

Approval Sign Off-Sheet

I certify that I have read and approve of the contents of the Model 49i UV Photometric Ozone (O₃) Analyzer Monitoring System-Operator Responsibilities Standard Operating Procedure Section 2.7.3 with an effective date of March 1, 2019.

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2.7.3.1 Ozone Monitoring Site Equipment and Procedures

The Division of Air Quality of the Department of Environmental Quality (DAQ) determines the ground level concentration of ambient air ozone throughout North Carolina as required by the 1970 Clean Air Act and the subsequent Amendments (1977 & 1990) thereto. In response to increasing levels of air pollution the Clean Air Act was written with the Transfer purpose to “protect and enhance the quality of the Nation's air resources so as to promote the public health and welfare and the productive capacity of its population”. In short, the Clean Air Act established ambient air quality as a national resource that must be protected. The EPA is designated with the responsibility to administer and assist in the nationwide program to protect and improve air quality. Each state is assigned the direct responsibility for assuring air quality within its borders. Monitoring and reporting of ozone concentration across North Carolina is required by the EPA to occur from March 1st through October 31st each year. This is a major undertaking and requires a coordinated effort by both Regional and Headquarters staffs of the Division of Air Quality to satisfactorily meet this requirement. North Carolina operates one of the most extensive monitoring networks and effectively measures ground level ambient ozone concentrations in urban, rural, and regional transport areas of the state.

This section presents the operating procedures to be followed for the ozone monitoring systems installed statewide. These operating procedures are designed to produce the highest quality ozone data possible. It is critical that these procedures be followed. If questions arise technical assistance is available from the Projects and Procedures Branch (PPB) and the Electronics and Calibration Branch (ECB) of the Ambient Monitoring Section of the NC Division of Air Quality.

Ozone Monitoring Instrumentation, Equipment, and Accessories

Ozone monitoring sites are equipped with ozone monitor calibrators, ozone monitors, zero air supplies, data collection software. Also included are Windows compatible computers, modems, air conditioners and heaters. The critical and essential procedures for the operation and checks to establish and verify performance of the ozone monitoring system are contained in this section. The significant instrumentation and equipment at each NCDAQ ozone monitoring site includes:

1. Thermo Environmental Model 49i-PS Transfer Standard
2. Thermo Environmental Model 49i Ozone Analyzer.
3. Teflon Sampling Line (5/32” ID)
4. Zero Air Supply
5. Computer/Modem System/Wireless
6. Temperature Controlled Monitoring Shelter
7. HOBO back up temperature sensor (shelter temperature)

Note: minor components are not specified but included by reference

Ozone Monitoring Procedures

Following the installation of the monitoring system, the Regional Monitoring staff has responsibility for the operation of the monitoring system at each site throughout the ozone season. The Regional Staff Operational Responsibilities include the following:

1. **Ozone Monitoring Logbook.** The site-specific Ozone Monitoring Logbook is the Transfer document and record for the evaluation of the performance of the ozone monitoring system and the quality of all ozone data produced at each site. This essential record must be completed by the site operator during each site visit to thoroughly document the results and findings of all site activities. The ozone monitoring logbook contains sections with Instructions, a Flow Chart of Activities, Site Documentation, Monitor Calibration, Filter Conditioning, On-Site Calibration Check, and Office Actuated Checks. The Ozone Logbook worksheet sections are included on pages 39-60 of this section.
2. **Ozone Monitor Performance Evaluation and Flow Chart.** This flow chart details activities in a decision tree model. See page 43.
3. **Site Documentation and Inspection.** The ozone monitoring site must be inspected and the instrumentation and equipment must be documented during each site visit (see page 50). The condition of the overall monitoring system, the security of the monitoring site, and activities adjacent to the monitoring site that may impact the quality of the ozone data produced must be documented. The site documentation worksheet also contains the recording of lamp frequencies and the sample cell flow rates. The recorded sample cell flow rates are then used to determine the sample line sample residence time which must be less than 20 seconds. Site inspections are a critical step to ensure representative and accurate ozone data is reported. If the site operator determines additional site visits are necessary to ensure accurate data and/or if the site operator is tracking a site performance issue or condition that may impact data quality then additional site inspection visits are warranted. This is to a degree site dependent.
4. **Ozone Monitor Calibration.** The initial adjusted Calibration performed prior to **March 1st** establishes the starting point for ozone data collected each year at each site. If the site monitor fails the On-Site Calibration Check Acceptance Criteria any time during site operation the ozone monitoring system is considered “out of control” and the ozone monitor must be Calibrated to bring the system back within data acceptance control limits. In addition, if the monitor, calibrator, or zero air supply is replaced, if major maintenance is performed (cell cleaning, solenoid replacement, lamp replacement, pump replacement, scrubber replacement, sample tubing external or internal to the monitor) and if the site loses power for greater than 72 hours, at a minimum, an Unadjusted Calibration must be performed to re-establish the direct data link to the North Carolina Standard Ozone Photometer. The Ozone Monitor Calibration Worksheet is included on page 44 and 52-53.
5. **Daily Auto-Precision/Zero/Span (PZS) Check and Precision Point Analysis.** This unattended daily performance evaluation (auto PZS) determines the ongoing accuracy and stability of site-specific ozone monitoring system. The review of this ongoing performance evaluation of the ozone monitoring system must occur as early as possible each day. This daily quality of data reported

check includes the required analysis of the Precision Point (65 ppb) that is reported to the EPA on an on-going basis. If the ozone monitoring system fails to meet the Critical Data Acceptance Criteria of the Daily Auto-PZS Check, at a minimum an Office Actuated Calibration check would be merited. An On-Site Calibration Check and site inspection may be required depending on the circumstances. Sometimes anomalies occur such as ‘Data Drop’, small power failures, etc and it is up to the Site Technician and Regional Office to determine if a site visit is merited. If the Auto PZS fails twice consecutively (over a 48 hr period) a site visit is highly recommended. If the operator opts to not visit the site, then a significant amount of data could potentially have to be invalidated affecting the completeness requirements.

The first Daily Auto-PZS Check immediately following the end of the ozone monitoring season also serves as the closing calibration check for all ozone data reported at each ozone site. These daily evaluation reports are reviewed by the site operator, Regional Chemist and the Projects and Procedures Chemist.

6. **Daily Site Temperature Review.** The ozone monitoring sites must be maintained between 5-40° C for the ozone data collected to meet federal acceptability standards. All data reported including all calibrations and QA checks must be invalidated if reported outside of this temperature range. The values are reported as is and not rounded (i.e. values are truncated; 20.9=20, 19.9=19, etc.). A high value of **40.1** would exceed the acceptable standard (40.0) and would have to be marked as invalid (coded **AE**) due to shelter temp.
7. **Daily Ozone Site Data Review.** This review is to determine if any unusual hourly average ozone concentration values (high or low) or patterns have been reported. Site Operators/technicians are required to review the overnight data polled by and contained in the Envista system. An abbreviated version of the Daily Polling report is presented below.
8. **Changing and Conditioning of Particulate Filters.** The particulate filter is a critical part of the ambient air sampling system for it protects the ozone monitor from contamination. A new particulate filter must be installed and conditioned prior to all ozone monitor Calibrations and is **required** every 30 days throughout the ozone season. It is now **mandatory** that a pre-leak check be performed before changing the filter and then a post-leak check following the filter conditioning and change out. The conditioning of the new particulate filter is performance based. When the results of the conditioning cycle meet the Acceptance Criteria the filter is conditioned. The installation and conditioning of the particulate filter requires the ozone monitoring system to be taken out of the ambient air sampling and analysis mode.

During the ozone monitoring season if the Ozone **AQI** forecast is ≥ 70 and Code Yellow and the ozone monitoring system has met all of the Data Acceptance Criteria of the Daily Auto-PZS Check, it is recommended that the changing and conditioning of the particulate filter be postponed until the AQI forecast is < 70 . If this is not possible due to regional staff schedules it is recommended that the particulate filter change and conditioning be performed following the 12 Minute Rule described below. If the changing and conditioning of the particulate filter is postponed due to the elevated ozone forecast (AQI ≥ 70) the operator must continue to monitor and evaluate the performance of the Daily Auto-PZS Check and must change and condition the particulate filter when the ozone AQI Forecast is < 70 . If the ozone monitoring system fails the Daily Auto-PZS Check an On-Site

Calibration Check **must** be performed prior to performing the Particulate filter Change and Conditioning. See page 44 and 55-56.

9. **On-Site Calibration Check.** The On-Site Calibration Check is required to be performed following **ALL FAILURES** of the ozone monitoring system to meet the Daily Auto-PZS Check and Precision Point Analysis data acceptance criteria regardless of the Ozone AQI forecast. This check is performed when eminent failure of the monitoring system is observed or suspected. The On-Site Calibration Check includes a complete site inspection and evaluation of the Ozone monitoring system. An On-Site Calibration Check requires the ozone monitoring system to be taken offline and out of the ambient air sampling and analysis mode. It is highly recommended that the On-Site Calibration Check be performed as early in the day as possible throughout the ozone season. The operator is encouraged to use the 12- Minute Rule to minimize the loss of hourly data. However, if a problem in the operation of the ozone monitoring system has been identified, the Transfer goal is to report the highest quality ozone data possible. All necessary time and effort to ensure the ozone data is of highest quality to the operator and support staff and to correct any problems that are found. See page 46 and 57-58.
10. **Office Actuated Calibration Check** An office actuated calibration check may be performed to evaluate instrument performance problems and is noted that it may be due to a power failure or data drop when all additional data indicates the site is operating properly and meeting data acceptance criteria. See page 48 and 59-60.
11. **The Envista System** is the source of ozone data reported to the EPA and used for all comparisons with the ambient air quality standards. **The Data Loggers** (temporary- ESC 8816 or 8832) have been phased out. The site computer real time data is utilized as the primary, and if computer fails, then storage in the O3 analyzer (49i) will be used as secondary back-up source of monitoring data.
12. **Data report Validation.** The Regional operator and Chemist are required to validate the monthly concentration data and precision point analysis (Precision/Zero/Span (PZS) reports prior to sending to RCO Chemists for final validation.

Note: 12-Minute Rule. Site Activities such as an On-Site Calibration Check and Particulate Filter Change and Conditioning requires the ozone monitor to be taken out of the sampling mode. This should be performed whenever possible between 12 minutes before the hour and 12 minutes after the hour. The loss of 12 minutes of data in either hour will not result in the invalidation of either hour of ozone data. The EPA hourly data reporting requirement is that 75% of an hour or 45 minutes of the 60 minutes in an hour constitutes the minimum number of minutes that can be used to produce a valid hour of ozone data. With the exception of the mountain top sites it is recommended that all site activities that require the ozone monitoring system to be taken off line or out of the ambient air sampling mode be completed before 9:12 am. **The 9 am hour has a high probability of being included in the maximum daily 8-hour average concentration each day, so only on Code Green or low Code Yellow forecast days should site activities extend beyond 9:12 am.** At the **mountain top sites**, operators are encouraged to use the **1:00 pm** hour and the first 12 minutes of the following hour. See pg. 43.

2.7.3.2 Ozone Monitoring Site Documentation and Inspection

The Initial Step during all ozone site activities is the performance of the Site Documentation and Inspection of the ozone monitoring system and equipment. This critical inspection can detect if site adjacent activities are possibly impacting the ambient air samples being collected and analyzed. This Documentation establishes the essential record that links all equipment located at each specific site to additional records located at the Electronics and Calibration Branch (ECB) on Maywood Avenue and the Projects and Procedures Branch (PPB) located at Raleigh Central Office on 217 W. Jones St.

The **Ozone Monitoring eLogbook is the essential record that documents the performance of the ozone monitoring system and All site operator activities.** It is the site operator's responsibility to ensure that the logbook is accurately and thoroughly completed. The first section of the logbook is the **Site Documentation Section.**

When driving up to the site, observe the outside of the sampling building looking for vandalism, security breaches, and the presence of unauthorized personnel. **If the operator has any concern for personal safety the operator should not proceed with the site visit.** The site operator should not confront unauthorized personnel that may be present but instead should notify the local police. If there is any evidence of vandalism contact the local police department and DAQ headquarters before proceeding further with site activities. Also note the activities adjacent to the sampling site such as construction, paving of highways, timbering, farming etc. and document these observations in the logbook. Comments on observations should be made in the comments section of the documentation page.

Note: It is recommended to open the eLogbook **first** upon sign in and have it ready to populate with site activities before proceeding with any other Envidas activities.

With the new Envidas data system, logging in to the computer has been modified and is as follows to access the eLog notebook and active data acquisition files:

Upon entering site building, log in to site computer with your Personal EADS Username and your Personal EADS Password (if necessary). Next to log into the Envidas software use your personal Envidas Username and Personal Envidas Password.

Note: Due to new IT requirements, we are no longer allowed to use Site ID or Site Passwords to log in!

Note: It is recommended that the site operator put a 'Sticky note' on the board (computer desktop) indicating that you he/she is working at xyz site and will be performing instrument work (i.e. site visit, filter change, cal, etc.). This is recommended due to the fact that any other operator or ECB or Central office staff can log into the site remotely and knock the current active operator out of their activities during their site visit.

Next, go into Envidas and change /mark the Channel. To achieve this, log into **Envidas Viewer** (operator specific Username and Password) open the **Tabular site view**, and right click on the

pollutant you will be working with, i.e. **O3** and select an appropriate **channel flag** in the drop-down menu (maintenance, calibration, etc.). Next, set a timer for the flag (recommend “1” hr at a **minimum** depending on your site visit). It is also recommended that the operator open an elog **prior** to logging in and starting any work. If the visit is a routine filter change and abiding by the 9/12 rule, then you want to be as efficient as possible with your time and downed channel(s).

The following data is entered on the **Documentation Page** of the **Ozone Logbook**

EXAMPLE ONLY

Date	Date of the Site Visit	5/4/2017
Site	Site Name	Millbrook
Operator	Site Operator Name	J. Doe
Site Visit Purpose	Choose Activity	Onsite-Cal Check

<u>Step</u>	<u>Item</u>	<u>Enter</u>	<u>Example Only</u>
1.	Site Temperature	DAS Temperature from the monitor	“20.3”
	NIST Temperature	(mineral thermometer temp.)	“20.5”
	HOBO Temperature	As is , on face of HOBO thermometer	“20.2”

Additional Instructions Required site temperature is 5-40° C; if not, temperature must be adjusted prior to all site activities.

Must check HOBO temperature **before** plugging HOBO into computer (plugging in to computer can actually elevate the internal temp. in HOBO causing false display). Refer to **RCO Guidance Documents** under the Documents section on NC DAQ’s Ambient Monitoring [Sharepoint](#) page for instructions.

2.	Ozone conc. and Site Time	Record Ozone concentration (ppb)	“55.3”
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Additional Instructions If ozone concentration is > 59 ppb downing of the channels may create a False Exceedance

Record Site Time(s)	Computer clock (DAS) Time	“8:15”
	49i time (should be the same as DAS)	“8:15”
	(home>>page to Main menu>>inst. Controls>>Date/time)	
	NIST time (nist.time.gov)	“8:15”
	HOBO time*	“8:16”

6. Press the **Menu** Button
7. Scroll down and **Highlight Diagnostics** and press **Enter**
8. Scroll down and **Highlight Intensities** and press **Enter**
9. **Record Lamp Intensity Cell A** in Logbook "81200"
10. **Record Lamp Intensity Cell B** in Logbook "81150"
11. Press the **Menu** Button
12. Scroll down and **Highlight Diagnostics** and press **Enter**
13. Scroll down and **Highlight Cell Flows** and press **Enter**
14. **Record Cell A Flow** in Logbook "0.610"
15. **Record Cell B Flow** in Logbook "0.612"
16. Record Sample Line **Installation Date** in Logbook "3/1/2015"
Note: The sample Lines are replaced every 2 years
17. **Record Sample Line Length** in meters in the Logbook "7"

The Documentation Worksheet of the Ozone Logbook then Compares the Sample Flow and the Sample Line Residence Time to Acceptance Criteria.

- a. **Sample Cell Flow** acceptance criteria between cells is "+/- 0.1 lpm"
- b. **Total Sample Flow** through both cells must be between "1.0 – 1.6 lpm"
- c. **Maximum Sample Line Residence Time** is "20 Seconds"

Note: The EPA has a **maximum sample line residence acceptance criteria** of **20 seconds**. The table below illustrates sample line (5/32" ID) residence time at 1.0 and 1.5 lpm flow rates for various lengths of sample tubing.

Sample Tubing (meters)	Residence Time (Seconds) at Flow Rates	
	Flow Rate = 1.0 lpm	Flow Rate = 1.5 lpm
5	3.7	2.5
10	7.5	5.0
15	11.2	7.5
20	14.9	10.0
25	18.7	12.4
26	19.4	13.0
40		19.9

Note:

Less than 20 seconds Residence time is required

At a Flow Rate of 1.0 lpm the maximum sampe tube length is 26 Meters

At a Flow Rate of 1.5 lpm the maximum sampe tube length is 40 Meters

Note: The **Federal Equivalent Method (FEM) Designation** for the **Thermo 49i Ozone Monitor** is at a total flow rate between **1.0** and **1.6 lpm**

If the Sample Cell Flow or Total Sample Flow or Sample Line Residence Time **Does Not Meet Acceptance Criteria**. The operator actions are:

Action 1: Notify ECB and PPB

Action 2: If the site activity is a "**Calibration**" the operator should not proceed with the calibration until the instrument flow problem is resolved or repaired. The monitor should be placed in 'standby' or put offline if not resolved.

Action 3: If the site activity is an “On-Site Calibration Check” the operator should proceed with **ONLY** the On-Site Calibration Check after Notifying ECB and PPB of the monitor flows or sample residence time failing acceptance criteria. Following the On-Site Calibration Check the monitor should not be returned to the sampling ambient air but instead left offline.

