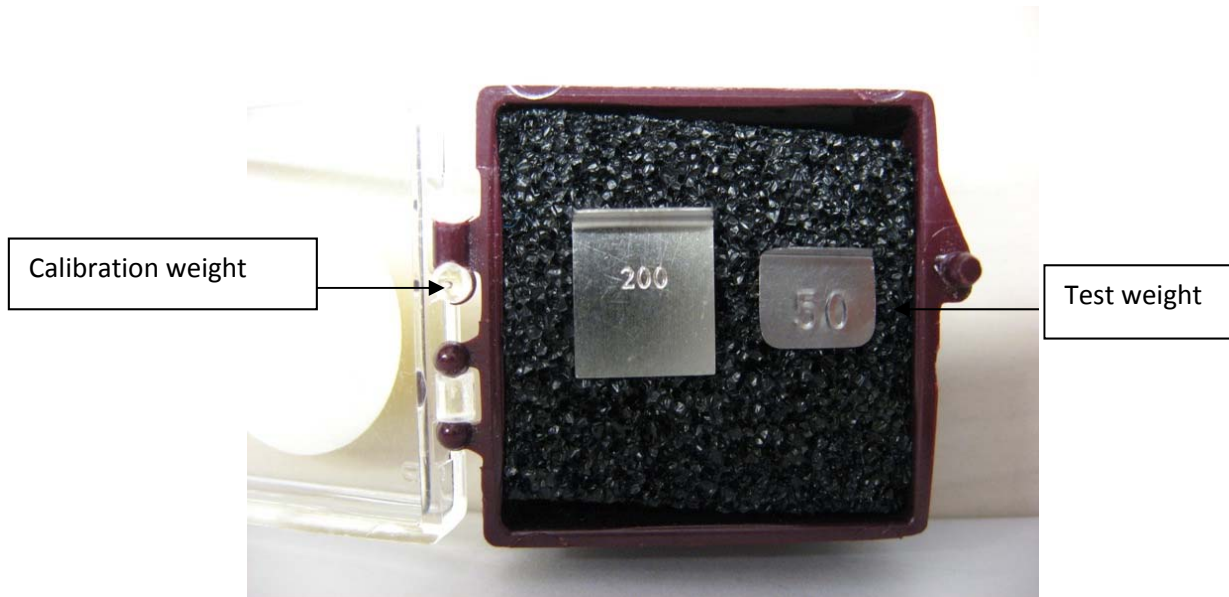
Figure 1: Cahn microbalance (front view)



Each balance has an individual calibration weight. “Test” weights are shared between balances. Balances Cahn 30 and Cahn 30a share a test weight, as do balances Cahn 31 and Cahn

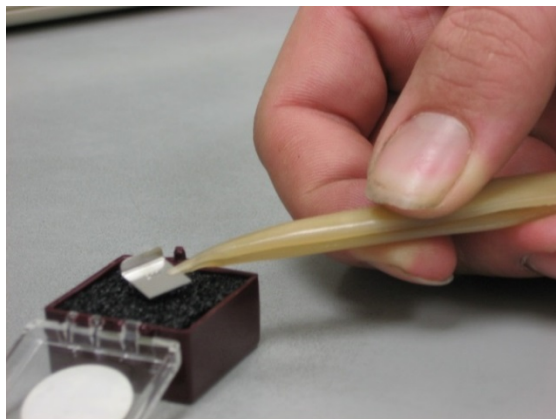
31a. It is important that calibration weights and “test” weights are used at their designated balances (see Figure 2).

**Figure 2: Calibration and “Test” Weights**



**IMPORTANT:** Never use metal forceps for grasping calibration weights or “test” weights; always use the plastic forceps provided (see Figure 3). Metal forceps can chip metal off of the weights and alter the balance readings. Make sure to wave the weights above the polonium strips before placing them on the scales. The polonium strips remove any static electricity from the weights; static electricity could affect the balance readings. Do not let the weights touch the polonium strips, because any contact with the metal strips may chip the weights and affect their balance readings. The polonium strips can always be found on the counter in front of the balances or on the shelf in front of the computer screen.

**Figure 3: Using Plastic Forceps to Grasp the Weights**



During calibration, the program will display a prompt to provide a gauss reading, which can be found by reading the gauss meter at the top center of the west wall of the sample handling lab. Gauss is a measure of magnetic flux density. If the balances are giving unusual readings during calibration, the most likely reason for the situation is a change in the gauss. If the gauss reading changes during or after calibration, inform a supervisor. Changes in the gauss affect the readings of the balances, and the balances will then usually require recalibration.

**CLEANING:** For the balances to be accurate, it is essential to reduce fugitive dust levels and keep the sample handling lab clean. The countertops and forceps are cleaned with ethanol and Kimwipes<sup>®</sup> every morning. On Fridays, the lab receives a more thorough cleaning. The floors are cleaned with a HEPA vacuum. In addition, the outside of the polonium strips and the inside of the balances are cleaned with ethanol and cotton swabs. The balance pans are also removed and cleaned with ethanol.

#### *7.2 Balance Calibration Procedure*

**NOTE:** Steps 1-4 apply to morning calibrations only.

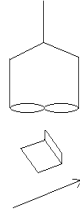
1. Remove items from countertops and wipe down the countertops using ethanol and Kimwipes<sup>®</sup>. Replace items.
2. Turn on all four computer monitors.
3. The computer will ask for a username and password. The username is the balance name (cahn31, cahn31a, cahn30, or cahn30a). The password is the word *Balance* followed by the balance number (e.g. Balance30a). The username and password are both case sensitive.
4. After logging in, the computer should automatically open the TeraTerm program (which has a green screen) and either the PRE or POST program. The PRE program will be opened for balances 31A and 30 while the POST program will be opened for balances 30a and 31. Move the windows so that both the TeraTerm and the PRE/POST program can be viewed at the same time.

5. The TeraTerm window is bright green and displays filter weights on the left-hand side. Look at these filter readings when determining if a filter is stable.

**NOTE:** Steps 6-15 are for both morning and afternoon calibrations.

6. Follow the prompts closely from this point forward. Do not do anything without being prompted by the computer program. Enter user initials into either the PRE or POST program (depending on which station is being occupied).
7. The top right corner of the screen should read: **F1**=calibrate **F2**=controls. Press **F1** to calibrate the balance.
8. Remove the plastic "dummy filter" from the balance pan using metal forceps. (The plastic "dummy filter" prevents the balance from resting at zero and prevents drifting of the calibration.)
9. Press "Enter."
10. Allow the scale to stabilize with no weight on the pan. The computer will automatically record the mass on the screen when the balance has stabilized. This is the "zero" mass.
11. If the "zero mass" picked up by the computer is unstable, select the DISCARD AND RETRY option by pressing the letter **D** on the keyboard. Any weight (included the zero weight) picked up by the balance is considered unstable if:
  - a. it has not been on the balance pan for at least 1.5 minutes.
  - b. the weight measured by the scale is continuing to decrease.
  - c. the weight on the computer screen does not match the weight on the balance and/or the weight on the TeraTerm window.
12. Press "Enter" to accept the correct zero weight. The program will display a prompt to zero the balance and then mount the calibration weight. Press the **TARE** button once. This brings the zero of the balance to 0.000 mg. The **TARE** button needs to be pressed even if the recorded zero weight is 0.000. Do not open the balance door until the **TARE** button has been processed. Wait for the message box on the top right corner of the screen, which reads "Please zero the balance" to go away.
13. Place the calibration weight on the balance (see Figure 4). Make sure the correct calibration weight is used for each balance. During morning calibrations, wait for at least 5 minutes for the balance to stabilize. For afternoon calibrations, wait for at least 90 seconds for the balance to stabilize. Make sure the balance has picked up a correct and stable weight and then press "Enter."
14. Press the **CAL** button when prompted. Do not remove the calibration weight from the balance until the **CAL** button has been pressed and the balance reads 200.000 mg. For morning calibrations only: wait 1-2 minutes after pressing the **CAL** button to ensure the balance reading stays at 200.000mg. If the reading changes, press the **CAL** button again.
15. Using plastic forceps, remove the calibration weight and place the "test" weight on the balance pan. Wait for the balance to stabilize and pick up the proper weight for the "test" weight. The recorded "test" weight value should be close to the value from the last calibration (listed at the bottom of the computer screen). The screen may display a prompt to get a supervisor if the "test" weight values differ greatly between the current and previous calibration.
16. Enter the current gauss reading and press "Enter" twice. This ends the calibration sequence.

**Figure 4: Proper Orientation for Calibration and Test Weights**



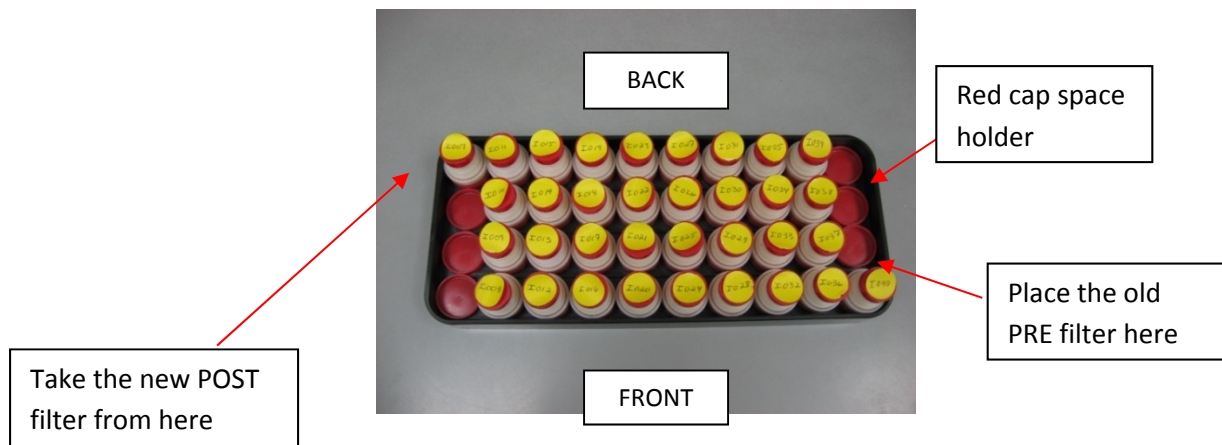
### 7.3 Circulation of Controls

After calibrating the balances the controls can be weighed. There are two control filters to be weighed every day: a PRE control and a POST control. Different control filters are used every day. Every morning a supervisor will swap out the old controls for new controls.

The PRE control is always a brand new filter. Once a filter has been used as a PRE control, it is then placed into a cassette and stored for 32 days in the black tray found on the shelf above Cahn 31. Orient the tray so that the smallest numbers are on the left and the largest numbers are on the right. There is one exception: after the numbers reach 999, they start over again at 001. In this case the largest numbers go to the left, until only double and triple-digit numbers remain the tray.

The PRE control used the previous day is always placed in the tray to the far right. The order of rotation is youngest to oldest from right to left then back to front. The order “snakes” in the tray, as shown by the sequence of the numbers (see Figure 5). Six red caps hold unused places in the tray and should be rotated into the new empty spots created by PRE and POST control circulation.

**Figure 5: Organization of controls in 32-day storage**



After it has been in storage in the black tray above the master balance for 32 days, the old PRE control is removed from its cassette and becomes a new POST control. New POST controls

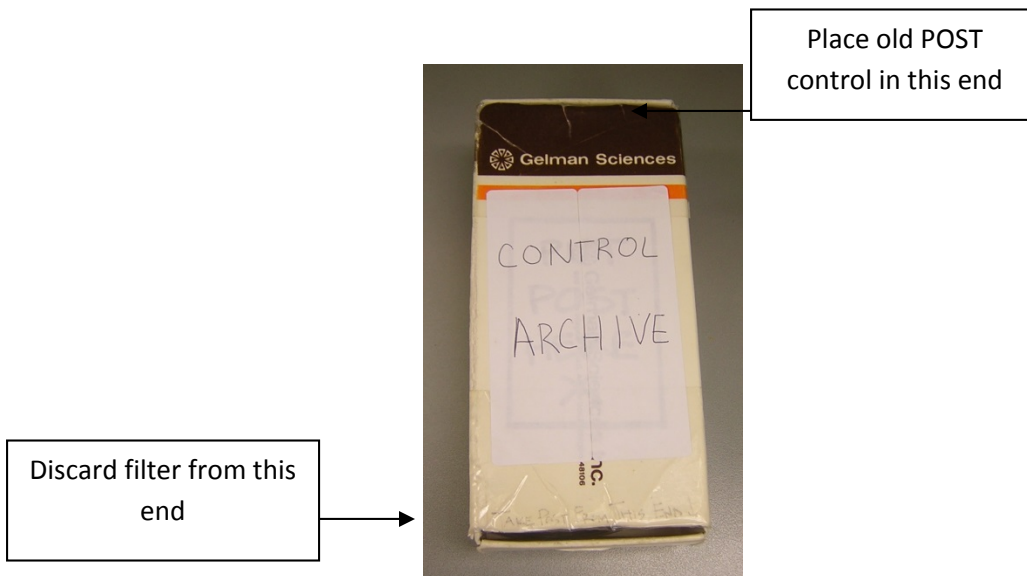
are taken from the far left position (the position where the oldest cassette is located). After it has been used as a POST control, the filter is placed into the back end of the white control archive box for 22 days (Figure 6). After 22 days in the archive box, a filter is taken out of rotation and discarded.

#### 7.4 Changing the POST Control Filter

**NOTE:** Always use metal forceps while handling control filters.

1. Retrieve the prior day's PRE and POST control filters, which can be found in Petri dishes above Cahn 31. The PRE control will always be labeled with a lower number than the POST control. Retrieve the control archive box and the black control storage tray from above Cahn 31.

**Figure 6: Control Archive Box**



2. Hold the control archive box so that the writing is right-side up and readable. Find the number on the filter at the back of the box; this number should be one higher than that of the POST control from the day before (Figure 6). Place the POST control from the day before in the back of the control archive box.
3. Remove the filter from the very front of the box for disposal. Remove and discard the label from this filter. Retain the Petri dish.
4. There should now be one empty unlabeled Petri dish. Remove the oldest filter cassette from the black storage tray (this will be in the far left position).
5. Place the label from the cassette on the top of the empty Petri dish.
6. Open the cassette with the arbor press and place the filter into the newly labeled Petri dish. Make sure not to touch or damage the filter. Put the new POST control to the side to minimize confusion.

### *7.5 Changing the PRE Control Filter*

**NOTE:** *Always* use metal forceps to handle control filters.

1. There should now be an old PRE control in a Petri dish and an empty unlabeled cassette.
2. Remove the label from the old PRE control Petri dish and place it on the top of the empty unlabeled cassette.
3. Remove the filter from the old PRE control Petri dish and place it in the newly labeled cassette. Close the cassette using the press and place the red cap back on.
4. Place the cassette into the correct place in the black tray (see Figure 5). There should now be an empty, unlabeled Petri dish.
5. Find a new undamaged Teflon<sup>®</sup> filter from the filter boxes in the filing cabinet between the PRE and POST stations.
6. Check the integrity of the filter. Check for holes, contaminants, and manufacturing defects. Do not use the filter if it appears to be faulty.
7. Place the new filter in the empty unlabeled Petri dish; this is the new PRE control.
8. There should be pre-labeled circular stickers that are for the PRE controls on the shelf above Cahn31. Take the sticker labeled with the lowest number from this sheet of stickers and use it as the PRE control label. Place the sticker on the Petri dish. The PRE and POST controls are now ready for measurement.

