UCD IMPROVE Technical Instruction #276A

Preparation of Filters for HIPS Analysis

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

June 15, 2021
Version 5.4

Prepared By: *Lindsay Kline*   Date: 6/14/2021
B7A73C50DF23499...

Reviewed By: *Jason Giacomo*   Date: 6/15/2021
B62B01F81613421...

Approved By: _____   Date: 6/14/2021
C4452D4B4E1D400...

UCDAVIS
AIR QUALITY RESEARCH CENTER

DOCUMENT HISTORY

Date Modified	Initials	Section/s Modified	Brief Description of Modifications
05/20/21	SRS	All	Previous anthologized version separated into individual TIs.

TABLE OF CONTENTS

LIST OF FIGURES

1. PURPOSE AND APPLICABILITY

This technical instruction (TI) describes the procedure used for preparing filters for HIPS analysis. All routine, valid IMPROVE 1A module filters are prepared for HIPS analysis using the described method.

2. SUMMARY OF THE METHOD

All valid, routine IMPROVE 1A module filters are transferred from Petri dishes or similar containers to 2" x 2" slide frames. Slides are stored in slide trays that hold 40 filters. Filters are transferred into slides by sampling month and year.

3. DEFINITIONS

- HIPS: Hybrid Integrating Plate/Sphere
- IMPROVE: Interagency Monitoring Program of Visual Environments
- TI: Technical Instruction
- XRF: X-ray Fluorescence

4. CAUTIONS

Many site codes are similar. Ensure the identifying information on the Petri dish, slide and LabVIEW all match prior to transferring the filter to the slide.

Make sure the filter is placed in the slide so the sampled side of the filter is facing away from the labeled slide piece.

Note any mishaps that occur while transferring the filters (such as dropping a filter) on a status adjustment sheet.

Verify the slide sandwich is secured tightly after the filter is transferred.

5. EQUIPMENT AND SUPPLIES

- Slide trays containing labeled slides organized by month and site
- Forceps
- Slide block
- Slide press
- Slide labels
- 2x2 Slides

6.   PROCEDURAL STEPS

Filters ready for HIPS analysis are in labeled Petri trays that have been analyzed via X-ray fluorescence (XRF) located in the XRF lab. Following XRF analysis, Petri trays are relocated to the Optical Analysis lab.

The station for transferring filters from Petri dishes to slide trays is located in the Optical Analysis lab. All pertinent equipment and supplies (pre-labeled slide trays, slide blocks, etc.) for transferring filters from Petri dishes to slides are at the station.

Labels are printed for slides by sampling month and year, and are based on inventory order generated in the Sample Handling Lab. Information is copied from files exported from the IMPROVE web app and pasted into a sticker template.

6.1   Generating Filter Slide Labels

1. From the U:\drive open the LASER labels folder: U:\IMPROVE_Lab\LASER\Labels

2. Open the "Slide Label Template: "U:\IMPROVE_Lab\LASER\Labels\Slide Label Template.xls"

3. From the U:\ drive open the Lab Gravimetric folder, U:\IMPROVE_Lab\Lab_Gravimetric.

4. Click on Applications and Macros folder: U:\IMPROVE_Lab\Lab_Gravimetric\Applications and Macros

5. Click on the XRF folder

6. Click on the folder for the year corresponding to the year needed for printing (example 2020 Closed). The year folder contains "Sets" and a Master list. Open the excel file for the Master list. The Master list contains multiple worksheets and will be filtered by month. Information from each worksheet in the Master list workbook will be sorted and copied.

7. Select the worksheet labeled "A SET 1-10", highlight row 1 and click on "Sort and Filter" from the ribbon and select "Filter". Column C is labeled "SAMDAT", click on the dropdown arrow and deselect all months except the month that will be printed and click "Ok". For example, if printing June 2020, deselect all months except June 2020.

8. Copy the information from the "Master List" in columns B-I (starting with Row 2), then paste this information into the "Slide Label Template" under the worksheet "Master".