Action 4: If the site activity was to “Change and Condition the Particulate Filter” the operator should not proceed with the change and conditioning of the particulate filter but instead should first **Notify PPB and ECB** of the failure and then perform On-Site Calibration Check. Following the On-Site Calibration Check the monitor should not be returned to the sampling ambient air but instead left offline.

Example Only

5.	49i Transfer Standard	ID Number	“41”
		Certification Date	“2/23/2013”
		Alarms displayed	“Y”
		Cooling Fan Filter Clean	“Y”
		Additional Instruction	The flow Alarm should be Displayed upon Arrival All other Alarms - Contact ECB and/or PPB
6.	Zero Air Supply	ID Number	“42”
		Certification Date	“2/15/2013”
		Dew Point Sensor Light (Red or Green)	“Green”
		Pressure Gauge (20-30 psi)	“Y”

Note: If Dew Point Sensor Light is Red – Notify ECB and PPB

7.	HOBO Time and Data	Data Download	“y/n”
	Additional Instructions	HOBO Temperature data must be downloaded and saved into a secure file share <u>once per month</u> (this is now the back-up temperature data for the site)	
		Revised Time Sync (Relaunch)	“y/n”
	Additional Instructions	Once the HOBO data is downloaded and HOBO relaunched, this will synchronize the HOBO time with the DAS computer time. The Y/N will serve as a check to confirm that the HOBO and DAS times are now synchronized. If they do not sync after relaunch, contact the ECB. Refer to RCO Guidance Documents under the Documents section on NC DAQ’s Ambient Monitoring <u>Sharepoint</u> page for instructions.	
8.	Operator Comments. The section is for recording any site-specific observations and problems in accomplishing the task associated with the operation of the ozone monitoring system.		
9.	Regional Chemist Comments This section is for review comments and discussion.		

2.7.3.3 OZONE MONITOR CALIBRATION

The Ozone Monitor Calibration establishes the starting point for all data collected and reported at each site. This is the critical link in the chain that connects all ozone concentration data collected and reported from each site to the North Carolina Standard Ozone Photometer.

Throughout the ozone monitoring season performance checks are conducted on the ozone monitoring system. If the system fails these performance checks or maintenance and repair or replacement of instrumentation is required then the ozone monitor must be re-calibrated to maintain the system within the required performance standards. If critical components (Calibrator, Monitor, Zero Air Supply) are changed at the monitoring site or major system maintenance (cell cleaning, solenoid replacement, lamp replacement, pump replacement, scrubber replacement, and sample lines in the calibration pathway or internal to the instruments are changed) is performed or if electrical power is lost for greater than 72 hours then a Calibration (at a minimum Unadjusted Calibration) is required to re-establish the link to our state standard.

The **Ozone Monitoring Logbook is the essential record** that documents the performance of the ozone monitor calibration and all site operator activities. It is a critical document in evaluating the quality of the data collected and adherence to approved procedures at each site. It is the site operator's responsibility to ensure that the logbook is accurately and thoroughly completed. The Initial Step in all site activities is to complete the Site Documentation Section of the Ozone Logbook (Sect. 2.7.3.2) of this QA plan.

The Calibration Worksheet of the Ozone logbook is included on Page 52-53 of this section.

In order to avoid confusion, the following table will verify the nomenclature utilized in Envidas/Envista software to understand the relevant Span Levels for Ozone:

Envista software	Calibrator	Level	Comment(s)
Span	225 ppb	Level 4	
Span 4	180 ppb	Level 5	not currently used
Span 3	120 ppb	Level 3	
Span 1	65 ppb	Level 2	
Span 2	50 ppb	Level 1	not currently used
Zero	0 ppb	Level 6	

2.7.3.3.A Log into the Site Data System: Envidas

1. Log in to site computer with Personal **EADS ID** and your **Personal Password** (as necessary),
2. Log into Envidas **Viewer** and enter your personal Envidas Username and Envidas Password (operators personal)

3. Right click on the pollutant you will be working with, i.e. O3 and Set channel flag in the Drop down menu to “**Maintain**” or **Calibrate**, or etc.,
4. Specify duration (recommended at least 1 hr depending on site visit type),
5. Enter **Force Now** to activate.
6. Open elog (If not already opened)
7. Document all relevant information on Documentation Tab including time(s), temperatures, type of visit, and etc. (Please be thorough with any/all site activity information!).
8. Proceed to relevant site visit type Tab (i.e. **Maintenance, Calibration, etc.**)

2.7.3.3. B Calibration Particulate Filter Installation and Conditioning Procedure

A Leak check **must** be performed **before** the filter change, regardless of the reason for changing the filter. This will help bracket suspicious data, anomalies, or other issues which could occur outside of normal monitoring activity. A Leak check **must** be performed **after** the filter change as well.

Particulate Filter Conditioning prior to the performance of all Ozone Monitor Calibrations is a very critical step. A new Teflon particulate filter MUST be installed and conditioned prior to proceeding with the calibration procedure.

It may be necessary to perform a second or even third filter conditioning cycle to ensure the filter is completely conditioned. (Note: if too much drift from Acceptance Criteria is observed, then allow more time to stabilize before proceeding; a bit of patience could improve the resultant values)

Filter Conditioning Procedure Acceptance Criteria for Calibrations

225 ppb +/- 5 ppb

0 ppb +/- 3 ppb

The Acceptance Criteria has 2 components a Level such as 225 ppb and 0 ppb and a Range of acceptability at those levels of 5 ppb and 3 ppb. The Ozone Reading at the Monitor is expected to achieve between 220 to 230 ppb and +3 to -3 ppb rapidly due to two factors. The first being the initial site setup by the ECB Staff and the high quality particulate filters now available.

The added consideration during filter conditioning for a Calibration cycle is the filter MUST be conditioned and the readings MUST be stable (i.e. within 1 or 2 ppb consecutive values without deviation/fluctuation) prior to the recording of 5--one minute values in the filter Conditioning Section of the Calibration Worksheet. Copy and paste the 5 one-minute values by querying the site PC's sequel database using the EnviDas Reporter module and creating a site report

(Reports – Sites – Channels) and displaying it in Excel format. At the end of the site visit, all of the minutes are Required to be pasted onto a ‘minutes’ tab/worksheet (excel) in the workbook. This procedure can be found in Appendix B, RCO Guidance Documents, under the Documents section on NC DAQ’s *Sharepoint* web page.

Filter Change Procedure

Additional Instructions The channel(s) will already have been downed at this point in the process via the Envidas procedures and time(s) and temperature(s) should have already been documented in the elog book.

1. Run a **Pre-Leak** check prior to changing the filter by disconnecting the filter line to the ‘Common Solenoid port on the back of the Monitor and capping the port as well as the filter ‘open line’. Press the Menu Button on the front of the TEI 49i Ozone Monitor and select **Diagnostics** and then select **Pressure** (also see procedure 1 thru 7 below)
2. Disassemble the filter holder with the filter disassembly wrenches provided.
3. Remove the existing filter and inspect the filter support screen.
4. If the filter support screen is dirty rinse with de-ionized water and then dry.
5. Reinstall the filter support screen.
6. Touching only the outer edge of the new filter place the filter in the holder.
7. Reassemble the filter holder. **DO NOT OVER TIGHTEN THE FILTER HOLDER FOR THIS CAN TEAR THE FILTER AND/OR DAMAGE THE FILTER HOLDER.**

Perform a Leak Test on the 49i after changing the Filter

Press the Menu Button on the front of the TEI 49i Ozone Monitor

1. Select “**Diagnostics**” then select “**Pressure** “
2. Disconnect the Ambient input line from the back of the analyzer and plug the opening with a plastic insert. (This will check not only the filter, but the whole system for leaks).
3. The pressure should decrease below 250 mm Hg within 60 seconds (usually much faster).
4. If pressure does not drop there is a leak. Remove the Ambient Inlet plug fitting and check all fittings and check the input lines for cracks and correct as necessary (sometimes the replacement of an additional filter will solve the problem)
5. Repeat leak test. If fails. Contact ECB for assistance in correcting leaks.
6. If leak corrected and test is passed reattach the ambient input line to the filter holder.
7. Press Run and continue with filter conditioning.

Particulate Filter Ozone *Conditioning* Procedure (Record in the Calibration Worksheet).

Note: During Season Opening Calibration, the new particulate filter should be conditioned a minimum of **45 minutes**. This helps burn off any potential contaminants that may react with the ambient air via the inlet probe.

Begin by running a **SPAN** test (225 ppb)

1. in Envidas VIEWER, select [**Operational**].
2. Select [**Phase from Sequence**].
3. Select [**O3MAN**].
4. Select **SPAN**
5. Check duration to “**01:00:00**”.(the Operator can set a longer duration to prevent interruption during a longer procedure which may take more than an hour to perform (i.e. **Adjusted Calibration**)
6. Hit **Start** (phase will show countdown and start at top of minute)
7. View progress of burn in **Viewer >> Dynamic>> Charts>> Ozone** (you can also view the face of the analyzer to monitor the progress of the filter burn)

The **Span** Event (225 ppb Ozone—**Level 4**) will start and run in order to begin conditioning the particulate filter.

When the Ozone Readings Meet the Acceptance Criteria (**225 ppb +/- 5 ppb**) and are Stable then record 5 x 1 minute average ozone concentrations in the elog book.

Open **Reporter** (*Sharepoint*)

Note: If the readings do not stabilize at a level that meets the acceptance criteria, replace the Filter, leak check, and repeat. If second filter conditioning does not stabilize contact the ECB or PPB.

Next, Abort the Span Event and begin the **Zero Point Procedure**

Hit the **Abort selection** to end the Span check and get ready to start the Zero Point.

Note: Be sure to **use Abort** command and **not** the **Stop** command. The Stop command will end the sequence and we want to proceed with the next point(s).

Particulate Filter Ozone Conditioning Zero Point Procedure (Record in Calibration worksheet of elog book).

Calibration Zero Begins: Testing Phase

Note: You **must** Calibrate the Zero first when performing an **Adjusted Calibration!**

Begin by running a **ZERO test** (0 ppb)

1. in Envidas **VIEWER**, select [**Operational**].
2. Select [**Phase from Sequence**].
3. Select [**O3MAN**].
4. Select **ZERO**
5. Check **duration** to “**01:00:00**”.(Recommended to set it longer (2 hrs) to prevent premature aborting of sequences): Recommended to allow to stabilize at least **30-45** minutes

6. Hit **Start** (phase will show countdown and start at top of minute)
7. View progress of burn in **Viewer >> Dynamic >> Charts >> Ozone**

Once Stabilized (45 min.), then proceed as follows:

When the Zero Point Ozone Readings Meet the Acceptance Criteria, enter 5 x 1` minute concentrations into the elog book. These reading will be pulled from Envista Reporter (copied and pasted into an Excel worksheet to assure they match exactly minute for minute with the DAS system.

The ozone logbook data Calibration boxes will calculate the average for the values entered and compare the average values to the Acceptance Criteria. The Operator and the Logbook will evaluate the Filter Conditioning Data acceptability. The Filter Conditioning Acceptance Criteria are:

<u>iPS (cal)</u>	<u>O3 (monitor)</u>
0 ppb	0 ppb +/- 2 ppb
225 ppb	225 ppb +/- 5 ppb

If these acceptance criteria are not satisfied it is recommended to discuss with PPB and ECB.

If the acceptance criteria are satisfied, you have successfully conditioned the filter and performed the post leak check and are ready to start the *Adjustment* Phase of the Calibration. This will involve adjusting the Zero (0 ppb) point and the Span point (225 ppb) and then testing the linearity with 2 successive check points (120 ppb, and 65 ppb).

You are now ready to Adjust the Zero point.

2.7.3.3. C Calibration of the Ozone Monitor (step 3 in elog Calibration worksheet)

This is the **Adjustment Phase** of the **Zero Point** in the Adjusted Calibration

The TEI 49i Ozone Monitor needs to be Unlocked

1. Press The **soft** key under Password
2. Press the **Enter** to unlock instrument
3. For Password press **Enter** key once slowly
4. Press the **Menu Key** once to Display the main **Menu Options**
5. Use down Arrow to highlight **Calibration** and Press **Enter**
6. Once the **0 Event** has stabilized, then Down Arrow to highlight **Cal Zero** and Press **Enter**
7. Press **Enter** again to calibrate the **Zero**.
8. Press Run to return to main screen (if stability is achieved)

The Zero Span Event (0 ppb Ozone) should run until stable (**5-10** minutes to confirm stability).

9. **Record 5 x 1 minute readings from the iPS and O₃ channels in the ozone logbook**

The ozone logbook macro calculates the average of the 5 x 1-minute values. The Operator and Ozone Logbook compare the Average Readings to the Data Acceptance Criteria and determine the acceptability. The Acceptance Criteria for the average ozone concentration readings are below.

iPS
0 ppb +/- 2 ppb

O3
iPS +/- 2 ppb

If the Zero Calibration Point DOES NOT meet data Acceptance Criteria, check the sample line connections from the calibrator and Re-run the Zero Calibration Point. If the Zero Calibration Point fails the 2nd attempt contact PPB and ECB!

To end the **Zero Adjustment** event, Press the **Abort** key to stop the process.

You are now ready to begin the SPAN (225 ppb) Level 4 Adjustment step of the Calibration.

Level 4, SPAN, (225 ppb) Event Calibration Procedure (Full Span 225 ppb step 3 in elog Calibration worksheet)

Begin by running a **SPAN** (Level 4) **test** (225 ppb)

1. in Envidas **VIEWER**, select [**Operational**].
2. Select [**Phase from Sequence**].
3. Select [**O3MAN**].
4. Select **SPAN**
5. Check duration to “**01:00:00**”.
6. Hit **Start** (phase will show countdown and start at top of minute)

View progress of Calibration in: *Viewer >> Dynamic>> Charts>> Ozone*

The Level 4 Span Event (225 ppb Ozone) will start and run until stability is observed. This will normally take 30-45 minutes to achieve, but may take longer with some instruments. Please be patient and allow ample time to stabilize for an **adjusted Calibration** procedure.

Allow the readings to stabilize

7. Press the **Menu Key** to Calibrate the level 4 **SPAN** Event (225 ppb)
8. Select the **Calibration O3 Coeffecient then**, the Calibrate O3 screen should be displayed. The Span Concentration displayed is **000000225**.
9. Press **Enter** to **Calibrate (the SPAN 225 ppb)**

10. Press **Run** to return to the Main Run Screen
11. **Record 5 x 1 minute readings from the O₃ and O₃CAL channel in the ozone logbook.**

The ozone logbook calculates the average of the 5 x 1 minute values. The Operator and the Ozone Logbook compare the Average Readings to the Data Acceptance Criteria and determines the acceptability. The Acceptance Criteria for the average ozone concentration readings are below.

<u>iPS (calibrator)</u>	<u>O3 (monitor)</u>
225 ppb +/- 2 ppb	iPS +/- 2 ppb

If the **SPAN** (225 ppb) Calibration Point **DOES NOT** meet the Data Acceptance Criteria as determined by the Ozone Logbook the operator should check the sample line connections from the calibrator to the ozone monitor and Re-run the Zero and SPAN Calibration Procedure. If the Zero and or SPAN Calibration Point FAILS to PASS the second calibration cycle contact PPB and ECB.

If the SPAN Calibration Point PASSES the Data Acceptance Criteria proceed to the Review of the Ozone **Span Coefficient Calibration Factor** and ozone **Background Factor**.

Record the 49i Monitor **Ozone Span Coefficient Calibration Factor** and the **Ozone Background Factor** in the **Ozone Calibration Worksheet**. The Acceptance Criteria for the **Calibration Factor** is **0.95 - 1.05** and the **Background Factor Acceptance Criteria** is **-3 - +3**.

1. Press the **Menu Key** to display the 49i menu.
2. Press the **Down Arrow** to Highlight the **Calibration Factors**
3. Press the **Enter Key** to select **Calibration Factors**
4. **Record** the **Calibration Factor** and the **Background Factor** in the Logbook
5. The **Ozone Logbook will Evaluate** the **Ozone Coeff** and the **Background Factors**

Note: If the Ozone Coefficient is Greater than 1.05, a leak is suspected. The following action list is required to be performed:

1. All fittings should be checked. This includes all fittings and connectors on the ozone monitor and the ozone calibrator.
2. A leak test should be performed.
3. The **ZERO** and SPAN Calibration procedures above should be Repeated.
4. If the Ozone Coefficient is greater than 1.05 and the second attempt to calibrate the ozone monitor the operator should contact ECB and PPB

If the Ozone Coefficient is Less Than 0.95 the calibration (**Zero and SPAN**) should be repeated. **If the second attempt to calibrate fails to meet acceptance criteria the operator should contact ECB and PPB..**

If the Ozone Span Coefficient PASSES Acceptance Criteria, proceed below and perform the Calibration Curve Verification at Level 3 (120 ppb), and Level 2 65 ppb)

Press **Run** to return to the Run Screen

To Stop the Level 4 (225 ppb) Adjusted SPAN Event and Start the Level 3 Curve Verification (120ppb) Event:

1. To end the Level 4 (225 ppb) Event Hit the **Abort** key to stop the process

Note: the STOP key will only Pause the operation and would try to continue to run until that sequence was timed out (all have been preset to **1 hr** run time by default).

Level 3 (120 ppb) Event Calibration Curve Verification Procedure

Begin by running a **SPAN 3 (Level 3) test (120 ppb)**

1. in Envidas **VIEWER**, select [**Operational**].
2. Select [**Phase from Sequence**]
3. Select [**O3MAN**].
4. Select **SPAN 4**
5. Check duration to “**01:00:00**”.
6. Hit **Start** (phase will show countdown and start at top of minute)
7. View progress in **Viewer >> Dynamic >> Charts >> Ozone**

The Span 3 (Level 3) Event (120 ppb Ozone) will start and run until stability is observed and recorded in the elog book.