### *7.6 Background Information for Controls*

The PRE and POST control filters must be swapped out in the morning before control measurements are conducted. Controls must be measured after the balance calibrations are completed. Both the PRE and POST controls must be measured on the master balance (Cahn 31) before they are measured on any other scale. Be careful not to damage the control filters. Before weighing any of the controls, place them on the polonium strips with metal forceps to remove any static that could affect filter weight.

### *7.7 Control Measurements Procedure*

**NOTE:** *Always* use the metal forceps when handling control filters

1. Obtain the new PRE and POST controls (sections 7.4 and 7.5). Because the Cahn 31 is the master balance, the PRE and POST controls must BOTH be weighed on Cahn 31 before they can be weighed on any other balance.
2. Enter user initials into either the PRE or the POST Microsoft Visual FoxPro Program (depending on the station). The top right screen should read **F1**=calibration **F2**=controls. Press **F2** for controls.
3. Rest the PRE filter on a polonium strip for about 5 seconds. Now place the PRE control filter on the balance pan. Ensure that the PRE control filter number on the Petri dish matches the

- number for the PRE control on the computer screen. The PRE control filter will be labeled with a letter—capital I—followed by three digits.
4. Wait for the balance to stabilize. If the wrong weight is picked up, press **D** for discard. Then wait for the computer to pick up the correct weight. If the program takes too long to pick up the correct weight, press the spacebar to force it to pick up the current weight.
  5. Press “Enter” to accept the stable filter weight. Remove the PRE control from the balance pan. Check that the POST control filter number on the Petri dish matches the number on the computer screen. Place the POST control on a polonium strip for five seconds and then place it on the balance pan.
  6. Let the balance stabilize and take the correct weight value, as in Step 4. The difference between the PRE weight (taken 32 days ago) and the POST weight (taken today) for the POST control filter is listed on the bottom right of the screen and should be no larger than  $\pm 0.003$  mg. If the difference is larger than  $\pm 0.003$  mg, inform a supervisor.
  7. Record all weights and weight differences onto the Controls Report Sheet found in the weight room (Figure 7). Each Controls Report Sheet has sections to record the POST and PRE control in both the morning and the afternoon for all the balances for two days. Make sure to record the weights in the correct section. Initial under the weights along with the date, time and filter number. Press “Enter” to accept the control weights.
  8. Repeat Steps 1-6 on balances 30, 30a and 31a.

**NOTE:** There should never be an entry under DIFF for Cahn 31 in the morning controls report.

**Figure 7: Controls Report Sheet**

|                        |                    |                     |                    |                     |
|------------------------|--------------------|---------------------|--------------------|---------------------|
| <b>CONTROLS REPORT</b> |                    |                     |                    |                     |
| (Morning)              |                    |                     |                    |                     |
|                        |                    | <b>DATE:</b>        |                    |                     |
|                        |                    | <b>TIME:</b>        |                    |                     |
|                        |                    | <b>FIL ID:</b>      |                    |                     |
|                        | <b>CAHN<br/>31</b> | <b>CAHN<br/>31a</b> | <b>CAHN<br/>30</b> | <b>CAHN<br/>30a</b> |
| <b>WEIGHT</b>          |                    |                     |                    |                     |
| <b>DIFF</b>            |                    |                     |                    |                     |
| <b>INITIALS</b>        |                    |                     |                    |                     |

|                        |                    |                     |                    |                     |
|------------------------|--------------------|---------------------|--------------------|---------------------|
| <b>CONTROLS REPORT</b> |                    |                     |                    |                     |
| (Afternoon)            |                    |                     |                    |                     |
|                        |                    | <b>DATE:</b>        |                    |                     |
|                        |                    | <b>TIME:</b>        |                    |                     |
|                        |                    | <b>FIL ID:</b>      |                    |                     |
|                        | <b>CAHN<br/>31</b> | <b>CAHN<br/>31a</b> | <b>CAHN<br/>30</b> | <b>CAHN<br/>30a</b> |
| <b>WEIGHT</b>          |                    |                     |                    |                     |
| <b>DIFF</b>            |                    |                     |                    |                     |
| <b>INITIALS</b>        |                    |                     |                    |                     |

**8.0 DATA AND RECORDS MANAGEMENT**



The calibration and “test” weights from each balance are stored in U:\IMPROVE\BALCTRLS\calib.dbf. Be careful when editing the .dbf file and only make changes if absolutely necessary.

The Controls database is primarily accessed through the POST program and is organized to include the following information: filter identification; pre-weight date; number of days between pre and post; mask type; name of the balance operator responsible for each measurement; any comments; Pre, Post, re-Pre and re-Post weights; Post minus Pre weights; re-Pre minus Pre-weights; and differences between the Pre, Post, re-Pre, and re-Post weights measured on the microbalances.

The Controls database can also be accessed through the U drive at U:\IMPROVE\BALCTRLS\controls.dbf. Caution is warranted when making any changes to this database; make sure any changes are entered correctly.

## **9.0 QUALITY ASSURANCE AND QUALITY CONTROL**

Calibration and “test” weights are monitored by laboratory staff in order to ensure that the balances are both accurate and precise in their measurements. If laboratory personnel notice a consistent, significant change in weight for a calibration or “test” weight, it is either sent for recertification and a “backup” weight is introduced, or the weight is simply replaced.

Several checks are provided by the POST program when taking control weights. The identification numbers of the control filters that need to be weighed are shown on the screen while weights are taken, allowing the balance operator to confirm that the control filters they have are the ones that need to be weighed.

The differences in weights between control filters are displayed on the screen while controls are being performed, which can assist the user in spotting filter mix-ups or bad weights. During morning controls, the POST filter shows the difference between the weight taken that morning and its PRE weight, taken a month previously. If the difference is very large, that could imply that the wrong filter is being weighed. During afternoon controls, the differences between the morning weight and the afternoon weights are displayed for both the PRE filter and the POST filter. If filter differences are significant, that could mean that conditions in the lab or a problem with the balance caused a bad weight to be taken. Any weights considered invalid should be noted in the comments field of controls.dbf.

Control filters are kept in an archive box for 22 business days before being returned into circulation in case of any potential POST filter mix-up. Filters can be retrieved and reweighed as necessary during that time.

**TI 251C** Box Processing

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## **1. PURPOSE AND APPLICABILITY**

The purpose of this SOP is to describe the procedures used to open boxes, download flashcard information, diagnose simple sampling problems, and enter log sheet data. These procedures are applicable to all routine IMPROVE sites.

## **2. SUMMARY OF THE METHOD**

Returning blue boxes are opened and log sheets and flashcards are removed. Box contents are inspected and log sheets undergo an initial review. Flashcard data is downloaded and ingested, and "problem" log sheets are evaluated for further diagnosis. Log sheet data are then entered into an application called Logsin, which writes the information to a .dbf file.

## **3. CAUTIONS**

If a main box has an X-box also, make sure to enter X-box log sheets immediately after entering the main box log sheets. Keep the main box and X-boxes together as they go from station to station.

Examine log sheet values and flow data carefully. Missing a substantial problem could lead to losing a site for the year. If unsure about whether or not something is a problem, err on the side of caution and contact the laboratory manager.

Report equipment problems to the laboratory manager immediately. Not doing so could result in further sample loss.

Pay careful attention to the site code when entering log sheets. Some site codes are very similar, and the correct site code must be typed in when entering the log sheets. Typing in the wrong site code could result in significant confusion later in the process.

## **4. PERSONNEL QUALIFICATIONS**

The student lab assistant shall:

- Open blue boxes.
- Perform initial review of log sheets.
- Inspect box contents to confirm that all filters have been returned and have been properly sampled.
- "Double" normal log sheets.

The staff research associate shall:

- Review and ingest flashcard data.
- Diagnose equipment problems.
- Enter log sheet data.
- "Double" problem log sheets.

## 5. EQUIPMENT AND SUPPLIES

- Flashcard reader
- Computer with network access
- Pens

## 6. PROCEDURE

### 6.1 *Picking Up and Organizing the Boxes*

FedEx delivers boxes to the bay in the main building of Crocker Nuclear Lab between 10:30am and 1pm. The campus mail division usually delivers USPS boxes to the CNL lobby by 9 or 10am every business day. All boxes should be picked up and transferred to the rear annex. There are three shelves in the rear annex designated for receiving boxes. Boxes should be placed on the shelves starting from right to left and bottom to top. Make sure that "X" boxes are placed next to their corresponding "main" boxes. Priority boxes (those with pink labels) should be placed ahead of all other boxes (in the bottom right position).

Dot boxes (2-3-2') should start arriving one week before the non-dot boxes (3-2'-2). Most of the dot boxes should have already been delivered before non-dots begin arriving, and all non-dot boxes should be sent out again before the next dot cycle comes in. Thus, dot and non-dot boxes should generally not arrive at the same time. If a box of the wrong cycle arrives, check the dates on the label found in the upper left corner of the face of the box. The most likely reason for an off-cycle delivery is that the box is late. Hence, it will have to be given the highest priority if a replacement box has not already been sent out in its place. A box is generally considered late if the last date on the label is more than fourteen days prior to the current date. If the box is early (as in, dates on the label are after the current date), the most likely reason is that the operator sent the box back at the wrong time, or sent back the incorrect box. Detailed instructions on how to handle early/late boxes can be found in section 6.18.

Once the boxes are on the shelves, they should be opened one at a time. Start at the bottom right corner and work towards the top left.

### 6.2 *Box Contents*

Before opening a box, check the labels on the outside. The label in the upper left hand corner on the face of the box should have the site code (i.e. BOWA1) with three dates under it (e.g. 5/22, 5/29, 6/5), corresponding to the installation date for each set of filters (see Fig. 1).

Note that each of the dates is a Tuesday. All IMPROVE sites have Tuesday installation dates with the exception of one (WHPE1), which has Thursday installation dates. The last date listed on the label should be anywhere from a few days to one week before the current date.

Next, open the box. There should be three large re-closable bags inside (see Fig. 2). Each bag should have a sticker on it labeled with the week number (1, 2, or 3) and the date on which the cartridges were to be installed.

Open one bag at a time to avoid confusion. In “main” boxes, there should be four cartridges and one log sheet in each bag. There should also be a flashcard in one of the three bags or in the blue box. The four types of cartridges in a “main” box are: “A” (red), “B” (yellow), “C” (green), and “D” (blue). Each cartridge contains three to four cassettes. The cassettes in “A” and “D” cartridges contain Teflon® filters. The cassettes in “B” cartridges contain nylon filters, and the cassettes in “C” cartridges contain quartz filters.

“X” boxes should be opened immediately after its associated “main” box. “X” boxes will contain three bags as well and will have one cartridge and one log sheet in each bag. The cartridges will contain one of the four types of filters listed above (“A,” “B,” “C,” or “D”), but instead of using the traditional associated color, “X” module cartridges will always be orange to avoid mix-ups with the “main” box cartridges.



Figure 1: Box, Face Side, with Labels



Figure 2: Contents of Main Box

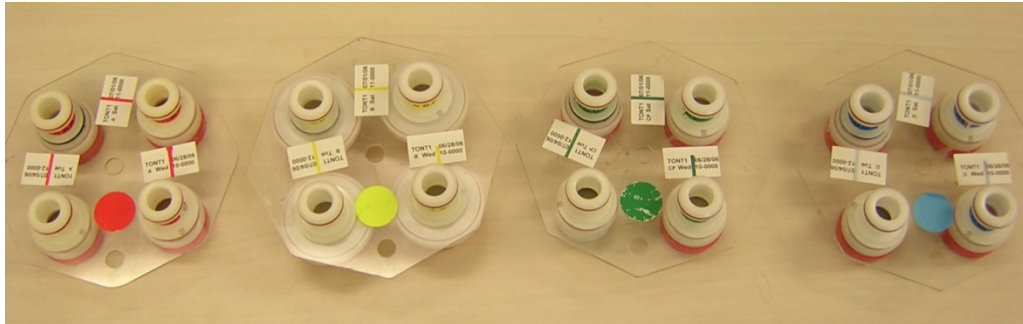


Figure 3: Contents of a Bag

IMPROVE Network Field Log  
 2662

INSTALL ON -->   
 0,000,000

Prewieghed by: JN  
 05/09/2007  
 CurTemp \_\_\_\_\_

| INITIAL READINGS        |          |                   |      |     |     | FINAL READINGS |     |                   |
|-------------------------|----------|-------------------|------|-----|-----|----------------|-----|-------------------|
| Operator Initials _____ |          | Date: ___/___/___ |      |     |     | Init _____     |     | Date: ___/___/___ |
| Time: _____             |          |                   |      |     |     | Time: _____    |     |                   |
| SamDate                 | StrTim   | MxVac             | Cass | Vac | Mag | Vac            | Mag | ET                |
| *****                   |          |                   |      |     |     |                |     |                   |
| 05/24/2007              | 0000 Thu |                   | 1    |     |     |                |     |                   |
| 05/27/2007              | 0000 Sun | Mod A             | 2    |     |     |                |     |                   |
| *****                   |          |                   |      |     |     |                |     |                   |
| 05/24/2007              | 0000 Thu |                   | 1    |     |     |                |     | *                 |
| 05/27/2007              | 0000 Sun | Mod B             | 2    |     |     |                |     |                   |
| *****                   |          |                   |      |     |     |                |     |                   |
| 05/24/2007              | 0000 Thu |                   | 1    |     |     |                |     |                   |
| 05/27/2007              | 0000 Sun | Mod C             | 2    |     |     |                |     |                   |
| *****                   |          |                   |      |     |     |                |     |                   |
| 05/24/2007              | 0000 Thu |                   | 1    |     |     |                |     |                   |
| 05/27/2007              | 0000 Sun | Mod D             | 2    |     |     |                |     |                   |
| *****                   |          |                   |      |     |     |                |     |                   |

Remove Flash Card After Doing Initials  
 Always Orient each Cartridge Plate as per Instructions on each Door

Lab Use Only      Comments      For Help Call (530) 752-1123  
 40.558 39.647  
 40.252 42.207

C31

Figure 4: Blank Log Sheet

### 6.3 *Box Inspection*

Before continuing, several checks need to be performed. If any inconsistencies are found in the contents of any bag, stop the inspection and consult with a staff member.

Perform the following checks:

- Confirm that the dates at the top of each log sheet match the dates on the corresponding bag labels.
- Confirm that the labels on each cartridge match the sample dates listed on the corresponding log sheets.
- Check to make sure that all of the cassettes within a cartridge have an appropriate color neck-tie. If the colors within a cartridge are mismatched, a mix-up may have occurred. Refer to section 6.17.
- Make sure that each cartridge has the correct number of cassettes.

### 6.4 *Flashcards*

After the box inspection, locate the flashcard. The flashcard is typically located in the Week 3 bag but can (on occasion) be found in the other two bags. If the flashcard is not in any of the bags, check within the box itself. If the flashcard is missing, notify a staff member and write “No Flashcard” in the comments field of the Week 1 log sheet.

Each flashcard should be labeled with a site code and inventory number. Confirm that the four-digit UCID located next to the site code matches the first four digits of the inventory number on the opposite side of the card. Alert a staff member if the numbers do not match.

Confirm that the site code on the flashcard matches the site code of the box that it came in. If the flashcard site code does not match the box, get a sticky note and write down the name of the box that it came in. Place the sticky note on the flashcard so that the downloader can troubleshoot the problem more effectively.

Place the flashcard in the flashcard pile near the thin client located below the shelves in the “Opening Boxes” area. Flashcard bags should be returned to the proper container located in the balance room.