9. Column I will auto-populate once information is pasted into columns B-I.

10. Repeat steps 7-9 for additional worksheets contained in the "Master List" workbook.

11. Copy the information from column I and paste the information into the "List for Printing" worksheet.

12. Field blanks need to be filtered out before printing the labels. Filter column D on the Master worksheet by "FB" for field blank. Copy the field blank information in columns A-I and paste the information into columns A-I of the Field Blank worksheet. Delete the information in these rows from "Master". Remove the filter from column D.

13. Delete the blanks rows from the Master worksheet, type CTRL + A to select all. With the sheet highlighted click "Find and Select" from the ribbon, click "Go to special". From the list click on "Blanks" and ok. All blank rows and possibly some blank columns will be highlighted. Right-click and select "delete", and then shift rows up.

14. From the field blank worksheet highlight the information in columns A-H (do not highlight I), and paste this information at the bottom of the list on the Master worksheet. Column I will auto-populate. If Column I does not have the correct formula, drag the formula down from the rows above it.

15. Starting with row 2 highlight the information in column I, paste this information into the "List for printing" worksheet. Verify the label information is correct on each print worksheet (print 1-18) and then print the individual sheets. Not all sheets will need to be printed for each sampling month.

16. Click "Save As" and save the file in the following format "Slide Label sampling month and year" in the folder for the current year located here, U:\IMPROVE_Lab\LASER\Labels. Example for June 2020, "Slide Label June 2020"

17. Printed slide labels are placed in the Optical Analysis lab for labeling, process is described in section 5.3 "Labeling IMPROVE slides and slide trays.

6.2   Printing Tray Stickers

1. Open the Microsoft Word document **"**Slide Tray Label Printout" located here, *U:\IMPROVE_Lab\LASER\Labels\Slide Tray Labels Printout.,*.

2. Update the sampling month to the month needed and print the number of labels needed.

3. Place the labels in the printer and select print, save and close the file.

4. Printed labels are placed in the Optical Analysis lab for labeling slide trays, process is described in Section 7.3 Labeling IMPROVE slides and slide tray.

Figure 1. Slide Tray Label.

IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____	IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____
IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____	IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____
IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____	IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____
IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____	IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____
IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____	IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____
IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____	IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____
IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____	IMPROVE A Module Month: JULY 2020 Month Tray#_____ LabVIEW Tray#_____

6.3   Labeling IMPROVE Slides and Slide Trays

Before transferring filters can begin, slides and slide trays need to be labeled. A lab technician will print out labels for the current month being transferred.

1. A red sharpie and ruler are used to draw a line down the center of each slide label (the same way it is done for A filters in the sample lab).

2. Fill out the slide tray number beginning with 1 prior to placing labels on the slide trays. Additionally, the last slide tray for the month will contain field blanks, write field blanks on this label. Begin by labeling the front of the empty slide trays with the slide tray stickers. Place the labeled slide trays on the tray rack (located on the IMPROVE HIPS desk). The LabVIEW tray number will be empty, this will be filled in as trays are created in the tray building program.

3. Locate the first tray in the set being transferred and verify the first slide sticker matches the first sample to be transferred for the month. This is to help ensure labels are in the same order as the physical filters. Grab an unlabeled, empty slide from the stack and place the first sticker above the cutout on the slide.

Figure 2. Example of labeled and unlabeled slide.

4. When placing labeled slides into slide trays make sure the numbers 1-40 (printed on the side of the slide tray) are positioned on the right-hand side when the labeled slides are facing toward you. This guarantees the small cutouts on the bottom of the slide tray (on the opposite side on the numbers) will be the side in contact with the instrument when slide trays are loaded for analysis.

5. Once all slides within a set have been labeled, creating trays and transferring filters can begin.

Note: the following sites have 1A and 5A modules: BYIS1, MEVE1, PMRF1, SAMA1, and YOSE1. These sites will have two sets of filters that are routinely mixed together within a white Petri tray. Petri labels for 1A modules will have a 1A and red line down the center of the label. Petri labels for 5A modules will have a 5A and an orange line down the center of

the label, Figure 3. The slide labels will also contain information to differentiate 1A and 5A slides, Figure 4.