8. **Record 5 x 1 minute readings from the O₃ and O₃CAL channels from the Envista Reporter Excel worksheet in the ozone logbook.**

The Calibration Curve Verification Data Acceptance Criteria for the Level 3 Event are:

$$\begin{array}{cc} \underline{iPS} & \underline{O3} \\ 120 \text{ ppb } +/- 2 \text{ ppb} & iPS +/- 2 \text{ ppb} \end{array}$$

The Ozone Logbook macro calculates the average of the 5 x 1-minute concentration values for the Level 3 (120 ppb) Event. The Operator will compare the results in Logbook entries to evaluate the data versus Acceptance Criteria.

If the Level 3 (120 ppb) Event data **PASSES** Acceptance Criteria proceed and perform the Level 2 (65 ppb) Event. **If the Level 3 Event data FAILS the data acceptance criteria then RE-RUN the Level 3 Event and patiently allow time to stabilize. If the Level 3 Event FAILS the second evaluation contact ECB.**

To Stop the Level 3 (120 ppb) Event and Start the Level 2 (65 ppb) Event:

A. To end the Level 3 Event Hit the **Abort** key to stop the process

Note: the STOP key will only Pause the operation and would try to continue to run until that sequence was timed out (all have been preset to **1 hr** run time by default).

Start The Level 2/Span 1 (65 ppb) Event.

1. Begin by running a **SPAN 1 (Level 2)** test (**65 ppb**)
2. In Envistas **VIEWER**, select [**Operational**]
3. Select [Phase from Sequence]
4. Select [**O3MAN**].
5. Select **SPAN 1**
6. Check duration to "**01:00:00**".
 - a. Hit **Start** (phase will show countdown and start at top of minute)
7. View progress in **Viewer >> Dynamic >> Charts >> Ozone**

Once the readings stabilize record the Level 2 (**65 ppb**) Event concentrations Readings from Envista Reporter in the Ozone Logbook.

The Calibration Curve Verification Data Acceptance Criteria for the Level 2 Event are:

<u>iPS</u>	<u>O3</u>
65 ppb +/- 2 ppb	iPS +/- 2 ppb

The Ozone Logbook calculates the average of the 5 x 1-minute concentration values for both the Level 2 (65 ppb) Event. The Operator uses the Logbook calculations to evaluate the data versus the Acceptance Criteria.

If the Level 2 Event data **FAILS** the data acceptance criteria then RE-RUN the Level 2 Event. If the Level 2 Event FAILS the second evaluation contact ECB.

If any of the Intermediate Calibration Curve Verification Points (120 ppb, and 65 ppb) FAILS the Calibration Curve Data Acceptance Criteria but the Adjusted Zero Event (0 ppb) and the Level 4 Adjusted SPAN (225 ppb) PASSES data acceptance criteria then a complete Calibration Procedure including the change and conditioning of a new Particulate Filter must be performed before the ozone monitor can be considered to meet ambient air data reporting criteria. This is the Adjusted Calibration that represents alignment with the transfer standard for the seasonal data. If the monitor fails any aspect of this 2nd Calibration Procedure contact both the PPB and ECB!

If the results of the analysis of all intermediate points (120 ppb and, 65 ppb) PASS the Data Acceptance Criteria the ozone monitor has now been calibrated. Proceed below and “Up” the Monitor Channel(s) and the monitor will then begin reporting ambient air ozone concentration data.

To end Level 2 (65 ppb), hit the **Abort** key. Allow **2-3** minutes for the instrument to stabilize to ambient ozone levels before proceeding. Next, up the data channels (reset the flag).

Up the Monitor Data Channels (reset flag)

Once all data points have been tested and recorded for Calibration, then the operator will unflag/up the channels

1. **Go to Viewer Dynamic tabular**
2. Right click the channel in the Tabular display
3. In the options box, select the **Set Channel Flag**
4. Select **Reset Flag** (at the top of the dropdown list)
5. The instrument status should now change to “**OK**”
6. The other marked channel(s) will follow suit as their respective average times is/are satisfied (i.e. 1 min., 5 min., and etc.)
7. The channel(s) is/are now up and the Calibration procedure is complete
8. Once the calibration is completed, the Operator should generate an Excel data spreadsheet capturing all data recorded during the visit and highlight the relevant ‘points’ generated and times captured. This information will then be cut and pasted into the **DAS Minutes tab** in the Ozone eLog book (also see detailed process in Share Drive procedures, *Sharepoint*).

2.7.3.4 DAILY AUTO-Precision/Zero/Span (PZS) CHECK AND PRECISION POINT ANALYSIS.

Daily Auto-PZS Checks and Precision Point Analysis are programmed to occur automatically each day during periods of time when the ambient air ozone levels are the lowest. At the mountain top sites this check occurs at 12 noon each day and at the lower elevation sites this occurs at 3 am each day. The Daily Auto-PZS Check and Precision Point Analysis is the ongoing ozone monitoring system performance evaluation that enables the reporting of the highest quality data possible. The Daily Precision Point Analysis, also known as the **Single Point QC check** results are **“Reported to the EPA”** as an ongoing measurement of the quality of the ozone concentration data produced at each site. Currently, RCO and Site Operators and Regional chemists do observe the Zero and Span points, but they are not reported to AQS nor the EPA. The Zero and Span are good daily indicators on how the monitor is performing on a day-to-day basis and often help with preliminary troubleshooting should ‘out of range’ values occur.

The Daily Auto-Calibration and Precision Check Analysis Data Acceptance Criteria are:

<u>Theoretical Conc.</u>	<u>iPS</u>	<u>O3</u>
0 ppb	0 ppb +/- 2 ppb	iPS +/- 2 ppb
65 ppb	65 ppb +/- 3 ppb	iPS +/- 3 ppb
225 ppb	225 ppb +/- 3 ppb	iPS +/- 5 ppb

The Daily Auto-PZS Check Results Report MUST be Reviewed Daily. The results of this daily performance check are compared to the Data Acceptance Criteria by the site operator, the regional chemist, or a designee. **This critical review MUST occur as the first daily activity throughout the ozone monitoring season.** This early review enables any required on-site investigations and performance evaluations to occur as early in the day as possible. The earlier the site visit the fewer the number of hours of valid ozone data that will be potentially lost during the higher ozone levels normally experienced during the middle of the day at our sites. **This early review can also reduce the time required if additional assistance or replacement equipment is needed to return the ozone monitoring system to reporting acceptable ambient air ozone concentration data. An example of the Daily Auto-PZS and Precision Point Analysis and Site Temperature Evaluation report is shown below**

If the Daily Auto PZS and Precision Point Analysis **FAILS** the Acceptance Criteria a Site Visit, Inspection, and On-Site Calibration Check is recommended.

If the results of the Daily Auto PZS and Precision Point Analysis **PASS** the Acceptance Criteria then no further action is required based upon the results of the Daily Auto-Calibration and Precision Point Analysis.

Ozone Daily Auto-Calibration Check and Precision Point							i Ps Evaluation			Monitor Evaluation			Temp. Range	Comment	AQI Forecast		Forecast Source
31-Jul-17	i Ps			Monitor			Comparison to Expected			Comparison to CP					20-30 ^o C	Code	
	Zero	Span1	Span	Zero	Span1	Span	0 ppb	65 ppb	225 ppb								
Joanna Bald	0.0	64.0	225.0	0.0	64.0	225.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	45	Mtn Top	
Frying Pan	0.0	65.0	225.0	0.0	65.0	226.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	45	Mtn Top	
Mt Mitchell	0.0	65.0	224.0	0.0	64.0	224.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	45	Mtn Top	
Purchase Knob	0.0	65.0	225.0	0.0	64.0	224.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	45	Mtn Top	
Linville Falls	0.0	64.0	225.0	0.0	64.0	224.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	46	Valleys	
Bryson City	0.0	64.0	225.0	0.0	65.0	225.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	46	Valleys	
Waynesville	0.0	64.0	225.0	0.0	64.0	225.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	46	Valleys	
Bent Creek	0.0	65.0	225.0	0.0	65.0	224.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	46	Valleys	
Lenoir	0.0	65.0	225.0	0.0	64.0	223.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	47	Hickory	
Monroe	0.0	65.0	224.0	0.0	64.0	226.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Moderate	51	Charlotte	
Crouse	0.0	65.0	224.0	0.0	64.0	223.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Moderate	51	Charlotte	
Rockwell	0.0	64.0	225.0	0.0	64.0	225.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Moderate	51	Charlotte	
Liledoun	0.0	64.0	225.0	0.0	64.0	225.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	47	Hickory	
Bethany	0.0	65.0	225.0	0.0	64.0	224.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	48	Triad	
Mendenhall	0.0	65.0	225.0	0.0	63.0	222.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	48	Triad	
Cherry Grove	0.0	65.0	225.0	0.0	64.0	224.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	48	Triad	
Wade	0.0	65.0	225.0	0.0	64.0	225.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	47	Fayetteville	
Honeycutt	0.0	64.0	225.0	0.0	65.0	225.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	47	Fayetteville	
Blackstone	0.0	64.0	225.0	-1.0	63.0	223.0	Pass	Pass	Pass	Pass	Pass	Pass	Pass	Green	47	Fayetteville	

2.7.3.5 DAILY SITE TEMPERATURE REVIEW

The ozone monitoring shelters must be operated between 5 -40° C for the ozone concentration data reported by the ozone monitoring system to be acceptable. Each day as part of the early morning review associated with e review of the Daily Auto-Calibration and Precision Point Analysis Review described above, the operator, regional chemist, or designee **MUST** review the temperature of the monitoring building for each site. The **Daily Auto-Calibration and Precision Point Analysis and Site Temperature Evaluation report is shown above.**

If the monitoring building **FAILS** the **5 -40° C Temperature Range Acceptance Criteria** a site visit is **recommended** to correct the loss of temperature control at the site and reduce the number of hours that ambient air ozone data will be lost. At the beginning of Ozone season and at the end of the season, temperature swings are expected. It is at the discretion of the site operator and Regional Supervisor to determine if a site visit is merited and the potential consequences of loss of monitoring data is to be considered as well.

For **all** site visits including the Site Temperature Control Adjustment the **Documentation Page** of the Ozone Logbook must be thoroughly completed. This includes recording the NIST (mineral thermometer) temperature, the DAS (computer---Comet) temperature, the display on the 49i monitor, and the HOBO temperature (if relaunching the HOBO). Please see Refer to **RCO Guidance Documents** under the Documents section on NC DAQ's Ambient Monitoring Sharepoint page for instructions and for specific procedures.

The operator should also consider performing a Particulate Filter Change and Conditioning during the Temperature Range Failure site visit. This latter procedure is dependent upon the site operator time availability considering other regional responsibilities and when particulate filter were last changed.

If the monitoring building **PASSES** the **5 -40° C Temperature Range Acceptance Criteria** no temperature related activity is required.

2.7.3.6 DAILY REPORTED OZONE DATA REVIEW

Each morning as early as possible the site operator, regional chemist, or designee **MUST** review the hourly ozone data reported from each ozone site (during normal working hours M-F). This review is to determine if any unusual hourly average ozone concentration values (high or low) have been reported or unusual data patterns are being reported. This review can determine many problems such as electrical power outages, leaking sample lines, possible water condensation in the sample lines, pump failures, a calibrator failure, a monitor lamp failure, and many others. It is the ultimate responsibility of the Site Operators/Technicians to obtain their own data and verify it. Second hand copies could be in error or misleading. The Operators should generate their own unique report(s) and own the data.

If an unusual hourly average ozone concentration has been reported a site visit is **REQUIRED** to investigate possible causes of the odd or unexplainable reported ozone concentration data. The operator, regional chemist, or designee should contact both the PPB and the ECB to discuss their findings and observations during their data review. An example of a *Daily Ozone Polling report* is below.

Date & Time	O3 [ppb]	Status	TMP [DEGC]	Status
8/16/2017 00:00	6	Ok	23.7	Ok
8/16/2017 01:00	7	Ok	23.7	Ok
8/16/2017 02:00	6	Ok	23.7	Ok
8/16/2017 03:00	127	BF - Calib	23.7	Ok
8/16/2017 04:00	7	Ok	23.7	Ok
8/16/2017 05:00	10	Ok	23.6	Ok
8/16/2017 06:00	11	Ok	23.6	Ok
8/16/2017 07:00	15	Ok	23.7	Ok
8/16/2017 08:00	28	Ok	23.8	Ok
8/16/2017 09:00	33	Ok	23.9	Ok
8/16/2017 10:00	35	Ok	24.0	Ok
8/16/2017 11:00	41	Ok	24.3	Ok
8/16/2017 12:00	41	Ok	24.2	Ok
8/16/2017 13:00	43	Ok	23.9	Ok
8/16/2017 14:00	43	Ok	23.8	Ok
8/16/2017 15:00	44	Ok	24.2	Ok
8/16/2017 16:00	43	Ok	24.0	Ok
8/16/2017 17:00	38	Ok	23.8	Ok
8/16/2017 18:00	35	Ok	23.7	Ok
8/16/2017 19:00	29	Ok	23.7	Ok
8/16/2017 20:00	22	Ok	23.6	Ok
8/16/2017 21:00	19	Ok	23.6	Ok
8/16/2017 22:00	25	Ok	23.6	Ok
8/16/2017 23:00	22	Ok	23.5	Ok

Date	StationID	MonitorID	Monitor	Unit	Type	Ref	Meas	Value	Diff%	STD	Status
8/16/2017 04:04	39	4	O3	ppb	Zero	0	2	2	0	0	Valid
					Span	225	226	1.001	0.8	0	
					Span1	65	65	1	0	0	
8/17/2017 04:04	39	4	O3	ppb	Zero	0	0	0	0	0	Valid
					Span	225	226	0.994	0.4	0	
					Span1	65	64	1	0	0	

2.7.3.7 ROUTINE PARTICULATE FILTER CHANGE AND CONDITIONING

The particulate filter is a critical part of the ambient air sampling system for it protects the ozone monitor from contamination. A new particulate filter must be installed and conditioned prior to all ozone monitor Calibrations and is required every **30 days** throughout the ozone season. The conditioning of the new particulate filter is performance based. When the results of the conditioning cycle **Pass** the Acceptance Criteria, the filter is considered conditioned. The performance of a **Leak test** on the particulate filter holder is now **required** both **prior to** and **after** the particulate filter conditioning step. The prior to check would help bracket suspect data if an anomaly occurs with the instrument.

The installation and conditioning of the particulate filter requires the ozone monitoring system to be taken out of the ambient air sampling and analysis mode.

If during the ozone monitoring season the Air Quality Forecast is Code Yellow with AQI > 70 and the ozone monitoring system has met all of the Data Acceptance Criteria of the Daily Auto-Calibration Check and Precision Point Analysis and a particulate filter change and conditioning is due it is recommended that the changing and conditioning of the particulate filter be postponed until the AQI forecast is < 70. If this is not possible due to regional staff schedules and responsibilities it is recommended that the particulate filter changing and conditioning be performed following the **9:12 Minute Rule** (i.e. before 9:12 a.m. to be able to capture 75% of before and after visit hours).

If the changing and conditioning of the particulate filter is postponed due to the elevated ozone forecast (AQI > 70) the operator must continue to monitor and evaluate the performance of the Daily Auto-PZS Check and must change and condition the particulate filter as soon as possible when the ozone AQI Forecast is < 70. If the ozone monitoring system fails the Daily Auto-PZS Check during this extended filter use period an On-Site Calibration Check must be performed prior to performing the Particulate filter Change and Conditioning.

The Documentation page of the Ozone Logbook must be thoroughly completed as part of the site visit to change and conditioning of a new **Particulate Filter** as well as the **Routine Filter Change** page.

The Routine Particulate Filter Change Worksheet from the Ozone Logbook is included on page 55-56 of this procedure.

2.7.3.7.1 Particulate Filter Change and Conditioning Procedure

1. Log in to site computer with Personal EADS ID and your Personal Password (as necessary),
2. Log into Envidas **Viewer** and enter your Envidas Username and Envidas Password (operators personal)

3. Right click on the pollutant you will be working with, i.e. O3 and Set channel flag in the Drop down menu to “**Maintain**”,
4. Specify duration (recommended at least 1 hr depending on site visit type)
5. Enter **Force Now** to activate.
6. Open elog
7. Document all relevant information on **Documentation Tab** including time(s), temperatures, type of visit, and, etc.
8. Proceed to relevant site visit type Tab (i.e. **Routine filter**)
9. **Check and Record the Computer Time(s) and Temperature(s)**

10. Pre-Leak test

Note: It is **Now Required** to Perform a **Pre-leak test** before changing the filter (this often helps uncover potential issues early on, especially if anomalies have been sporadically occurring at a site.). This process could also help bracket and save suspect data.

- i. Press the **Menu Button** on the front of the 49i Monitor
- ii. Go to Diagnostics Menu and Select the **Pressure Screen**
- iii. Disconnect the Ambient input line from the sampler input port and plug the line with a plastic plug
- iv. The pressure should decrease below 250 mm Hg within a **minute** or less.
- v. If the pressure does not drop there is already an existing leak in the system and this should be noted in the elog and this could affect data review and **data bracketing**
- vi. Proceed with the Filter Change as follows

Filter Change Procedure

- i. Disassemble the filter holder with the filter disassembly wrenches provided.
- ii. Remove the existing filter and inspect the filter support screen.
- iii. If the filter support screen is dirty rinse with de-ionized water and then dry.
- iv. Reinstall the filter support screen.
- v. Touching only the outer edge of the new filter place the filter in the holder.
- vi. Reassemble the filter holder. **DO NOT OVER TIGHTEN THE FILTER HOLDER FOR THIS CAN TEAR THE FILTER AND/OR DAMAGE THE FILTER HOLDER.**

Perform a Post Leak Test on the 49i

- i. Press the Menu Button on the front of the TEI 49i Ozone Monitor
- ii. On the “Diagnostics Menu” Select **Pressure Screen**
- iii. Disconnect the Ambient input line from the back of the particulate filter holder and plug the opening with a plastic plug.