### 6.5 *Initial Review of Log Sheets*

- Organize the log sheets so that they are in sequential order. For sites with “X”-boxes, organize the log sheets so that the three “main” box log sheets are first, followed by the “X”-box log sheets.
- Review the dates for each log sheet, beginning with Week 1. The date at the top of the page should match the date the operator recorded in the top left date field. If it does not match, compare it to the first sample date. If the date the operator provided is either the same as or is more recent than the first sample date, circle the recorded date in red pen.



- The first column on the left gives a list of the sample dates. To the right of that is a column that lists the MxVAC (maximum vacuum) values. The MxVAC values should be 40mv for most sites. Some high elevation sites tend to have values in the mid 30's. These are also acceptable. Make sure that all of the MxVAC values are within the same range. Any outliers (those deviating more than three points from the rest) and anything below 32mv should be circled with green pen.
- Review the Vacuum (VAC) and Magnehelic (MAG) columns for both initial and final readings. The final values should be similar to their corresponding initial values. Circle any final value that differs by more than 25% from the initial value.
- MAG values for the A, B, and C modules should all be similar to each other. They may differ by no more than 2mv. Circle any outlying MAG values.
- Finally, look over the Elapsed Time (ET) values. The ET values represent minutes of sampling. A normal sample period is 24 hours long (24 hours=1440 minutes). All of the ET values should be 1440, with the exception of the movable sample. There are two elapsed times for the movable sample. The first time is an intermediate time and will represent the time elapsed before the operator's visit, which is distinguishable because it is inside parentheses; ignore this value. The second elapsed time (on the following log sheet) will be the final elapsed time. This is the one to pay close attention to. For the 2-3-2' cycle, the final elapsed time is on the Week 3 log sheet; for the 3-2'-2 cycle it is on the Week 2 log sheet. It should take the operator no more than 30 minutes to do a sample change. Thus, the elapsed time should be at least 1410 minutes. If the elapsed time on the final log sheet is less than 1410, circle it in green ink.

#### 6.6 Pulling Up Flashcard Data

The primary station for reading cards is the one located directly under the check-in shelves. There should be a permanent USB reader at this station. Other terminals may be used, but a flashcard reader is needed.

Start by plugging in the flashcard into the card reader. There is only one way the card can be inserted into the reader (see Figure 5).



Figure 5: Flashcard Reader

Once the card is plugged into the reader, open Window's Explorer program and go to *Files on TC024\_13\_01/Hard Disk2/*. The file will always be named *Tempflsh.txt*. Each file will be approximately 200 ± 10KB depending on how many days of data were recorded.

Below are some problems that may be encountered:

- No file present – If the flashcard is blank, it must be put aside for data retrieval. Write a note in the log sheet's comment section, stating that the flashcard was blank. Often, the flashcard actually does contain the desired data, but it is not visible through the current program.
- Small file – If the file is less than 190KB, copy the existing data and treat it as normal but place the flashcard aside for data retrieval.
- Multiple files – If there is more than one file present, open both files and note the start and end dates. The current cycle's data should be treated as normal if it is problem-free. The additional data should be inspected to make sure that it is not duplicate data that has already been incorporated into the database. If the additional data is a duplicate, then it should simply be erased. If the data is not a duplicate, it must be named appropriately with the dates of its cycle.
- Multiple flashcards – When multiple flashcards are present, all flashcards must be read. The files retrieved should be treated as multiple files.
- Missing flashcards – If the flashcard is missing, make a note of it in the log sheet's comment section. The site operators must be contacted and questioned about the missing flashcard.
- Open tempflsh.txt to confirm that it opens properly /is not corrupt. A large file size with a white screen of blank text requires a restart of the thin client before being read.

### 6.7 Transferring and Naming Data

Once the file is opened, it must be transferred to the corresponding site folder.

- Open the flash text folder that corresponds to the site in question. This folder will be in *U:\Improve\FlashTXT\Site Name*.
- Next, copy the Tempflsh.txt file from *\Hard Disk2\* and paste it into the site folder. Confirm it opens / is not corrupt.
- Once the text file is in the proper folder, it is time to rename it. The name of the file should be composed of eight digits the site inventory number and the month and day of first installation date for that cycle. For example, if the inventory number is 1234 and the first installation date is 12/10/2006, the file name should be **12341210.TXT**. The installation date can be found on the label on the face of the box (see Figure 1) or on the Week 1 log sheet. The inventory number can be found on the label on the side of the box (Figure 6) or on the flashcard. If the UCID shows up as 3 digits on the flashcard's label, put a zero in the front. Dates are also 4-digit format.
- Make sure that all the files have been transferred and deleted from the flashcard before removing it from the reader.
- After the flashcard has been read, place it in the flashcard box next to the "PRE" balances.



**Figure 6: Side Box Label**

### *6.8 Reviewing Data*

It is important to make sure that the data is complete and in chronological order. Open the text file and run through the following checklist:

- Make sure that the size of the file is close to 200KB. If it is larger than 210KB it may have more data than it should. If it is larger, check the start and end dates and compare them to the dates on the log sheets. These must agree. If it is under 190KB it is likely that there was a power outage that needs investigation.
- Make sure that the site inventory number is correct. Compare it to the inventory number on the box side label. If the number does not match, determine whether or not the controller is programmed incorrectly or whether or not the correct flashcard file is being reviewed. If the data does belong to the current site in question, replace the incorrect UCID with the proper one. Acquire the proper number from the side box sticker and use the “replace all” function to fix the problem. Notify the laboratory manager regarding the incorrect site inventory number so that they can call the operator to remedy the issue.
- Check the start and end date. It is important that the start date matches the installation date on the Week 1 log sheet. In the same fashion, the end date must match the final “uninstall” date on the Week 3 log sheet.
- Finally, make sure that the all of the dates are in chronological order. If the dates are out of order there may be a problem with the controller. Flag the corresponding set of log sheets with a sticky note and try to make sense of the dates. Keep an original copy of the file, rename with .bad extension, and try to rearrange the entries.
- If the dates are from a previous cycle, it is important to determine if the data is redundant. If the data is already archived, then delete the new copy of the data. If the data does not already exist, treat it as normal but name it with the proper cycle’s date.

### 6.9 Documenting Data Download

The last step in flashcard data processing is documenting the files recovered in the Problem File log:

- Open “Problems File” through Visual FoxPro. The program is located in  
*U:\IMPROVE\PROGRAMS\problem.FXP*
- Go to the proper site log by pressing the F2 key and typing the site name (e.g. BOWA1).
- The following is a sample entry: First press F3 to place a timestamp, then add

-(12/20) DATA DOWNLOAD.

| MEDIA | FILE     | STRDAT | ENDDAT | SIZE  | COMMENTS         |
|-------|----------|--------|--------|-------|------------------|
| CFLSH | 12341220 | 12/20  | 01/10  | 203KB | Full SMPL period |

- The Media type will always be CFLSH. File is the file name, STRDAT is the start date, ENDDAT is the end date, Size is the file size, and COMMENTS is a description of the data’s integrity. Note large power outages in the COMMENTS, i.e. power outage from (01/05) to (01/15).
- To exit the Problems File press F4. Any changes made will be automatically saved.

### 6.10 Normal Log Sheet Values

A log sheet is divided into two main sets of values. The left side of the sheet shows Initial values while the right side shows Final values. Both sets of values contain VAC (vacuum) and MAG (magnehelic) values. The left side of the log sheet also contains the MxVAC (maximum vacuum) values, while the right side contains the ET (elapsed Time) values.

- The majority of MxVAC values should be approximately 40mv. High elevation sites may have MxVAC values as low as 32mv—but this is a rare case. Only a handful of sites have high enough elevations that their values would be below 36mv. Despite the range of values, all values should be within 2mv of each other (across all log sheets).
- The majority of ET values should be 1440min. Only the movable position may have an ET less than 1440. The movable position filter is usually interrupted during its sampling and the intermediate ET should represent the accumulated time up to the point of the sample change (interruption). The final ET for the movable position will be short by the amount of time required to do the sample change on that date. It should not take an operator more than 30min to do a full sample change.
- The VAC and MAG values may vary significantly. The VAC value may be as low as 11mv and as high as 19mv. Each module will have a different VAC value. What is important to note is that all filters for each module are similar to each other. All values for each individual module should not vary more than 2mv from the other samples in that module.
- The MAG values will also vary, but modules A, B, and C will all have similar values. They should not vary by more than 2mv from each other. They can be as low as 11mv and as high

as 27mv. The D module does not have a working magnetohelic so the recorded value is just a resting zero and should be 5mv. In some cases the D MAG can also be 10mv.

### *6.11 Sample Codes*

The following codes are status flags for any problems:

- **CG** – Clogged filter. This filter is sufficiently loaded with aerosol to degrade the flow and render it unreliable.
- **QD** – Questionable data. The samples are questionable, but are processed normally. Further analysis will determine whether or not to keep the sample.
- **NS** – No sample /not serviced. This is an unusable sample.
- **EP** – Equipment problem. This sample is invalid because of a mechanical problem with the sampler or associated equipment.
- **PO** – Power outage. This sample is invalid because of lack of power resulting in an elapsed time that is less than 1050 minutes.
- **XX** – Unusable samples. Examples of unusual samples include torn filters, highly contaminated filters, and all other undefined sample discrepancies.
- **OL** – Off line. Samples are unusable due to the shutdown of the site.

### *6.12 Pump Problems*

The majority of pump problems can be detected by the MxVAC values.

- If any module has a value less than 35 (except for high-elevation sites), check the flashcard data and make sure that the pump ran for the entire sample period and that the VAC and MAG values are within the nominal range.
- If any module has a MxVAC of 10mv, it means that the pump was not running during the initial check, or that the VAC transducer is malfunctioning for that module. If the VAC transducer is the problem, then the MAG will display nominal values. If both the VAC and MAG values are not within their nominal range, it means that the pump has failed during the initial check. In either case, check the flashcard to determine if this malfunction was only during the initial check or if it affected the actual sample.
- If the pump did affect the sample by either delayed starting or early shutdown, calculate the correct ET for the affected sample and change the value on the log sheet, noting in the comments section that the pump was “slow starting” or had failed. If the new ET is less than 1050, the data is invalid and should be given an EP status due to pump issues.

### *6.13 Short ET Problems*

ET values should be 1440 minutes for all samples except those from the movable position. There are three ranges for a short ET:

- If the short ET is greater than or equal to 1080 minutes, the sample is considered normal and is assigned a status of NM. The comment assigned to this sample should mention a power interruption, controller freeze, pump problem, or late/early sample change.
- If the short ET is greater than or equal to 1050 minutes, but less than 1080 minutes, the sample is considered questionable and is assigned a status of QD. The comment assigned to this sample should mention a power interruption, controller freeze, pump problem, or a late sample change.
- If the short ET is less than 1050 minutes, the sample is considered invalid and a status of PO (for a power outage), EP (for a controller freeze or pump failure), or NS (for a late sample change) should be assigned. The comment assigned should mention a power outage, controller freeze, pump failure, or a late sample change.

A late sample change can be identified by comparing the installation date on the log sheet to the date of the first sample. If the samples are installed on or at any point after the beginning of the first sample date, the ET values will indicate a loss in run time. No matter what the reason for the late sample change, the operator must be contacted and made aware of the necessity of changing the samples on time.

Distinguishing between power outages and controller freezes is not straightforward. Both cases will produce a short ET as well as a gap in flashcard data. On occasion, the operators will comment on the nature of the problem and this information can be used to make the final decision. If there is no operator comment on the log sheet the operator responsible for the sample change must be contacted and questioned. Any given detail, no matter how small, will be helpful. It is also vital to study the flashcard data. Often the data will have other indicators that will further help with the diagnosing of short sample ET.

#### *6.14 Missing Flashcard*

Every blue or white box must contain a flashcard. If a flashcard is not present (and all bags and the box itself have been thoroughly inspected), the following steps must be taken:

- The operator must be contacted and made aware of the situation. Many times the flashcards are misplaced by the operators or are accidentally placed in the new blue or white box.
- All of the samples for the given set of filters are assigned a status of QD. The data for these samples is considered questionable until the flashcard data is recovered or the filter weights have been analyzed and confirm a normal sample period.
- The sample comment should mention that the flashcard data is missing.

#### *6.15 Clogged Filters*

A filter is considered clogged when the amount of deposit on the filter is enough to lower the flow rate below eighteen liters per minute for the duration of one hour. It is difficult to translate

millivolt readings into flow rates, but a rule of thumb is to look for a 75% drop from initial to final MAG values. A clogged filter is assigned a status of CG.

#### *6.16 Lab Error*

A lab error is any mistake that originated at the "PRE" or "Leak Check" station for the box in question. The following are typical lab errors:

- A mask error occurs in two circumstances: a mask is loaded onto a filter that does **not** require a mask or a mask is not loaded onto a filter that **does** require a mask. Mask errors are assigned a status of QD.
- Double filter errors also occur in two circumstances: two filters may be loaded for a single filter site or one filter may be loaded for a double filter site. Double filter errors are assigned a status of QD.
- Filter dummy (filter plug) errors occur when a filter dummy is loaded along with a normal filter. This error occurs more frequently with the "B" filters, due to the size and physical nature of the dummy material. Filter dummy errors are assigned a terminal status of XX.

#### *6.17 Bad Installations*

There are many possible ways that an operator can install the cartridges incorrectly. The following is a list of the more common instances, together with instructions on how to recognize their symptoms.

- **Upside-down cartridges.** This problem can be identified by a high VAC value (greater than 35mv) and a low MAG value (close to 5mv) for the number one position. Upside-down cartridges may also tear the second or third-position filter if the manifold makes a good seal. In the case of an upside-down cartridge, if the CFLSH data shows that the cartridge remained upside-down for the whole week, all of the samples on a cartridge will be invalid and must receive a status of BI.
- **Manifold not properly sealed.** This will cause low values on all of the positions for both the VAC and MAG. These lower values are sometimes difficult to spot, depending on the extent of the leak. A leak is associated with decreasing VAC and MAG values. In the case of an improper seal, all of the samples on a cartridge will be invalid and must receive a status of BI.
- **No transference of the movable position cassette to the next cartridge.** The symptoms for this problem are similar to that of a non-sealing manifold (low MAG values for all positions). As is the case with the improper-seal problem, all of the filters on this cartridge will be invalid and must receive a status of BI.
- **Cartridge installed on the wrong week.** Only one set of cartridges within a box contains two filters, while the remaining sets have three filters. This makes it possible to identify when the two-filter cartridge is installed during the wrong week. When a two-filter cartridge is installed in a week that should have a three-filter cartridge, the third position values will be out of their normal range. The VAC value will be near the maximum vacuum

(in most cases 40mv), and the MAG value will be near the resting zero (in most cases 5mv). If a cartridge ran during the wrong week, it is important to investigate further. Determine if the cartridge was installed twice (once during its normal sampling period and a second time during the improper week). If a cartridge was installed twice, determine which samples ran more than the standard 1440 minutes. This may necessitate a call to the site operator. Both the samples that run more than 1800 minutes and those that run less than 1050 minutes must be assigned a status of BI.

- **Movable position filter moved into the wrong cartridge.** This problem is difficult to identify because its symptoms are subtle, compared to most other problems. Look for variances of more than 4mv in the VAC and MAG values of the third position. If a filter sample is in the wrong cartridge, it must be assigned a status of BI.

### 6.18 Early or Late Boxes

If a box is early, determine whether it is complete or whether it is missing any of its contents. If the box is complete, note whether there are any filters that have not sampled yet. Depending on the sample dates and the date that the box is received, it may be possible to ship back the early samples and have them run on their normal sampling day. In order to save these samples, carefully judge whether they will arrive at the site in time and whether the operator will be able to install them before their sampling date. In any case, the operator has to be contacted and questioned about the untimely shipment. If it is too late to ship back the early samples, they will receive the status of BI. When shipping back samples, note that only entire cartridges can be sent back (usually a full set containing A, B, C, and D) and never individual filters.