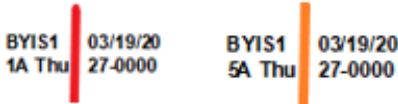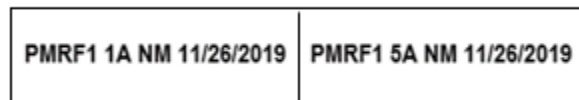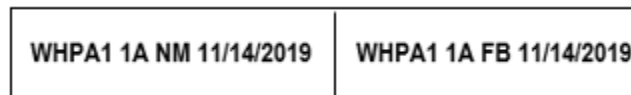Figure 3. Left is for a 1A Petri label, right is for a 5A Petri label.

Figure 4. Left is for a 1A slide label, right is for a 5A slide label.

Slide Labels will also contain either an NM for normal or FB for field blank as seen in Figure 5.

Figure 5. Left is for a 1A normal (NM) filter, right is for a 1A field blank (FB) label.

Each IMPROVE sampling month contains approximately 40 field blanks. Petri dishes containing field blanks will have an "FB-A" on the label and are typically hand-written labels. Field blanks are placed in a separate slide tray by sampling month and year. The slide tray for field blanks is the last slide tray for each sampling month.

BYIS is a special site and has a mixture of 37 mm and 25 mm filters. The 37 mm slides are kept in a separate cabinet in the Optical Lab, please ask a lab lead to show you where. Labeled 37 mm slides are placed in a separate slide tray (they will be analyzed separately). Additionally, take care to not label 25 mm slides with stickers that are meant for 37 mm slides (the labels used in HIPS are not removable and difficult to clean off the slides). Ask a lab lead if unsure.

6.4 Performing Tray Checks

Filters ready for HIPS analysis will be placed in the HIPS lab following XRF analysis. A tray check will be performed prior to transferring any filters to ensure order integrity. The filter inventory label is removed from the Petri tray and placed on a blank HIPS analysis form and is used to perform a tray check. Blank HIPS analysis forms are located here, U:\IMPROVE_Lab\LASER\Templates\template status adjustment form (Laser).

1. Locate a blank HIPS Analysis form (in a tray on the IMPROVE desk, ask a lab lead if more need to be printed).

2. Locate the Petri tray with the lowest set number and tray number (ex. Set 3 Tray 1 would be transferred before Set 3 Tray 2). Once all of the filters from the lowest set number

have been verified then move on to the next set (based on the previous example would be Set 4 Tray 1). If unsure or trays are missing please ask a lab lead.

3. Fill out the date, set number and tray number on the HIPS analysis form.

4. Remove the inventory label from the front/top of the Petri tray and place it in the designated box on the HIPS analysis form.

5. Open the Petri tray and perform a tray check by beginning with the filter in position 1 (the top-left side) verify this sample matches the first sample listed on the inventory label. Continue on until all 50 filters have been verified. If you find any discrepancies in the order, notify a lab lead immediately (DO NOT move the filters into the correct order). If a lab lead is not available please mark the information on the HIPS analysis form and notify a lead as soon as possible. No filters will be transferred from this tray until the order discrepancy has been resolved. In this case you would begin transferring filters from the next tray in the set provided the tray check is good.

6. Once all filters in a Petri tray have been verified, fill out your initials and the date in the designated "Filter Check" box on the HIPS analysis form.

7. Wrap the HIPS analysis form around the Petri tray and place it in the designated area on the desk.

6.5 Transferring Samples to Slides

Prepare the workstation; ensure the correct Slide Trays are on the racks. Note the Petri trays belong to multiple sets, only transfer samples from one set at a time. Petri trays ready for transferring will be in the area labeled "ready for transferring". A tray check is performed prior to scanning or transferring filters, refer to section 5.4 for performing tray checks. A HIPS analysis form with an inventory label adhered to the form will be wrapped around the Petri tray indicating a tray check has been performed. Additionally, on the HIPS analysis form the box for "Filter Check" will be filled in with a completion date and initials. Filters are scanned into the Build a Tray software prior to transferring into slides, refer to section 5.6 for step-by-step procedure.