- iv. The pressure should decrease below 250 mm Hg within 1 minute or less.
- v. If pressure does not drop there is a leak. Remove Ambient Inlet plug fitting and check all fittings and check the input lines for cracks and correct as necessary
- vi. Repeat leak test. If fails. Contact ECB for assistance in correcting leaks.
- vii. If leak corrected and test is passed reattach the ambient input line to the sample input port.
- viii. Press Run and continue with filter conditioning.

Particulate Filter Ozone Conditioning Procedure Level 4 (225 ppb) Event

1. Begin by running a **SPAN** test (225 ppb)
2. **in Envidas VIEWER, select [Operational]**
3. Select [**Phase from Sequence**]
4. Select [**O3MAN**]
5. Select **SPAN**
6. Check duration to "**01:00:00**"
7. Hit **Start** (phase will show countdown and start at top of minute)
8. View progress of burn in **Viewer >> Dynamic>> Charts>> Ozone**

The Level 4 Span Event (225 ppb Ozone) will start and should run for at least **10** minutes to condition the particulate filter. (It may take longer to stabilize.)

When the Ozone Readings Meet the Acceptance Criteria (225 ppb +/- 5 ppb) and are Stable then record 5 x 1-minute average ozone concentrations in the elog book on the **Routine Filter tab**.

Note: If the readings do **not** stabilize at a level that meets the acceptance criteria, replace the Filter, leak check, and repeat. If second filter conditioning does not stabilize contact the ECB or PPB. At this point, an **Adjusted Calibration** may be merited and necessary!

To Stop the Level 4 Span Event (225 ppb) Event and Start the Level 0 (0 ppb) Event:

1. To end the Level 4 Event Hit the **Abort** key to stop the process

Note: the STOP key will only Pause the operation and would try to continue to run until that sequence was timed out (all have been preset to **1 hr** run time by default).

Particulate Filter Ozone Conditioning Zero Point Procedure (Record in **Routine filter tab** of elog book).

Begin by running a ZERO test (0 ppb)

1. in Envidas VIEWER, select [**Operational**].

2. Select [**Phase from Sequence**].
3. Select [**O3MAN**].
4. Select **ZERO**
5. Check duration to “01:00:00”.
6. Hit Start (phase will show countdown and start at top of minute)
7. View progress of burn in Viewer >> Dynamic >> Charts >> Ozone

When the Zero Point Ozone Readings Meet the Acceptance Criteria enter 5 x 1` minute concentrations into the elog book.

The ozone logbook will calculate the average for the values entered and compare the average values to the Acceptance Criteria. The Operator and the Logbook will evaluate the Filter Conditioning Data acceptability. The Filter Conditioning Acceptance Criteria are:

<u>iPS</u>	<u>O3</u>
0 ppb	0 ppb +/- 2 ppb
225 ppb	225 ppb +/- 5 ppb

If these **acceptance criteria** are **not** satisfied **it is recommended to discuss with PPB and ECB.**

If the Filter Conditioning **PASSES** the Acceptance Criteria the **flag/Channel must be reset, “Upped”** (brought back on line) to collect and report ambient air ozone concentration data.

“Up”/Enable the 49i Channel(s) Resetting the Maintenance flag

Once all data points have been tested and recorded for Calibration, then the operator will unflag/**Up (reset)** the channels

1. **Go to Viewer Dynamic tabular**
2. Right click the channel in the Tabular display
3. In the options box, select the **Set Channel Flag**
4. Select **Reset Flag** (at the top of the dropdown list)
5. The instrument status should now change to “**OK**”
6. The other marked channel(s) will follow suit as their respective average times is/are satisfied (i.e. 1 min., 5 min., and etc.)
7. The channel(s) is/are now up and the Particulate filter and Conditioning procedure is complete

2.7.3.8 ON-SITE OZONE MONITOR CALIBRATION CHECK

An On-Site Calibration Check is a MANDATORY ozone monitoring system performance evaluation when the ozone monitoring system **FAILS** the Daily Auto-PZS Check and Precision Point Analysis Data Acceptance Criteria. (There are of course exceptions to this rule and the cause of the failure would certainly be a determining factor as to the necessity of a Calibration; i.e. computer/software network failures may not merit Calibration). **This critical on-site performance evaluation requires the ozone monitoring system to be taken out of ambient air sampling analysis mode. This performance check must occur even if the ozone Forecast AQI is ≥ 70 . If possible, this critical performance check should occur as early in the day as possible to hopefully minimize the ozone monitoring data that will be lost during the middle part of the day when the higher levels of ozone concentrations generally occur. The main goal of this performance evaluation is to correct a performance problem that was identified during the Daily Auto-PZS Check and re-establish the high level of data confidence required for the ozone data to be reported.** If possible, it is also recommended that the 12 Minute Rule be followed to minimize potential lost hours of ozone data.

The Site Documentation and Inspection page of the Ozone Logbook must be thoroughly completed as part of the site visit to perform the On-Site Calibration Check. The On-Site Calibration Check Worksheet from the ozone logbook is included on page 58-59 of this procedure.

Log In to Site Computer

1. Log in to site computer with personal EADS Username and personal EADS Password (as necessary),
2. Log into Envidas **Viewer** and enter the Username and Password (operators personal Envidas)
3. Right click on the pollutant you will be working with, i.e. O3 and Set channel flag in the Drop down menu to “**Maintain**”, (Note: we use **Maintain** rather than **Calibrate** due to the fact that when we use **Calibrate** it can negatively impact the next day’s auto PZS check---this is a software issue!).
4. Specify duration (recommended at least 1 hr depending on site visit type),
5. Enter **Force Now** to activate.
6. Open elog
7. Document all relevant information on Documentation Tab including time(s), temperatures, type of visit, and etc.
8. Proceed to relevant site visit type Tab (i.e. **On-Site Ozone Calibration Check**)

Comment: If this calibration check is for any other purpose than a Season Opening, or malfunctioning equipment replacement, then some investigative work should be performed prior to performing the Calibration check. This could include visual inspection, leak check, etc. A filter change and Leak check should Always precede a Calibration.

Start the Level 4 (225 ppb) Calibration Check Point

1. Begin by running a **SPAN** test (225 ppb)
2. In Envidas VIEWER, select [**Operational**].
3. Select [**Phase from Sequence**].
4. Select [**O3MAN**].
5. Select **SPAN**
6. Check duration to “**01:00:00**”.
7. Hit **Start** (phase will show countdown and start at top of minute)
8. View progress of burn in Viewer >> Dynamic>> Charts>> Ozone

The Level 4 Span Event (225 ppb Ozone) will start and run until stability is observed.

When the Ozone Readings Stabilize Record 5 x 1 minute average ozone concentrations in the On-Site Calibration Check section of the Ozone Logbook.

To Stop the Level 4 Event and Start the Level 2 (65 ppb) Event:

To end the Level 4 Event (225 ppb) Hit the **Abort** key to stop the process

Note: the **STOP** key will only Pause the operation and would try to continue to run until that sequence was timed out (all have been preset to **1 hr** run time by default).

Start The Level 2 (65 ppb) Span Event.

1. Begin by running a **SPAN 2** test (65 ppb)
2. In Envidas **VIEWER**, select [**Operational**]
3. Select [**Phase from Sequence**].
4. Select [**O3MAN**].
5. Select **SPAN 2**
6. Check duration to “**01:00:00**”.
7. Hit **Start** (phase will show countdown and start at top of minute)
8. View progress in Viewer >> **Dynamic** >> **Charts** >> **Ozone**

The Level 2 Span Event (65 ppb Ozone) will start.

When the Level 2 Event Ozone Readings Stabilize Record 5 x 1 minute average ozone concentrations in the On-Site Calibration Check section of the Ozone Logbook.

To Stop the Level 2 (65 ppb) Event and Start the Zero Span Event:

To end the Level 2 Event (65 ppb) Hit the **Abort** key to stop the process

Note: the **STOP** key will **only Pause** the operation and would try to continue to run until that sequence was timed out (all have been preset to **1 hr** run time by default).

On-Site Calibration Check Zero Event Procedure

Run a ZERO test (0 ppb)

- 1.in Envidas VIEWER, select [**Operational**].
- 2.Select [**Phase from Sequence**].
- 3.Select [**O3MAN**].
- 4.Select ZERO
5. Check duration to “01:00:00”.
- 6.Hit Start (phase will show countdown and start at top of minute)
- 7.View progress of burn in Viewer >> Dynamic >> Charts >> Ozone

The Zero Span Event (0 ppb Ozone) will start and should stabilize for at least 10 minutes (some equipment may require additional time and and Operator patience to stabilize)

When the Zero Event Ozone Readings Stabilize, Record 5 x 1 minute average ozone concentrations in the On-Site Calibration Check section of the Ozone Logbook.

To end the Level 2 Event (65 ppb) Hit the **Abort** key to stop the process

Note: the **STOP** key will **only Pause** the operation and would try to continue to run until that sequence was timed out (all have been preset to **1 hr** run time by default).

The logbook will calculate the average for the values entered. The Operator and the Logbook will evaluate the average values with the Acceptance Criteria. The Acceptance Criteria are:

<u>iPS</u>	<u>O3</u>
0 ppb \leq +/- 2 ppb	iPS \leq +/- 2 ppb
65 ppb \leq +/- 2 ppb	iPS \leq +/- 2 ppb
225 ppb \leq +/- 2 ppb	iPS \leq +/- 5 ppb

The following On-Site Calibration Check Evaluations are performed by the Operator and recorded in the Ozone Logbook:

(1) Transfer Standard (49i-PS) Performance Evaluation

PASSES Acceptance Criteria. No additional action required

FAILS Acceptance Criteria. Contact PPB and ECB

The operator must contact the ECB and PPB. The operator must also review the performance of the ozone monitor. Under no circumstance should any adjustments to the ozone monitor be performed using the Transfer Standard that has failed acceptance criteria.

(2) Ozone Monitor (49i) Performance Evaluation

PASSES Acceptance Criteria. No additional action required

The operator should review when the particulate filter was last changed and conditioned. If the AQI forecast is < 70 and a new filter was installed and conditioned greater than 2 weeks before this check was performed and the operator's schedule and task allows the time to do so it is recommended that the operator perform a filter change and conditioning at the end of a passed On-Site Calibration Check and thus reduce the necessity of additional trips to the site.

FAILS Acceptance Criteria. Contact PPB and ECB* to get instructions on how to investigate the failure and potentially resolve during the site visit.

The operator must notify PPB and ECB. The Ozone Monitor must be Calibrated if and only if the onsite Transfer Standard has PASSED Data Acceptance Criteria.

If the onsite Transfer Standard has also failed data Acceptance Criteria a **Full Calibration** must not be performed.

If the Failure of the Ozone Monitor to Pass the Data Acceptance Criteria is believed to be due the simultaneous failure of the onsite Transfer Standard, the ozone monitor should be brought back on-line and continue to sample and analyze ambient air until the Failure of the Transfer Standard is Resolved. If the failure of the monitor is later determined to be independent of the Transfer Standard Failure the ozone data collected during this period will be invalidated.

NOTE: If the on-site Transfer Standard to FAILS Acceptance then a new Transfer Standard Unit will be brought to the ozone monitoring site. When the New Transfer Standard Unit arrives the operator should

1. **Perform an Unadjusted On-Site Calibration Check of the monitor**

2. Then **Perform a Calibration including a Particulate Filter Change, leak check, and Conditioning** immediately prior to performing the calibration.

Refer to page 12 if an Adjusted Calibration is required!

“Up” (unflag/reset) the 49i Channel(s)

Once all data points have been tested and recorded for the **On-Site Calibration Check**, then the operator will unflag/**Up** the channels

1. **Go to Viewer Dynamic tabular**
2. Right click the channel in the Tabular display
3. In the options box, select the **Set Channel Flag**
4. Select **Reset Flag** (at the top of the dropdown list)
5. The instrument status should now change to **“OK”**
6. The other marked channel(s) will follow suit as their respective average times is/are satisfied (i.e. 1 min., 5 min., and etc.)
7. The channel(s) is/are now up and the Calibration procedure is complete

2.7.3.9 OFFICE ACTUATED CALIBRATION CHECK

An **Office Actuated Calibration Check** can be a powerful tool to investigate and validate the performance of an ozone monitoring system. This procedure requires logging into the site computer from the office. This tool can provide additional information when a monitoring system evaluation report shows the system to be operating properly but additional data shows the system is not operating properly. One prime example is the results from the Daily Auto-Precision/Zero/Span (PZS) Check on Saturday morning during an electrical storm FAIL Data Acceptance Criteria but the data from the Daily Auto-PZS Checks on Sunday and Monday mornings PASS the Data Acceptance Criteria. A passing Office Actuated Calibration Check does not eliminate the necessity to continue to review this monitoring system to a higher degree than normal but it does reduce the urgency to immediately change work plans and visit the ozone monitoring site to investigate the performance of the ozone monitoring system when available performance data shows the system to be operating properly. **If the ozone monitoring system FAILS the Office Actuated Calibration Check it is MANDATORY that an On-Site Calibration Check be performed immediately.**

An important aspect of the Office Actuated Calibration Check is the documentation of this check in the Ozone Logbook. It is not possible to remotely provide all the documentation required during all other sites activities on the Documentation worksheet. It is required in the Office Actuated Calibration Check Worksheet that a detailed explanation is provided as to the purpose for performing this check. A significant amount of the Documentation information can be acquired remotely via IPort and taking control of the monitor and calibrator face plate(s).

This remote performance evaluation tool requires the ozone monitoring system to be taken out of ambient air sampling analysis mode. Prior to performing this check the operator is required to review the Air Quality Forecast and the Air Quality Index of the Forecast (AQI). If the air quality forecast is yellow with AQI>70 then this performance check should be delayed if possible because additional information is available which shows the ozone system to be operating with data acceptance criteria. This performance check should occur as early in the day as possible to hopefully minimize the ozone monitoring data that will be lost. If possible it is also recommended that the 12 Minute Rule be followed to minimize potential lost hours of ozone data.

Remote into the Site Computer(s) via the Regional Office Computer or VPN

1. Open Windows
2. Go to Remote Desktop Connection
3. Enter IP address for site modem
(A complete list is available on the “P” Drive under Ambient >> ECB >>Site Wireless Information >> use most current dated file and Address will start with **10.251.197.xxx**)
4. Enter site IP address and hit Enter and then Connect
5. Enter your credentials and
6. Select **Use Another Account**
5. Use **EADS** Log in information and **EADS** Password
6. Hit ‘OK’
Note: if a Warning Box appears, answer YES
7. A State of NC Box will appear and hit the OK button

You are now online with the site computer remotely

8. Log into Envidas Viewer and enter your Username and Password (operators personal)
9. Right click on the pollutant you will be observing (i.e. O3)
10. Set Channel Flag in the dropdown menu and pick “**Maintain**”
11. Specify a time duration (recommended **at least 1 hour** depending on estimated site visit activities)
12. Enter **Force Now** to activate
13. Open your elog and fill in as much information as obtainable from remote site

Note: at a minimum you will need **Documentation Page** and Remote- **Office Actuated Calibration Page(s)** to be recorded with explanation for Off-Site (Remote) check and rationale for visit (i.e. Bad Precision/Zero/Sspan checks, etc.)

14. Proceed to relevant site visit type (i.e. Remote-**Office Actuated Calibration Check**)

Start the Level 4 (225 ppb) Calibration Check Point.

Begin by running a SPAN test (225 ppb)

1. In Envidas **VIEWER**, select [**Operational**]
2. Select [**Phase from Sequence**]
3. Select **O3MAN**
4. Select **SPAN**
5. Set Duration to “**01:00:00**” (1 hr)
6. Hit **Start** (phase will display countdown and start at top of the next minute)
7. You can view the progress of Level 4 in *Viewer >> Dynamic >> Charts >> Ozone*

The Level 4 Span Event (225 ppb Ozone) will start and run until stability is observed (usually 10 min. or less)

When the Ozone Readings Stabilize Record 5 x 1 minute average ozone concentrations in the Remote-Office Actuated Calibration Check section of the Ozone Logbook.

To Stop the Level 4 Event and Start the Level 0 Event:

1. Hit the **Abort** key to Stop the process (level 4)

Note: The **STOP** key will only Pause the operation and would try to continue to run until that sequence was timed out (all have been preset to 1 hr run time by default); Hence use the **Abort** key to Stop!

2. Run a **ZERO** test (O ppb)
3. In Envidas **VIEWER**, select [Operational]
4. Select [Phase from Sequence]
5. Select **O3MAN**
6. Select **ZERO**

7. Set duration to “01:00:00” (1 hr)
8. Hit START (the ZERO phase will display countdown and start at the top of the next minute)
9. View progress of ZERO phase in *Viewer >> Dynamic >> Charts >> Ozone*

The Zero Span Event (0 ppb Ozone) will start and run until stability is observed (usually 10 min. or less)

When the Zero Event Ozone Readings Stabilize Record 5 x 1 minute average ozone concentrations in the Remote-Office Actuated Calibration Check section of the Ozone Logbook.

Hit the **Abort** key to stop the process.

The logbook will calculate the average for the values entered. The Operator should double check the values to confirm.

The Logbook will evaluate the average values with the Acceptance Criteria. The Acceptance Criteria are:

<u>iPS</u>	<u>O3</u>
0 ppb \leq +/- 2 ppb	iPS \leq +/- 2 ppb
225 ppb \leq +/- 2 ppb	iPS \leq +/- 5 ppb

The following Office Actuated Calibration Check Evaluations are performed by the Operator and recorded in the Ozone Logbook:

(1) Transfer Standard (49i-PS) Performance Evaluation

PASSES Acceptance Criteria. No additional action required

FAILS Acceptance Criteria. Contact PPB and ECB

The operator must contact the ECB and PPB. The operator must perform an On-site Calibration Check.

