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DAQ-09-002.2 Standard Operating Procedure (SOP)  
ATEC 8000 PAMS Carbonyl Sampler  
OPERATOR RESPONSIBILITIES

Revision 0

1.0 Approval Sign Off-Sheet

I certify that I have read and approve of the contents of the ATEC 8000 PAMS Carbonyl Sampler Operator Responsibilities Standard Operating Procedure with an effective date of April 15th, 2021.

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Disclaimer: This document, and any revision hereto, is intended solely as a reference guide to assist individuals in the operation of the instrument, related to the North Carolina Division of Air Quality's Ambient Monitoring Program

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## SOP Acronym Glossary

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ADQ - Audit of data quality

AQS - Air Quality System (EPA's Air database)

°C – degrees Celsius

CFR – Code of Federal Regulations

CGA – Compressed Gasses Association

Chief – Ambient Monitoring Section chief

COC – Chain of custody

DAQ - North Carolina Division of Air Quality

DAS – Data acquisition system

DEQ – North Carolina Department of Environmental Quality

DI – deionized water

Director – Division of Air Quality Director

DNPH – 2,4-dinitrophenylhydrazine

ECB – Electronics and Calibration Branch

e-log – electronic logbook

EPA – United States Environmental Protection Agency

FAS – fixed asset number

FB – field blank

FEM – Federal equivalent method

FRM – Federal reference method

hrs - hours

in - inches

L – liters

L/min – liters per minute

LAB – Laboratory Analysis Branch – DAQ Lab located at 4403 Reedy Creek Rd in Raleigh, NC

MDL – Method detection limit

min – minute

mm – millimeter

NC – North Carolina

NIST – National institute of standards and technology

PAMS – Photochemical assessment monitoring station

PDF – portable document format

PM – Particulate matter

PPB – Projects and Procedures Branch

PPE – Personal Protective Equipment

psi – pounds per square inch

QA – Quality assurance

QA/QC - Quality assurance/quality control

QAPP - Quality assurance project plan

QC – Quality control

RCO – Raleigh central office

SOP - Standard operating procedure

TSA - Technical systems audit

UAT – Urban Air Toxics

USB – Universal Serial Bus

µg – microgram

VOC – Volatile organic compound

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## 2.0 SCOPE AND PURPOSE

The scope and purpose of this document is to describe the steps required to operate an ATEC 8000 Carbonyl Sampler. The ATEC 8000 Carbonyl Sampler is deployed at the North Carolina Photochemical Assessment Monitoring Station (PAMS). The PAMS is located at the Millbrook Site at 3801 Spring Forest Rd. in Raleigh, NC 27616. The Millbrook Site serves to monitor the Raleigh, NC metropolitan statical area air shed.

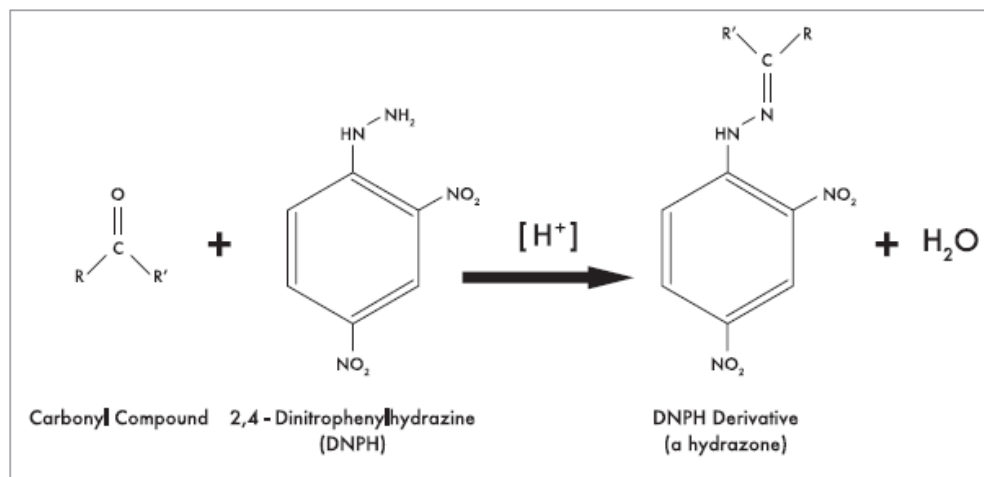


Figure 1: ATEC 8000 Cartridge Sampler



Figure 2: Waters Sep-Pak 2,4-Dinitrophenylhydrazine-Silica Cartridge

The carbonyls sampler collects ambient air through a 2,4-Dinitrophenylhydrazine-Silica impregnated cartridge as depicted in figure 2. The cartridges are installed into the ATEC 8000 and the sampler maintains a set flow with a calibrated mass flow controller over three preset collection periods. The ATEC 8000 samples ambient air sequentially, in three 8-hour increments, through the cartridges to sample over a 24-hour period. The standard sampling periods are 04:00 – 12:00, 12:00-20:00 and 20:00-04:00. Carbonyls in the cartridge react with the 2,4-Dinitrophenylhydrazine over the collection period to form stable hydrazine derivatives via the following reaction mechanism:



*Figure 3: Carbonyl Derivatization Reaction Mechanism*

The collected samples over the 24-hour period can then be extracted and analyzed by **DAQ SOP-03.004.2 Thermo Ultimate 3000 Ultra-High Performance Liquid Chromatography Ultra-Violet and Mass Spectrometer Analysis**.

### 3.0 EQUIPMENT CHECKS AND MATERIALS

This section describes the equipment and materials that are required to complete the steps described in this document. Additional subsection(s) or SOPs will also describe the equipment and materials as needed.

#### 3.1 Equipment and Material List

- ATEC 8000 Cartridge Sampler
  - Certified and installed via **SOP DAQ-09-002.1**
- ATEC Stylus Pen
- NIST-Traceable Flow Meter: Mesa Labs BGI TetraCal with accessory pack or equivalent
- NIST-Traceable Clock: Fisherbrand Traceable Big-Digit Radio Atomic Wall Clock or equivalent
- Waters Sep-Pak 2,4-Dinitrophenylhydrazine-Sicila (DNPH-Silica) Cartridge or equivalent
- Cartridge Chain of Custody (COC) Form – An example form is in Appendix A
- PPE:
  - Nitrile Gloves
  - Non-Slip steel toed shoes or boots
  - Safety glasses: prescription or impact resistant are acceptable
- Portable USB storage device
- Insulated cooler with ice packs
- Freezer, located at LAB
- Clear Ziploc bag or equivalent
- Monitoring Site Logbook (bound, numbered pages, laboratory grade)
- Scissors

- Clear Tape
- Pen (blue or black ink)

### 3.1 Chemical and Material Checks

Chemicals and materials used in this SOP are inspected prior to use and upon receipt at the LAB. No damaged, uncalibrated, or expired equipment is to be employed in the discharge of procedures detailed in this document. Cartridges are lot checked for impurities as detailed in **DAQ SOP-03.004.2 Thermo Ultimate 3000 Ultra-High Performance Liquid Chromatography Ultra-Violet and Mass Spectrometer Analysis** prior to their use in this SOP.

