TI 226A Site Maintenance for Field Technicians

Table of Contents

1. PURPOSE AND APPLICABILITY

This standard operating procedure (SOP) details the procedures the field technicians must follow for routine maintenance of equipment in the IMPROVE sampling network. Prior to 2013, routine site maintenance occurred on a yearly basis; starting in January 2013, sites will receive biannual maintenance, with half of the network receiving maintenance one year and the other half the next year. Routine maintenance is divided into "loops," with an average of ten sites being visited on each loop. Maintenance is solely the responsibility of the Air Quality Group's field operations team, comprised of the field manager and field technicians.

2. SUMMARY OF THE METHOD

Prior to routine maintenance, the field technician shall review and summarize all of the information collected at each site during the previous year(s) in order to characterize how well each site is functioning. The data recorded during weekly visits to the IMPROVE samplers by the operators, as well as any problems detected during quality assurance procedures, shall be incorporated into the site summary. This reference will be used to determine whether extra maintenance or troubleshooting is required at each site.

Routine site maintenance shall be performed by Air Quality Group field technicians. For those sites receiving maintenance in a given year, during the site visit, the cyclones, stacks, and inlets are cleaned, the electronics are checked, the pumps are flagged for replacement or repair as needed, the samplers are audited, and new calibration equations are recorded. Operator training and review sessions as well as any sampler upgrades are also performed at this time.

3. DEFINITIONS

- Cassette: a plastic holder that contains a filter substrate or "dummy."
- "Dummy": a 25mm or 37mm piece of material used in cassettes that are not sampled.
- Cartridge: consists of a cartridge plate and 3-4 cassettes inserted in the cartridge plate.
- $PM_{2.5}$: Particulate matter, aerodynamic diameter of 2.5 micrometers or less.
- PM_{10}: Particulate matter, aerodynamic diameter of 10 micrometers or less.
- "A" module: one of four channels routinely run at every site in the IMPROVE network. Measures $PM_{2.5}$ with Teflon® as the filter medium and runs at 23 liters per minute.
- "B" module: one of four channels routinely run at every site in the IMPROVE network. Measures $PM_{2.5}$ with nylon as the filter medium and runs at 23 liters per minute.
- "C" module: one of four channels routinely run at every site in the IMPROVE network. Measures $PM_{2.5}$ with quartz as the filter medium and runs at 23 liters per minute.
- "D" module: one of four channels routinely run at every site in the IMPROVE network. Measures PM_{10} with Teflon® as the filter medium and runs at 16.9 liters per minute.
- Double-C site: refers to sites that have two quartz filters loaded per cassette instead of the typical single C filter.
- Cyclone: IMPROVE particle size separator based on aerodynamic equivalency diameter of 2.5 micrometers.
- Denuder: Set of concentric aluminum tubes used to remove nitric acid from air stream.
- Ebox: Electronic box which houses pressure transducers and manifold drive relays.

- Rbox: Relay box which houses relays that turn on pumps.
- LPM: liters per minute
- EPROM: Erasable Programmable Read Only Memory which holds IMPROVE software.
- Stack: Inlet tube for module
- Inlet: Cap over $PM_{2.5}$ stack with insect screen
- Magnehelic: Device which measures differential pressure used for auditing modules.
- Sierra inlet: EPA Louvered PM_{10} Inlet

4. HEALTH AND SAFETY WARNINGS

Be aware that various stinging insects, venomous creatures, and large mammals (such as bears) can be found at many of the IMPROVE sites. Be cautious when stepping in tall grass surrounding a site or when opening pump boxes.

Maintenance requires cleaning the inlets for the stacks, which typically require accessing the roof of a structure. A ladder should be available at any given site. If a ladder is not available, do not go on the roof. Contact the field manager and an alternate plan will be determined for cleaning the inlets.

Inclement weather is often an issue at many IMPROVE sites. If severe weather is impending, wait it out in the vehicle or reschedule the site visit.

Always carry a first aid kit. Report any injuries to the field manager immediately.