(2) Ozone Monitor (49i) Performance Evaluation

PASSES Acceptance Criteria. No additional action required

FAILS Acceptance Criteria. A Site Visit is Required

The operator must perform an On-Site Calibration Check

“Up” the 49i Channel(s): (reset Flag)

Once all data points have been tested and recorded for the **Office Actuated Calibration Check**, then the operator will **reset the flag/Up** the channels

1. **Go to Viewer Dynamic tabular**
2. Right click the channel in the Tabular display
3. In the options box, select the **Set Channel Flag**
4. Select **Reset Flag** (at the top of the dropdown list)
5. The instrument status should now change to “**OK**”
6. The other marked channel(s) will follow suit as their respective average times is/are satisfied (i.e. 1 min., 5 min., and etc.)
7. The channel(s) is/are now up and the **Office Actuated Calibration check** procedure is complete
8. Document the Check in the elog with as much information as possible to explain the rationale of the Office check
9. **Close** any open programs (i.e. Viewer, Reporter, etc.)
10. **Sign Out** by Starting Windows menu by **Right clicking on the ‘body shaped’ icon**, select **Sign out**, and this will take you back to the computer monitor screen.

2.7.3.10 OZONE LOGBOOK SUBMITTAL

The Ozone Logbook serves as the Transfer Record and Document for evaluating the Success/Failure of the operation of the ozone monitoring site and is the essential record for determining the quality of the ozone data reported from each site.

1. The **Site Operator** must complete the Ozone Logbook to document the purpose of **Every** site visit, the observations and findings during the site visit, and the evaluation of the performance of the ozone monitoring system for each site visit. This includes any and **all** startups and shutdowns (including severe weather events, power loss, temperature extremes, and etc.).
2. The Site Operator must submit the ozone logbook to the Regional Chemist or Designee for review and comment as soon as reasonably possible after the site visit and at a minimum by the end of each month. Additionally, a Site log **Documentation page** should be annotated with any site visit; i.e. shutting down for approaching weather, final calibrations for close out of season, season start-ups and shut downs, and etc. **All site visits** merit, at a minimum, the input and comments on the Documentation page. (If it is not documented, then we cannot conclude nor prove that anything happened!).

3. The **Regional Chemist** or Designee must review site operator monthly submitted ozone logbooks for each region and evaluate each logbook for completeness and operator adherence to operating procedures. The regional chemist must also consider and compare all ozone logbooks submitted for all ozone sites in the region and determine if a pattern of operation is negatively impacting the ozone sites in that region. Following that review the Regional Chemist **must** Initial and submit each the ozone logbook to the Projects and Procedures Branch Chemist for review.
 - A. The **Projects and Procedures Branch Chemist** must review the logbooks submitted by each region from all ozone sites for completeness and adherence to operating procedures. The Projects and Procedures Branch Chemist must also review the logbook submitted from each region and from all regions to determine if there is a procedures or pattern of operation that may be negatively impacting the overall operation of the ozone monitoring network and the quality of the ozone data reported.

2.7.3.11 DATA REPORTING AND VALIDATION BY REGIONAL OFFICE

Each month the Regional Operator and Chemist are required to Review and Validate the Hourly Ozone Concentration Data and the Precision Point Analysis Reports for each site. These electronic reports are provided by Envista software and reviewed by the Data Management and Statistical Analysis Branch. The review and validation are performed in the office based upon the results and documentation provided in the ozone logbook and supplemental Envista data retrieval as well. The most commonly utilized Standard EPA Qualifier and null codes are provided below. (Also, Refer to **RCO Guidance Documents** under the Documents section on NC DAQ's Ambient Monitoring [Sharepoint](#) page for more detailed instructions.

Ozone Data Invalidation Codes		
CODE	Description	Condition
AB	Personnel Unavailable	Pandemic Flu Situation, etc
AC	Construction/repairs in area	Building demolition, blasting, road construction, building construction, etc.
AD	Shelter Storm damage	Hurricane, High Winds, Rain, Lightning
AE	Shelter Temperature Outside of Limits	Bldg. Temperature outside of 20 - 30 °C
AJ	Filter Damage	Water in filter/sample line
AK	Filter Leak	Filter and or sample line leak
AN	Machine Malfunction	Pumps, Lamps, Solenoids, computer system failure, monitor failure, etc..
AP	Vandalism	Probe, Sampling line, Monitoring station Damage
AV	Power Failure	Power Failure
AW	Wildlife Damage	Insects build nest in probe, mice chew through power cord, etc.
AZ	Q C Audit	ECB or EPA Audit
BA	Miscellaneous Repairs	Unscheduled Maintenance including Troubleshooting
BB	Unable to Reach Site	Road Conditions or Order of Governor or Emergency Personnel
BC	Calibration	Calibration
BD	Onsite & Office Actuated Calibration Check	On Site Manual Calibration Check
BF	Daily Auto-Calibration Precision Check	Remote Precision Zero Span Check
BJ	Operator Error	Operator error, i.e., operator fails to return monitor to sample mode
SA	Storm Approaching	Site Shut down because of approaching Hurricane

The **Review the Monthly Ozone Hourly Concentration Data and the Precision Point Analysis Reports** at the Regional Office is a critical step that insures the highest quality data possible is reported from each ozone monitoring site. This Review and Validation includes but is not limited to the following:

1. The **Operator** (site technician) must investigate, correct as necessary, and detail the cause for all missing ozone hourly concentration data and any and all corrections proposed to the existing data reports. The **Operator** must also investigate, correct as necessary, and detail the cause for missing, and/or corrections made to the Precision Point Analysis Results Report including Precision Analysis Reported Results that do not meet Data Acceptance Criteria. Assistance shall be provided as requested by the Regional Chemist, the Projects and Procedures Branch Chemist, the Electronics and Calibration Branch Senior Electronics Specialist, and the staff of the Data Management and Statistical Services Branch. Thorough Documentation is essential for all activities.
2. The **Operator** (site technician) shall provide an explanation for **all** invalidated Ozone Data and Invalidated Precision Point Analysis Results. An AM (Miscellaneous Void) invalidation code will **no** longer be accepted by EPA as an Invalidation code. The Invalidation code must represent more compelling clarity of what the relevant issue was that occurred to necessarily invalidate any suspect data. The Envista software will stamp the relevant Operator that has reviewed and edited the data. In most cases the Data Invalidation Code will provide enough information but that is not true for all cases. In some instances, the site Operator will notify the Regional chemists and/or PPB chemists with more detailed explanations of anomalies or errors. The Operator then submits these Reviewed reports to the Regional Chemist for Review and Approval.
3. The **Regional Chemist** must investigate any and all loss of hourly ozone data and missing or failed Precision Point Analysis Results. The **Regional Chemist** must provide any further explanation or clarification as they deem necessary to detail the cause for any lost ozone data

from each ozone monitoring site in the respective region. The **Regional Chemist is also charged** with evaluation of data from each ozone site operated in the region and determining if a similar pattern of missing data and/failures is occurring. Each observed pattern must be investigated further by the Regional Chemist. Assistance shall be provided as requested by the Regional Operator, the Projects and Procedures Branch Chemist, the Electronics and Calibration Branch Senior Electronics Specialist, and the staff of the Data Management and Statistical Services Branch.

4. The **Regional Chemist** submits the **Initialed and Dated** reviewed reports to Envista (Level 2) and subsequently the Projects and Procedures Branch Chemists will review (Final Review) for Approval.
5. The **Projects and Procedures Branch Chemist** must investigate any and all loss of hourly ozone data and missing or failed Precision Point Analysis Results. The **Projects and Procedures Branch Chemist** must provide any further explanation or clarification as they deem necessary to detail the cause for any and all lost ozone data for each ozone monitoring site. The Projects and Procedures Branch Chemist is also charged with the evaluation of the ozone data reports from the entire Ozone Monitoring Network. The Projects and Procedures Branch Chemist must evaluate the data from all monitors to determine if similar patterns in Lost Data, Invalidated Data, and data failing to meet Data Acceptance Criteria exist. Assistance **must** be provided as requested by the Regional Operator, the Regional Chemist, the Electronics and Calibration Branch Senior Electronics Specialist, and the staff of the Data Management and Statistical Services Branch.
6. The **Projects and Procedures Branch Chemist** submits the Reviewed Monthly Ozone Concentration Data and Precision Point Analysis Reports **Level 3** final approval to the Data Management and Statistical Analysis Branch. These Reviewed and Approved Reports serve as the basis and required documentation to make changes to the existing ozone hourly concentration reports and Precision Point Analysis Reports that are provided as required to the EPA and submitted to AQS.

A summary Table of the Ozone Monitoring System Performance Acceptance Criteria is included on Page 46---**Site Activities**.

NC Ambient Air Ozone Monitoring Logbook

The Ozone Monitoring Logbook is "The Essential Record" that documents the performance of the ozone monitoring system and all site operator activities. The logbook is the Critical Document and the adherence to approved procedures and the evaluation of the quality of the ambient air ozone data reported from each site.

The "Site Operator" must accurately complete this REQUIRED site documentation for All Ozone Site Activities. A NEW LOGBOOK must be completed to document ALL Activities to maintain a continuous site evaluation and instrument performance record that is necessary to ensure that only the highest quality possible ozone data is reported.

1	<p>Site Documentation - This Site Documentation section of the Ozone Logbook serves as the REQUIRED permanent record of the instrumentation installed at each site and <u>must be completed during each site activity</u>. This log serves as a RECORD for all Site Visits, Site Inspections, Shelter Temperatures, site operator activities, and instrument performance.</p> <p>Inspecting the Sample Probe and Lines. This is to insure the sample line is unobstructed and the ozone measured is not artificially reduced due to the contamination with water and or particulate matter.</p> <p>Solar Radiation Sensor Inspection (if applicable). A solar radiation sensor should be installed at all ozone sites and should be inspected and documented as best possible during each site visit. Any issues such as misalignment, detachment, sensor face dirty, or cleaning activities should be reported to ECB and PPB</p> <p>Lamp Intensity Recording Lamp Intensity provides a record which may show impending lamp failure</p> <p>Record the Monitor Sample Cell Flow Rates to document and evaluate the sampling pump performance. The required sample residence time is less than 20 seconds. The documentation of the sample residence time in the Teflon sampling line is part of the ozone Monitor documentation procedures. If the sampling pump fails the flow rate evaluation an On-Site Calibration Check should be performed and the ECB should be notified.</p> <p>Regenerative Zero Air Supply The Pressure Gauge should read 20- 30 psi and the Dew Point Sensor Light should be "Green"</p> <p>*** Computer and Data Acquisition System (DAS) time are set to Eastern Standard Time in agreement to NIST tracability. This must be verified during each site visit and adjusted as necessary. Can verify at time.nist.gov. Additionally, you must record the 49i time display at each site visit, and the HOBO relaunch time when performed (required 1/mo).</p> <p>*** Battery Back-Up (UPS) Charged to at least 50% Yes NO (call ECB for replacement)</p> <p>*** Site Temperature must be checked and Documented in the Documentation tab. The primary standard is the NIST traceable Mineral thermometer and the serial number and certification date must be recorded. The HOBO (back-up) temperature should also be recorded as well as the main monitoring computer displayed on the computer--The Comet temperature.</p> <p>Comment Section of the Site Documentation - This section of the site documentation is used to address all problems, failures, changes in site instrumentation and support equipment, site security issues, site power problems, pest and insects, changes in activities adjacent to the site, monitoring building integrity problems (leaks, door misalignment, etc.). This section should document first observation of any and all problems and activities that continue to be not corrected or have the potential impact our ability to accurately measure ambient air ozone in a safe and efficient manner. The section should also serve as documentation of notification to the Ambient Air Monitoring Section of said problems or activities and as documentation of all assistance received.</p>
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2	<p>Calibration. The Initial Calibration performed prior to March 1st establishes the starting point for all ambient air ozone data collected each year at each site. Throughout the year if the site monitor fails an On-site Calibration Check the system is considered to be "out of control" and a new Calibration of the Ozone Monitor is required to bring the system back within acceptable control limits. A new Particulate Filter must be installed and conditioned in the ambient air sampling line prior to performing a Calibration. In addition, if the monitor is replaced, if the site Transfer Standard is replaced, or if major maintenance is performed, a Calibration must be performed to re-establish the data link between each site and the North Carolina Standard Reference Photometer. Maintenance items requiring the performance of a Calibration include cell cleaning, solenoid changes, pump changes, lamp changes, etc. <u>The comments section of the Calibration Log should be used to document all problems or difficulties and in calibrating the on-site ozone monitor.</u> If unsure about the Calibration Requirement contact Joette Steger at (919) 707-8460 or Jeff Gobel (919) 707-8457 of the Projects and Procedure Branch or the assigned PPB chemist or contact Jake Eagle, Derrick House, or James Olcott at the Electronics Calibration Branch at 919-715-1761</p>
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	<p><u>Comments Section of the Calibration Log</u> should be used to document any and all problems or difficulties encountered in calibrating the on-site ozone monitor and if possible any resolution of those problems. This record can serve as a valuable record in data validation issues and in the resolution of future problems.</p>
<p>3</p>	<p><u>Daily Auto-Calibration Check</u> is the ongoing ozone monitoring system performance evaluation tool. Each day the ozone monitor is challenged with three known ozone concentrations (0, 65, and 225 ppb ozone). The daily performance of the ozone monitor and the on-site transfer standard must be evaluated versus the Data Acceptance Criteria Limits. The failure of the ozone monitoring system to meet the acceptance criteria requires immediate action on the part of the site operator to ensure that the most accurate ozone data possible is produced at his or her assigned ozone monitoring site. The Daily Auto-Cal tab of this workbook provides guidance.</p>
<p>4</p>	<p><u>Changing and Conditioning of New Particulate Filters</u>. This protects the monitor and insures that a clean sample is being analyzed. The Routine changing and conditioning of the particulate filter is a stand alone ongoing activity through out the season. Filter Change and Conditioning is required immediately prior to every Calibration and is required every 30 days in normal operation. The Filter Conditioning Step is no longer time based but instead as soon as the readings meet the criteria and are stable the operator is to record 5 x 1 minute readings and end the conditioning step.</p> <p><u>Leak Testing</u>. This is required following all filter changes to insure the ambient air sample is not being diluted with "room air" from inside the monitoring shelter. The system must pass the leak test for the system performance to be considered acceptable. It is highly recommended to leak check both pre and post activity at the sites.</p>
<p>5</p>	<p><u>On-Site Calibration Check</u> is the required on-site operator evaluation of the ozone monitoring system when the system FAILS the Daily Auto-Calibration Check Analysis. This on-site operator evaluation of the instrument performance is a powerful tool to ensure the highest quality ozone data possible is being produced.</p>
	<p><u>Comments Section of the On-Site Calibration Check</u> should be used to document all problems or difficulties encountered in checking the performance of the site specific ozone monitoring system and if possible any resolution of found problems. This record can serve as a valuable record in data validation issues and in the resolution of future problems.</p>
<p>6</p>	<p><u>Office Actuated Calibration Check</u> is an optional tool to evaluate the ozone monitoring system performance remotely when the operator believes the system is meeting data quality acceptance criteria but because of an operational anomaly the data has become questionable. An example of such is the situation where a power interruption may have occurred during the Daily Auto-Calibration Check Cycle because of an electrical storm. Another example is the system PASSES the Saturday Morning Auto-Calibration Check, FAILS the Sunday Morning Calibration Check, and then PASSES the Monday Morning Calibration Check. During these operational situations it may be more prudent to perform an Office Actuated Calibration Check to confirm the monitoring system is operating properly if no additional evidence indicates the system is producing unacceptable data. It is the regional office operator's option to utilize this evaluation tool based upon their first hand knowledge of the ongoing performance of the site specific ozone monitoring system. <u>If the monitoring system FAILS the Office Actuated Calibration Check a site visit is required to correct the monitoring system performance failure.</u></p>
	<p><u>Comments Section of the Office Actuated Calibration Check</u> is critical to document the ongoing ozone system performance, the situation leading to the utilization of this evaluation tool, and the findings from this test. The completion of the Site Documentation Section is not possible during this remote performance evaluation test. In all cases the Regional Chemist the Projects and Procedures Branch Chemist, and the staff at ECB will assist as necessary.</p>

7	<p><u>Closing Auto-Calibration Check</u> The November 1st Daily Auto-Calibration Check serves as the ozone monitoring season yearly final systems performance evaluation. If the November 1st Daily-Auto-Calibration Check is unavailable an On-Site Calibration Check should be performed when the Daily Auto-Cal Check does not run properly for two days. This critical Check provides the closing bracket for all data collected during the year.</p>
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8	<p>Ozone Logbook</p>	<p>The Completed Ozone Logbook shall be submitted 15 days after the end of each month of operation to become part of the Permanent Site Record. The log book for each site shall be Reviewed by the Regional Chemist and Transferred to the Ambient Monitoring Central Data Storage "P Drive" of the central office computer for Review.</p>
	<p>Review and Submittal</p>	

NOTE: As an aid in the review of the ozone log book a summary of the performance of the Site Transfer Standard, and the Ozone Monitor have been added to the bottom of the Calibration, the on-site Calibration Check, the Filter Conditioning, and the office actuated Cal Check Worksheets.