### 3.2 Support Equipment Checks

#### 3.2.1 BGI-Tetracal Flow Meter Check

The BGI-Tetracal Flow Meter is calibrated annually by a third party NIST-traceable source. Ensure the calibration is within date before proceeding with the detailed procedures of this SOP.

## 4.0 SITE CHECKS

The site operator will confirm the following before proceeding with the detailed procedures within this document:

- **Site infrastructure check:** Is the shelter in good condition? Is there any damage or safety hazards to note? Is the electrical power on? Site HVAC running?
- **Sampler Check:** Is the ATEC 8000 powered on and pre-heated to 50°C? Is the ATEC 8000 within the stickered certification date? Is the inlet connected to the rear of the sampler? If the sampler displays a blank screen, simply touch it to wake it up and populate the display. The temperature is shown in the bottom right corner of the main tab:

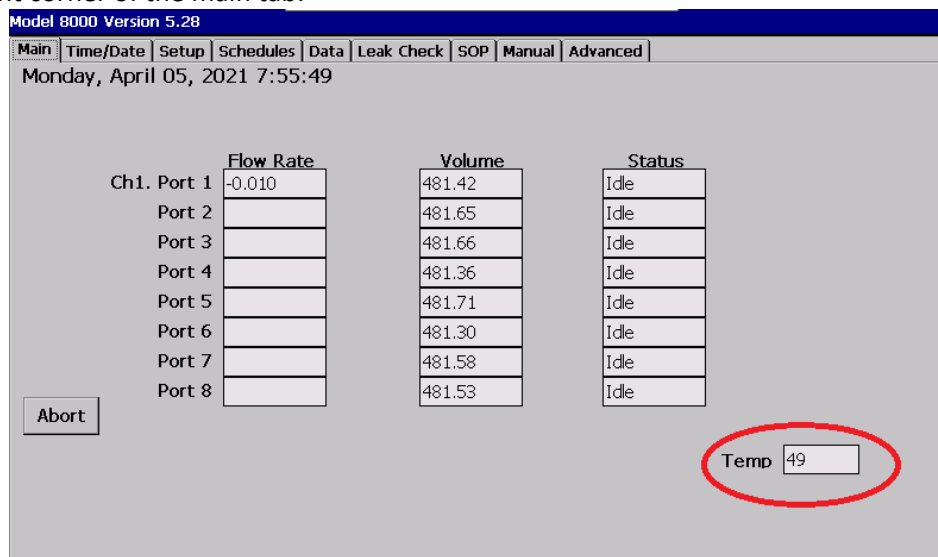


Figure 4: ATEC 8000 Main Screen with Oven Temperature Circled in Red

## 5.0 DETAILED PROCEDURES

### 5.1 Preparing the ATEC 8000 for Sampling

- 1 Obtain DNPH cartridges from the LAB Chemist with completed COC forms. The “Laboratory setup information” section of each COC must be completed by the LAB Chemist prior to use of the cartridges in the field. There will be one COC form per cartridge.
- 2 If a field blank (FB) is to be collected, pack an insulated cooler and ice packs. Pack the BGI-Tetracal flow meter and accessories.
- 3 Drive to the Millbrook PAMS site. Bring supplies into the shelter and begin by completing the “Field Setup Information” section as detailed in the subsequent steps:
- 4 Locate the ATEC 8000 sampler serial number (SN) or Fixed Asset Number (FAS). Record the number in the “Sampler SN or FAS#” field on the Cartridge COC form.
- 5 Record the sampling site location in the “Sampling Site” field of the COC form as Millbrook PAMS.
- 6 Record the sampler certification expiration date in the “Sampler expiration Date” field on the COC form.
- 7 Record the initials of the site operator, including the date and time of the cartridge setup in the “Site Operator (Initial, Date, and Time of Setup)” field of the COC.
- 8 Record the date and time displayed on the ATEC 8000 sampler screen in the “As Found Sampler Display Date and Time:” field on the Cartridge COC form.
- 9 Calculate the time difference, in minutes, and record the result in the “Time Difference (min)” field on the COC.
- 10 If the sampler display time differs more than or equal to 5 minutes, use the ATEC stylus to select the Date/Time tab on the sampler screen. A popup window titled “Date/Time Properties” will appear as shown below:

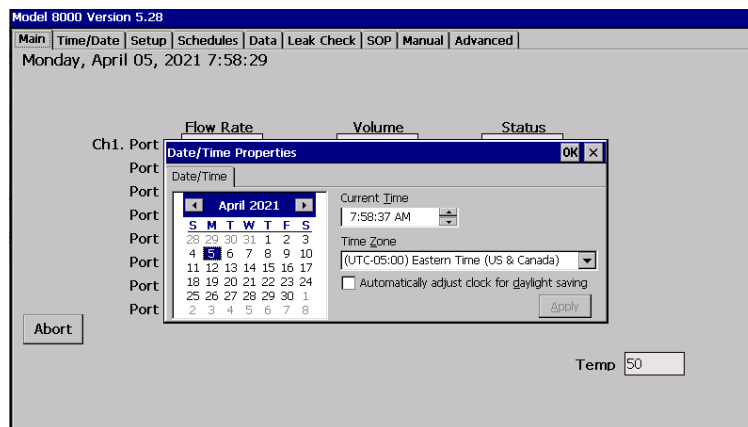
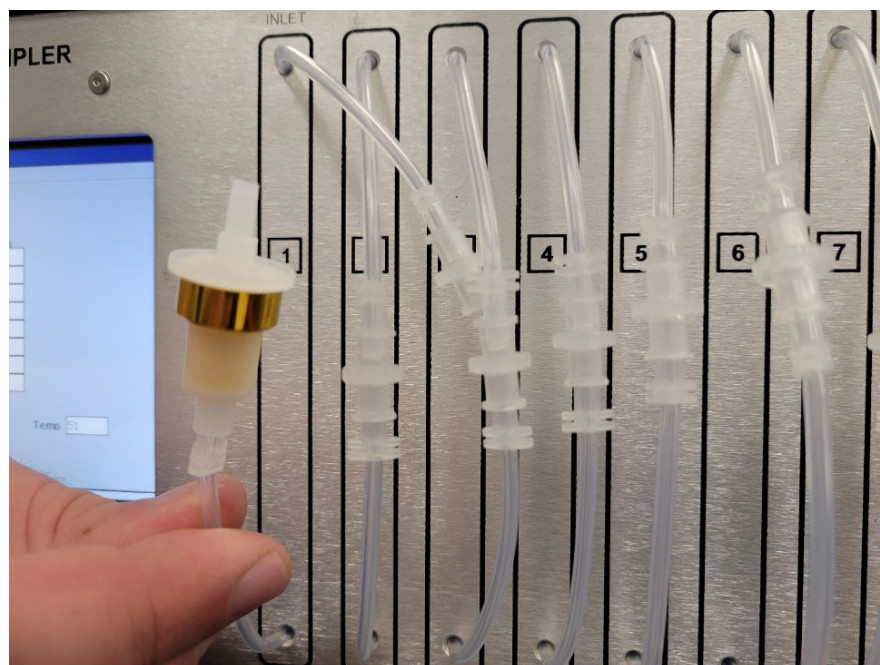