5. CAUTIONS

Many access roads to IMPROVE sites are locked after regular business hours. Be sure to communicate with any necessary staff regarding how long the visit is expected to take to avoid being locked in the area.

Some IMPROVE sites are remote and require hiking to the site or driving off-road. Be sure to have detailed directions on how to get to a site that requires walking or off-road driving.

Many IMPROVE sites do not have cellular reception. Take this into consideration when planning site visits.

6. INTERFERENCES

Sometimes, due to weather conditions or the way a site is housed, the “D” stack at a site may rub against the funnel. This results in the formation of a black powder, referred to as “anodizing dust,” that collects and falls down onto the filters. During site maintenance, check to make sure there is no sign of anodizing dust on any of the “D” module filters at the site before and during maintenance. If any anodizing dust is present on the filters, flag the site for a tripod and inform the field manager. If any anodizing dust is found in the funnel, locate the cause and flag any equipment that needs replacing.

7. PERSONNEL DUTIES

The field manager shall:

- Oversee and maintain records on site and sampler operation
- Organize and schedule maintenance loops
- Review flow rate audits and calibration equations
- Oversee the training of field technicians both at the Air Quality Group and in the field
- Respond to any issues or concerns brought up by field technicians during maintenance

The site operator shall:

- Note deviations from normal operations and inform Air Quality Group personnel
- Attend site operator training and review sessions during site maintenance
- Replace equipment when requested by field operations
- Maintain a clean site

The field technician shall:

- Perform routine site maintenance
- Perform site operator training and review sessions
- Maintain records on equipment repair and modification
- Report any issues or concerns in the field to the field manager

8. EQUIPMENT AND SUPPLIES

The equipment list for site maintenance trips will vary depending on the number of sites that will be visited and whether any new sites will be installed during the trip. Because of this and due to the extensive amount of supplies needed, equipment lists will not be reported within this SOP but can be located in Attachment 1 of SOP 226, "Maintenance Packing Lists."

9. PROCEDURAL STEPS

Routine site maintenance is performed by field technicians, generally in the spring or summer. This visit to the site is an opportunity to flag non-vital sampler components for replacement, verify calibration equations, replace or update obsolete equipment, thoroughly clean each sampling module, and test the vacuum systems. It also allows trained personnel to inspect the site to ensure compliance with EPA sampling regulations and provides an excellent opportunity for operator training.

The following sections describe the site maintenance procedure:

9.1 Preparation for Maintenance Loop
9.2 Operator Training and/or Review
9.3 Site Maintenance

9.1 Preparation for Maintenance Loop

Preparation for site maintenance involves contacting each site, scheduling visit dates and times, and creating a site audit and maintenance kit. The field manager is responsible for

scheduling maintenance trips and overseeing the training and supplying of the field technicians, both prior to leaving the Air Quality Group and while in the field. The process to prepare for site maintenance is described below:

1) The field technician notifies the site operator of the impending visit two to four weeks prior to the scheduled date. The following topics are covered during operator notification:
   - The exact date of scheduled maintenance at the site.
   - Scheduling of operator training sessions or review. The operator should agree to meet for at least twenty minutes so that any changes to the site can be explained.
   - Details of site access, including keys, combinations, etc.
   - Current problems with the sampler, power, site, etc.
   - Past performance/collection rate of the sampler (if requested by the operator or if the collection rate is low).
2) The field technician prepares the following documents:
   - Site access sheets
   - Site information
   - Site data
   - Sample log sheets for each site
   - Maintenance checklist (one for each site; tasks should be checked off on the checklist as they are performed)
   - Labels (for controller and electronics boxes)
   - Notes generated during maintenance preparation meeting with field manager
   - History of all equipment replaced since last maintenance. Also include any out of the ordinary troubleshooting that has occurred at the site that will provide insight on any other problems that may be encountered during the visit.
   - Maintenance loop schedule. Check with the field manager to see if any sites have time restrictions.
3) The field technician must prepare the audit devices and calibration cartridges. First, the field technician must select two complete audit devices (one as primary and the other as backup). The field technician must also prepare two sets of cartridges: one set for the audit (with old lot Teflon® and nylon filters) and the other set for calibration (new lot Teflon® and nylon filters). Quartz filters are typically very stable without significant changes from lot to lot, so the quartz filters can be loaded from the current open box of filters in the lab. The field technician must load both single "C" calibration cartridges and double "C" calibration cartridges in preparation for any double "C" site on the maintenance loop. Any Teflon® filters from the old lot and any from the new lot may be used for the "A" and "D" cartridges, as Teflon® filters tend to be very consistent within lots. Nylon filters, however, vary in resistance fairly significantly between each other. Thus, many "B" filters of both the old lot and the new lot must be tested and the one with average resistance in each lot must be selected and loaded in the cartridges. The field technician must also bring extra filters, as each filter should not be used for more than four sites. Use the following equation to determine the number of additional filters to bring:

$$(\#\ of\ sites) \div 4 = (\#\ of\ filters\ to\ prepare)$$

4) The field technician checks the calibration of the two audit devices with the DryCal DC2. If the flow rates are not within 2% of the previous calibration, the audit device is recalibrated.
5) The field technician assembles a tool kit and organizes a comprehensive parts kit. Parts and tools required for basic electrical and carpentry tasks should be included. At this time, the maintenance loop documents should be reviewed to determine any extra work or suspected problems for which the technician must be prepared.
6) The field technician prepares clean, coated denuders to replace the used denuders in the "B" modules at each site. For instructions on how to clean and coat each denuder, please see TI 226D.
7) The field technician ships the maintenance gear a day or two before departing on the maintenance trip.

9.2 Operator Training and/or Review

Once at the site, the field technician should meet with the operator and discuss the following:

- Introduce any new software that will be installed. Talk about any changes the operator will see and leave behind an explanation letter.
- Ask about any concerns or pending problems at the site. Make sure that each of the problems is addressed before leaving the site. If a particular problem cannot be resolved, leave a note or call the operator and explain what the plan is to resolve it in the near future. Call the lab for assistance or equipment if needed.
- Explain the range of temperature values that the operators should expect. This is particularly important with software version 6.02 because it displays an mV value only. This mV value is arbitrary to the operator and it has no relevance to actual temperature. If the operator is interested, show them the "1" hot key so that they can see the actual temperature in degrees Celsius.
- Show the operator where the AQG lab number is located on each log sheet and on the controller door cheat sheet.
- Stress the importance of updating the time on the controller if it drifts more than five minutes ahead or behind actual time. It is critical that if they adjust the date at all, they must perform filter readings after the adjustment. Otherwise, they may potentially lock out the controller. Also remind them that all IMPROVE network controllers should run on standard time, and that the operators should not adjust the controller to match DST.
- Stress the important of writing comments in the comment section of the log sheets. These comments help the AQG lab determine when equipment has failed, been requested, and been replaced. This is very important.
- In addition to writing comments, stress the importance of also calling the lab, especially if equipment seems to be malfunctioning or when equipment is replaced.

If there is a new operator for the site who has not received training, make sure to set aside time to train the operator on sample change procedures. Site operator training involves review of

the materials covered in SOP 201, "Sampler Maintenance by Site Operators." The site operator must be trained to perform the following tasks:

- Recording of the final readings for exposed filter cassettes
- Removal of exposed filter cassettes
- Installation of clean filter cassettes
- Recording of initial readings for the clean filter cassettes
- Memory card installation
- Shipping/mailing procedures for the return of exposed filter cassettes and log sheets.
- Air Quality Group phone numbers
- Changing the date/time on the controller
- Basic troubleshooting procedures
- Overview of the site audit procedure, as operators are occasionally required to perform audits due to significant changes in flow, equipment, replacements, etc.
- Replace some of the basic components, including the controller, electronics boxes, and pumps
- Ability to disengage the manifold motors in case they stop working between maintenance visits

9.3 Site Maintenance

9.3.1 Pre-Maintenance Inspection at Site

Prior to maintenance of the sampler, inspect the site for any general repairs needed. Any repair or changes to the sampler or site should be noted. The following is a review of the suggested pre-maintenance procedures:

1) Determine the location of the breaker for power to the sampler.
2) Check the integrity of the sampler stand, noting any parts that require repair or replacement.
3) Note the condition of the sampler modules; are they rusted?
4) Visually inspect the sample cassettes. Note and correct any errors involving the sample change protocol.