Late boxes are treated like normal boxes, but they are given the highest priority. This means that they are processed first at all stations until they are ready to be shipped out.

### 6.19 Log Entry

When entering the log sheet values, start by opening the logs entry program, Logsin. It is located in *U:\IMPROVE\PROGRAMS\vlogsin.FXP*. The first page will ask for user initials. Next, enter the Site Code (Figure 7). The site code is located either at the top center of the log sheet or on the side box sticker.

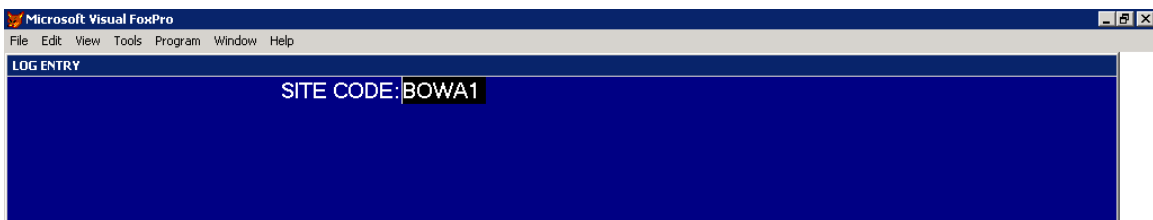


Figure 7: Log Entry- Initial Page



After the side code has been entered, the main page will load (Figure 8).

Microsoft Visual FoxPro  
 File Edit View Tools Program Window Help

LOG ENTRY  
 Entered by: JM BOX CODE: MELA1 05/01/2007 Final OpInit: C

| Sam Date | Mod    | INIT READ | MAXV/Cass | SmGau | Mag | FIN READ | SmGau | Mag | ET   | STAT | UseL | Temp | UseTL |
|----------|--------|-----------|-----------|-------|-----|----------|-------|-----|------|------|------|------|-------|
| 05/03/07 | A      |           |           | 0     | 0   | Thu      | 0     | 0   | 1440 | SO   | F    | 0    | F     |
| 05/06/07 | RED    | 0         |           | 0     | 0   | Sun      | 0     | 0   | 1440 | SO   | F    | 0    | F     |
| 05/03/07 | B      |           |           | 0     | 0   | Thu      | 0     | 0   | 1440 | SO   | F    |      |       |
| 05/06/07 | YELLOW | 0         |           | 0     | 0   | Sun      | 0     | 0   | 1440 | SO   | F    |      |       |
| 05/03/07 | C      |           |           | 0     | 0   | Thu      | 0     | 0   | 1440 | SO   | F    |      |       |
| 05/06/07 | GREEN  | 0         |           | 0     | 0   | Sun      | 0     | 0   | 1440 | SO   | F    |      |       |
| 05/03/07 | D      |           |           | 0     | 0   | Thu      | 0     | 0   | 1440 | SO   | F    |      |       |
| 05/06/07 | BLUE   | 0         |           | 0     | 0   | Sun      | 0     | 0   | 1440 | SO   | F    |      |       |

PGDN/PGUP=Next/Prev; F1=LoadFlash; F3=Save&Cont; F4=NoSave; F12=Comments; Shift+F12=Flags

Figure 8: Log Entry: Second Page

### 6.20 Entering Log Sheet Values

The layout of this screen is similar to that of the log sheet. Start by verifying that the date at the top center matches the first log sheet. If it does not, use the page up or page down keys to go to the correct week. Log entry must be performed in correct date order. Next enter the operator's initials from the final readings into the box labeled "Final OpInit." Next, enter all of the log sheet values into the corresponding boxes. There are four extra columns in the program that are not on the log sheet.

The first column (STAT) is for a status flag. All normal samples will receive a status of NM (normal). If a sample is not normal, enter the appropriate status instead.

The second column (UseL) is for a logical flag. UseL stands for use log sheet information. This means that, if there is valid flashcard information for the sample, keep the default F (false). If there is no valid data for the sample, enter a T (true).

The next column (Temp) is for temperature. Enter the temperature from the log sheet in degrees Celsius. The temperature from the log sheet is displayed in a voltage value and needs to be converted to Celsius. The equation for this conversion is

$$\text{Temp } (^{\circ}\text{C}) = 1.141(\text{Voltage}) - 85.024$$

Most stations in the lab have a table of temperature values attached to the monitor for a quick reference.

The final column (UseTL) is a logical flag for the temperature information. This means that if there is valid flashcard information for the sample, enter an F (false). If there is no valid data for the sample, enter a T (true). If the temperature is invalid, enter "20" as the temperature value and enter a T in the (UseTL) column.

### 6.21 Entering Status Comments

Each sample date must be accompanied by a comment describing the reason for the particular status. If the status is normal (NM), no comment is necessary. If the status is anything other than normal, then a clear and standardized comment must be chosen that best describes the situation. For a list of approved standard comments, go to U:\IMPROVE\LOGS>Status Flags\2007 Comment Database.xls. Make sure to edit comments as needed in order to fit the situation.

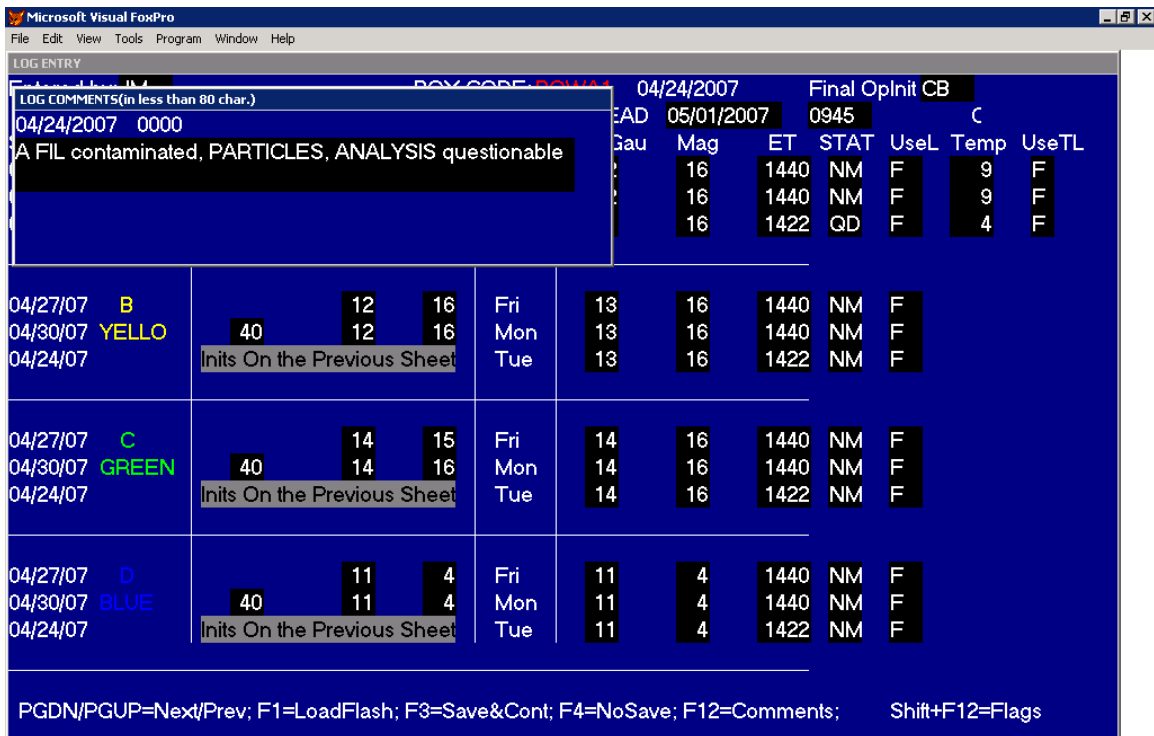


Figure 9: Log Comments

To enter comments, press the F12 key. A small window will open above the current window (Figure 9). The first sample date will be in the top left corner. In order to advance to the second and third sample date, press the "Enter" key. At the last sample date, pressing "Enter" one more time will save all comments and close the window. The previous screen will then become active again.

### 6.22 Entering Operator Comments

The final step for log entry is entering operator comments in the problem file database:

- Open Problems File through Visual FoxPro. The program is located in U:\IMPROVE\PROGRAMS\vproblem.FXP
- Go to the proper site log by pressing the F2 key and typing the site name (e.g. BOWA1).
- Make sure to note the operator's initials and the date of the log sheet which necessitated the comment. In the following example, notice that the word "operator" is abbreviated and capitalized to "OPRTR"; similarly, log sheet becomes "LGSHT."
- Ex: -OPRTR note on LGSHT (7/25/06)  
HA = Monsoon showers and thunderstorms on 7/31/06.
- To exit the problems file, press F4. Any changes made will be automatically saved.

## 7. DATA AND RECORDS MANAGEMENT

### 7.1 Logsin

The Logsin program is a FoxPro® application used to record data from the field log sheets for exposed filters into the LOGS database. Through this program, temperature, pump vacuum readings, orifice and cyclone values, elapsed sampling time, and filter status are recorded for each filter. This program is located in U:\IMPROVE\Programs\logsin.app.

### 7.2 Comment Database

The Comment Database is an Excel file that contains standardized comments to use in Logsin and SWAP. The comments are grouped according to common issues/problems. Each comment also indicates what status code to use for the samples the comment applies to. This file is located in U:\IMPROVE\LOGS>Status Flags\2007 Comment Database.

## 8. QUALITY ASSURANCE/QUALITY CONTROL

Because diagnosing of problems can be difficult and somewhat up to interpretation based on available data, all log sheets that have significant problems or those that required a differential diagnosis are "doubled" after they have been entered. "Doubling" in this case refers to another staff research associate re-diagnosing the log sheets and making any changes as necessary. The person doubling will also check to make sure comments and values were typed in correctly.

Student lab assistants may “double” normal log sheets, as entered values only need to be checked for typos.

Also, student lab assistants are trained to alert staff research associates anywhere down the line during filter processing if anything unusual occurs or is found with a sample (ex. anodizing dust present on the filter, large hole, low filter weight difference, etc.) that may affect the filter status.

**TI 251D B/C Download**

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## 1. PURPOSE AND APPLICABILITY

The purpose of this SOP is to describe in detail the procedures used at the “B/C” download station. It is applicable to all routine filters in the IMPROVE network.

## 2. SUMMARY OF THE METHOD

Once all log sheets have been entered for a box, the box is ready for the first station of the download process. At the “B/C” download station, sampled nylon and quartz filters are placed into Petri dishes and put away in a specific order generated by a macro. Any “problem” status filters of any filter type are removed at this station as well. These filters are also ordered according to a generated list and stored permanently.

## 3. CAUTIONS

Many site codes look similar. It is important to make sure that the correct box is being downloaded.

Be very careful to make sure that the correct forceps are used for each filter medium. Quartz filters flake very easily and can contaminate other filter types, so it is important to use the appropriate forceps (labeled with a “C” neck-tie) when processing these filters.

Be cautious when separating double-“C” filters. The filters are fragile and can tear easily. Also make sure to put the primary and secondary filters in the correct Petri dishes. A good guideline to follow is that primary quartz filters are typically much more sampled than secondary filters, but this does not allow apply.

Do not clean nylon cassette bottoms with a Kimwipe™ that has been used to clean quartz cassette bottoms. The simplest way to prevent this from happening is to discard Kimwipes™ after cleaning all quartz cassette bottoms and getting new Kimwipes™ for the next box or cartridge.

## 4. EQUIPMENT AND SUPPLIES

- Forceps for nylon filters
- Forceps for quartz filters
- Forceps for HANCS filters
- Computer printouts of download list
- Five empty Petri trays (one for nylons, one for quartz, one for problem filters, one for FB problem filters, and one for inactive C’s)
- Brush for quartz
- Ethanol in appropriate container
- Kimwipes™
- Arbor press
- Clean Petri dishes
- Status adjustment sheets

## 5. PROCEDURE

### *5.1 Petri Dish and Tray Setup*

On the counter to the right of the “B/C” download station are half trays full of Petri dishes with “B” and “C” filters that have already been downloaded. The top of the Petri dish (the side without the PALL company symbol) should have a sticker placed on it. The top should be facing forward (towards the front of the tray) when placed in the tray. The Petri dishes are placed in the tray starting from the back left and moving forward in the order given on the download log sheet. Within each site the oldest dates go in first. Problem filters should be placed in a separate tray (labeled “Problems”) with the oldest date first as well. If problem filters share a date, place them in trays by their cartridge letters, from “A” (first) to “D” (last).

All trays are labeled with the code for either the current quarter or the previous quarter. Trays labeled with the letter of the cartridge (B or C) followed by the letter FB (field blank) are for the field blanks from “B” and “C” cartridges. Trays for the normal B and C filters are labeled with the cartridge letter (B or C) and the current quarter. Problem filters are placed in the tray labeled with the correct quarter followed by the abbreviation PROB. There is also a special tray for filters from the HANCS site that is labeled with the quarter and the abbreviation SO<sub>2</sub>. It is important to make sure the downloaded filters are placed in the tray designated with the correct quarter.

### 5.2 Checking the Download List Printout

Before beginning any work, review the computer printout (download list or contractor’s log) with the information for the boxes that will be downloaded. Do not begin downloading a box without a download list. On the download list, the first column is the site ID name; the second column is the date the sample was taken. Following this are four columns with a variety of abbreviations. These four columns correspond to cartridges **A-D** from left to right on the given date. Within these four columns of data, any abbreviations besides NM, QD, and CG need to be highlighted (see Chart 1 for full list). The highlighted data indicates problem cassettes, which will be handled in a different manner. Refer to section 5.4 for instructions on how to handle problem cassettes.