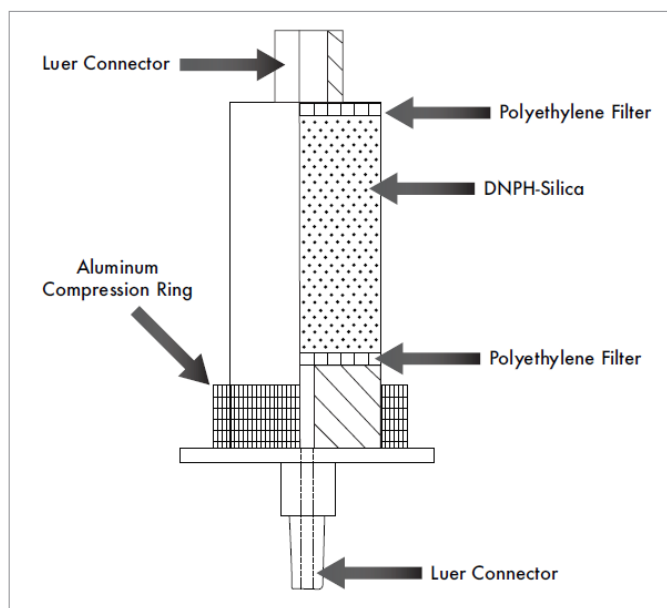
Figure 5: ATEC 8000 Time/Date Tab

- 11 Adjust the date and/or time to match the NIST-traceable date and time device. Click “Apply” when finished to push the settings to the instrument. Record the newly adjusted sampler display date and time in the “As Left Sampler Display Date and Time (if adjustment made)” field on the COC form. If no adjustment was required, put a line through the entry field or write N/A. **Note:** DAQ does not observe daylight savings times on ambient monitoring equipment and no offset will be applied when daylight savings occurs. All recorded times are Eastern Standard Time.
- 12 Perform a pre-sampling flow check of the ATEC 8000 sampler by installing the designated flow check DNPH cartridge to the outlet line of Channel 1 on the ATEC 8000 sampler. Leave the cartridge inlet disconnected from the channel inlet line of Channel 1 on the ATEC 8000 sampler as depicted below:



*Figure 6: ATEC 8000 DNPH Cartridge Flow Check Connection Setup*

The cartridge is inserted in this direction due to the design and a “cutaway view” is provided by Waters:



*Figure 7: Waters Cartridge Design*

- 13 Turn on the sampler flow by selecting the “Manual” tab on the sampler display home screen with the ATEC Stylus Pen. The following will appear on the sampler screen:

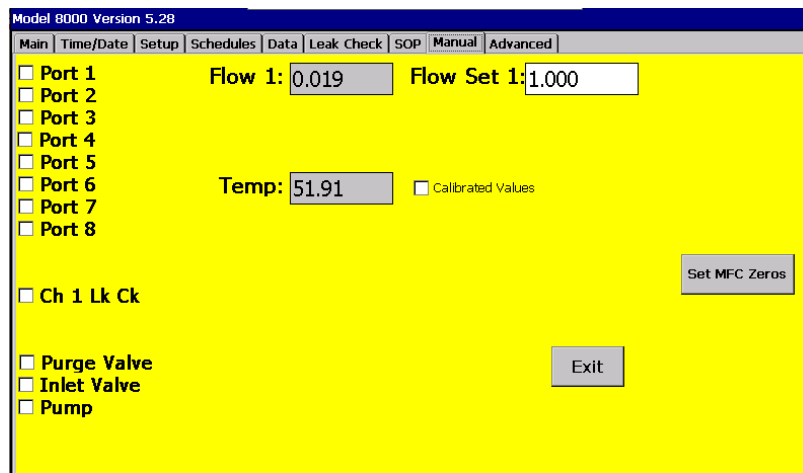


Figure 8: ATEC 8000 Manual Tab

- 14 Turn on the sampler flow by selecting the “Manual” tab on the sampler display home screen with the ATEC Stylus Pen. Check the “Port 1” box, the “Pump” box, the “Inlet Valve” box and check “Use Calibrated Values” box. The sampler will turn on and gas will begin flowing through the sampler. The mass flow controller (MFC) flow set point should be 1.000L/min and the actual flow rate will be displayed in the “Flow 1” box on the sampler display screen as shown below:

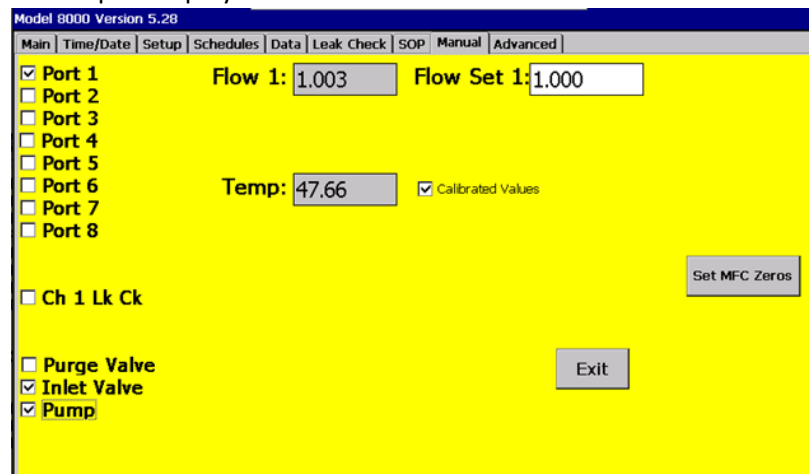
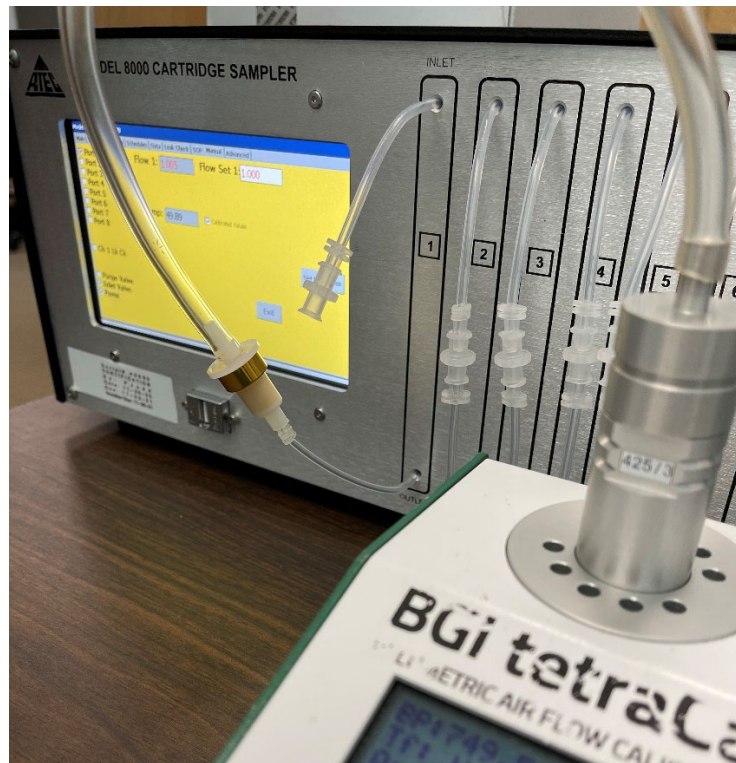


Figure 9: ATEC 8000 Flow Check Configuration for Port 1

Allow the sampler to equilibrate for 5 minutes.