Additional Instructions

A	<p>No monitor checks that interrupt the collection of ambient air ozone data are to be performed during periods of elevated or forecasted Air Quality Code Yellow or Orange or Red with AQI > 65 unless these activities are in response to any Failure of Data Acceptance Criteria</p> <p>The Ambient Air Ozone Concentration must be recorded on the Site Documentation Page. Activities that require taking the ozone monitor off-line at ambient air ozone concentrations of 60 ppb and above have the potential for creating a Falsely High 8-Hr average ozone concentration and even an Exceedance</p> <p style="text-align: center;">NOTE - Unless these activities are to address any Failure of Data Acceptance Criteria.</p>
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B	<p>Failure of the Site Transfer Standard and/or Monitor to meet the Data Acceptance Criteria</p>
1	<p>All Data Acceptance Criteria Failures must be reported to Jake Eagle, Derrick House and/or James Olcott at the ECB and the PPB as they occur if possible or As Soon As Possible.</p>
2	<p>All Ozone Logbooks documenting the "Failure of Data Acceptance Criteria" must be sent to the Projects and Procedures Branch Chemist assigned to evaluate ozone monitoring system performance</p>

C	<p>Ozone Sites that Operate Year Round - The ozone monitoring sites that operate year round require special considerations and procedural adaptations. Each year NDAQ recertifies the Site Transfer Standard to establish direct traceability to the NC Standard Ozone Photometer. The site Transfer Standard is used to calibrate the site ozone monitor. To accomplish this recertification of the Site Transfer Standard and Zero Air Supply the following special procedures must be followed to ensure quality data is collected and minimize the lost of data.</p>
1	<p>Prior to the removal of Site Transfer Standard and Zero Air Supply for Recertification an On-Site Calibration Check must be performed on the site ozone monitor. If the site monitor Failed the immediately Prior Daily Auto-Calibration Check. Then if the Monitor passes the On-Site Calibration Check Acceptance Criteria the site Transfer Standard and Zero Air Supply may be removed for re-certification. If the monitor fails the On-Site Calibration Check the Monitor must be recalibrated. If the monitor passes calibration the site Transfer Standard and Zero Air Supply can be removed for recertification.</p>
2	<p>When the recertified Transfer Standard and Zero Air Supply are reinstalled at the site the site operator should first run a On-Site Calibration Check on the site monitor. If the site monitor passes the Calibration Check the operator should then calibrate the site monitor with the recertified Site Transfer Standard and Zero Air Supply to establish the direct link to the NC Standard Ozone Photometer. If the site monitor does not pass the On-Site Calibration Check with the recertified Site Transfer Standard and Zero Air Supply contact Joette Steger at (919-707-*8460) before proceeding with the calibration of the site monitor.</p>

Contacts

Projects and Procedures Branch

Joette Steger 919-707-8460

Jeff Gobel 919-707-8457

Electronics and Calibration Branch

Derrick House 919-715-1761
919-715-1761

James Olcott 919-715-1761

Version 3.45 2019	
<u>Air Quality Forecast Rule</u>	
<u>AIR QUALITY FORECAST RULE</u>	If the AQI Forecast for Ozone in the Region that most closely represents the ozone monitoring site is Code Yellow AQI > 65 , then all site activities that require the ozone monitor to be taken out of the ambient air sampling mode should be postponed until the Air Quality Forecast is AQI is Less Than 65 .
AIR QUALITY FORECAST RULE EXCEPTION	If the ozone monitor has Failed the Daily Auto- Precision/Zero/Span Check, the performance of the ozone monitor must be immediately evaluated by the operator to ensure instrument performance is within the established data Acceptance Criteria. This includes all actions and evaluations necessary to return the ozone monitoring instrumentation and equipment performance to within performance Acceptance Criteria regardless of the Air Quality Forecast.
9:12 am Rule	It is highly recommended that site activities which require the ozone monitor to be taken out of the ambient air sampling mode be completed before 9:12 am. This specifically applies to Filter Change & Conditioning activities which is other most frequent reason for the ozone monitoring system to be taken off line. Loss of a reported 1 hour average ozone concentration can result in a falsely high 8-hour average concentration and even an Exceedance.
9:12 am Rule Exception	The <u>Mountain Top Sites</u> are exempt from the 9:12 am rule. Site operators should whenever possible utilize the last 12 min of an hour and the first 12 min of the following hour to minimize the loss of acceptable hourly data values
12 Minute Rule	Site activities requiring the ozone monitor to be taken out of the sampling mode can be performed during the last 15 minutes of an hour up to and including the first 15 minutes of the following hour without the invalidation of the ozone hourly averages for either hour. Fifteen (15) minutes is the absolute maximum hourly reduction allowable per the EPA 75% complete rule. A max of 30 minutes is available to take the ozone monitor offline without a reduction in reported hourly ozone concentrations. It is recommended that the operator attempt to accomplish all task from the period of 12 minutes before and after the hour (24 minutes). For example -- If a filter is being changed and conditioned and the monitor is taken offline at 7:48 and the filter change and conditioning procedure is completed and the monitor is returned to sampling ambient air at 8:12 <u>both</u> the 7:00 or 8:00 hourly values are valid.

Version 3.45 2019

NC Ambient Air Ozone Monitoring Logbook

Ozone Site Operation Activities	<ol style="list-style-type: none"> 1. Installation of Equipment and Instrumentation by ECB prior to March 1st. 2. Site Documentation and Site Inspection during each site visit. 3. Initial Calibration of the O3 Monitor Prior to start of ozone monitoring season. 4. Office Actuated Calibration Check to investigate performance issues remotely. 5. On-Site Calibration Check is performed when Daily Auto P/Z/S-Check Fails
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Site Activities

O3 Monitor Calibrations	<p>Performed prior to the start of the ozone monitoring season, following All Failed On-Site Calibration Checks, and if the Transfer Standard, O3 Monitor, or the Regenerative Zero Air Supply, and any of their respective system components are repaired or replaced.</p>																	
	<p>Required following all significant maintenance to either the O3 Monitor, the Transfer Standard, the Zero Air Supply or the tubing connecting these instruments. Examples of significant maintenance include the replacement of pumps, scrubbers, temperature or pressure sensors, filter holders, Teflon tubing, cell cleanings, lamp replacements, solenoid valves, detectors, flow transducers, ozone lamps, etc. Contact PPB and ECB when any and all repairs are performed and for guidance to protect data quality.</p>																	
	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">Theoretical Ozone Concentration</td></tr> <tr><td style="text-align: center;">0 ppb</td></tr> <tr style="background-color: yellow;"><td style="text-align: center;">65 ppb</td></tr> <tr><td style="text-align: center;">120 ppb</td></tr> <tr><td style="text-align: center;">225 ppb</td></tr> </table>	Theoretical Ozone Concentration	0 ppb	65 ppb	120 ppb	225 ppb	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">Site Transfer Standard Acceptance Criteria</td></tr> <tr><td style="text-align: center;">0 ppb +/- 2.0 ppb</td></tr> <tr style="background-color: yellow;"><td style="text-align: center;">65 ppb +/- 2.0 ppb</td></tr> <tr><td style="text-align: center;">120 ppb +/- 2.0 ppb</td></tr> <tr><td style="text-align: center;">225 ppb +/- 2.0 ppb</td></tr> </table>	Site Transfer Standard Acceptance Criteria	0 ppb +/- 2.0 ppb	65 ppb +/- 2.0 ppb	120 ppb +/- 2.0 ppb	225 ppb +/- 2.0 ppb	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td style="text-align: center;">Site Ozone Monitor Acceptance Criteria</td></tr> <tr><td style="text-align: center;">Transfer Std +/- 2 ppb</td></tr> <tr style="background-color: yellow;"><td style="text-align: center;">Transfer Std +/- 2 ppb</td></tr> <tr><td style="text-align: center;">Transfer Std +/- 2 ppb</td></tr> <tr><td style="text-align: center;">Transfer Std +/- 2 ppb</td></tr> </table>	Site Ozone Monitor Acceptance Criteria	Transfer Std +/- 2 ppb	Transfer Std +/- 2 ppb	Transfer Std +/- 2 ppb	Transfer Std +/- 2 ppb
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PASS	The O3 Monitor and the Transfer Standard PASS Data Acceptance Criteria																	
Action	The O3 Monitor can begin sampling and reporting ambient air Ozone Conc.																	
FAIL	O3 Monitor FAILS and the Transfer Standard PASS Calibration Acceptance Criteria																	
Action	Check all calibration tubing connections and Repeat Entire Calibration Procedure including the change and conditioning of a new particulate filter																	
FAIL	O3 Monitor FAILS and the Transfer Standard PASS the 2nd Calibration																	
Action	Notify Region Chemist, ECB, and PPB Do not place or return the ozone Monitor to sampling ambient air mode																	
FAIL	Transfer Standard FAILS and the O3 Monitor PASS Calibration																	
Action	Notify ECB and PPB and make no adjustments to the O3 Monitor																	
Action	Do not Place the O3 Monitor in the Sampling mode																	
Action	If the calibration was being performed because Transfer Standard or Zero air supply were replaced or repaired and there have been NO adjustments made to the O3 Monitor settings then the O3 Monitor can be placed in the Ambient Air Sampling Mode and report ambient air ozone for later data review.																	

Particulate Filter Changes	Particulate Filter Change - Calibration			
	A NEW particulate filter must be installed in the filter holder, a leak check must be performed, and the filter must be Conditioned immediately prior to all O3 Monitor Calibrations.			
	PASS	Action	Proceed with Calibration	
	FAIL	Action	Check the tubing and fittings for Leaks and Install and Condition a 2nd Filter	
		PASS	Action	2nd Filter Conditioning PASSES Proceed with Calibration
		FAIL	Action	2nd Filter conditioning FAILS Contact ECB and PPB before proceeding
	Particulate Filter Change - Routine			
	Routine Particulate Filter Change and Conditioning every 30 Days or less is a key component of the ongoing efforts to protect the quality of ozone data being reported and to protect the instrumentation from contamination.			
	If the <u>Routine Particulate Filter change and conditioning is scheduled</u> when the Air Quality Forecast is Yellow and AQI > 65 and the Daily Auto-Calibration Check is has Passed all Acceptance Criteria the routine particulate filter change and conditioning should be postponed until the Air Quality Forecast is Code Green or Yellow with AQI < 65 . This is referred to as the <u>Air Quality Forecast Rule</u> (see below). If necessary, due to scheduling difficulties and additional regional responsibilities the operator may arrange to have another staff member to change the filter when the forecast improves. <u>The routine particulate filter conditioning is performance based. As soon as the filter conditioning values satisfy conditioning acceptance</u>			
	<u>9:12 Rule</u> The operator whenever possible is encouraged to use the 9:12 Rule whenever performing a Routine Filter Change and conditioning. (see below). This will minimize the loss of valid ozone data which can lead to a false high 8-hour average			
	PASS	Action	Return the O3 Monitor to the sampling air mode	
	FAIL	Action	Check the tubing and fittings for Leaks and Install and Condition a 2nd Filter	
	PASS	Action	2nd Filter Conditioning PASSES return the O3 Monitor to sampling mode	
	FAIL	Action	2nd Filter conditioning FAILS Contact ECB and PPB before proceeding	

Daily Auto P/Z/S Check	This daily performance evaluation challenges the O3 Monitor at 3 ozone concentration levels (0 ppb, 65 ppb, 225 ppb ozone) generated by the site specific Ozone Transfer Standard. The Daily 65 ppb ozone analysis results serve as the EPA REQUIRED One-Point Quality Assurance Check and is submitted to the EPA as the Precision Point Analysis. The results from this powerful tool must be evaluated early each morning.	
	Daily Auto-Precision/Zero/Span Check Data Acceptance Criteria	
	Site Transfer Standard	Site Ozone Monitor
	0 ppb +/- 2 ppb	Transfer Std +/- 3 ppb
	65 ppb +/- 2 ppb	Transfer Std +/- 3 ppb
	225 ppb +/- 2 ppb	Transfer Std +/- 5 ppb
<u>PASS</u>	O3 Monitor and the Transfer Standard PASS Acceptance Criteria	
Action	No Additional Action is required and the Precision Point is reported	
<u>FAIL</u>	O3 Monitor and/or Transfer Standard FAIL Acceptance criteria	
Action	A Site Visit is Required to perform a On-Site Calibration Check	

Ozone Shelter Temperature	The monitoring site is REQUIRED to be maintained between 5 - 40⁰ C during all site operations including all Calibrations, Daily Auto-Calibration Checks, On-Site Calibration Checks, and daily ozone concentration measurements.		
	NOTE	All data collected and calibration checks performed at temperatures outside of the EPA Required temperature range must be Invalidated.	
	<u>PASS</u>	Shelter Temperature between 5- 40 ⁰ C	
	Action	No Action Required	
	<u>FAIL</u>	Shelter Temperature is Outside of the 5 - 40⁰ C Range	
	Action	The shelter temperature must be immediately adjusted to maintain the site temp between 5 - 40 ⁰ C to reduce the amount of data that will be invalidated due to the temperature not meeting acceptance criteria.	

Required when the Daily Auto-Cal Check Fails to meet Acceptance Criteria. The onsite performance evaluation is performed at the 0 ppb, 65 ppb, and the 225 ppb ozone.												
<table border="1" style="margin: auto;"> <thead> <tr> <th colspan="2">On-Site Calibration Check Data Acceptance Criteria</th> </tr> </thead> <tbody> <tr> <td style="width: 50%;">Site Transfer Standard</td> <td style="width: 50%;">Site Ozone Monitor</td> </tr> <tr> <td>0 ppb +/- 2 ppb</td> <td>Transfer Std +/- 2 ppb</td> </tr> <tr> <td style="background-color: yellow;">65 ppb +/- 2 ppb</td> <td>Transfer Std +/- 3 ppb</td> </tr> <tr> <td>225 ppb +/- 2 ppb</td> <td>Transfer Std +/- 5 ppb</td> </tr> </tbody> </table>			On-Site Calibration Check Data Acceptance Criteria		Site Transfer Standard	Site Ozone Monitor	0 ppb +/- 2 ppb	Transfer Std +/- 2 ppb	65 ppb +/- 2 ppb	Transfer Std +/- 3 ppb	225 ppb +/- 2 ppb	Transfer Std +/- 5 ppb
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Site Transfer Standard	Site Ozone Monitor											
0 ppb +/- 2 ppb	Transfer Std +/- 2 ppb											
65 ppb +/- 2 ppb	Transfer Std +/- 3 ppb											
225 ppb +/- 2 ppb	Transfer Std +/- 5 ppb											
<u>PASS</u>	O3 Monitor and Transfer Standard both <u>PASS</u>											
	Action	No hourly ozone data is invalidated. The Auto-Calibration Data not Reported										
	Action	Return the O3 Monitor to sampling ambient air.										
<u>FAIL</u>	<u>O3 Monitor FAIL</u> and the Transfer Standard <u>PASS</u> after a Failed Daily Auto-Cal											
	Action	Ozone data back to the most recent PASSED Auto-Cal Check, On-site Cal-Check, Calibration, or Performance Audit is Invalidated										
	Action	The Failed auto calibration check data is not reported because impacted data has been invalidated.										
	Action	The ozone monitor must be recalibrated										
<u>FAIL</u>	<u>Transfer Standard FAIL</u> and O3 Monitor <u>PASS</u> following a Failed Auto-Cal Check											
	Action	No data is invalidated. The Auto-Calibration Data not Reported										
	Action	Return the O3 Monitor to sampling ambient air.										
	Action	The Transfer Standard must be Replaced (Notify Regional Chemist, ECB, & PPB)										
	Action	Perform an On-site Calibration Check on the site Ozone Monitor with the replacement Transfer Standard before calibrating the ozone monitor										
	Action	Calibrate with Site Ozone Monitor with the Replacement Transfer Standard										
<u>FAIL</u>	<u>O3 Monitor and Transfer Standard</u> (Both FAIL)											
	Action	Ozone data back to the most recent PASSED Auto-Cal Check, On-site Cal-Check, Calibration, or Performance Audit is Invalidated										
	Action	Contact ECB and Do Not return the Ozone Monitor to sampling ambient air										

**On-Site
Calibration
Check**

Office Actuated Calibration Check	<p>Staff may actuate a Calibration Check at an ozone monitoring site from the office to investigate a performance problem that may be due to a power failure or other anomaly when existing additional data indicates that the ozone monitoring system is operating within acceptable criteria. The performance evaluation data from this quality assurance check is recorded in the Office Actuated Calibration Check section of the Logbook. A detailed explanation of observed problem and findings must be provided in the comment section.</p>									
	<p>NOTE: If the system <u>Did Not FAIL Any Data Acceptance Criteria</u> and the AQI Forecast is ≥ 65 and the Ambient Air Ozone concentration is > 60 ppb then the Office Actuated Calibration Check should not be performed and the system performance should be closely monitored.</p>									
	<table border="1"> <tr> <th colspan="2">Office Actuated Calibration Check Data Acceptance Criteria</th> </tr> <tr> <td style="text-align: center;">Site Transfer</td> <td style="text-align: center;">Site Ozone Monitor</td> </tr> <tr> <td style="text-align: center;">0 ppb +/- 2 ppb</td> <td style="text-align: center;">Transfer Std +/- 2 ppb</td> </tr> <tr> <td style="text-align: center;">225 ppb +/- 3 ppb</td> <td style="text-align: center;">Transfer Std +/- 5 ppb</td> </tr> </table>		Office Actuated Calibration Check Data Acceptance Criteria		Site Transfer	Site Ozone Monitor	0 ppb +/- 2 ppb	Transfer Std +/- 2 ppb	225 ppb +/- 3 ppb	Transfer Std +/- 5 ppb
	Office Actuated Calibration Check Data Acceptance Criteria									
	Site Transfer	Site Ozone Monitor								
0 ppb +/- 2 ppb	Transfer Std +/- 2 ppb									
225 ppb +/- 3 ppb	Transfer Std +/- 5 ppb									
PASS	<p>If the O3 Monitor and the Transfer Standard PASS</p>									
Action	<p>No further action is required.</p>									