**Chart 1. Filter Statuses**

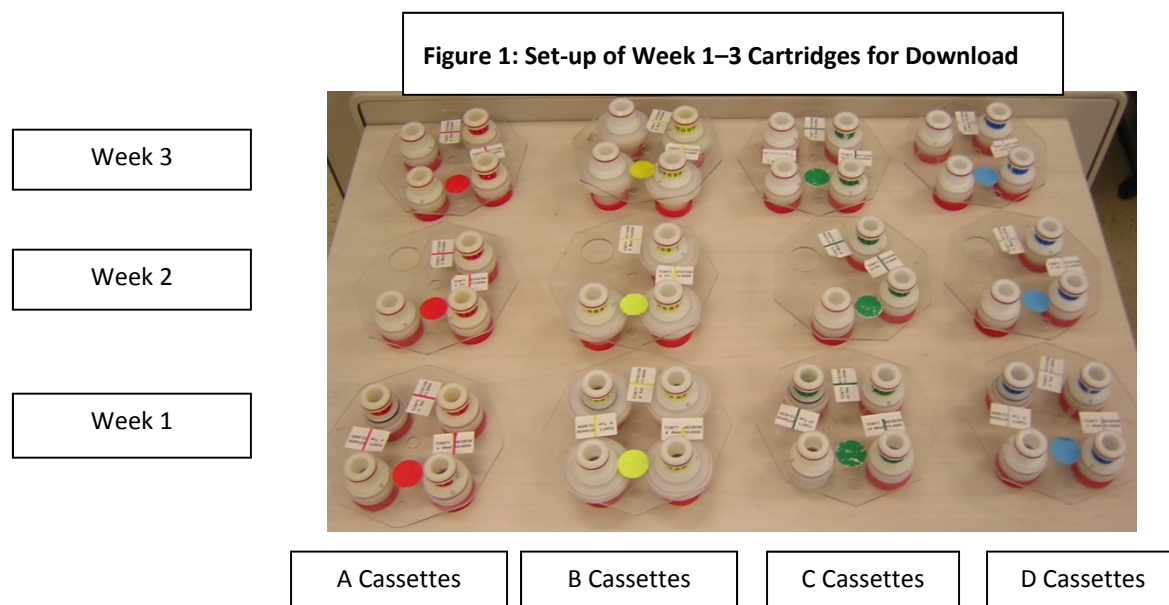
|    |                                      |
|----|--------------------------------------|
| NM | Normal                               |
| QD | Questionable Data, process as Normal |
| CG | Clogged, process as Normal           |
| PO | Power Outage                         |
| EP | Equipment Problem                    |
| NS | Not Serviced                         |
| BI | Bad Install                          |
| OL | Offline                              |
| XX | Invalid Sample                       |

### 5.3 Downloading Normal Cassettes

1. Open the bags labeled Week 1–Week 3 and check that the dates on ALL of the cartridges within a given bag are within one week of the date on the outside of their bag. If they are not, return them to the proper bag to avoid later confusion. If there is no proper bag (e.g., the cartridges are from a different box), consult a supervisor.
2. Remove cartridges from Week 1 first and line them up on the desktop from left to right, A to D.
3. Remove cartridges from Week 2 and place them in a line above Week 1 on desktop going from A to D, from left to right. Place Week 3 cartridges above Week 2 cartridges in the same manner. Now there should be four columns, for cartridges “A,” “B,” “C,” and “D” and three rows, for Weeks 1, 2 and 3 (Figure 1).
4. Find the removable cassette with the black band around its center in the third position of the cartridge. There should be one removable cassette for each cartridge type (A, B, C and D). Depending on the cycle the box is in, 3-2'-2 (non-dot) or 2-3-2' (dot), the removable cassette will be in the Week 2 or Week 3 cartridges, respectively. A removable cassette in Week 3 should be moved to Week 2 and a removable cassette in Week 2 should be moved to Week 1 so that each cassette with a neck-tie matches up with a label.
5. Set the “A” and “D” cartridges to the side.
6. Remove all the red caps from the “B” and “C” cassettes and place the caps in the Week 1 bag. The red caps simply snap off; no twisting should be necessary.
7. From this point forward handle only one cartridge at a time. Start with “B” cartridges and then move to the “C” cartridges. If any field blanks are present, treat them in the same manner as other cassettes. Field blanks will have handwritten labels and will be placed in a different location once download is complete.
8. Remove the label from the first position cassette and place it on the top of a Petri dish.
9. Remove the bottom of the cassette using the arbor press and invert the cassette over the Petri dish. The filter should drop into it. Close the Petri dish. If the filter does not drop into the Petri dish, gently use forceps to loosen the filter. Use green-labeled forceps for C filters and unlabeled forceps for B filters. Make sure not to touch the filter. If the filter sticks within the bottom piece, nudge the edges with the forceps to loosen it; then try inverting it again.
10. Clean all of the cassette bottoms and any dirty red caps using ethanol and Kimwipes®. Wipe the screens and cartridge plates, and then snap the cassette bottoms back on.
11. Once filters are placed in the properly labeled dishes, place them in their corresponding trays that are labeled with the cartridge letter (B or C) and the current quarter. The current quarter is signified by a three digit code. The first letter of this code is the current quarter (A, B, C, or D), followed by the last two digits of the current year. The proper order of placement in trays is left side first, from back to front, and with the latest date placed in first. Make sure to keep field blanks separate and place them in the separately labeled tray.
12. If the tray is filled, please see Section 5.6
13. Stack cartridges A-D for each week and place them back in their corresponding reclosable bags. Place the “B” and “C” cartridges in the bottom of the bag and the “A” and “D” cartridges on the top.
14. Place the reclosable bags back in their BLUE or WHITE box. Place the box on the shelf next to the “A/D” Download station. Boxes with site names starting with A-L should be placed on



the shelves to the left of Cahn 30a, and boxes with site names starting with M-Z should be placed on the shelves in between Cahn 30a and Cahn 31.



#### 5.4 Downloading Sulfur Cassettes

HANCS has two cartridges stacked on top of each other. The top cartridge has stickers labeled S (for SO<sub>2</sub>, sulfur dioxide) and has one big blue sticker on it. The bottom cartridge has stickers labeled F (for fluoropore) and has one big orange sticker on it. Leave the bottom cartridge as is. Download the top cartridge as described in Section 5.3. Use the designated HANCS forceps to handle the filters. Place the downloaded SO<sub>2</sub> filters in the designated tray. The SO<sub>2</sub> filters are quartz filters, although they are bigger. There will be a mesh filter between the screen and the filter. Download only the quartz filters and replace the mesh.

#### 5.5 Handling Problem Cassettes

1. Once problem cassettes have been identified, remove the cartridges containing them from their reclosable bags.
2. Write the abbreviation given on the download list (e.g. BI)—in red ink— directly on the label belonging to the problem cassette. Make sure the proper cassette has been identified by double checking the sample date and the cartridge letter with the download list.
3. Place a bright pink label on the bag that contained the problem cassette. The bright pink labels are pre-printed and can be found at the download station. On the label, there are three rows (labeled 1, 2 and 3) to indicate the three different positions on a cartridge. Next to the position number, the different designations for problem statuses are listed. Circle the problem type in the correct position number row. At the top of the sticker write what type of cartridge the problem was located in (A, B, C or D).

4. Once problem cassettes are labeled, proceed with download. All problem cassettes should be downloaded prior to download of non-problem cassettes.
5. To begin the download of the problem cassettes, handle only one cartridge and one cassette at a time. Start with the oldest date and the earliest letter. Remove the cassette label and place it on the Petri dish.
6. Open the cassette using the arbor press.
7. Remove the bottom of the cassette using the arbor press. Invert the cassette over a Petri dish, until the filter drops into it. Close the Petri dish. Make sure not to touch the filter. If the filter sticks to the screen of the cassette when detaching the cassette bottom, gently remove it using forceps. If the filter sticks to the bottom piece of the cassette, nudge the edges with the forceps to loosen it then try inverting it again.
8. Repeat Steps 4-6 for all problem cassettes.
9. Once they are downloaded, place the problem Petri dishes in the problem tray. The problem tray is labeled with the current quarter, followed by the abbreviation PROB. Make sure to fill the left side of the tray first, from back to front, followed by the right side. Filters with the oldest dates (from A to D) should go into the tray first.
10. If the tray is filled, follow the procedure in Section 5.6. There will be no identification number to label. Place the full carton on the shelf near leak check.
11. Continue with the download procedure for normal "B" and "C" cassettes in the manner described in the previous section.

#### *5.6 Preparing Trays for Inventory*

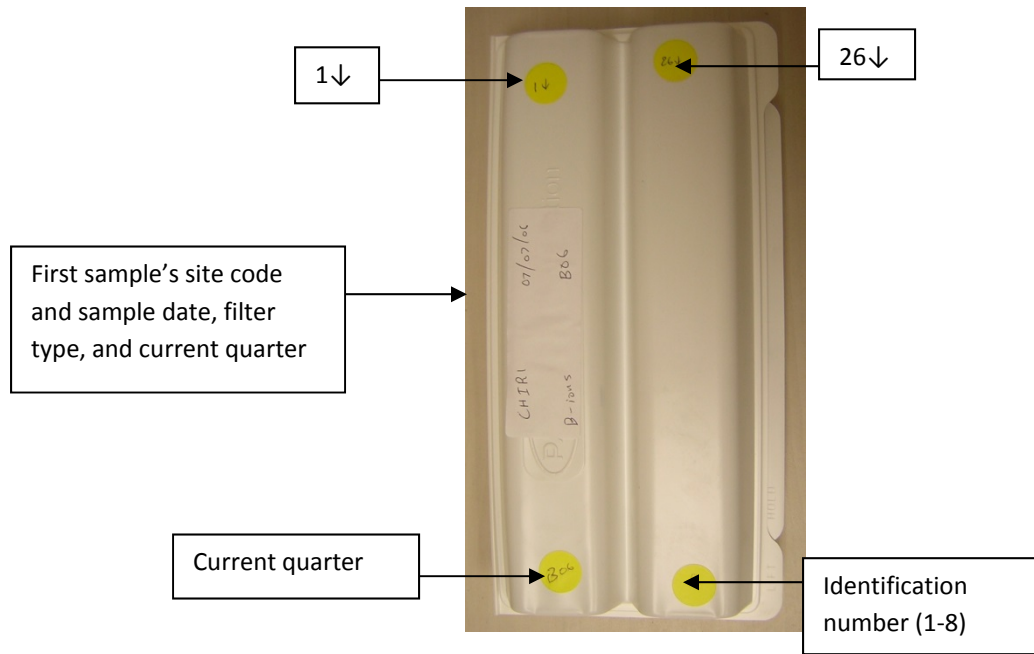
If the tray is filled, place the dishes from the full tray into an empty carton. Make sure to maintain the order of the Petri dishes. Six small, round stickers will be used to label the tray, four on the top and two on the side (Figure 6). The top left sticker should be labeled with the number 1 and the top right sticker with a number 26. Both of these stickers should have a downwards pointing arrow written below the number to indicate the order of the Petri dishes. The bottom left sticker will have the quarter number and the bottom right will have the identification number. These last two sticker labels are repeated and placed on the side of the carton. They are placed on the side of the carton that is directly under their corresponding sticker. The identification number is a number from 1-8. The identification number is the number following the highest number found on the cartons in either the fridge for "B" cartons or the freezer for "C" cartons.

In addition to the six small round stickers, one large white rectangular sticker is placed on the top of the tray in the center of the left side for the "B" and "C" trays. The information on the large white label should match the information contained on the label of the first Petri dish in the tray.

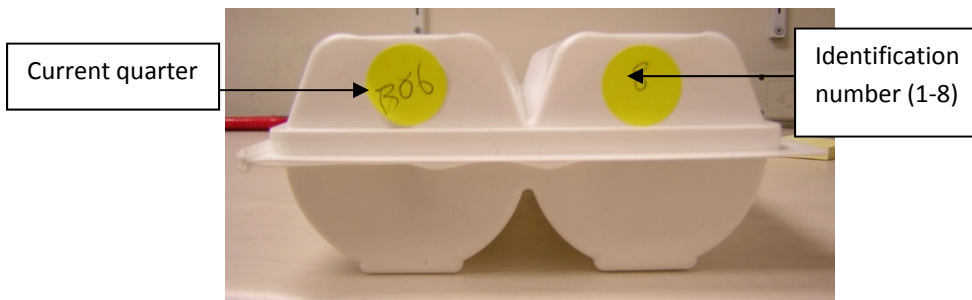
Place completed "C" cartons in the freezer and completed "B" cartons in the fridge to await shipping.

**Figure 2: Properly Labeled Filter Trays**

Top View



Side View



**TI 251E A/D Download Station**

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## **1. PURPOSE AND APPLICABILITY**

The purpose of this SOP is to describe the procedures used to download sampled Teflon® filters and prepare them either for further analysis or for storage. Procedures listed are applicable to all routine IMPROVE filters.

## **2. SUMMARY OF THE METHOD**

Once all nylon, quartz, and problem filters have been removed from a box, it is ready to be A/D downloaded. Sampled Teflon® filters are weighed on a microbalance and their post-weights are recorded using a FoxPro "POST" program. "A" filters are prepared for further analysis and "D" filters are prepared for permanent storage.

## **3. CAUTIONS**

Many site codes are similar. It is important to ensure that the site being downloaded in the "POST" program matches the site code on the box.

Make sure to handle only one cassette at a time. Having two or more cassettes open while downloading filters increases the risk of filter swaps.

Sometimes filters are accidentally loaded upside-down so the sample is on the wrong side of the filter. Make sure to weigh the filter sample side up, even if the sample is on the incorrect side. Also make sure to place the filter in the slide sample-side up. If a filter has sample on the wrong side, note this on a status adjustment sheet and give the sheet to a supervisor.

## **4. EQUIPMENT AND SUPPLIES**

- Microbalance
- Computer with "POST" balance application and TeraTerm program
- Forceps
- Polonium strips
- Labeled "A" and "D" slides for each site
- Status adjustment forms
- Slide trays for "A" and "D" field blanks

## **5. PROCEDURE**

- 1) Log into the computer. Make sure the POST program is open. Move the TeraTerm window (the one with the green background) so that both the POST and the TeraTerm windows are visible at the same time.
- 2) Log in with initials. The POST program will prompt the balance user for a specific box; unless there are priority boxes (pink labels), locate and process the indicated box. To process a priority box, type in the five character site code.
- 3) Open the appropriate box and check the contents. There should be three reclosable bags labeled Week 1, Week 2, and Week 3. Each bag should contain four cartridges. "A" and "D" cartridges should be the only cartridges with labels. Ensure that the dates on the "A" and "D" labels fall within a week of the date on their bag. If they do not, notify a supervisor and verify

whether the mix-up occurred in the lab or in the field. Place the cartridges in the correct bags. If an "X" or an "S" box needs to be processed, see section 5.4.

- 4) Take the "A" and "D" cartridges out of the Week 1 reclosable bag and remove the red caps from the bottom of the cassettes. The red caps simply snap off; no twisting is required. All of the red caps should be returned to the Week 1 bag.
- 5) Lay out the polonium strips in two groups of three. Polonium strips are located in front of the balance or in front of the computer screen on the shelf. Polonium strips are used to remove static from the filter. Excessive static can interfere with obtaining an accurate weight.
- 6) Retrieve the slide boxes that correspond to the site name given on the blue or white box. Filters will be placed in these slide casings and the cased filters will be placed in the appropriate slide boxes. Slide boxes for the "A" filters are to the left of the station and slide boxes for the "D" filters are to the right. Before processing new slides, check the cased filters that are already in the slide box to make sure that the slide cases are tightly closed.
- 7) Find and remove the slide casings that have dates and site codes that correspond to the Week 1 labels on the "A" and "D" cartridges. Place these white slide casings below the polonium strips with "A" slide casings on the left and "D" slide casings on the right. If the first slide casing without a filter is not the first date for the box being downloaded, notify a supervisor.
- 8) If there is a field blank, write out a label for the slide using the longer white labels at the station. Copy the information from the original handwritten sticker onto the new sticker for the slide. The new labels can be found at the bottom left of the far left POST station.
- 9) Remove labels from the "A" and the "D" cartridges. Place "A" labels on the left side panel next to the computer screen and place "D" labels on the right side panel next to the computer screen. Align them from the earliest date to the most recent date, from top to bottom. Take out only one week at a time and maintain the proper alignment of the cartridge to minimize any confusion. Placing the labels on the side panels will also make them easily accessible if they must be placed on the comment sheet.

### *5.1 Filter Removal*

- 1) Open the "A" cassettes one at a time, starting with the first sampled position. Use the arbor press. Place the red caps in the Week 1 reclosable bag. Some of the cassettes that should have been sampled may be missing filters and labels. Filters and labels are often removed at "B/C" download if a supervisor classifies a filter as a problem. The computer will not ask for weights for these missing problem filters.
- 2) If there are problem filters that have been removed from the cartridge, remove their white slide casings from the tray. Remove and discard the sticker on the slide casing and place the blank slide into the box of white slides. **Important:** leave this position empty when returning the slides to the slide tray after download. Always match the position number on the slide to the position number stamped on the side of the slide tray.
- 3) Once the cassette of interest is open, place the filter on the polonium strip with the proper slide casing below it. This slide should have the earliest date and should be clearly marked for "A" filters. Make sure to place the filter on the polonium strip sample side up. The filter is sample side up when the dull side of the rim is facing up and the shiny side is facing down. If the filter sticks to the bottom of the cassette or to the bottom of the screen,

carefully use forceps to loosen it. Try to touch only the rim of the filter with the forceps to avoid sample removal and filter damage. Never touch the filter.