Take final readings on any samples that are complete and record them on the appropriate log sheet. If the blue box and log sheet are not available, make sure to record the information in the audit/calibration spreadsheet and transmit it to the sample handling laboratory upon returning from maintenance.

If the controller is running upon arrival, the field technician only needs to record the elapsed time of the running samples unless the site is being converted from one type of electronic box to another (version I to version II or vice versa). If the site is being converted, record the final ORI and CYC values for the sample currently running and then take new initial readings for the sampler after the conversion and calibration. With this particular type of conversion, the calibration equations will be changed significantly and thus ORI and CYC values for each section of data (before and after maintenance) are needed. Record these values on the log sheet.

Write them down in the audit/calibration spreadsheet if the log sheet is unavailable, and transfer the values onto the log sheet when it returns from the field.

Write a note in the comment section of the log sheet (if available) mentioning the visit. For example, "Site maintenance performed on 11/08/2007 by JWM."

9.3.2 Flow Rate Audit

1) Remove the sampling cartridges from the modules, replace their red caps, and place them in their blue box or another clean area.
2) Disconnect the temperature probe from the "C" module and place the tip of the probe in the shade. Place the NIST certified digital thermometer in the shade next to the "C" module's temperature probe and allow it to reach equilibrium (approximately ten minutes). Do not remove the tip cover from the digital thermometer, as this can cause the reading to become unstable. Record the current temperature from the controller keypad and the external thermometer in the audit portion of the audit/calibration spreadsheet.
3) Record the Max Orifice and zero flows for all the modules. Max Orifice is hot key "2" from the main menu and zero flows can be accessed through either the "1123" or "9051" advanced menu depending on the firmware running the controller.
4) Perform the audit. Make sure the magnehelic dial is perfectly zeroed before starting. The hoses attached to the dial must be completely straight through the length of the protective springs; otherwise, the dial will shift. Determine whether the "C" module is a single "C" or double "C" module. If the module is a double "C", be sure to use the special double "C" calibration cartridge. Remember that "X" modules do not have their own special cartridge. Use the same cartridge as the module that the "X" module represents ("A," "B," "C," or "D"). See TI 226B for step-by-step instructions on how to perform the audit.
5) Review the audit results. Compare the nominal values to the previous year's values. The errors generated through the audit should be under 5%. If large errors occur, remember to review the problem file. Electronic box or controller replacements may account for large errors. Call the lab if phone reception is available so that a lab staff can confirm whether or not they have seen these large errors in the data from blue boxes. If the data from blue boxes is different than the results of the audit, a recent problem may have occurred with the module. Record all original audit values for all four positions in the audit spread sheet. Select solenoid 1 on the keypad and then try to wiggle the valve without actually turning it. If the magnehelic values change, note all these new values in the spreadsheet. If in doubt, call the lab for help.

9.3.3 Sampler Cleaning and Maintenance

<u>9.3.3.1 Clean Cyclones</u>

1) Remove the cyclones in the "A," "B," and "C" modules. Move the cyclones to an area where they can be cleaned comfortably and where there is low risk of dropping any tools or parts into dirt, water, etc.
2) As each cyclone is disassembled and reassembled, check each O-ring. If any O-ring is damaged or missing, replace it and report it in the site notes. When working with

cyclone assemblies, use caution when using metal tools as they can damage the anodized surface. All internal surfaces of the cyclone assembly should be cleaned with alcohol and Kimwipes™, or another sterile, dust-free cloth.