Ozone Site Inspections	<p>Site inspections are a valuable performance quality tool and must be thorough and performed during each site visit. Additional site visits solely to perform a site inspection can be beneficial and should occur as the operator determines is necessary to ensure and protect reported data quality. Additional site inspections can be site dependent if the operator is tracking a specific issue in the equipment or activities at an ozone site.</p>
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Please review the Flow Chart Of Activities Tab of this Log Book.
If you have any question please contact the Projects and Procedures Branch

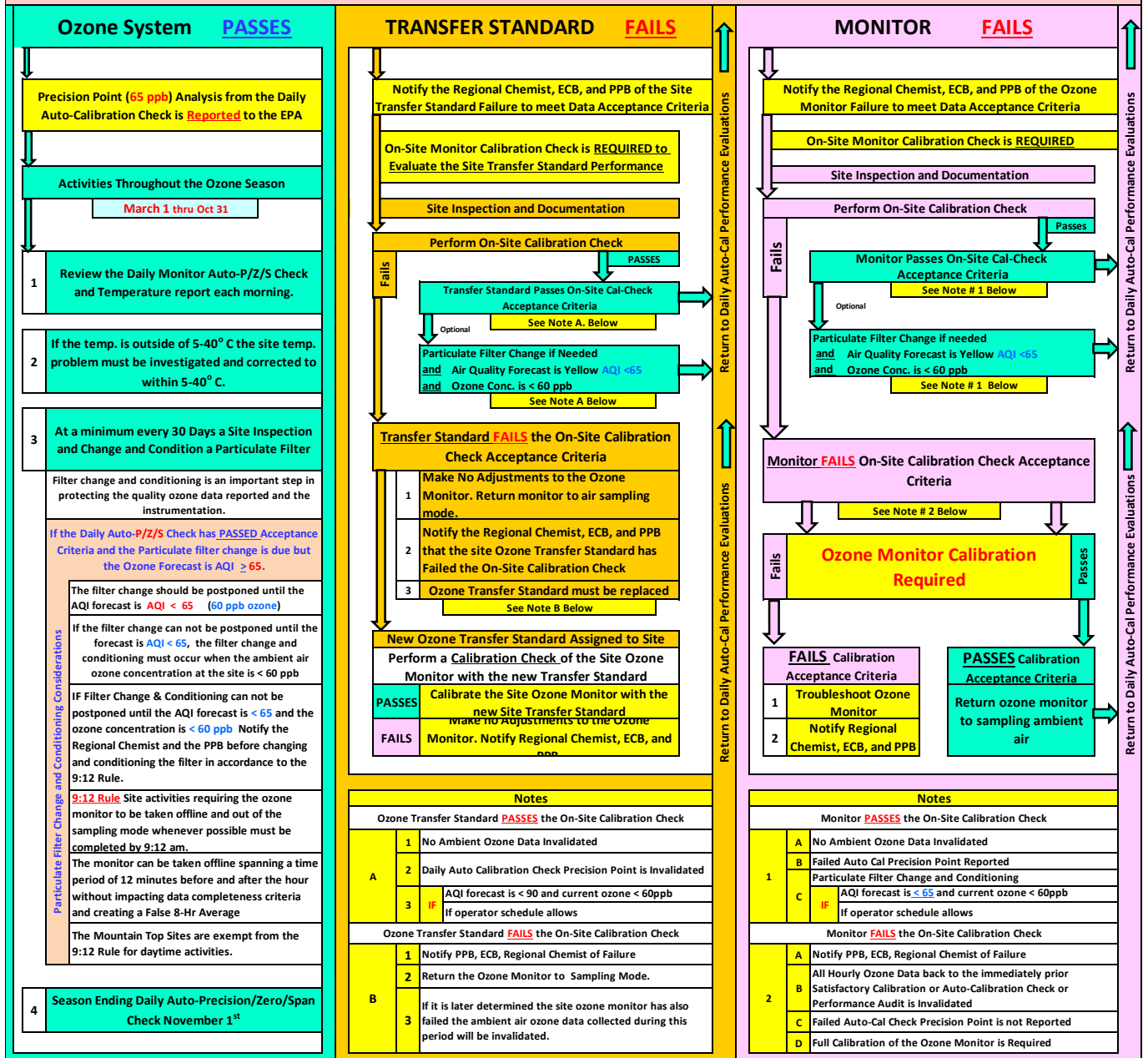
<u>Projects and Procedures Branch</u>	Joette Steger 919-707-8460
	Jeff Gobel 919-707-8457
<u>Electronics and Calibration Branch</u>	919-715-1761
	Derrick House 919-715-1761
	James Olcott 919-715-1761

Version 3.45 2019

Daily Auto-Precision/Zero/Span (P/Z/S) Check and Precision Point Analysis Evaluation

<p>The Daily Ozone Auto-P/Z/S Check is the day-to-day performance metric for the Ozone Monitoring System. The Ozone Monitor is challenged daily with 3 concentrations (0 ppb, 65 ppb, and 225 ppb) of ozone generated by the Ozone Transfer Standard. The Transfer Standard has Acceptance Criteria compared to expected concentration values and the Ozone Monitor values are compared to the Transfer Standard Values.</p>	Site Transfer Standard	Site Ozone Monitor
	0 ppb +/- ≤ 2 ppb	Site Transfer (0 ppb) Value +/- ≤ 3 ppb
	65 ppb +/- ≤ 2 ppb	Site Transfer (65 ppb) Value +/- ≤ 3 ppb
	225 ppb +/- ≤ 2 ppb	Site Transfer (225 ppb) Value +/- ≤ 5 ppb

Daily Auto-Calibration Performance Evaluation and Activity Flow Chart



Ozone Monitoring Site Documentation				Version 3.45	2019
Must Be Completed First to Document Each Site Activity				Site Activity Purpose	
Date	3/1/2019	Note: Restart Computer Once per Month!		Calibration	Y/N
		YES	<input type="checkbox"/>	Filter Conditioning	Y/N
		NO	<input type="checkbox"/>	On-Site Cal Check	Y/N
Site	abc123			Site Temperature	Y/N
				Office Actuated Cal-Check	Y/N
				Site Inspection	Y/N
				Other	
Operator				Documentation for Office Actuated Calibration Check is limited to Items #1 and # 2 Below.	
jon doe					
1	Site Temperature	Site	21.0	Proceed with Site Activities	
		DAS Temperature			
	NIST Temperature (mineral)	20.1	HOBO Temp. 20.4	Note: check HOBO Temperature before plugging it into computer, it can misread higher temps. once the HOBO is plugged into computer.	
	Serial #	Site temp. must be 5-40°C for Ozone Data, Calibrations, and Checks to be Valid			
	Expiration	mm/dd/yy			
2	Record Ambient Air Ozone Conc. Ppb	45.0		Proceed with Site Activities. If the Monitor is to be taken out of sampling mode it is recommended that the 9:12 Rule be used	
	Prior to Downing Data Collection Channels and the Start of All Site Activities				
	49i Time	8:44	NIST	8:43	DAS Time 8:44
	HOBO Time	8:44			Note: NIST and DAS time should be within +/- 1 minute;
	also see item 7 below*			if not, call ECB. If analyzer time is > +/- 2 min. from DAS or NIST Call ECB!	
3	Site Inspection	Site Secure (Y/N)		Detail Site Inspection Exceptions and Site Activities in Comments Section Below	
		Change in Activities Around Site (Y/N)			
		Sampling Line, Probe and Funnel Intact (Y/N)			
		Moisture or Debris in Sample Line (Y/N)			
	*Some sites will no longer have Solar Radiator!	Solar Radiation Sensor *(If applicable)	Is the Sensor secure ? (Yes, No, n/a)		
		Detail all Radiation Sensor Issues in Comment Section Below		Does the Sensor face skyward ? (Yes, No, n/a)	
				Is the Sensor Face clean ? (Yes, No, n/a)	
				Sensor Face Cleaned during site Visit ? (Y/N)	
4	Thermo 49i Ozone Monitor	ID #	Ozone Bkg Factor		
			Ozone Coefficient Cal Factor		
		Alarms Displayed (Y/N)	n	Which Alarm ?	na
	If Alarm is Displayed contact ECB and PPB Before Proceeding				
		Cooling Fan Filter Clean (Y/N)			
	Lamp Intensity Evaluation				
	Lamp Intensity	Cell "A"		Cell " B "	
	Range 45Khz - 175Khz Monitoring the intensity provides a record for comparative purposes				

Sample Flow and Sample Line Residence Time Evaluation						
Sample Line	Install Date	Line Length (meters)				
Cell Flow LPM	Cell "A"	Cell "B"				
Cell Flow Balance (difference < +/- 0.1 lpm)			0.00	Pass		
Total Sample Flow Range is 1.0 - 3.0 lpm			0.00	Total Flow Failed Contact ECB		
Sample Line Residence Time Max = 20 Sec			#DIV/0!	#DIV/0!		
Note	If the sample cell flow, total sample flow, or the sample line residence time evaluations "FAIL" an On-Site Calibration Check should be performed prior to the investigation to determine the cause of the failure. <u>All Data must be invalidated back to previous Satisfactory Sample Flow and Sample Line Residence Time Determination.</u>					
Notify ECB and PPB of all Sample Flow and Sample Residence Time Failures						
5	49/PS- Site Transfer Standard	ID #		Certification Date		
		Alarms Displayed (Y/N)		Other Alarms (?)		
		The Flow Alarm should be Displayed Upon Arrival		All Other Alarms Contact ECB and/or PPB		
				Cooling Fan Filter Clean (Y/N)		
6	Zero Air Supply	ID#		Certification Date		
		Dew Point Sensor Indicator Light - Red or Green			If Red Contact ECB	
		Pressure Gauge (20-30 psi) (Y/N)			If "NO" Contact ECB/PPB	
7	Computer (DAS) Time	8:44	NIST (EST) time	8:43	Corrected Computer and Data Acquisition System (DAS) Y/N?	
7a	HOBO time/data	HOBO to be downloaded and launched 1/month at site visit		HOBO data download DATE	Y/N? []	Time match Y/N? []
				03/01/18	Time	7:15 AM
7b	Back up (UPS)	Back up Battery (UPS) Charged to at least 50% (and no Warning 'beep' is occurring), if not contact ECB for Replacement (Note: not all UPS's currently have power level indicators but replacement units will have)				
	addl. Comments					
8	Operator Comments, Problems, Discussions, Site Issues, Resolutions					
9	Regional Chemist Review Comments					

Version
3.45
2019

Date 3/1/2019

Ozone Monitor Calibration

Site abc123

EPA Temperature Requirement for Calibration is 5-40° C

Operator jon doe

Site Temperature	21
Adjusted Site Temp (If Applicable)	

Ambient Air Ozone ppb 45

Step One

Site Documentation Must be Completed prior to starting the Calibration Procedure

Step Two

Particulate Filter Change and Conditioning - Immediately Prior to All Calibrations

New Filter Y/N	Leak Checked Y/N	Acceptance Criteria	iPS	O3
		iPS Compared to Theoretical	225 ± 2 ppb	$\leq iPS \pm 5$ ppb
		O3 Compared to iPS	0 ± 2 ppb	$\leq iPS \pm 3$ ppb

Level 4 (Env.SPAN) Event 225 ppb Zero Event 0 ppb Filter Conditioning Evaluation

Time	Reading	iPS	O3	Time	Reading	iPS	O3	
1				1				<p style="color: red; font-weight: bold; font-size: 1.2em;">UNACCEPTABLE</p> <p style="color: cyan; font-weight: bold;">Action</p> <p style="color: blue; font-weight: bold;">Check for Leaks and Recondition the Filter a Second Time or Replace with a New filter and Re-Run Conditioning Procedure</p>
2				2				
3				3				
4				4				
5				5				
Avg.	0.0		0.0	Avg.	0.0		0.0	

Step Three

Ozone Monitor Calibration Data

O3 man (Envidas) Zero Event 0 ppb	SPAN (Envidas) Level 4 Event 225 ppb	SPAN 3 (Envidas) Level 3 Event 120 ppb	Span 1 (Envidas) Level 2 Event 65 ppb																																																																								
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th>Time</th><td></td></tr> <tr><th>Reading</th><td>iPS O3</td></tr> <tr><td>1</td><td></td></tr> <tr><td>2</td><td></td></tr> <tr><td>3</td><td></td></tr> <tr><td>4</td><td></td></tr> <tr><td>5</td><td></td></tr> <tr><td>Avg</td><td>0.0 0.0</td></tr> <tr><td>Diff</td><td>0.0</td></tr> </table>	Time		Reading	iPS O3	1		2		3		4		5		Avg	0.0 0.0	Diff	0.0	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th>Time</th><td></td></tr> <tr><th>Reading</th><td>iPS O3</td></tr> <tr><td>1</td><td></td></tr> <tr><td>2</td><td></td></tr> <tr><td>3</td><td></td></tr> <tr><td>4</td><td></td></tr> <tr><td>5</td><td></td></tr> <tr><td>Avg</td><td>0.0 0.0</td></tr> <tr><td>Diff</td><td>0.0</td></tr> </table>	Time		Reading	iPS O3	1		2		3		4		5		Avg	0.0 0.0	Diff	0.0	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th>Time</th><td></td></tr> <tr><th>Reading</th><td>iPS O3</td></tr> <tr><td>1</td><td></td></tr> <tr><td>2</td><td></td></tr> <tr><td>3</td><td></td></tr> <tr><td>4</td><td></td></tr> <tr><td>5</td><td></td></tr> <tr><td>Avg</td><td>0.0 0.0</td></tr> <tr><td>Diff</td><td>0.0</td></tr> </table>	Time		Reading	iPS O3	1		2		3		4		5		Avg	0.0 0.0	Diff	0.0	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><th>Time</th><td></td></tr> <tr><th>Reading</th><td>iPS O3</td></tr> <tr><td>1</td><td></td></tr> <tr><td>2</td><td></td></tr> <tr><td>3</td><td></td></tr> <tr><td>4</td><td></td></tr> <tr><td>5</td><td></td></tr> <tr><td>Avg</td><td>0.0 0.0</td></tr> <tr><td>Diff</td><td>0.0</td></tr> </table>	Time		Reading	iPS O3	1		2		3		4		5		Avg	0.0 0.0	Diff	0.0
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Step Four				Step Five			
Calibration Evaluation				Calibration Factor Evaluation			
iPS Values are compared to Theoretical Values	Acceptance Criteria		O3 values are compared to iPS values	Background Factor	> -3 & < +3		Unacceptable
	iPS	O3		Ozone Coefficient	>0.95 & < 1.05		
	0 ppb ± 2	≤ iPS ± 2		Enter Monitor			
	65 ppb ± 2	≤ iPS ± 2		Background Factor			
	120 ppb ± 2	≤ iPS ± 2		Enter Monitor			
225 ppb ± 2	≤ iPS ± 2	Monitor	Ozone Coefficient Factor				
Site Transfer Standard			Unacceptable Performance				
Monitor			Acceptable Performance				
Calibration Invalid -- Site Transfer Standard Exceeds Limits Notify PPB and ECB			Cal Factor Evaluation Actions		Check for Leaks and Perform Calibration Procedure a Second Time, If Second Calibration Fails Calibration Factor Evaluation Notify PPB and ECB		
Step Six		Has the 49i Ozone Monitor been returned to the Lock Mode ?		<input type="checkbox"/>	Yes/No/NA		
Operator Comments				Regional Chemist Review Comments			

DATE	3/1/2019	Site	abc123	Site Temp	21	5 - 40 C Required for Calibration
Operator	jon doe		Critical Steps	Findings		
			Site Temperature	Passed		
Calibration Evaluation			Filter Conditioning			Failed Acceptance Criteria
			Site Transfer Standard			Failed Acceptance Criteria
			Ozone Monitor	Passed		
			Cal Factors			Failed Acceptance Criteria

New: Minutes Data Tab

2/8/2018 9:18 AM	228.7	Calib	224.7	Ok
2/8/2018 9:19 AM	229.1	Calib	224.9	Ok
2/8/2018 9:20 AM	229.4	Calib	225.2	Ok
2/8/2018 9:21 AM	229.5	Calib	224.9	Ok
2/8/2018 9:22 AM	229.5	Calib	225.1	Ok
2/8/2018 9:23 AM	199.7	Calib	181.7	Ok
2/8/2018 9:24 AM	24.4	Calib	12.7	Ok
2/8/2018 9:25 AM	-6.1	Calib	0.6	Ok
2/8/2018 9:26 AM	-2.6	Calib	0.5	Ok
2/8/2018 9:27 AM	-1.8	Calib	0.6	Ok
2/8/2018 9:28 AM	-1.1	Calib	0.5	Ok
2/8/2018 9:29 AM	-0.4	Calib	0.6	Ok
2/8/2018 9:30 AM	-0.3	Calib	0.6	Ok
2/8/2018 9:31 AM	-0.1	Calib	0.4	Ok
2/8/2018 9:32 AM	0	Calib	0.6	Ok
2/8/2018 9:33 AM	0	Calib	0.7	Ok
2/8/2018 9:34 AM	0.1	Calib	0.4	Ok
2/8/2018 9:35 AM	0.3	Calib	0.6	Ok
2/8/2018 9:36 AM	0.2	Calib	0.5	Ok
2/8/2018 9:37 AM	0.4	Calib	0.4	Ok
2/8/2018 9:38 AM	0.3	Calib	0.6	Ok
2/8/2018 9:39 AM	0.4	Calib	0.5	Ok
2/8/2018 9:40 AM	0.6	Calib	0.5	Ok
2/8/2018 9:41 AM	0.6	Calib	0.4	Ok
2/8/2018 9:42 AM	0.4	Calib	0.5	Ok
2/8/2018 9:43 AM	0.3	Calib	0.5	Ok
2/8/2018 9:44 AM	0.3	Calib	0.5	Ok
2/8/2018 9:45 AM	0.5	Calib	0.4	Ok
2/8/2018 9:46 AM	0.6	Calib	0.5	Ok
2/8/2018 9:47 AM	0.5	Calib	0.5	Ok
2/8/2018 9:48 AM	0.5	Calib	0.4	Ok
2/8/2018 9:49 AM	-0.1	Calib	0.6	Ok
2/8/2018 9:50 AM	-0.2	Calib	0.5	Ok
2/8/2018 9:51 AM	-0.1	Calib	0.6	Ok
2/8/2018 9:52 AM	-0.2	Calib	0.5	Ok
2/8/2018 9:53 AM	-0.1	Calib	0.6	Ok
2/8/2018 9:54 AM	-0.1	Calib	0.5	<Samp
2/8/2018 9:55 AM	-0.2	Calib	0.5	Ok
2/8/2018 9:56 AM	0	Calib	0.6	Ok
2/8/2018 9:57 AM	0.1	Calib	0.6	Ok
2/8/2018 9:58 AM	85.8	Calib	131.8	Ok
2/8/2018 9:59 AM	227.3	Calib	227.7	Ok
2/8/2018 10:00 AM	226.7	Calib	225.5	Ok

Version 3.45 2019	
Date	3/1/19
Site	abc123
Operator	jon doe
Time	8:44

Routine Particulate Filter Change and Conditioning Procedure

<u>Performance Based.</u>	Conditioning is not Time Based. When the Conditioning Values Pass the Acceptance Criteria the Filter is Conditioned and Values should be recorded.
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The **GOAL** of the Routine Particulate Filter Change and Conditioning Procedure is to replace the existing particulate filter with a new conditioned filter every 30 days or less. The filters do have a finite service life due to the "potential buildup" of contaminants on the filter which can lead to falsely low reported ambient air ozone concentrations. Which can be site dependent also. The ≤ 30 day schedule for changing particulate filters does not mean the existing particulate filter at a site is negatively impacting the reported ozone concentration values. Changing particulate filters every 30 days or less is to hopefully prevent the loss of quality ozone data. Each day the performance of the particulate filter is evaluated as part of the Daily Auto-Calibration Check and Precision point Analysis.