- 4) Proceed with the placement of both "A" and "D" filters onto polonium strips. Open only one cassette at a time.
- 5) Check the integrity of the filters. Note any problems with the filter on a comment sheet (see section 5.2 for potential problems). If a questionable filter is encountered, place the proper label from the cassette next to the description of the questionable filter. Place Scotch® brand tape over the top of the label.
- 6) Once all filters have been removed from "A" and "D" cartridges, place the "A" and "D" cartridges back into their reclosable bag. Now the post-weight of the filter can be measured.

### 5.2 Dealing with Questionable Filters

After removing a filter from its cassette, inspect the filter closely to determine whether it is questionable. Filters can be questionable for a variety of reasons, and all questionable filters must be reported to a supervisor. The standard procedure for reporting questionable filters involves filling out a status adjustment sheet. The sheet should include brief descriptions and drawings of the filter problem encountered and the identifying sticker for the filter that exhibits problems. The identifying sticker should be removed from the cassette and placed onto the sheet, next to the descriptive comment. If there is no sticker available or if the sticker is too worn to read, write down the information (site, date, channel, day of week, and filter number). Scotch® brand tape should be placed over the top of each sticker to ensure that it stays on the paper. Place the completed status adjustment sheet in the "Problems" wall pocket so that a supervisor can handle it.

These are some of the questionable filter conditions that must be reported:

- 1) *Rips or holes.* Make a drawing demonstrating the size and location of the rip/hole and give a brief explanation. Note whether the hole was made at the POST station or made elsewhere. If the hole was not made at the POST station, check the screen of the cassette for sample. If there is sample on the screen, state that this is so.
- 2) *Specks, unsampled regions, or a patterned sample.* Note if there are multiple specks or just one single speck on the filter.
- 3) *Anodized dust ("D" filters only).* When there is anodized dust, small black particles on the filter look as if they have been grouped together in several spots on the filter.
- 4) *Bugs.* The weight of the filter should first be taken with the bug; wait for the balance to stabilize and then record the weight on the status adjustment sheet. Press "D" to discard the weight from the program. Remove the filter from the balance. Using forceps, remove the bug from the filter. Avoid damaging the filter when removing the bug. Reload the filter onto the balance pan and wait for the balance to stabilize. Record the new weight both in the "POST" program and on the status adjustment sheet.
- 5) *Weight problems.* Filters can have problems with their weights that should be noted. Any value not well within the range of 0.010-1.000 mg needs to be reported as questionable, unless it represents the value of a field blank. Field blank weights should be close to zero.

A weight of  $\pm 0.003$  mg or more away from zero for a field blank should be reported. Also, if an "A" filter ever weighs more than a "D" filter, it should be reported.

- 6) *Peeling*. When a filter is "peeling," it looks as if the sample is coming off (or skinning off) the filter itself. Record the location and size of peeling and include a drawing. Peeling will only occur at the edge of the filter.
- 7) *Sun rays*. These occur when the sample collects in streaks that look like rays from a shining sun. Sun rays only occur in masked filters. The mask is a paper ring shape that is placed between the filter and the screen.
- 8) *Dropped filters*. If a filter is dropped on the counter or on the floor (in any manner), this incident should be reported on the comment sheet. Make sure to note if it was dropped sample side up or sample side down.
- 9) *Water spots*. Water contamination leaves a small spot that looks similar to a hard water deposit. Make a drawing of the water spot.
- 10) *Miscellaneous*. Finally, if there is anything else abnormal, even if it is not listed above, be sure to record it. It is better to record something that turns out to be normal than to ignore something that may be abnormal.

### 5.3 POST Weight Measurement

- 1) All the filters for Week 1 "A" and "D" cartridges should be lined up on polonium strips, sample side up, with labeled slide casings below them so that they cannot be confused. Enter user initials into the Microsoft FoxPro POST program to begin.
- 2) Check the reading on the balance. It should be 0.000mg. If the reading is  $\pm 0.003$ mg, the balance needs to be recalibrated. If the reading is  $\pm 0.001$  or  $\pm 0.002$ mg, place the test weight on the balance. Give the balance 90 seconds to stabilize. When learning the station, make sure to use the minute timer for this. Compare the reading on the balance with the test weight taken earlier in the day (at the bottom of the screen). If these values are the same, proceed with post-weight measurements. If the values are not the same, inform a supervisor and recalibrate.
- 3) The Microsoft FoxPro POST program will automatically bring up a site name for a box that needs to be downloaded. Press "Enter" to accept. The displayed box must be downloaded next unless a supervisor says otherwise. The computer will prompt "X" and "S" boxes to be downloaded even if they do not contain "A" or "D" filters. Follow the instructions on the screen and place the box on the PRE shelf when finished. Be attentive for flags (warnings) from the computer as soon as download has begun. Flags may appear in the upper right corner (where directions normally appear) and these flags will usually instruct the user to find a certain supervisor.
- 4) Check that the computer is waiting for the weight for the first date for the "A" cartridge. Gently place this filter onto the balance pan. If the filter is not gently placed on the balance pan, the balance will not be able to read the weight and will read "E" for "Error." In this case, remove the filter until the balance reads a number value again. If the balance continues to read "E," inform a supervisor.
- 5) While waiting for the balance to stabilize, place the white slide casing that corresponds to the filter being weighed face down on the small white plastic mounting block provided.



- 6) Once a filter is on the balance, it takes about 1.5 minutes to stabilize, or four consecutive readings on TeraTerm; at that point, the "POST" program should pick up the weight. If necessary, set the timer at the station for 1.5 minutes. When the program picks up a weight, make sure that the display on the balance, the value in the program, and the value on the green TeraTerm window agree within  $\pm 0.001\text{mg}$ . If the incorrect weight is taken, press "D" to discard the value and wait for the "POST" program to pick up a new weight. An incorrect weight is a weight picked by the "POST" program that varies by  $\pm 0.002\text{mg}$  from the weight on the balance screen. If the program will not pick up the weight but the balance has stabilized, press the spacebar to force the program to pick up the weight. Press "Enter" to accept the weight.
- 7) After the proper weight is recorded, remove the filter from the balance with forceps. Place the filter sample side up on the upside-down white slide.
- 8) Center the filter on the slide. Gently close the slide with a black slide casing. Remove the slide from the small white plastic mounting block and firmly press all edges to ensure the slide is closed.
- 9) Return the closed slide to its proper location in the slide tray. Make sure the number at the top of the white sticker on the slide is the same as the number on the tray where the slide is placed. Make sure that slides are not placed in the slots where slides for problem filters were removed; these slots should remain empty.
- 10) Continue weighing all the filters for Week 1. Make sure the filter that is placed on the balance always corresponds to the filter for which the program is asking.
- 11) While waiting for the balance to stabilize, clean the cassette bottoms and screens with ethanol and Kimwipes® and then use the arbor press to put the cassette bottoms back on.
- 12) Once Week 1 is complete, begin weighing Weeks 2 and 3. Make sure to remove and weigh only one week at a time.
- 13) Occasionally there will be a field blank in one of the cartridges. After all the normal "A" and "D" filter weights have been measured, the program will prompt for the field blank to be weighed. If this value has a difference of  $\pm 0.002\text{mg}$  from the pre-weight, make a note of it on the filter problems sheet. Remember that stickers for field blanks must be handmade and must contain the site name, sample date, and filter type. Place the slide in the field blank box labeled either "FB-A" (for "A" filters) or "FB-D" (for "D" filters). The field blank boxes are stored above the computer screen at the Cahn 30A station.
- 14) Return all cartridges to the proper bags and close the box. Throw away any leftover cassette labels. Place the box on the shelf to the right of the "A/D" download stations. This box will now go on to the "PRE" station.

#### 5.4 "X" Box Downloading

An "X" box is a single-channel fifth module that has been assigned to some sites throughout the network. An "X" module may be any type of module—"A", "B," "C," or "D." These modules serve as audit modules because they mirror the data generated by the module with which they share filter types. All "X" modules are color-coded orange.

All "X" boxes must be processed through the "A/D" download station, even if it contains "B" or "C" filters. The "X" box should be processed immediately following the "1" box that it matches. The boxes constitute a set and must be processed together at all stations.

If the "X" box is an "A" or a "D," it must be post-weighed. This is similar to the post weight of the "A" and "D" filters, but there will only be a single channel to download. The slide trays for "X" boxes are located directly above the computer monitor at the Cahn 30A or Cahn 31 stations.

If the "X" box is a "B" or "C," the filters have already been removed from the cassettes. All that is required is to advance the box through the station, which tells the LOGS database that the box is ready for the "PRE" station. To advance the box, simply press "Enter" each time the "POST" program prompts for it.

When finished, move the "X" box over to the "PRE" shelf.

## **6. DATABASE MANAGEMENT**

The POST program is a FoxPro® program that accesses the LOGS database to develop a list of exposed filters to be downloaded from cassettes. Next, it queues the exposed filters for weighing, and it records post weight values from the microbalance into the WEIGHTS database. Finally, after download is finished, it notes that the record is complete in the LOGS database.

**TI 251F “PRE” Station**

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## **1. PURPOSE AND APPLICABILITY**

The purpose of this SOP is to describe the procedures used to weigh clean “A” and “D” Teflon® filters and to upload nylon, quartz, and Teflon® filters to be sent out into the field. These procedures are used for every site in the IMPROVE network, though many of them generally apply to special studies as well.

## **2. SUMMARY OF THE METHOD**

Clean Teflon® filters are weighed on a microbalance. The weights are recorded using a FoxPro® program. Teflon®, nylon, and quartz filters are uploaded into labeled cassettes. A flashcard is assigned to each box and a log sheet is generated for each week. Boxes are then ready for the “Leak Check” station.

## **3. CAUTIONS**

Many site codes are similar. It is important to ensure that the site being uploaded in the “PRE” program matches the site code on the box.

Make sure to handle only one cassette at a time. Having two or more cassettes open while uploading filters increases the risk of filter swaps.

## **4. EQUIPMENT AND SUPPLIES**

- Microbalance
- Computer with FoxPro® “PRE” program and TeraTerm application
- Forceps for handling nylon and Teflon® filters
- Forceps for handling quartz filters
- Ethanol
- Ethanol wash bottle
- Kimwipes™
- Polonium strips
- Clean nylon, quartz, and Teflon® filters
- Compact flashcards (site specific and replacements)
- Printer
- Log sheet paper
- Extra red caps
- Week stickers (with installation date)
- Cassette stickers (with site name and sample date)
- Sharpies (red, yellow, green, blue, black)
- Necktie stickers (A,B,C,D)
- Dot stickers (red, yellow, green, blue)
- Blank cassette stickers
- Box top stickers
- Black pen
- Clean 6 mil re-closable bags

## 5. PERSONNEL QUALIFICATIONS

Student laboratory assistants must have familiarity with the cassettes and cartridges that house the filters as well as with the two box cycles. In addition, student laboratory assistants must have experience with the "POST" station before being permitted to work the "PRE" station.

## 6. PROCEDURE

At the "PRE" station, new filters are loaded into cassettes for each site's next box. Teflon® filters ("A" and "D") are weighed, while the nylon ("B") and quartz ("C") filters are simply placed into cassettes. Student laboratory assistants must already be experienced with the POST station before being permitted to work the "PRE" station.

### 6.1 Field Blanks

Field blanks are filters that are loaded into cassettes and sent out into the field, but they do not get sampled. Field blanks are important for determining possible contamination issues in the filter handling process or environment, as well as helping to maintain scientifically defensible data. In a 2-3-2' cycle box, field blanks are only loaded in a Week 1 cartridge, while 3-2'-2 cycle boxes are only loaded in a Week 3 cartridge. Field blanks will always be loaded in the third position of the appropriate week, no matter the cycle.

The PRE program randomly generates a field blank assignment in the appropriate week. When the appropriate week is started, there will be a notation on the screen indicating what type of field blank to load. If the field blank is an "A" filter or a "D" filter, it will be weighed after all the routine filters for that channel and week have been weighed. If the field blank is a "B" or a "C" filter, load the field blank when loading the routine filters for that type. For any field blank, remove the paper dummies from the cassette in position 3 and make a handwritten label for the filter. The label should have the site code, the sample date (which should match the sample date for the first position), and the designation "FB-#," with "#" being the filter type ("A," "B," "C," or "D").

To remove a field blank that the program generated, press the ALT button and then the F button for the associated filter type listed on the screen; F5 is for "A" field blanks, F6 is for "B," F7 is for "C," and F8 is for "D." To force or change a field blank, press ALT and the F button for the filter type that will be loaded as a field blank. There should be a total of 40 "A," 40 "B," 40 "C," and 20 "D" filters every sampling month.

### 6.2 The "PRE" Program

The "PRE" program should be at the preliminary screen. Enter user initials (three characters). A new screen should come up, which will list the site code of the first box in the queue. Check the boxes that are ready for the "PRE" station, which are located on the east wall shelves above the printer. If there are priority boxes on the shelf (white boxes that are sent through USPS or blue boxes that have pink labels), those should be uploaded first. They will need to be processed out of sequence from the queue. Manually enter the site code of the priority box to start. If there are

no priority boxes, take the box that corresponds to the site code displayed on the screen. Press "Enter" to continue.

### *6.3 Preparing Filters*

- 1) Teflon® filters for "A" and "D" cassettes are located in the green cabinet on the east wall of the balance room. Use an opened box of filters if there is one available. If not, take any unopened box in the cabinet.
- 2) The nylon ("B") filters are stored in the refrigerator. Take the box currently in use, which should be positioned in front of the current inventory stack. If there isn't a box that has already been opened, take out the box with the next sequential inventory number. Inform a supervisor of the box number so they can note it as being checked out.
- 3) The quartz ("C") filters are stored in the freezer. Before getting them, check the bottom of the PRE screen. The lot number will be there with the designation "Quartz = CQ####." Locate the box with the designated lot number.
- 4) At the balance, set the nylon and quartz filters aside, since they are not weighed.
- 5) Start placing Teflon® filters on the polonium strips. Fourteen are needed for each blue box. As a precaution, set out two or three extra Teflon® filters in case any replacements are needed or an "A" or "D" field blank is encountered.
- 6) Examine each Teflon® filter by holding it up to the light and inspecting it for holes, scratches, or anything else that would preclude using the filter. Ask a supervisor or other students about what the current trends are in defects and flaws in order to check for them more thoroughly.
- 7) Looking at the plastic rim of each Teflon® filter, one side is shiny and one is dull. Place acceptable filters shiny side down on a polonium strip. It is important to orient all of the filters correctly, since the dull side needs to be on the same side as the sample. Orienting the filters shiny side down during the weighing process ensures that no surfaces come into contact with the sample side of the filter.
- 8) Place rejected Teflon® filters in the appropriate reject bin so that they can be counted and a refund from the manufacturer can be requested.

### *6.4 Labels*

Pre-printed labels for the bags and cartridges for each site should be available. The labels are located in the cabinet underneath Cahn 31a (C31a). Opening and closing the cabinet has an effect on the weighing process for C31a. Access the cabinet only when a filter weight is not being acquired. Folders for each site are arranged alphabetically, and the dates needed for the current cycle will be listed on the PRE screen.