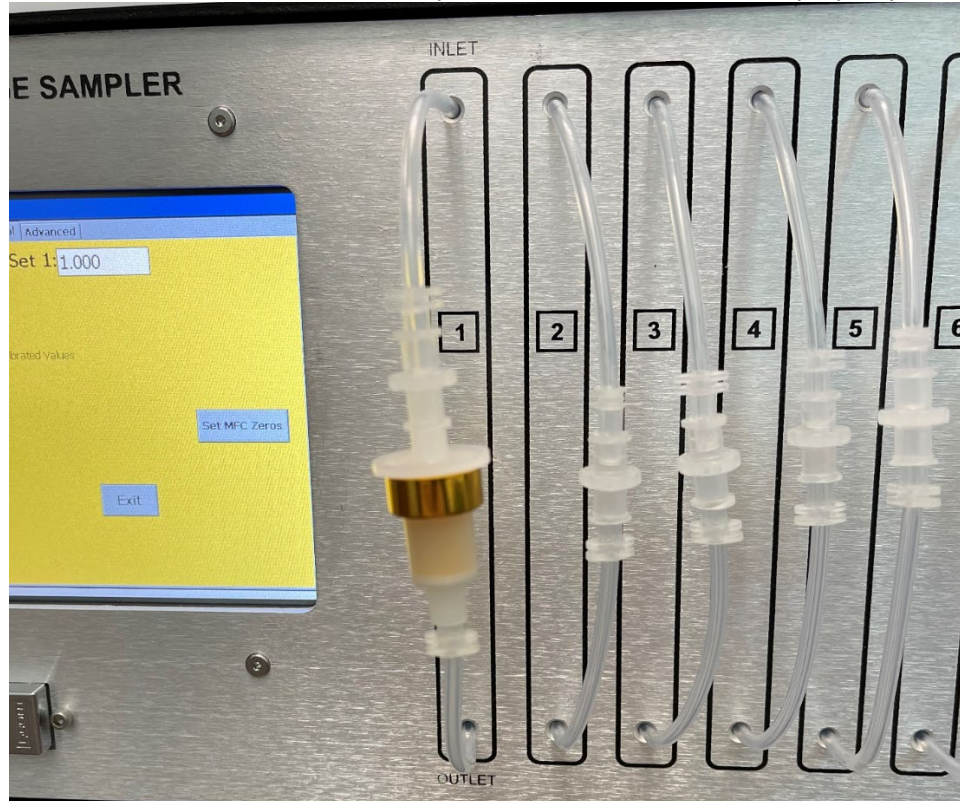
- 15 Install the 0.1 to 1.2 L/min flow rate orifice into the BGI-Tetracal flow meter. Turn on the flow meter and allow it to zero and warm up for 30 seconds. During the warmup period, the flow meter will briefly display the flow range of the orifice that is inserted into the flow meter. Record the flow meter type, serial number, and expiration date into the “NIST Flow Standard (Type, SN, Exp. Date)” field on the COC form.
- 16 Connect the BGI-Tetracal to the open end of the flow check DNPH cartridge installed on the sampler as depicted below:



*Figure 10: ATEC 8000 DNP Cartridge Flow Check Setup*

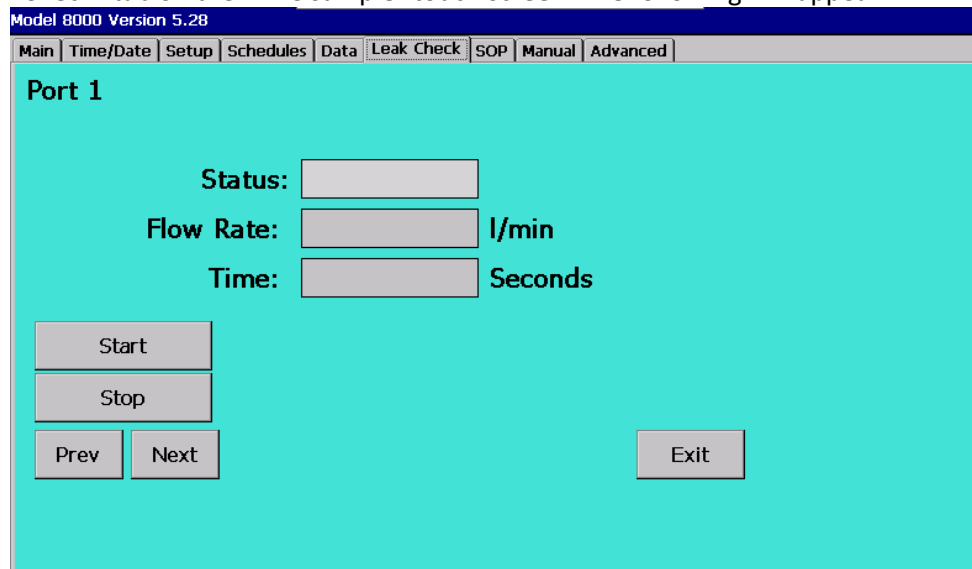
- 17 Allow the two systems to equilibrate for one minute and read the flow rate displayed on the BGI-TetraCal. Record the flow rate in the "Measured Pre-Sample Flow Rate (L/min)" field on the COC form. If the measured flow rate falls outside the acceptable range (0.9 – 1.1 L/min) record the flow but also add a comment to the "Field Comments" field on the COC form. An example comment for this situation would be: "pre-sample sampler flow rate failure." Proceed to the next step.
- 18 Turn off the BGI-TetraCal and disconnect it from the flow check DNP cartridge.
- 19 Remove the flow check DNP cartridge from the system.
- 20 Inspect the supplied DNP cartridge from the LAB. It will be labeled with a sampler number on the foil pouch. This number should match the sampler number listed on the COC form. In the event these two do not match, the operator can correct the sample number on the foil pouch to match the sample number on the COC form. The operator must document this change with a comment in the "Field Comments" section of the COC form. An example comment would be "cartridge sample number did not match COC sample number, operator corrected." Continue with sample installation.
- 21 Repeat steps 12-20 for channel 2/Port 2 and channel 3/Port 3.
- 22 If a field blank (FB) cartridge has been assigned, setup the FB sample collection first. While wearing nitrile gloves, open the FB DNP sample cartridge foil pouch and remove the cartridge. Disconnect the cartridge end caps and place them back into the foil pouch.
- 23 Install the FB cartridge onto the blank channel. Wait 5 to 10 minutes.
- 24 Remove the FB cartridge from the sampler, recap the cartridge and return it to its labeled foil pouch. Place the FB sample cartridge and COC form in their respective Ziploc® bags and place the bags under ice packs in the insulated cooler.
- 25 Proceed to connect the regularly scheduled sample cartridge to channel 1.