3) Clean the "D" module funnel. Note that this requires removing the lid.

9.3.3.2 Clean the Stacks, Inlets, Tees, and Stack Bottom Plugs

1) Remove the stack bottom plugs, checking the O-rings and replacing the entire plug if they are damaged. Clean the Tees with alcohol and Kimwipes™.
2) Remove and clean the inlet caps from the top of the stacks. Check and replace the O-rings if necessary. Use Kimwipes™ and alcohol to clean the screen and remove dust and any spider webs. Wasps and other stinging insects sometimes build nests in the inlets, so use caution when removing them and notify the field manager if any wasp nests are found.
3) For the Sierra inlet, which is located on the "D" stack:
   - Unscrew the water trap bottle, either plastic or glass, from the metal cover.
   - Empty the bottle and wipe out any sediments or materials that have collected inside it or on the metal cover. Check for cracks or chips. If the cup is damaged in any way, replace it immediately.
   - Reinstall the water trap bottle.
   - Unscrew the four Phillips head screws on the underside of the louvered flaps of the inlet and remove the top plate. Clean the cone attached to the top plate and the inlet funnel with alcohol and a lint-free cloth, such as a Kimwipe™.
   - Clean the exit tube for the inlet funnel with a cotton-tipped applicator and alcohol.
   - Reassemble the inlet. If any of the screws appear to be stripped, replace them. They are 8-32 x ½" Phillips head screws. Use anti-seize when replacing any screws and/or standoffs.
   - Hold the top of the inlet with one hand, grasp the pipe to the water trap bottle with the other hand, and unscrew the inlet top from the body at the seam located 7½" above the base of the inlet.
   - Clean the impaction surface thoroughly with lint-free cloths and alcohol.
   - Clean all interior surfaces with lint-free clothes or cotton-tipped applicators and alcohol.
   - Reassemble the inlet head.
   - Check the O-rings inside the stack sleeve, replacing them if necessary. They are ethylene propylene O-rings size 200-026 and are easily removed using a knife blade.
4) Remove the denuder from the "B" module by raising the stack, then removing the denuder detent O-ring. The denuder will now drop out of the Tee, or it can be pulled out of the top of the module if the stack is removed.
5) Clean the inlet stacks using a stack brush. Clean each stack at least twice.
6) Use alcohol and a clean rag or Kimwipe™ to clean the inlet Tee. Inspect and replace any damaged O-rings.
7) Reinstall the inlet caps.

9.3.3.3 Clean the Interior of the Module and Check All Hoses, Wires, and Connectors

1) Brush out the bottom of the modules to eliminate fugitive dust. Be sure the vents are clear of debris.
2) Remove the valves stems carefully using a ¾" wrench. Clean the inside of the valves with a cotton-tipped applicator and then reinstall them.
3) Check for cracked or aged hoses on the cyclone. Clip any damaged ends or, if the tubing is showing signs of wear, replace it with new tubing.
4) Use wire ties and anchors to keep wires out of the way of the site operator.

9.3.3.4 Pump Maintenance and Equipment Replacement

1) Listen to each pump to determine whether any of them are making any unusual noises. Record the rebuild dates for all the pumps. Flag any aging pumps (5+ years old) for replacement.
2) Replace any version II "D" funnels with version I funnels. These version II funnels are now rare.
3) Replace any grommets on module cases that have weathered and cracked.
4) Replace any broken or cracked manifold motor couplers.
5) Replace the used denuder with a clean, coated denuder. Make sure to record the inventory number of the new denuder in the site notes.

9.3.3.5 Inspect the Sampler Stand or Structure and the Pump House/Area

Look for deterioration of the stand or structure and the pump house or area, recording any issues in the site maintenance notes. The modules should be securely attached to the mounting structure, and the stacks should be firmly seated. The pumps should be in an area having enough air flow for effective cooling, and the area should be free from pest infestation. Inform the field manager if there are any issues that need to be addressed immediately.