Transfer samples from the lowest set number, with the lowest tray number. Locate the first Petri dish containing a sample from the Petri tray. Note the sample's site and sampling date (sampleidentity on the Filter Inventory), this information will be used to select the slide tray and should match the slide in position 1 of slide tray 1.

Slide trays are organized by sampling month and should be in the same order as the Petri tray inventory. Locate the slide within the slide tray that matches the Petri dish selected. Exercise caution when selecting the slide, many IMPROVE site codes have similar site names e.g. BADL1 and BALD1 or SAGA1, SAGO1, and SAGU1, it is important to ensure the filter is transferred to the correct slide.

The slide will be placed label side down on the arbor press and then the filter will be placed sample-side up on this slide (centered with the hole). A blank slide will be used to sandwich the filter, the sandwiched filter is then placed back in the correct slide tray/position.

1. Filters are transferred one at a time, beginning with the filter in position 1 (the top-left side of the Petri tray). Remove the Petri dish from the tray and then locate the slide tray that contains the site for the selected filter. Remember to only have 1 filter/Petri dish out at time.

2. Remove the lid from the slide tray and then locate the slide that matches the Petri dish you selected in the previous step. Place this slide on the arbor press with the label facing down.

3. Remove the lid from the Petri dish and leave the opened dish on the counter. Then use the handheld Cognex scanner to scan the barcode located on the filter support ring into the tray building software. For step by step instructions on using the Build a Tray software refer to Section 7.6: Generating Slide Trays.

4. Using forceps remove the filter from the Petri dish and place it in the designated spot on the slide (the hole shaped cutout). Remember the filter remains with the deposit/sample side face up (the labeled part of the slide is the non-sample side of the filter).

5. Grab an unlabeled slide and line it up with the filter and bottom slide (the bottom slide is the labeled slide) and then using the handle on the press, sandwich the two slides together. Double check the filter is not caught between the two slides before pressing them together (as long as the filter was aligned properly this should not be an issue).

6. Remove the sandwiched filter by gently pulling it through the slot at the front of the slide press. If the sandwich does not fit through this slot, it usually indicates the two slides are not pressed together all the way. You can lower the press again to finish the process. If that does not work then you made need to remove the unlabeled slide and then try another unlabeled slide. Another option is to carefully press the two slides together with your hands. Once the filter is properly sandwiched in the slides place it back in the correct slot of the slide tray you removed it from in step 2.

7. Place the now empty Petri dish back in the Petri tray in the same location you removed it from. It is important for the Petri dishes to stay in the correct order in the event that filters are transferred incorrectly, the order will be used for reconciliation.

8. Note any anomalies for the filters on the HIPS analysis form, such as; holes, particles, fibers, dropped filter etc. Draw a picture of the filter issue and list the site, date and module (1A or 5A). There are columns to mark the issue and an "other" option. Fill in any additional comments in the other box that are relevant.

6.6   Generating Slides Trays

The Build a Tray software within LabVIEW is utilized for generating slide trays. There are two versions of the "Build a Tray" software, one is for IMPROVE the other is for CSN (Chemical Speciation Network). Please ensure you are using the IMPROVE software for creating IMPROVE trays, you will see IMPROVE in blue in the top right corner, refer to Figure 7 Build a Tray IMPROVE. If you do not see this and instead see Chemical Speciation Network in red

please click on the other open version of "Build a Tray" in the taskbar. The file is located here, *U:\SharedData\HIPStrays - DO NOT EDIT\BuildTrayApp_IMPROVE.*