- 26 Connect the sample cartridge to the ATEC 8000 as shown below. Use a slight twisting motion while connecting the ATEC sampler to the DNPH cartridge to make luer fitting leak-tight connections. Be wary of twisting the ATEC inlet and outlet tubes as small tears are easily made and hard to see in the polyethylene tubing.



*Figure 11: ATEC 8000 DNPH Cartridge Collection Setup*

- 27 Select the “Leak Check” tab on the ATEC sampler touch screen. The following will appear:



*Figure 12: ATEC 8000 Leak Check Tab*

- 28 Press the “Start” button. The leak check takes approximately 20 seconds to complete.

- 29 Record the value in the “Flow Rate” box on the ATEC 8000 sampler screen in the “Leak Rate (L/min)” field on the COC form. If the leak rate passes acceptance criteria, circle “Yes” in the “Leak Check Pass? (Circle one)” field on the COC form. If the leak rate fails to meet criteria, circle “No” in the same field and see section 9.2 of this document for troubleshooting a failed leak check. Do not proceed with sample collection if the leak check fails.
- 30 Repeat steps 26-29 for channel 2/Port 2 and channel 3/Port 3. To perform a leak-check on the next channel hit the next button in the lower left of the leak check tab. Then hit start. The top right corner of the display panel will indicate the current port being leak checked. A completed dialog status and leak check for Port 3 is shown below:

Figure 13: ATEC 8000 Cartridge Leak Check Dialogue

- 31 The scheduled sample date should be pre-recorded in the “Schedule Sampling Date” field on the COC form. If that field happens to be empty, the sample date can be found coded in the “Sample #” field on the COC form. If the sample number is 032220C, the scheduled sample date is March 22, 2020. Record the scheduled sampling date and time in the “DNPH “Sample” Cartridge Scheduled Sampling Date/Time” field.
- 32 Select the “Schedules” tab on the ATEC 8000 display with the stylus. A new window will appear as shown below:

Figure 14: ATEC 8000 Cartridge Scheduling Tab

- 33 Use the drop-down arrow to select the Start Date for Port 1. This date should match the date recorded in the “DNPH Sample Cartridge Scheduled Sampling Date/Time” field on the COC form. The Start Time is always 04:00. Use the Left and Right arrows to adjust the start time, if needed. The Duration should always be 8.00 hours. Highlight the value entered in the Duration field. A new popup window will appear looking like a calculator; select 8.0, click apply when done. The Run Label should be the site name and port number: Millbrook PAMS 1.
- 34 Once the correct start date, time and duration has been entered, click the next button in the lower left corner of the Schedules screen. You should see the same screen, but for port 2.
- 35 Use the drop-down arrow to select the Start Date for Port 2. Check the “follow previous port box” to immediately follow the previous sample channel. This date should match the date recorded in the “DNPH “Sample” Cartridge Scheduled Sampling Date/Time” field on the COC form. The Start Time is always 12:00. Use the Left and Right arrows to adjust the start time, if needed. The Duration should always be 8.00 hours. Highlight the value entered in the Duration field. A new popup window will appear looking like a calculator; select 8.0, click apply when done. The Run Label should be the site name and port number: Millbrook PAMS 2.
- 36 Once the correct start date, time and duration has been entered, click the next button in the lower left corner of the Schedules screen. You should see the same screen, but for port 3.
- 37 Use the drop-down arrow to select the Start Date for Port 3. Check the “follow previous port box” to immediately follow the previous sample channel. This date should match the date recorded in the “DNPH “Sample” Cartridge Scheduled Sampling Date/Time” field on the COC form. The Start Time is always 20:00. Use the Left and Right arrows to adjust the start time, if needed. The Duration should always be 8.00 hours. Highlight the value entered in the Duration field. A new popup window will appear looking like a calculator; select 8.0, click apply when done. The Run Label should be the site name and port number: Millbrook PAMS 3.
- 38 Hit exit to apply the schedules and return to the main tab.
- 39 The “Status” field on the main screen should change to display “Waiting” as shown below. This may take a few seconds to appear. The “Waiting” status indicated the sampler has accepted the programmed start date, time and duration and will wait to start until the date and time has occurred locally on the unit.

Model 8000 Version 5.28

Main | Time/Date | Setup | Schedules | Data | Leak Check | SOP | Manual | Advanced

Monday, April 05, 2021 8:07:25

|             | Flow Rate | Volume | Status  |
|-------------|-----------|--------|---------|
| Ch1. Port 1 | -0.006    | 481.42 | Waiting |
| Port 2      |           | 481.65 | Waiting |
| Port 3      |           | 481.66 | Waiting |
| Port 4      |           | 481.36 | Idle    |
| Port 5      |           | 481.71 | Idle    |
| Port 6      |           | 481.30 | Idle    |
| Port 7      |           | 481.58 | Idle    |
| Port 8      |           | 481.53 | Idle    |

Abort

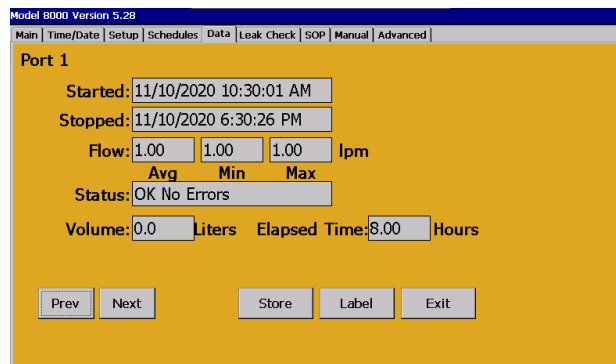
Temp 51

Figure 15: ATEC 8000 Status Screen

- 40 Return to the LAB and allow the collected field blank to cool to at least 4°C.
- 41 Transfer custody of the collected field blank cartridge, if any, to the LAB Chemist.

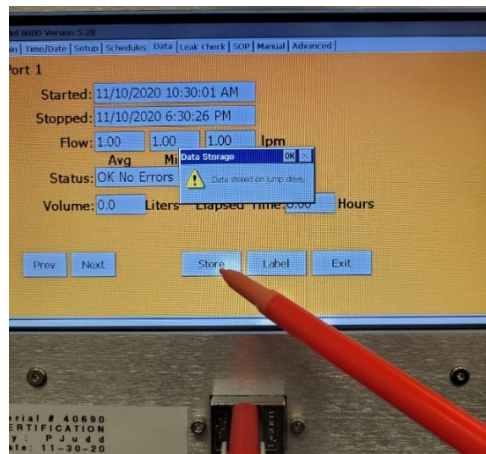
## 5.2 Post-Sampling Pickup and Collection

- 1 Return to the Millbrook site within 48 hours after the sampling period completes. Bring the insulated cooler with icepacks containing the next DNPB cartridge sample and accompanying COC form. Bring the BGI-Tetracal and accessories to the site.
- 2 Upon arrival at the site, record your initials, date, and time of sample pickup in the “Site Operator (initial, date, time of pickup)” field in the “Field Recovery Information” section of the COC form.
- 3 Touch the ATEC display screen to wake it up. The Status field on the main screen should display “Finished.”
- 4 Using the Stylus, select the “Data” tab and a screen like the example below should appear for the sampling event.