- 1) Open the cabinet and find the correct site folder. There should be two label sheets; one sheet should be a neon color with bag and box labels, and the other sheet should be white with cartridge labels for each of the filter cassette positions. Remove both of these sheets from the folder. If there are not corresponding labels that match the dates on the screen, find a supervisor to print them.
- 2) The first label to replace is the box label that has the site code and the three sample change dates on it. This label is located on the lid of the blue or white box in the upper left corner. Remove the old label and apply the new one.

- 3) Open the box and replace the old week-designation labels on each bag with the new ones. Make sure to place the labels on the appropriate week bags. Replace any dirty or torn week bags.
- 4) Once the new box and bag labels have been applied, put the neon label sheet away.
- 5) Set the cassette label sheet aside; it will be used shortly.

#### *6.5 Setting Up*

- 1) Take the Week 1 bag, remove the cartridges, and dump the red caps out in a convenient spot.
- 2) Check the cartridges to make sure that they are in the right configuration for the cycle that is appropriate for the box. A 3-2'-2 cycle Week 1 cartridge should have cassettes in the first, second, and third positions that receive filters, with the third position being the removable position. The fourth position should contain a paper dummy. If the removable cassette is not in the third position, check the corresponding Week 2 cartridge, as it may not have been moved back to the Week 1 cartridge. A 2-3-2' cycle Week 1 cartridge should have four permanent cassettes. The first and second positions will receive filters while the third and fourth positions should contain paper dummies. If there is any uncertainty about what cycle a site runs on, check the color of the stickers on the box and bags. 2-3-2' boxes have yellow stickers, and 3-2'-2 boxes have green stickers.
- 3) At this point, if the box is a 2-3-2' cycle box, check for returning field blank cassettes. They will appear as a third position cassette that lacks colored papers. The cassette will need new paper dummies loaded into it; these papers are located on the shelf next to the Cahn 30 balance.

#### *6.6 Understanding the "PRE" Program*

Check the Week 1 "PRE" screen to make sure the site code on the blue box matches the site code on the "PRE" screen, as some site codes are very similar. Note the number of sample dates listed on the screen. For a 3-2'-2 cycle box there should be three sample dates, and for a 2-3-2' cycle box there should be two sample dates. The "position" numbers on the screen mark the positions in the slide tray that the filters should occupy upon download. The "Mask" column denotes whether or not the filter receives a mask during upload. Filters that require masks will be marked as "M1" sites (which will be discussed later); sites without masks are designated "M0." The "A-CHAN" and "D-CHAN" columns are where the weights will be recorded on the screen. All of the "A" filters will be weighed first, followed by the "D" filters. The highlighted "Protocol" designates how often the sampler runs (1/3 = one 24-hour period every 3 days). There are also matched, color-coded boxes representing each cassette and their associated sample dates at the bottom of the screen. The color code is as follows: RED = "A" filters; YELLOW = "B" filters; GREEN = "C" filters; BLUE = "D" filters. The bottom of the screen also displays all of the filter lot numbers.

#### *6.7 Weighing Filters*

To start weighing filters, follow the prompts in the upper right corner of the PRE screen.

- 1) Press "Enter." The cursor will move to the first weight position, which is an "A" filter.

- 2) Load a Teflon® filter on the balance pan and close the balance window. Remember to orient the filter so that the shiny side is facing down.
- 3) While the balance is capturing the weight, get the white label sheet and start applying cassette labels to the “A” cartridge.
- 4) Apply cassette labels to the “B” cartridge.
- 5) Take the labeled “A” cartridge. Using the arbor press, open up the cassette in the first position.
- 6) Check the Tera Term window. Once the same weight has been posted five times, the weight is deemed stable. If the program has picked up a different weight, press “D” to discard. Press the spacebar to prompt the program to take the stabilized weight. Verify that the weight posted on the PRE screen matches the one on the balance display.
- 7) If the weight is acceptable, press “Enter.” Remove the filter and place it shiny side up in its corresponding cassette. Use the arbor press to close the finished cassette and to open the cassette bottom for the second position. Place another Teflon® filter onto the balance pan.
- 8) While the second “A” filter is being weighed, apply the “C” and “D” cassette labels.
- 9) If the second filter weight is still stabilizing, take the “B” cartridge and, using the arbor press, open up the cassettes that will receive filters.
- 10) When the second filter weight has stabilized, press the spacebar to acquire the weight. Before accepting it, make sure that it is at least +/- 0.100mg from the previous filter. All filter weights for the entire week must be at least +/- 0.100mg from each other. This is in part because weight differences are used to sort out problems if weights or filters get mixed up.
- 11) Press “Enter” if the weight is acceptable and remove the filter from the balance. Place it in its corresponding cassette bottom. Close the cassette with the arbor press. For 3-2'-2 boxes, remove the third cassette bottom on the “A” cartridge. If it is a 2-3-2' box, continue to the “D” cartridge. Remove the first position cassette. Place another Teflon® filter on the balance.
- 12) While the filter is weighing, load the “B” filters into the already opened cassettes. Each “B” filter is sandwiched between two spacer papers; make sure to separate the filter completely from both of these papers and to load only the filter into the cassette. The “B” filters have no true top or bottom so there is no specific orientation.
- 13) Once the “B” filters are loaded, open up the “C” cassettes with the arbor press and load the “C” filters. Look at the “C” filters carefully. Note that one side is very rough and contoured, while the other side is smooth. Load the filters with the smooth side facing down. The smoother side is the sample side. Handle these filters with care, touching only the edges with the forceps as the filters are quite fragile. Make sure to load only one filter per cassette. They tend to stick together, so loading two is a common mistake. Some sites are “double-C” filter sites, which will be discussed later.
- 14) When the balance has acquired the weight, verify that it is acceptable (at least +/- 0.100mg from all previous weights on the screen). If the weight meets the criteria, accept it, load it into the appropriate cassette shiny side up, and place the next Teflon® filter onto the balance pan.
- 15) Continue weighing Teflon® filters as outlined above, until the page is completed. Be sure to place each filter in the correct “A” or “D” cassette. If the box is a 2-3-2' box, the program may prompt for a field blank to be loaded during this week.



- 16) After the last weight of the Week 1 bag is accepted, the "Flash Code Number" prompt will appear. Choose the flashcard with the corresponding site name on it from the flashcard bin next to the C31A balance and type in the seven digit code listed on the back of the card.
- 17) The next prompt provides the option to go back and change the weights manually if a filter needs to be replaced or if an incorrect weight was accepted. Press "Tab" to cycle through the weights if a change needs to be made. Check the weights a final time to make sure that they are all acceptable and that none of the weights are within +/- 0.100mg of each other. If all of the weights are acceptable, follow the prompt and press "Enter."
- 18) At this point, the Week 1 log sheet will print and the program will move on to the Week 2 PRE screen. If any mistakes are noticed after the log sheet has printed, find a supervisor and notify them of the problem. If the log sheet does not print, notify a supervisor immediately. Do not continue weighing filters until the log sheet has been printed.
- 19) Before placing the cartridges in the Week 1 bag, inspect them to make sure they are configured appropriately for the box's cycle. If they are correct, make sure all the cassettes are covered with red caps and then place the completed cartridges in the bag. Fold up the log sheet and place the flashcard in a small flashcard bag. Put both of them into the Week 1 bag.
- 20) Press "Enter" one more time to start weighing Week 2 filters. The Week 2 screen is exactly the same as the Week 1 screen, but the number of filters to be weighed will be different. For 3-2'-2 cycle boxes, there should only be four filters to weigh (two "A" filters and two "D" filters). For a 2-3-2' box, there should be six filters to weigh (three "A" filters and three "D" filters). Again, make sure the cartridges for the week are configured appropriately. A 3-2'-2 cycle Week 2 cartridge should have cassettes in the first and second positions that need filters, an empty hole in the third position to accept the removable position, and a dummy in the fourth position. A 2-3-2' cycle Week 2 cartridge will accept filters in the first, second, and third positions, with the third position being the removable cassette. The methods are exactly the same for the Week 1 bag. As always, make sure the filter weights for the week are +/- 0.100mg apart. At the end of this bag, there will be no prompt for the flashcard but be sure to check the weights one last time before finalizing the page and printing the log sheet.
- 21) The third week screen is the same for both cycles, with four filter weights to be acquired (two "A" filters and two "D" filters). The Week 3 cartridge for a 3-2'-2 box will have four permanent cassettes; the first and second positions will receive filters and the third and fourth positions should contain paper dummies. A 2-3-2' Week 3 cartridge will have cassettes in the first and second position to receive filters, an empty hole in the third position to receive the removable cassette, and a dummy with colored paper in the fourth position. For a 3-2'-2 box, the Week 3 cartridges should be checked for returning field blank cassettes that will need new paper dummies. This is also the week for 3-2'-2' boxes where the program may prompt for a field blank to be loaded.

#### 6.8 Exceptions/Miscellaneous Tasks

- 1) "Double -C" filters. Some sites will require loading double "C" filters. The PRE program will display a prompt to remind the user to load two quartz filters per cassette for these sites. Also, at the bottom of the screen, the visual representation of the "C" filters will have both boxes colored green. When labeling double "C" cassettes, each cassette will get two labels, one for each filter in the cassette.

- 2) *Lot Change.* Another issue related to “C” filters is that of lot changes. Whenever a user runs out of “C” filters during “PRE,” a new box will have to be retrieved and opened, and the lot number must be changed. Lot changes can only be done between filter weights. When the “PRE” program has picked up a weight, a lot change prompt is displayed in the upper left corner of the “PRE” screen. Do not accept the weight until after doing the lot change. Press “F10” and the lot change box will appear. Enter the new lot number, including the “CQ” prefix. Remember that the new lot is often the next number in the sequence from the previous lot number, but there are occasional exceptions to this.
- 3) *Field Blanks.* In a 2-3-2’ cycle box, a field blank will always be placed in a Week 1 cartridge, while 3-2’-2 cycle boxes always have field blanks loaded in a Week 3 cartridge. The field blank will always be loaded in the third position of the appropriate week, no matter the cycle. When the appropriate week is started in “PRE,” there will be a notation on the screen if a field blank needs to be loaded. There will be a text field indicating what type of field blank to load. If the field blank is an “A” or a “D” filter, it will be weighed after all the routine filters for that channel for the week have been weighed. The cursor will automatically move to the correct spot after all the routine filters have been weighed. If the field blank is a “B” or a “C” filter, load the field blank when loading the routine filters for that type. For any field blank, remove the paper dummies from the cassette in position 3 and make a handwritten label for the filter. The label should have the site code, the sample date (which should match the sample date for the first position), and the designation “FB-#,” with “#” being the filter type (“A,” “B,” “C,” or “D”).
- 4) *M1 Sites.* Sites that are labeled as “M1” on the screen are relatively clean sites that need a mask to condense the sample area. Only “A” filters need a mask. These masks are placed on top of the filters during upload.
- 5) *X-Boxes with No “A” or “D” Filters.* Sites with X-boxes that have “B” or “C” filters still go through the “PRE” program even though no filters are weighed. This has to be done so that the log sheets are generated and printed and so that the X-box is removed from the PRE queue. Pause between printing each week’s log sheet so that the weeks aren’t cycled through too quickly, as this can occasionally prevent the program from registering that all the weeks for the box have been uploaded.

## 7. DATABASE MANAGEMENT

The “PRE” program is a FoxPro® program used to upload filters that will be sent out into the field. It accesses the LOGS database to develop a list of sites requiring boxes of filters. The order of this list is determined by the date and time that the site’s previous filters were downloaded. The “PRE” program downloads the site’s configuration information from the SITEFILE database and then checks the WEIGHTS database to determine the sample date of the last filter weighed for each site. “PRE” then determines the next seven sample dates required at each site. Next, it queues the filters for weighing and records pre-weight values from the microbalance to the WEIGHTS database. Finally, it records the site code, sample date, and start time to the LOGS database, thereby completing the initialization of the records for each filter being sent into the field.

**TI 251G "Leak Check" Station**

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## 1. PURPOSE AND APPLICABILITY

The purpose of this SOP is to describe in detail the procedures used at the "Leak Check" station in the sample handling laboratory. It is applicable to all routine filters in the IMPROVE network.

## 2. SUMMARY OF THE METHOD

Once all cartridges of a box have been uploaded with new filters, the box goes through a final check to make sure that each box has all of the components needed for the next sampling period. The box itself is inspected for the appropriate labels. Log sheets are examined for mistakes and the flashcard number is confirmed. Important instructions on each log sheet are highlighted for the site operator. Any issues are remedied. For FedEx sites, labels are printed and placed on the box. The boxes are transferred to the designated shipping area in the main bay of Crocker Nuclear Lab.

## 3. CAUTIONS

Many site codes look familiar. It is important to make sure that the correct FedEx labels are placed on each box so that they are sent to the correct site.

Remember that white boxes are shipped via the United States Postal Service. These sites do not need a FedEx label.

Remember to staple the return label to the Week 3 log sheet and place the outgoing label on the face of the box. Sometimes these labels are accidentally swapped and the box ultimately ends up back in the lab instead of its proper destination. This can cause loss of sample at the site and is to be avoided.

## 4. EQUIPMENT AND SUPPLIES

- Highlighters
- Pen (not red)
- Stapler
- External Box Labels
- Shipping labels (for FedEx sites)

## 5. PROCEDURE

The "Leak Check" station is located directly outside the balance room. Boxes are placed on a shelf above the station.

### 5.1 The Week 1 Bag

- 1) Starting with the priority boxes (white or blue boxes with pink labels), remove one box from the shelf and visually inspect the external labels. If any labels need replacing, retrieve new ones, which are located in the cabinets at the station. If there are no more pre-printed labels in the cabinet, ask a supervisor to print new ones. Try to remove the old label(s) as completely as possible. Be sure to check the label located at the top left corner on the face of the box. This label should contain the site code and the three sample change dates for

the box. Remember these dates, as they should be the same for every site in that cycle (3-2'-2 or 2-3-2'). The only exception to this is WHPE1, which has a unique sampling schedule. If the site has a corresponding X-box, be sure to process it right after the main box so that both boxes stay together. Do this also for PHOE1 and PHOE5.

- 2) Open the box and remove the Week 1 bag. The first thing to check for is the flashcard. Every Week 1 bag should contain a new flashcard for the sample change. Check that the flashcard is there and that its label matches the site label on the box. Also confirm that the number listed on the card matches the flashcard number listed on the log sheet.
- 3) Remove the log sheet and all of the cartridges from the bag. Put the flashcard back in the Week 1 bag. The site code and installation date are listed at the very top of the log sheet. Make sure that these match the label on the box lid. If they correspond, highlight them with a highlighter (kept in the center drawer of the "Leak Check" station) for the operator. If the date on the log sheet is incorrect, check the log sheets in the other two week bags to see if they may have been swapped. If the sample change dates on the log sheets do not match the dates on the external box label, ask a supervisor for help.
- 4) At the bottom of the log sheet, check for a dashed line with operator instructions above it. Some log sheets will have instructions on the first week log sheet, while others will have them on the second week log sheet, depending on the cycle. Both cycles should have instructions on the Week 3 log sheet. Highlight the instructions for the operator.
- 5) At the bottom left-hand corner of the log sheet, there will be recorded weights for the "A" and "D" filters. The "A" filter weights are on the left and the "D" filter weights are on the right. None of the weights should be within +/- 0.100mg of each other. If any of the weights are too close to each other, one or more filters will have to be replaced. Be sure to notify a supervisor so that a weight correction can be performed in the database.
- 6) After inspecting the log sheet, examine the cartridges. First, check that the dates for every cassette match the dates on the corresponding log sheet. This can be done easily by placing the "A," "B," "C," and "D" cartridges in order across the counter. The sampling dates are in the left-hand column of the log sheet.
- 7) After checking and confirming the cassette dates, note how many cassette labels are present on each cartridge. A 2-3-2' cycle box should have labels for the first and second positions and dummy cassettes in the third and fourth positions. A 3-2'-2 box will have labels for the first, second, and third positions, and a dummy in the fourth position. The third position of a 3-2'-2 box should be the removable O-ring cassette. For either cycle, any labeled position should have the appropriate filter loaded ("A," "B," "C," or "D"), and any unlabeled positions should have paper dummies loaded.
- 8) Inspect each cartridge independently. Remove the red caps from each cassette and inspect each for either a filter or a paper dummy. While looking at the filters, inspect them for anything out of the ordinary, such as holes, debris stuck to the filter, or anything else that may affect the analysis or mass of the filter. If anything questionable is found, bring it to the attention of a supervisor. When looking at quartz filters, make sure that the smooth side is visible. For some sites, the "A" filters need to be uploaded with masks. Make sure all of the "A" filters for the sites listed in Table 1 have masks.