Figure 6. Build a Tray IMPROVE.
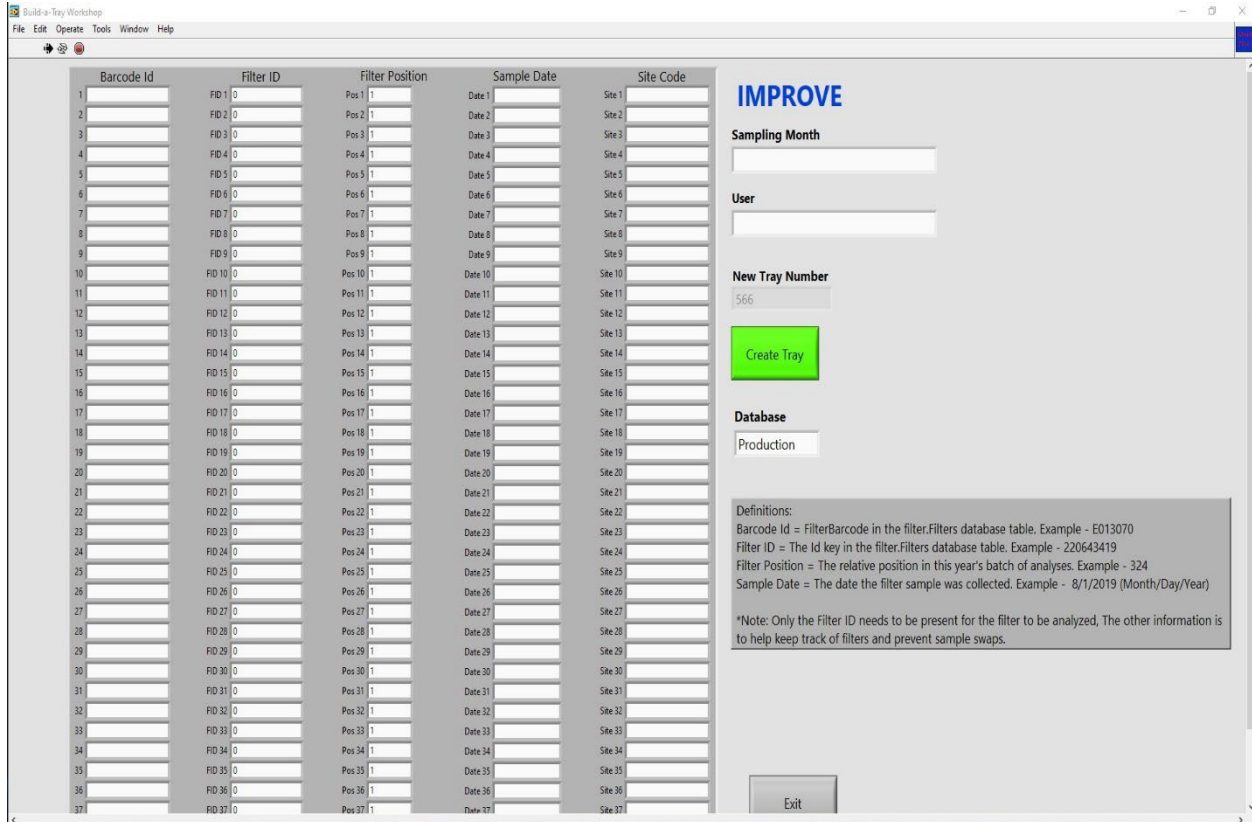
Once the IMPROVE Build a Tray software is open some fields will auto-populate while others will need to be filled in by the operator. If you see a tray in progress on the "build a tray" software please do not automatically click "create tray" until you have verified the tray is finished (meaning it contains 40 filters). A typical slide tray will contain 40 filters, with the exception of special circumstances.

1. Fill in the "Sampling Month" field with the correct month(s) and year. This information is located on the HIPS analysis form or the individual Petri dish labels.

2. Fill in your initials in the "USER" field.

3. The "New Tray Number" field will auto-populate and this is referred to as the LabVIEW tray number. It is important to note this field will always increase by 1 (it does not start over with a new set).

4. The database field should always be set to "Production" this will auto-populate (however can be changed, for routine tray building leave on "Production").

5. Locate the Petri tray with the lowest set number and tray number (ex. Set 3 Tray 1 would be transferred before Set 3 Tray 2). Once all of the filters from the lowest set number

have been transferred then move on to the next set (based on the previous example would be Set 4 Tray 1). If unsure or trays are missing please ask a lab lead.