9.3.3.6 Inspect the Controller

1) Check the CPU battery voltage. Ensure that the value is adjusted according to the calibration on the Volt-meter. If it is less than 2.98V, replace the battery. If the battery is soldered on, note the voltage and report it to the field manager. Replace the CPU if there is a spare available.
2) Check the CPU voltage regulator. The "+" test point is "U3" next to the regulator. If the value is not 5.00±0.02V, replace the CPU. Make sure to adjust the value according to the calibration on the Volt-meter. Remember to put a zip tie around the new CPU if it is a ribboned model.
3) Install any new software, if necessary.
4) Record the CPU serial number if it is not an AMD chip. The serial number is on the underside of the CPU. Either use a mirror and flashlight or remove the CPU in order to see the number.

5) If the motherboard is a V3, record the serial number. If the motherboard is not V3, then replace it.
6) Record the CFLSH reader serial number.
7) Install a new grounding harness to those controllers that do not have one. Remember to correct the polarity of the grounding harness.
8) Upgrade the DC power harness to the new type with double wires to the supplies.
9) Add controller information to the front plate. Remove any old labels or cover them if possible.
10) Evaluate and troubleshoot any apparent controller issues, and request a new controller if necessary. Refer to TI 226F for further information on troubleshooting controllers.

9.3.4 Leak Check All Modules

Return all equipment to its proper location and perform a leak-check of all the modules. Make sure to first equilibrate the vacuum gauge. Use the plug and extension bar from the audit probe to check the vacuum reading from each pump and module to ensure that the readings from each pump and its corresponding module are similar. Pump and module differences cannot be greater than 2.0" Hg. If a difference is greater than 2.0" Hg, investigate to determine what is causing the leak. Leaks may arise from a bad alignment on the cyclone between the cyclone block and funnel. Adjust the play in the two mating pieces. Leaks may also arise because of a loose valve, torn O-rings, or a cyclone that needs shimming. Refer to TI 226E for step-by-step instructions.

9.3.5 Set Zero Flows

Set the zero flows for all primary modules to be 10 for the ORI value and 5 for the CYC value. "X" module values will be changed to match the primary module during calibration. Please see TI226C for step-by-step instructions on how to perform the procedure.

9.3.6 Module Calibration

Calibrate the modules. Note that the calibration cartridges loaded with new lot filters are to be used for the "A," "B," and "D" modules (as well as the "X" module, if applicable). For step-by-step instructions on how to prepare for calibration, please see TI 226C.

1) Set the flow rate to 23 liters per minute (lpm) for module "A." Check the "Q_{SITE}" value in the "Device Constants" section of the audit/calibration sheet (cell B9). The number should be two significant digits. Type this number in the "$CALIB_{MAG}$" box (cell H25). Check the "Q_A" box (cell K25). The value in this cell should be 23.0 lpm. If the value is less than this, add "0.01" to the value in cell H25 until the liters per minute is at least 23. It is better to be over 23.0 lpm than to be under. Now, turn the valve of the module until the magnehelic dial matches the number in cell H25. Record the ORI and CYC values.
2) Cycle through the other three positions, recording the magnehelic reading and the ORI and CYC values for each.
3) If the R^2 value is reasonable (close to "1.000"), compare the generated nominal values for ORI and CYC to last year's values. If the values differ significantly (>5%), the cells on the

audit/calibration sheet with the new nominal values (cells E32 and E33) will change color. If the cells remain the same, the values are acceptable. Also compare the equation slope and intercept for both the ORI and CYC to last year's values. If they are not similar, please call the field manager for assistance. It may help to switch electronic boxes and try to calibrate again to see if the source of the problem is the particular electronic box.