*Figure 16: ATEC 8000 Data Screen Displaying Post-Sampling Data*

- 5 Record the “Started” and “Stopped” dates and times that are displayed in the “Sample Start Date & Time” and “Sample Stop Date & Time” fields on the COC form.
- 6 Record the “Volume” displayed on the ATEC 8000 screen in the “SAMPLE VOLUME (L):” field on the COC form.
- 7 Record the “Elapsed Time” displayed on the ATEC 8000 screen in the “Sample Duration (hrs)” field on the COC form.
- 8 Insert a USB storage device into the ATEC 8000. The port is located on the front panel underneath the touch display screen. Press the store button with the stylus. The following dialogue box will appear to confirm the data download:



*Figure 17: ATEC 8000 Data Download Confirmation*

- 9 Record any status language displayed on the ATEC 8000 screen in the "Field Comments" section of the COC form. If the sampler status says anything but "OK No Errors" see section 9.3 of this document for further instruction on what to do with downloaded data. Do not proceed to the next step until the sample data has been downloaded to a USB storage device.
- 10 Repeat steps 4-9 for each cartridge by hitting the next tab in the lower left corner of the display. The current port will be displayed in the top left corner of the display screen.
- 11 While wearing nitrile gloves, remove the sampled DNPH cartridge from the ATEC 8000 sampler. Install the end caps and place the cartridge in the labeled foil pouch that it was removed from during sample setup. Seal the foil pouch closed.
- 12 Place the foil pouch inside a clear Ziploc bag and seal closed. Place the cartridge in the insulated cooler, in between the ice packs.
- 13 Perform a post-sampling flow check of the ATEC 8000 sampler. Install a designated flow check DNPH cartridge to the outlet line of Channel 1 on the ATEC 8000 sampler. Leave the cartridge inlet disconnected from the channel inlet line of Channel 1 on the ATEC 8000 sampler as configured previously in Section 5.1, figure 6.
- 14 Turn on the sampler flow by selecting the "Manual" tab on the sampler display home screen with the ATEC Stylus Pen. Check the "Port 1" box, the "Pump" box, the "Inlet Valve" and check "Use Calibrated Values" box. The sampler will turn on and gas will begin flowing through the sampler. The mass flow controller (MFC) flow set point should be 1.000L/min and the actual flow rate will be displayed in the "Flow 1" box on the sampler display screen. Allow the sampler to equilibrate for 5 minutes.
- 15 Install the 0.1 to 1.2 L/min flow rate orifice into the BGI-Tetracal flow meter. Turn on the flow meter and allow it to zero and warm up for 30 seconds. During the warmup period, the flow meter will briefly display the flow range of the orifice that is inserted into the flow meter. Record the flow meter type, serial number, and expiration date into the "NIST Flow Standard (SN / Exp. Date)" field on the COC form.
- 16 Connect the BGI-Tetracal to the open end of flow check DNPH cartridge installed on the sampler as done previously in section 5.1, figure 10.
- 17 Allow the two systems to equilibrate for one minute and read the flow rate displayed on the BGI-Tetracal. Record the flow rate in the "Measured Post Sample Flow Rate (L/min)" field on the COC form. If the measured flow rate falls outside the acceptable range (0.9 – 1.1 L/min) record the flow but also add a comment to the "Field Comments" field on the COC form. An example comment for this situation would be: "post-sample sampler flow rate failure."
- 18 Repeat steps 13-17 for each additional sample port used: Port 2 and Port 3.
- 19 Turn off the BGI-Tetracal and disconnect it from the flow check DNPH cartridge.
- 20 Remove the flow check DNPH cartridge from the system.
- 21 At this point all fields in the Laboratory Setup Information; Field Setup Information; and Field Recovery Information of the Chain of Custody should be filled out in their entirety.
- 22 Remove the bottom copy (pink) of the COC form and store at the PAMS site or at the site operator's office for future reference.
- 23 Place the COC form in the document sized Ziploc bag and seal it. Place the COC form on top of the ice packs inside the insulated shipper containing the recently retrieved DNPH sample cartridge.
- 24 **Please note:** If the next DNPH cartridge sample is being setup, the post sample flow rate recorded in step #15 above can be recorded in the "Measured Pre-Sample Flow Rate (L/min):" field on the COC form assigned to the next DNPH cartridge sample. Ensure to log all applicable details to the flow meter involved in the measurement as detailed in section 5.1.

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## 6.0 DATA REVIEW

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This section of the SOP describes steps required for the operator to perform a self/Level 1 review on the ATEC 8000 sampler data. Additionally, this section describes steps required for LAB personnel not directly involved in the ATEC 8000 operation process to perform a peer/Level 2 data review.

### 6.1 Self/Level 1 ATEC 8000 COC Review (Site Operator and LAB Chemist)

---

Review the completed sections of the cartridge COC form. Review the COC form for completeness and accuracy. Confirm that all equipment serial numbers, expiration dates, times and other manual entries match the work performed. Initial and date cartridge COC form to indicate a level 1 review has occurred and submit for secondary, level 2 peer review. It is the responsibility of the primary, level 1, operator to find a suitable reviewer in a timely manner.

**Note:** The LAB Chemist can review the Site Operator work and the Site Operator can review the LAB Chemist work.

### 6.2 Peer/Level 2 ATEC 8000 COC Review (Site Operator and LAB Chemist)

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Review the completed sections of the cartridge COC form. Review the COC form for completeness and accuracy. Confirm that all equipment serial numbers, expiration dates, times and other manual entries match the work performed. Initial and date cartridge COC form to indicate a level 2 review has occurred.

**Note:** The LAB Chemist can review the Site Operator work and the Site Operator can review the LAB Chemist work.

### 6.3 Self/Level 1 Monitoring Site Logbook Review (Site Operator)

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Review the completed sections of the logbook entry. Confirm that all equipment serial numbers, expiration dates, times and other manual entries match the work performed. Initial and date the logbook entry to indicate a level 1 review has occurred and submit for secondary, level 2 peer review. It is the responsibility of the primary, level 1, operator to find a suitable reviewer in a timely manner.

**Note:** The site logbook is to remain at the monitoring site. Logbook review will occur onsite.

### 6.4 Peer/Level 2 Monitoring Site Logbook Review

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Review the completed sections of the logbook entry. Confirm that all equipment serial numbers, expiration dates, times and other manual entries match the work performed. Initial and date the logbook entry to indicate a level 2 review has occurred.

**Note:** The site logbook is to remain at the monitoring site. Logbook review will occur onsite periodically.

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## 7.0 FILE MANAGEMENT

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This section of the SOP describes the different files generated during the precision dilution process and the individual required to manage the file, either the operator or level 2 reviewer, or both. Files include the cartridge chain of custody form and Monitoring Site Logbook.

### 7.1 Cartridge Chain of Custody Management

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This form contains four-carbonless-copies (gold, pink, yellow, and white). During the DNPH cartridge sample setup and installation the COC form should only contain three of the four carbonless copies. The bottom copy should be pink.

#### 7.1.1 Gold Chain of Custody Form (LAB Chemist)

The LAB Chemist keeps the gold copy as a record of DNPH cartridge sample creation and COC form creation. If the bottom copy is gold, please remove the gold copy and return it to the LAB Chemist for record storage.