6. Filters are transferred one at a time, beginning with the filter in position1 (the top-left side). Remove the Petri dish from the tray and then locate the corresponding slide tray (the set number is listed on the Petri tray and slide tray). Remember to only have 1 filter/Petri dish out at time.

7. Remove the lid from the slide tray and then locate the slide that matches the Petri dish you selected in the previous step. Place this slide on the arbor press with the label facing down. Before transferring the filter, you will need to scan it into the Build a Tray software.

8. Before you begin scanning, ensure the cursor is in the "Barcode ID" box for position #1 (if you are at the start of a slide tray).

9. Remove the lid from the Petri dish and using the Cognex 2d scanner, scan the barcode located on the support ring of the filter. Leave the filter in the bottom of the Petri dish while scanning (to help ensure the filter is not dropped while scanning).

10. Verify the Barcode ID on the Build a Tray software matches the barcode ID you scanned. Also verify the sample date on the screen matches the sample date on the Petri dish and the slide label. Refer to Section 7.5: Transferring Samples to Slides for step-by-step procedure.

11. Place the sandwiched filter into the correct position in the slide tray, ensure the slide is visible at the top and facing toward you. Place the empty Petri dish back in the Petri tray, in the same location it was removed from.

12. Repeat steps 6-11 until the slide tray is full. A slide tray can hold 40 filters but may have less than 40. Empty slots are permissible in a slide tray provided the empties are in consecutive order. For example, if a tray contains 30 filters, the last 10 slots are allowed to remain empty.

13. Write the "New Tray Number" from the tray building software on the slide tray label in the LabVIEW tray number field.

14. Click the green "Create Tray" button on the Build a Tray software and when prompted "Are you ready to create a new tray?" select YES. The tray will be sent to a spreadsheet that is later used for analyzing the samples. The Build a Tray software is now ready for the next tray to be built. Place the completed slide tray back on the designated rack.

15. For any Petri trays that have been emptied of all filters (typically 50 filters, but can vary), set the empty tray in a bankers box. Fill out any information needed on the HIPS analysis form (date, your initials and positions transferred) and place these sheets in the completed tray. Any comments listed on the completed HIPS analysis forms will be added to the IMPROVE webapp and the forms are filed in a binder.

6.7   Additional Information for Transferring IMPROVE Samples

In the event you have a filter in a Petri that does not have a labeled slide, check the status of the filter via the IMPROVE webapp. If the filter is valid status then you will hand write a label and place it on the unlabeled slide before transferring the filter. If the filter is determined to be "terminal" status then you will write the status on the petri label and give the filter (still in the Petri) to the sample handling lab.

In the event you are preparing to transfer a filter into a slide and find there is already a filter in this slide, double check the label on the Petri matches the label on the slide you selected. If the two labels match notify the lab lead of the issue. If the filter has a barcode etched on the support ring this will be used to verify the filter with the IMPROVE web app. A secondary way to verify the filter, is by weighing it in the sample lab. The weight for the filter can also be looked up in the web app. The filter that was erroneously transferred into the slide will also need to be looked up using the barcode, again if no barcode exists then the filter will need to be weighed. Notes will be made on the inventory analysis sheet to keep track of the transferring error and reconciliation.

Not all filters will have a barcode on the support ring. For filters without a barcode to scan the Filter ID will be typed into the tray builder software in the Filter ID field. The other fields will be left blank when a Filter ID is manually added to the tray builder software. If a filter has a barcode on the support ring that will not scan, the alphanumeric code next to the barcode can be typed into the tray builder software in the Barcode ID field. After typing the barcode ID in, the other fields should auto-populate. If the Filter ID, sample date, and site code remain blank, locate the barcode in the IMPROVE webapp and verify it is in the database. If the barcode is not listed in the IMPROVE webapp, the Filter ID will need to be typed into the tray builder software.

Transfer any 37 mm filters into slides and place in a separate slide tray. This tray will be created in the tray building software separately. Filter IDs will be used to generate the 37 mm slide tray.

7.   REFERENCES

UCD IMPROVE SOP #276: Optical Absorption Analysis of PM$_{2.5}$ Samples