**Table 1: Mask Sites**

|       |       |       |
|-------|-------|-------|
| BRID1 | DENA1 | HALE1 |
| HANC1 | HAVO1 | MEVE1 |
| MORA1 | NOAB1 | NOCA1 |
| OLYM1 | PETE1 | SIME1 |
| SNPA1 | TRCR1 | TUXE1 |
| VIIS1 | WEMI1 | WHIT1 |
| WHPA1 | WHPE1 | WHRI1 |
| ZICA1 |       |       |

- 9) While checking the cassettes, replace any of the necktie labels ("A," "B," "C," "D," or "X") that are absent or peeling. These labels are located in the upper right-hand drawer at the station.
- 10) Check for field blanks in 2-3-2' cycle boxes. Field blank (FB) cassettes have handwritten labels and will always be in a Week 1 cartridge for a 2-3-2' cycle site. The module containing the field blank will be indicated with an asterisk to the right of the elapsed time (ET) column on the log sheet. Make sure that the field blank is present and that it is the correct filter type. "A" and "D" field blanks should also have recorded weights on the log sheet.
- 11) After everything has been inspected and verified, initial the log sheet near the recorded weights and neatly place the cartridges and log sheet back into the Week 1 bag. Continue on to the Week 2 bag.

*5.2 The Week 2 and Week 3 Bags*

- 1) The "Leak Check" procedure for the Week 2 and Week 3 bags is almost exactly the same as for the Week 1 bag. There should not be a flashcard in the Week 2 or Week 3 bags. The only other differences to watch out for involve the 2-3-2' and 3-2'-2 cycle configurations.
- 2) Week 2 cartridges for a 2-3-2' cycle should have labeled cassettes in the first, second, and third positions, and a dummy cassette in the fourth position. The third position cassette should be the O-ring cassette. A Week 2 cartridge for a 3-2'-2 cycle should have labeled cassettes in the first and second positions, an empty third position in which to move the O-ring cassette from the Week 1 cartridge, and a dummy cassette in the fourth position.
- 3) Week 3 cartridges for a 2-3-2' cycle should have labeled cassettes in the first and second positions, an empty third position in which to move the O-ring cassette from the Week 2 cartridge, and a dummy cassette in the fourth position. A Week 3 cartridge for the 3-2'-2

cycle will have labeled cassettes in the first and second positions and dummy cassettes in the third and fourth positions.

- 4) Check for field blanks in 3-2'-2 cycle Week 3 cartridges. Field blanks will always be loaded in Week 3 cartridges and have a handwritten label. The module containing the field blank will be denoted with an asterisk just to the right of the "ET" column on the log sheet.
- 5) Once all three weeks have been thoroughly examined, fill out and attach an "Initials" sticker to the back of the Week 3 log sheet in order to document that everything in the box has been checked.

### *5.3 FedEx Labels and USPS Boxes*

- 1) The FedEx shipping labels should already be in the blue box. One label is for shipping the box out to the site, and the other is the return label. Check the labels and make sure that they match the site label for the box. If no FedEx labels are present, print them out using TI251H, "Blue Box Shipping."
- 2) Make sure to put the correct label on the outside of the box. The outgoing label should list the site code in the recipient address section on the label. Find the site code and highlight it. This will help ensure that the box is sent out with the outgoing label and not the return label.
- 3) Remove any previous FedEx labels as thoroughly as possible. Peel the label off of its paper and apply it onto the top of the box. Avoid placing it over other relevant labels such as the "KEEP OUT OF DIRECT SUNLIGHT" label. If a relevant label is accidentally covered, make sure to apply a replacement label on the box where it can be seen.
- 4) Staple the return label to the Week 3 log sheet and place the log sheet in the Week 3 bag. Make sure the bag is sealed.
- 5) Apply a piece of shipping tape over the lid of the box so that it cannot open during transport. Do not use the USPS tape to seal the box; that tape should only be placed on USPS boxes. The box is now ready to be shipped out and can be taken to the loading dock for FedEx pickup.
- 6) **USPS Boxes:** White boxes are mailed out via USPS. Each box has a permanent reversible mailing label located in a pouch on the box. Be sure the label shows the site mailing address. Use the USPS tape to seal the white boxes.

**TI 251H Shipping Blue Boxes**

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## 1. PURPOSE AND APPLICABILITY

The purpose of this SOP is to describe the procedures used to print out FedEx labels for the IMPROVE network sites. It is applicable to all IMPROVE sites except for a select few that are shipped by the U.S. Postal Service.

## 2. SUMMARY OF THE METHOD

Outgoing and return labels are created for all IMPROVE site boxes that are shipped via FedEx. This includes the international sites, VIIS1 and EGBE1.

## 3. CAUTIONS

Many site codes are similar. It is important to pay close attention to the site code of the box and to ensure that the proper label is printed for it.

Make sure to send all three signed copies of the commercial invoice when shipping boxes to the two international sites. Not doing so will cause significant shipping delays.

## 4. EQUIPMENT AND SUPPLIES

- Computer with Internet access
- FedEx label printer
- FedEx label rolls
- FedEx pouches for international shipping
- Printer
- Computer paper

## 5. PROCEDURE

### *5.1 Getting Started: FedEx Boxes and USPS Boxes*

Some sites cannot receive boxes via FedEx for various reasons (remoteness, delivery issues, etc.). The boxes for these sites are white. There is a list of these sites at the "Leak Check" station for reference if needed. FedEx labels will not be generated for those sites unless authorized by a supervisor.

The boxes that need FedEx labels are blue and have green "FedEx Box" labels on their sides.

### *5.2 The FedEx Website*

- 1) Go to <http://www.fedex.com>. Choose "USA" as the location. The website will automatically redirect to the FedEx homepage.
- 2) Move the mouse cursor over the "Ship" tab found on the top middle of the page until the drop-down menu appears. Choose the "Prepare Shipment Online" option. The page will redirect to the account login page. When the login page loads, type in the following user ID and password (case sensitive):

User ID: AQGLAB

Password: aqg1123

### 5.3 Starting the Shipping Process

- 1) When the shipping information page loads, choose a site code from the “Company Name” drop-down menu located at the top left of the page. The page will refresh with the address information for that site. Select a contact name from the second drop-down menu if the refreshed page doesn’t show address information. If the site is international (VIIS1 or EGBE1), continue on to section 5.8.
- 2) In the “Package and Shipment Details” section on the right side of the screen for “Service Type,” select the “FedEx Express Saver” option from the drop-down menu. If the box is late getting sent out, check with a supervisor to determine what service type to use. Site HAVO1 (Hawaii Volcanoes) cannot be shipped using the “Express Saver” option. Use the “FedEx 2 day” service instead. Also, if the scheduled delivery day falls on a Saturday for any site, notify a supervisor and select the appropriate service so that the package arrives on the following Monday.
- 3) For “Package Type,” select “Your Packaging” from the drop-down menu.
- 4) If shipping only a blue box:
  - a. On the third drop-down menu, “Number of Packages,” select “1.”
  - b. Type in the weight: 3 (lbs.)
  - c. Select the dimensions from the drop-down menu: BLUBX 11x10x6
- 5) If shipping a main box and an X-box, select “2” instead of “1” in the “Number of Packages” option. A pop-up window will appear. Fill in the information for both boxes.
  - a. Enter quantity as “1” for the main blue box.
  - b. Type in the weight for the main blue box, which is 3 (lbs.).
  - c. Select the dimensions from the drop-down menu: BLUBX 11x10x6.
  - d. Click on “Add Row” in order to enter information for the X-box.
  - e. Type in the weight for the X-box, 2 (lbs.), and select “XBOX 9x8x6” for dimensions.
  - f. Click “OK.” The webpage will automatically refresh with the updated information.
- 6) In the “Shipment Notifications” category on the right side of the page, in the “Sender” box, check that the e-mail address [ixquiac@crocker.ucdavis.edu](mailto:ixquiac@crocker.ucdavis.edu) is present. If so, check the “Ship” box just to the right of it. If the e-mail address is not in the “Sender” box, click on the “Edit” button. A popup window will appear. Change the address so that it matches the e-mail address listed above. Check the “Ship” notification box and click on “Ok.”
- 7) In the “More Shipment Details” category, “Today” should already appear in the “Ship Date” box. If it is not, go ahead and select it.
- 8) Check the “Process Return Label” box.
- 9) Click on “Continue” at the end of the page.

### 5.4 Return Shipment Options

- 1) In the “Select Package and Shipment Details” section on the right of the page, select “Print” in the “Return label type” category.
- 2) For the “Service Type,” select “FedEx 2 day” from the drop-down menu.
- 3) For “Package Type,” select “Your packaging” from the drop-down menu.
- 4) For sites without X-boxes:

- a. Enter the quantity as "1" for the main blue box.
  - b. Type in the weight for the main box: 3 (lbs.).
  - c. Select dimensions from the drop-down menu: BLUBX 11x10x6.
- 5) For sites with an X-box, select "2" instead of "1." A pop-up window will appear so that information can be submitted for both boxes.
- a. Enter the quantity as "1" for the main blue box.
  - b. Type in the weight for the main box: 3(lbs).
  - c. Select dimensions from the drop-down menu: BLUBX 11x10x6.
  - d. Click on "add Row" in order to enter information from the drop-down menu.
  - e. Enter the weight for the X-box, 2 (lbs.), and select "XBOX 9x8x6" for the dimensions.
  - f. Click "OK." The webpage will automatically refresh with the updated information.
- 6) In the "Billing Details" section on the right-hand side of the page, in the section titled, "Your Reference," type in the site code and first installation date. This is crucial, as it will help track the return box in case of problems. The first installation date is located on a label containing the site code and the three installation dates for the box. This label should be on the face of the box in the upper left corner.

#### *5.5 Printing the Labels*

- 1) Click on the label icon above "Label 1."
- 2) A gray "Warning-Security" pop-up window will appear. Click "Yes" and the first label will print from the thermal printer located next to the "Leak Check" station.
- 3) Click on the label icon above "Label 2." The pop-up security window will not appear at this time, as it should only do so once per session. The second label will print. Before processing any more shipments, separate the labels from the printer and put them inside the blue box. If printing labels for both a main blue box and an X-box, there will be four labels. Make sure each box gets its correct labels. Repeat the same procedure for all labels. Place the box at the "Leak Check" station for inspection.

#### *5.6 Setting Up for Another Shipment*

- 1) Click on the "Go to Next Steps" link on the right side of the page.
- 2) Click on "Process Another Shipment" on the left of the webpage that appears.
- 3) A new shipment detail screen should appear.

#### *5.7 Special Circumstances/Exceptions*

- 1) *Saturday Deliveries.* There are no Saturday deliveries to any site. If a box happens to fall on a Saturday delivery date, change the service for the box so that the box will arrive on the following Monday.
- 2) *International Shipments.* Sites VIIS1 (Virgin Islands) and EGBE1 (Egbert) require Pro Forma Invoices. See section 5.8 for further instructions.
- 3) *Express Saver Service exception.* Site HAVO1 (Hawaii Volcanoes) cannot be shipped using the Express Saver option. Use the 2-day service option instead.

- 4) *X-Boxes*. These boxes should always be shipped out with their respective main blue box. Sites PHOE1 and PHOE5 should be treated as a two box shipment, but both boxes are standard size blue boxes. Be sure to use the appropriate dimensions.

### 5.8 International Sites

- 1) If either VIIS1 or EGBE1 is selected from the "Recipient Information" drop-down menu, the "International Shipment" page will come up. This is very similar to the normal page, but it has a few distinctive boxes.
- 2) The "Service Type" on the "Package and Shipment Details" section should be "International Priority." If it is not, open up the drop-down menu and select this option.
- 3) On the second drop-down menu, "Package Type," select "Other Packaging."
- 4) In the third drop-down menu, "Number of Packages," select "1." Type in the weight of the box, 3 (lbs.). Select the dimensions from the drop-down menu: BLUBX 11x10x6.
- 5) In the "Carriage Value" box, enter "100." US dollars should be selected in the box immediately to the right. If this is not the case, open up the drop-down menu and select it.
- 6) In "Package Contents," select "Products/Commodities."
- 7) In the "Shipment Notifications" category on the right side of the page, the "Sender" box should read [ixquiac@crocker.ucdavis.edu](mailto:ixquiac@crocker.ucdavis.edu) for the e-mail address. If so, check the "Ship" box just to the right of the "Sender" box. If this address is not in the "Sender" box, click on the "Edit" button. A pop-up window will appear. Change the e-mail address from whatever it happens to be to the e-mail address listed above. Then check the "Ship" notification box and click "OK."
- 8) For "Ship Date," choose "Today" and click "Continue."
- 9) The next page is the Product/Commodity summary page. In the "Product/Commodity Description" box (for Customs), type in "Air Filters."
- 10) "Country of Manufacture" is "United States."
- 11) For "Quantity," enter "1."
- 12) For "Unit of Measure," select "Pieces."
- 13) For "Weight and Value are specified," select "As totals."
- 14) For "Weight," enter 3 (lbs.).
- 15) For "Value for Customs," again enter "100."
- 16) For "Harmonized Code," enter "4823201000."
- 17) Click the "Add this product to shipment" button, which should fill in the upper right box with the totals entered in the previous steps. Be sure the totals do not change. If they do, one of the previous fields was incorrectly entered and needs to be changed.
- 18) Check the "Print Commercial Invoice or Pro Forma Invoice" box and click the "Continue" button.
- 19) On the next screen, check the "Create Pro Forma Invoice instead of Commercial Invoice" box and click on the "Continue" button.
- 20) The next screen will be the shipping label screen. Print one copy of the label from the FedEx label printer, which will print one shipping label and one cosignee label. Separate the shipping label from the cosignee label. Set the cosignee label aside. Apply the shipping label to the box. Click the "Continue" button, which will then display the Pro Forma Invoice screen. A return label is not processed for international shipments.

- 21) Print four copies of the Pro Forma invoice, which will print out on the normal lab printer. Give the four copies to a supervisor, who must sign them. Attach a FedEx label pouch to the box and place three copies of the Pro Forma invoice in the pouch, making sure the bar codes on the forms are visible. Also place the cosignee label into the pouch. Take the fourth copy of the invoice to the front desk.

#### *5.9 Dealing with USPS Boxes*

The only precaution to take when shipping USPS boxes is to verify that the correct side of the reversible address card is visible. At the "Leak Check" station, the card should be on the outbound side, with the address of the site it is being shipped to on display.