4) Move on to the "B" module. Repeat the steps listed above, making sure the calibration value in cell H25 creates a flow rate of at least 23.0 liters per minute in cell K25. Record all of the values and compare them to last year's values. Then, proceed with module "C" in the same manner.
5) Module "D" is slightly different. The probe has to be modified in order to fit properly. For step-by-step instructions on how to modify the probe, please see TI 226C. Also, the "Q_{SITE}" value will be much different than the previous three. Enter this new value into cell H25. Make sure that it produces a flow rate of at least 16.9lpm. Finally, only ORI values are taken during "D" module calibrations, as the CYC is not used in the "D" mod. All other procedures, such as comparing values to the previous year's values, still apply.
6) Record the new temperature values from the keypad display. Also make sure the "Max Orifice" and "Zero Flow" values were recorded during calibration. Run through the "Acquire Zero Flows" option to give the controller a reference point when diagnosing leaks and/or flows. To do this, go to the "9051" advanced menu and press "F2" for "Zero Flows."
7) Record the time of calibration in the audit/calibration spreadsheet.

9.3.7 Post Calibration Procedures and Checks

1) Update the date and time on the controller display if necessary. Do this by pressing "F2" while in the main menu. Ensure that the GMT is set correctly.
2) Verify that all of the site configuration parameters are correct. Go to the "1123" advanced menu and press "F2." The following menus will come up:
   - "Old UC Code": This is a four digit number that is used as the site's inventory number. In most cases, it should match the last four digits under the barcode in the interior of the "A" module case.
   - Module Type: This screen should list the numbers "1 2 3 4 5" with the characters "A B C D _" under them, respectively. Note that if the site has an "X" module, the letter "X" should be under the number "5." The following screen will ask if the "X" module is a $PM_{2.5}$ or a PM_{10}. Select the appropriate value.
   - Time Average: This should be set to fifteen minutes.
   - Change Day: Tuesday should be selected unless the site is WHPE1 or BALA1, in which case Thursday should be selected.
   - Box Sequence: Each site will be either a "2-3-2" or a "3-2-2." If the blue box has a yellow sticker with the site code printed on it, the site is a "2-3-2." If the blue box has a green sticker with the site code printed on it, it is a "3-2-2."
   - Controller ID: This number should match the number listed on the interior left wall of the controller module.
3) Update operator initials if needed. Do this by pressing "F3" in the "1123" advanced menu.
4) Install the current sampling set of cartridges and run through Final/Initial readings by pressing "F1" in the main menu. Correct initial readings for any samples that have not yet run.

5) Restore all elapsed times. Use the "9051" advanced menu and press "F1."
6) Fill out or update the site data sheet and note any equipment changes.
7) Leave any pertinent documents for operators either inside the controller or in the blue box if the documents cannot be given directly to the operator.
8) Make sure all equipment inventory numbers have been recorded. These include inventory numbers for:
    - Pumps
    - Controller
    - Electronic boxes: both the electronic box inventory number and the inventory numbers of the parts inside, which should be listed on a paper taped to the outside of the electronic box.
    - Denuder
9) Make sure the pump rebuild dates have been recorded.
10) Record breaker amperage and quantity.
11) Label all equipment with colored tape to make it easy for the operator to troubleshoot.
12) Tape "A," "B," and "C" Tee plugs to the Tees and add "A," "B," "C," and "D" stack labels to the stacks. Use the appropriate color of tape (red, yellow, green, blue, or orange for "X" modules) for each module.
13) Take pictures of the following:
    - Eight inward views while standing approximately 30 yards away from the site. Take pictures of the site looking N, NE, E, SE, S, SW, W, and NW.
    - Four outward views while standing with back against the site and looking towards N, E, S, W.
    - All of the modules
    - Pumps and relay boxes
    - Source of power for controller and relay boxes (i.e., A/C outlets, power strip)
    - Breaker, from a distance and up close
    - Roof
    - Stacks (include inlets)
14) Call lab for any necessary equipment.

10. REFERENCES

SOP 226, Attachment 1, "Maintenance Packing Lists"
SOP 226, Attachment 2, "Maintenance Checklist"
SOP 201, "Sampler Maintenance by Site Operators."
TI 226B, "Audit."
TI 226C, "Calibration."
TI 226D, "Denuders."
TI 226E, "Leak Check."
TI 226F, "Controller Repair."