#### 7.1.2 Pink Chain of Custody Form (Site Operator)

After the DNPH cartridge sample has been retrieved, all laboratory setup information, field setup information, and field recovery information fields on the COC form should be completed. Remove the pink copy of the COC form to keep as a backup record for the DNPH cartridge sampling event. Store the pink copy at the field site if room permits or in the site operator's office.

#### 7.1.3 White and Yellow Chain of Custody Form (Site Operator/LAB Chemist)

Place the white and yellow copies of the COC form in the clear Ziploc bag and place in the insulated cooler for return to the LAB Chemist. These are used to transfer custody of the sample from the field to the LAB Chemist.

### 7.2 Monitoring Site Logbook (Site Operator)

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This record is stored at the monitoring site and maintained by the site operator. During the sample setup steps, the site operator will fill out the logbook by initialing and dating the logbook entry using blue or black indelible ink. Include a summary of the site activities performed and results of instrument checks (if any performed). Routine site checks will be entered on the COC form. The site logbook may be used as additional space if the Cartridge COC form does not contain adequate space to record sampling information.

Site logbook entries should include:

- Cartridge Sample #
- Pre and Post Measured flow rate readings
- Sample Date
- Total Sample Volume
- Sample Duration
- Sampler status flags

A template site logbook entry is available in appendix B. If the template is to be used, cut, and paste it into the site logbook. Initial and date over the interface where the logbook entry meets the logbook page. Place a piece of clear tape over the entry. Logbook entry mistakes/typos will be crossed out with a single line with the initials and date of when the correction was made. Write the corrected entry next to the crossed-out errata. The logbook

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entries are considered a secondary record of the sampling event. There may be instances when copies of the logbook entries must be sent via email or stored electronically for equipment troubleshooting and data validation procedures

### 7.3 Monitoring Site Logbook (Peer/Level 2 Reviewer)

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The site operator will store the completed ATEC 8000 logbook entry within the Monitoring Site Logbook. The reviewer does not need to maintain this entry.

## 8.0 DATA QUALITY ASSURANCE AND DATA HANDLING

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### 8.1 Records Management

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Printed records will be held at the DAQ LAB for the period specified in the DAQ document retention guidelines.

### 8.2 Quarterly Data Archival and Digitization

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Reviewed records from each quarter will be scanned and archived on the P: network drive in the LAB folder.

## 9.0 TROUBLESHOOTING AND CORRECTIVE ACTIONS

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The following troubleshooting and corrective actions can be performed by the site operator in the event a DNPH cartridge sampling issue occurs. The most common issues encountered during DNPH cartridge sampling are discussed below. Please refer to the instrument manual for additional troubleshooting steps in the event a sampling issue occurs that is not described below. Please contact the LAB electronics technician for further troubleshooting and corrective action steps.

### 9.1 Blank ATEC 8000 Display Screen

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The ATEC 8000 display screen has a time out, or screen saver, feature that will cause the screen to go dark when not in use. Simply touch the screen to wake it up and you should be able to select sampler display menu screens and functions. If the screen does not come back on. Try to power the instrument on and off again. During power up the display screen should illuminate with various starting windows. If the display screen continues to remain blank, contact the LAB electronics technician to schedule the installation of a replacement ATEC 8000 sampler.

### 9.2 Failing Leak Check (Leak Rate is Too High)

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If a failing leak check occurs, where the leak rate exceeds the acceptance criteria listed in the COC form, remove the sampled DNPH cartridge and re-install. Pay close attention to how snug the sampler line fittings attach to the DNPH cartridge. Remember the connection is not threaded; it is a luer-lock type fitting. This means that a slight push and twist motion should create a leak tight fitting between the DNPH cartridge and sampler lines. If the leak check continues to fail, the sampler may require maintenance. Contact the LAB electronics tech to schedule the installation of a replacement ATEC 8000 sampler or for further troubleshooting instructions.

### 9.3 ATEC Sample Event Status Flags

The ATEC sampler software performs several internal checks of the instrument performance during the sampling event. A successful sample event will display “OK No Errors” in the Status field as shown in Figure 16. Failure of these internal checks will produce a sampler status flag other than “OK No Errors.”

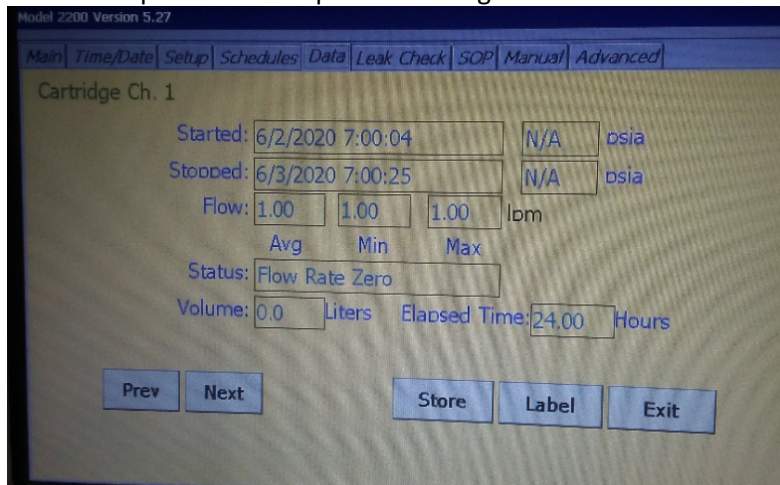


Figure 18: ATEC Data Download Example with an Error

In Figure 18 above, the sampler status is “flow rate zero.” The sample event data stored by the sampler software should be downloaded to a USB storage device as detailed in the steps of this SOP. Email the downloaded file to the LAB Electronics Tech and the LAB Chemist for further troubleshooting and record keeping.

### 9.4 Make-Up Samples: How and When to Schedule

A make-up sample should be scheduled if the following occur:

- The site operator was unable to visit the site in a reasonable amount of time to set up the sample prior to an originally scheduled sample date. The site operator may schedule a make-up. Please correct the sample# to match the make-up sample date. Please note the reason why the original sample was missed. The make-up sample must run from 04:00-12:00, 12:00-20:00, and 20:00-04:00 (three sequential 8-hour samples over 24 hours).
- The site operator returned to the site to retrieve the sample only to find the sampler did not run. The site operator must send the cartridges back to the LAB for processing and should request new cartridges from the LAB to be used for a make-up sample. The COC form must be noted as to why this sample was missed.

## 10.0 REVISION HISTORY

1. Rev 0 – BDV 04/15/2021 Original Publication

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## 11.0 REFERENCES

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2. Waters (2009) Waters SEP-PAK DNPH-Silica Cartridge: Care and Use Manual. Revision B. Milford, MA Waters Corporation.
3. United States Environmental Protection Agency: Office of Research and Development (1999). Compendium Method TO-11A: Determination of Formaldehyde in Ambient Air using Adsorbent Cartridge Followed by High Performance Liquid Chromatography (HPLC). Second Edition. Cincinnati, OH. William T. "Jerry" Winberry Jr., Silvestre Tejada, Bill Lonneman and Ted Kleindienst.
4. United States Environmental Protection Agency: Office of Air Quality Planning and Standards (2016). Technical Assistance Document for the National Air Toxics Trends Station Program. Revision 3. Research Triangle Park, NC. Authored by Battelle Memorial Institute (Columbus, OH).
5. U.S. EPA. 2019. Technical Assistance Document for Sampling and Analysis of Ozone Precursors for The Photochemical Assessment Monitoring Stations Program. Revision 2. Available at: [https://www.epa.gov/sites/production/files/2019-11/documents/pams\\_technical\\_assistance\\_document\\_revision\\_2\\_april\\_2019.pdf](https://www.epa.gov/sites/production/files/2019-11/documents/pams_technical_assistance_document_revision_2_april_2019.pdf).

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## 12.0 APPENDICES

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1. Appendix A – Carbonyls Cartridge Chain of Custody (COC) Form
2. Appendix B – ATEC 8000 Monitoring Site Logbook Entry Template

Appendix A – Carbonyls Cartridge Chain of Custody (COC) Form

| North Carolina Division of Air Quality Laboratory Analysis Branch<br>Cartridge Chain of Custody Form  |  |                          |  |  |    |
|---|--|--------------------------|--|--|----|
| NC DAQ Laboratory Analysis Branch: 4403 Reedy Creek Road, Raleigh, NC 27607 Phone: (919)-733-9777   |  |                          |  |  |    |
| Revision 0, Effective: 5/1/2020   |  |                          |  |  |    |
| Laboratory Setup Information  |  |                          |  |  |    |
| Sample Type (Circle one):    SAMPLE    FIELD BLANK    TRIP BLANK    DUPLICATE/COLLOCATED    SAMPLER CERTIFICATION                               |  |                          |  |  |    |
| QC Sample Type (Circle One):    CARTRIDGE BLANK    CARTRIDGE SPIKE    CARTRIDGE SPIKE DUPLICATE    MDL SPIKE    PT SPIKE    CARTRIDGE LOT BLANK |  |                          |  |  |    |
| Sampling Site:  |  |                          | <b>Sample #</b>  |  |    |
| DNPH Cartridge Lot#:  |  |                          |  |  |    |
| Lab setup by (initial & date):  |  |                          | Scheduled Sampling Date:                                 |  |    |
| Field Setup Information   |  |                          |  |  |    |
| Sampler SN or FAS#:   |  |                          | Site Operator (initials, date & time of setup):          |  |    |
| Sampler Expiration Date:  |  |                          | NIST Device Date and Time:                               |  |    |
| As Found Sampler Display Date & Time:   |  |                          | Time Difference (mins):                                  | Time Difference >5 minutes?              |    |
|   |  |                          |  | Yes                                      | No |
| NIST Flow Standard (Type, SN, Exp. Date):   |  |                          | AS Left Sampler Display Date, Time: (if adjustment made) |  |    |
|   |  |                          | Measured Pre Sample Flow Rate (L/min):                   | Acceptable Range (0.9 L/min - 1.1 L/min) |    |
| DNPH "Sample" Cartridge Scheduled Sampling Date/Time:   |  |                          | Leak Check Pass? (Circle One):                           | Yes                                      | No |
|   |  |                          | Leak Rate (L/min):                                       | Acceptable Range (< 0.01 L/min)          |    |
| Field Recovery Information  |  |                          |  |  |    |
| Site Operator (initials, date, time of pickup)  |  |                          | Sample Start Date & Time:                                |  |    |
|   |  |                          | Sample Stop Date & Time:                                 |  |    |
| <b>SAMPLE VOLUME (L):</b>   |  |                          | Sample Duration (hrs):                                   |  |    |
| NIST Flow Device (SN / Exp. Date):  |  |                          | Measured Post Sample Flow Rate (L/min):                  |  |    |
| Field Comments:   |  |                          |  |  |    |
|   |  |                          |  |  |    |
| Laboratory Receipt/Login Information  |  |                          |  |  |    |
| Sample Received by:   |  |                          | <b>Sample Receipt Temperature (°C):</b>                  |  |    |
| Date and Time Sample Received:  |  |                          |  |  |    |
| Laboratory Comments:  |  |                          |  |  |    |
|   |  |                          |  |  |    |
| Extraction Date:  |  | Extracted by (initials): |  | Extraction Manifold Port Number:         |    |

Appendix B – ATEC 8000 Monitoring Site Logbook Entry Template

**North Carolina Department of Environmental Quality, Division of Air Quality Laboratory**

| ATEC 8000 Monitoring Site Logbook Entry Template   |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
|--|------------------|-----------------|---------------------------------|--|---|------------------|------------------------|----------------------------------|----------------------------|--|-------------------------|--|--|------------------|--|---------------------|--|----------------------|--|------------------------|--|
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="width: 20%;">Date:</td><td></td></tr> <tr><td>Pick up Date:</td><td></td></tr> <tr><td>Operator ID:</td><td></td></tr> <tr><td>ATEC 8000 S/N or FAS#:</td><td></td></tr> <tr><td>BIGI-Tetracal S/N and Exp:</td><td></td></tr> <tr><td>ATEC 8000 Status Flags:</td><td></td></tr> </table> | Date:            |                 | Pick up Date:                   |  | Operator ID:  |                  | ATEC 8000 S/N or FAS#: |                                  | BIGI-Tetracal S/N and Exp: |  | ATEC 8000 Status Flags: |  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td colspan="2" style="text-align: right;"><i>Channel #</i></td></tr> <tr><td style="width: 20%;">Cartridge Sample #:</td><td></td></tr> <tr><td>Total Sample Volume:</td><td></td></tr> <tr><td>Sample Duration (hrs):</td><td></td></tr> </table> | <i>Channel #</i> |  | Cartridge Sample #: |  | Total Sample Volume: |  | Sample Duration (hrs): |  |
| Date:  |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| Pick up Date:  |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| Operator ID:   |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| ATEC 8000 S/N or FAS#:   |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| BIGI-Tetracal S/N and Exp:   |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| ATEC 8000 Status Flags:  |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| <i>Channel #</i>   |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| Cartridge Sample #:  |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| Total Sample Volume:   |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| Sample Duration (hrs):   |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td colspan="2" style="text-align: right;"><i>Channel #</i></td></tr> <tr><td style="width: 20%;">Pre-Sampling Flow Rate Reading:</td><td></td></tr> </table>   | <i>Channel #</i> |                 | Pre-Sampling Flow Rate Reading: |  | <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td colspan="2" style="text-align: right;"><i>Channel #</i></td></tr> <tr><td style="width: 20%;">Post-Sampling Flow Rate Reading:</td><td></td></tr> </table> | <i>Channel #</i> |                        | Post-Sampling Flow Rate Reading: |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| <i>Channel #</i>   |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| Pre-Sampling Flow Rate Reading:  |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| <i>Channel #</i>   |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| Post-Sampling Flow Rate Reading:   |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| Site Activities Performed:   |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| Field Comments:  |                  |                 |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |
| Level 1 Review:  |                  | Level 2 Review: |                                 |  |   |                  |                        |                                  |                            |  |                         |  |  |                  |  |                     |  |                      |  |                        |  |