If the Daily Auto-Calibration Check or the Immediately Prior On-Site Calibration Check **PASSES** Acceptance Criteria and the Ambient Air Ozone Concentration is ≥ 60 ppb with an Air Quality Forecast of Code Yellow with **AQI > 65** the ozone monitor should **not** be taken out of the sampling mode to change and condition a new particulate filter. Doing so can create a Falsely High 8-Hr Average or even a False Exceedance. The replacement of the existing particulate filter should be re-scheduled if the operator's schedule allow them to do so. If it is not possible to reschedule a site visit then it is highly recommended for the operator to follow the 9:12 rule to minimize the loss of accurate ozone data.

HOB0 Data download **Y/N?** [] **Reqd. 1/mo. HOB0 Time match **Y/N?** []

Step One

Site Documentation Must be Completed prior to Start of Filter Change and Conditioning Procedure

Step Two

Ambient Air Ozone Concentration Evaluation Prior to Filter Change and Conditioning Procedure	45.0	Proceed with Filter Change and Conditioning using the 9:12 Rule if possible.
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Step Three

Filter Change and Conditioning ≤ 30 Days

Pre-Filter Change Leak Check	Pass	Y/N
New Filter Installed	Y/N	
Leak Check Post Filter change	Pass	Y/N

Acceptance Criteria

	<u>iPS</u>	<u>O3</u>	
iPS Values are compared to Theoretical Values	$225 \leq \pm 2$ ppb	$\leq iPS \pm 5$ ppb	O3 values are compared to the iPS Values
	$0 \leq \pm 2$ ppb	$\leq iPS \pm 3$ ppb	

STEP Four			STEP Five		
Level 4 Event 225 ppb			Zero Event 0 ppb		
TIME			TIME		
Reading	<i>iPS</i>	O3	Reading	<i>iPS</i>	O3
1			1		
2			2		
3			3		
4			4		
5			5		
Avg	0.0	0.0	Avg	0.0	0.0
	-225.0	0.0		0.0	0.0
	0.0			0.0	0.0
After Readings Stabilize Record 5 x 1 Min Values					
Step Six					
Site Transfer Standard Evaluation			Unacceptable		
Filter Conditioning Evaluation		Filter Conditioning Acceptable			
<p>If Filter Values Fail Low a Leak at Holder or Contamination is Probable Cause If Filters Fail High a Poor Monitor Calibration is the Probable Cause</p>					
If Site Transfer Standard Fails Contact ECB & PPB					
<p>If the Conditioning of a 2nd Particulate Filter Fails to PASS Acceptance Criteria contact ECB and PPB. Considering the Monitor passed the immediately prior Daily Auto-Calibration Check or the On-Site Calibration Check the performance of the Monitor and Sampling line is now Suspect.</p>					
Operator Comments			Regional Chemist Review Comments		
Date	3/1/19	Site	abc123	Site Temperature	21
Operator	Critical Steps		Findings		
jon doe	Ambient Air Ozone Concentration	45	Passed		
Filter Conditioning Evaluation	Site Transfer Standard				Failed Acceptance Criteria
	Filter Conditioning		Passed		

Date	3/1/19
Site	abc123
Operator	jon doe

Version 3.45 2019

On-Site Calibration-Check

Site Documentation must be Completed First during Each Site Visit

Required Following
Failed Daily Auto-Calibration Checks
Failed Office Actuated Calibration Checks

Initial Site Temperature	21
Site Temperature Criteria 5 - 40 °C	
Adjusted Site Temperature if Applicable	

Time	8:44
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Step One

Ambient Air Ozone Concentration Evaluation Prior to Start of the Calibration Check	45	PROCEED if the Daily Auto-Calibration Check FAILED. If possible perform this monitor evaluation step using the 9:12 Rule.
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Step Two									
On-Site Calibration Check									
Acceptance Criteria									
iPS values are compared to Theoretical Values	iPS		O3		O3 Values are Compared to iPS Values	0 ppb ± 2 ppb		≤ iPS ± 2 ppb	
	65 ppb ± 2 ppb		≤ iPS ± 3 ppb			225 ppb ± 2 ppb		≤ iPS ± 5 ppb	
Zero Event 0 ppb			Level 2 Event 65 ppb			Level 4 Event 225 ppb			
TIME			TIME			TIME			
Reading	iPS	O3	Reading	iPS	O3	Reading	iPS	O3	
1			1			1			
2			2			2			
3			3			3			
4			4			4			
5			5			5			
Avg	0.0	0.0	Avg	0.0	0.0	Avg	0.0	0.0	
O3 Diff		0.0		0.0	0.0		0.0	0.0	

Step Three	
On-Site Calibration Check Evaluation	
Site Transfer Standard	Unacceptable Performance
Ozone Monitor	Acceptable Performance
Action	Site Transfer Standard Exceeds Limits, Do Not Proceed Contact PPB and ECB

Step Four						
If the Ozone Monitor PASSES the On-Site Calibration Check Acceptance Criteria						
Ambient Air Ozone Conc.	Performing a Particulate Filter Change is Conditional					
45	If the site operator has time is available, the changing and conditioning of a new sample line particulate filter is recommended only if such time will not result in the loss of an hour of monitoring data when the ambient air ozone is ≥ 60 ppb which will result in a falsely high 8-Hour average ozone concentration and potentially even a false exceedance being reported.					
Operator Comments				Regional Chemist Review Comments		

Date	3/1/19	Site	abc123		Site Temp	21	Site Temp 5-40°C Requirement
Operator	Critical Steps			Findings			
jon doe	Ozone Concentration	45	Passed				
On-Site Calibration Check Evaluation	Site Transfer Standard				Failed Acceptance Criteria		
	Ozone Monitor		Passed				

Date	3/1/19	Office Actuated Calibration-Check	Version 3.45 2019
Site	abc123		<p style="color: red; font-weight: bold;">If the Ozone Monitor DID NOT FAIL Daily Auto-Cal Acceptance Criteria and the Air Quality Forecast is Yellow with a AQI > 65 the Office Actuated Calibration Check should not be performed and the system performance should be closely monitored.</p>
Operator	jon doe		

Step One

Purpose for Performing Office Actuated Calibration Check	
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Step Two

Ambient Air Ozone Concentration Evaluation Prior to Start of the Office Calibration Check	45	PROCEED if the Daily Auto-Calibration Check FAILED. If possible perform this monitor evaluation step using the 9:12 Rule.
	Time 8:44	

Step Three

Office Actuated Calibration Check

Acceptance Criteria				
iPS Values are compared to Theoretical Values	iPS	0 ± 2 ppb	O3	≤ iPS ± 3 ppb
		225 ± 3 ppb		≤ iPS ± 5 ppb
			O3 Values are Compared to iPS Values	

Zero Event 0 ppb				Level 4 Event 225 ppb			
TIME				TIME			
Reading	iPS		O3	Reading	iPS		O3
1				1			
2				2			
3				3			
4				4			
5				5			
Avg	0.0		0.0	Avg	0.0		0.0
O3 Diff			0.0	O3 Diff	0.0		

Step Four						
Office Actuated Cal-Check Evaluation						
Site Transfer Standard		Unacceptable Performance				
Ozone Monitor		Acceptable Performance				
Action		Site Transfer Standard Exceeds Limits, Onsite Calibration Check Required - Contact PPB and ECB				
Operator Comments			Regional Chemist Review Comments			
Date	3/1/19	Site	abc123		Site Temp	21
Site Temp 5-40°C Requirement						
Operator		Critical Steps			Findings	
jon doe		Ozone Concentration	45	Passed		
Office Actuated Calibration Check Evaluation		Site Transfer Standard		Failed Acceptance Criteria		
		Ozone Monitor		Passed		

Calibration Steps

Calibration Steps on the 49i Ozone Monitor																																																																																																																																																																								
<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; font-weight: bold;">49i Ozone Monitor Front Control Panel</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; font-weight: bold;">Front Panel Pushbuttons</p> <p> Display Shortcuts Accessed via use the soft key below</p> <p> 1-4 Soft Keys To access the identified display Shortcuts</p> <p> Run Key To display the Run Screen and Ozone</p> <p> Menu Displays the Main Menu when in the Run Screen or to move back up a level in the Menu</p> <p> Help Information about the displayed screen</p> <p> Enter Key used to select a menu item To accept To set To save a change To toggle between functions</p> <p> Used to move the cursor and change values</p> <p> The system is Locked and No Adjustments Can be Made</p> </div>	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>1</td><td>Press</td><td></td><td>To access Password Function to unlock the system</td></tr> <tr><td>2</td><td>Press</td><td></td><td>Twice slowly to unlock the Monitor Note #1</td></tr> <tr><td>3</td><td>Press</td><td></td><td>To return to the Sample Screen</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">Start the Zero Span Event on the Envidas (DAS) Computer System Note # 2</td></tr> <tr><td>5</td><td>Press</td><td></td><td>This will bring up the Menu Options</td></tr> <tr><td>6</td><td>Press</td><td></td><td>Use down arrow to Highlight Calibration</td></tr> <tr><td>7</td><td>Press</td><td></td><td>To select Calibration</td></tr> <tr><td>8</td><td>Press</td><td></td><td>Use down arrow to highlight Cal ZERO</td></tr> <tr><td>9</td><td>Press</td><td></td><td>To select Cal ZERO</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">Allow Zero Event Readings to Stabilize on the Calibrator and the Monitor Note # 3</td></tr> <tr><td>11</td><td>Press</td><td></td><td>To Calibrate the ZERO Point</td></tr> <tr><td>12</td><td>Press</td><td></td><td>To Return to the Sample Screen</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">When Readings are stable -- Record 5 x 1-Minute Zero Point Averages for the Zero Point from the Envidas (DAS) for the Calibrator and the Monitor in the Ozone Logbook</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">Stop the Zero Event & Start the Level 4 Span (225 ppb) Event on the Computer System Note # 2</td></tr> <tr><td>15</td><td>Press</td><td></td><td>This will bring up the Menu Options</td></tr> <tr><td>16</td><td>Press</td><td></td><td>Use down arrow to Highlight Calibration</td></tr> <tr><td>17</td><td>Press</td><td></td><td>To select Calibration</td></tr> <tr><td>18</td><td>Press</td><td></td><td>Use down arrow to highlight Cal O₃ Coeff</td></tr> <tr><td>19</td><td>Press</td><td></td><td>To select Cal O₃ Coeff</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">The Calibrate O3 Screen should be displayed. The Span Concentration should be 00000225 If true proceed to step 21 if not see Note 4 A-D to adjust Span Setting</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">Allow Level 4 (225ppb) Event Readings to Stabilize on the Calibrator and Monitor Note # 3</td></tr> <tr><td>22</td><td>Press</td><td></td><td>To calibrate the Cal O₃ Coeff (level 4) Point</td></tr> <tr><td>23</td><td>Press</td><td></td><td>To Return to the Sample Screen</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">When Readings are stable -- Record 5 x 1-Minute Level 4 Event Averages from the Data Logger for the Calibrator and the Monitor in the Ozone Logbook</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">Review the Ozone Logbook Calibration Performance Evaluation. If PASSES Acceptance Criteria Proceed to Step 26. If FAILED repeat steps 4 through 25</td></tr> <tr><td>26</td><td>Press</td><td></td><td>This will bring up the Menu Options</td></tr> <tr><td>27</td><td>Press</td><td></td><td>Use down arrow to Calibration Factors</td></tr> <tr><td>28</td><td>Press</td><td></td><td>To select Calibration Factors</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">Record the O3 Bkg Factor and the O3 Coef in the Ozone Logbook.</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">Review the Ozone Log Book Evaluation of O3 Bkg Factor and O3 Coeff Factor. If PASSES Acceptance Criteria proceed to Step 30. If FAILED repeat Steps 4 through 29</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">Stop Level 4 & Start Level 3 (120ppb) Event on the Computer System Note # 2 & #3</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">When the readings are stable -- Record 5 x 1-Minute Level 3 Event Averages from the Data Logger for the Calibrator and the Monitor in the Ozone Logbook</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">Stop Level 3 & Start Level 2 (65ppb) Event on the Computer System Note # 2 & 3</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">When the readings are stable -- Record 5 x 1-Minute Level 2 Event Averages from the Data Logger for the Calibrator and the Monitor in the Ozone Logbook</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">Review the Ozone Log Book Calibration Evaluation (Zero, Levels 4, 3, & 2). If PASSES Acceptance Criteria proceed to Step 35. If FAILED repeat Steps 4 through 34</td></tr> <tr><td colspan="4" style="text-align: center; background-color: #ffffcc;">Stop the Level 2 (65 ppb) Event on the Computer System</td></tr> <tr><td>36</td><td>Press</td><td></td><td>Press Press Note #5</td></tr> </table>	1	Press		To access Password Function to unlock the system	2	Press		Twice slowly to unlock the Monitor Note #1	3	Press		To return to the Sample Screen	Start the Zero Span Event on the Envidas (DAS) Computer System Note # 2				5	Press		This will bring up the Menu Options	6	Press		Use down arrow to Highlight Calibration	7	Press		To select Calibration	8	Press		Use down arrow to highlight Cal ZERO	9	Press		To select Cal ZERO	Allow Zero Event Readings to Stabilize on the Calibrator and the Monitor Note # 3				11	Press		To Calibrate the ZERO Point	12	Press		To Return to the Sample Screen	When Readings are stable -- Record 5 x 1-Minute Zero Point Averages for the Zero Point from the Envidas (DAS) for the Calibrator and the Monitor in the Ozone Logbook				Stop the Zero Event & Start the Level 4 Span (225 ppb) Event on the Computer System Note # 2				15	Press		This will bring up the Menu Options	16	Press		Use down arrow to Highlight Calibration	17	Press		To select Calibration	18	Press		Use down arrow to highlight Cal O ₃ Coeff	19	Press		To select Cal O ₃ Coeff	The Calibrate O3 Screen should be displayed. The Span Concentration should be 00000225 If true proceed to step 21 if not see Note 4 A-D to adjust Span Setting				Allow Level 4 (225ppb) Event Readings to Stabilize on the Calibrator and Monitor Note # 3				22	Press		To calibrate the Cal O ₃ Coeff (level 4) Point	23	Press		To Return to the Sample Screen	When Readings are stable -- Record 5 x 1-Minute Level 4 Event Averages from the Data Logger for the Calibrator and the Monitor in the Ozone Logbook				Review the Ozone Logbook Calibration Performance Evaluation. If PASSES Acceptance Criteria Proceed to Step 26. If FAILED repeat steps 4 through 25				26	Press		This will bring up the Menu Options	27	Press		Use down arrow to Calibration Factors	28	Press		To select Calibration Factors	Record the O3 Bkg Factor and the O3 Coef in the Ozone Logbook.				Review the Ozone Log Book Evaluation of O3 Bkg Factor and O3 Coeff Factor. If PASSES Acceptance Criteria proceed to Step 30. If FAILED repeat Steps 4 through 29				Stop Level 4 & Start Level 3 (120ppb) Event on the Computer System Note # 2 & #3				When the readings are stable -- Record 5 x 1-Minute Level 3 Event Averages from the Data Logger for the Calibrator and the Monitor in the Ozone Logbook				Stop Level 3 & Start Level 2 (65ppb) Event on the Computer System Note # 2 & 3				When the readings are stable -- Record 5 x 1-Minute Level 2 Event Averages from the Data Logger for the Calibrator and the Monitor in the Ozone Logbook				Review the Ozone Log Book Calibration Evaluation (Zero, Levels 4, 3, & 2). If PASSES Acceptance Criteria proceed to Step 35. If FAILED repeat Steps 4 through 34				Stop the Level 2 (65 ppb) Event on the Computer System				36	Press		Press Press Note #5	<div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; font-weight: bold;">Notes</p> <p>1 There is a slight delay in monitor response Lock Symbol on display will disappear</p> <p>2 Monitor display will change to Span</p> <p>3 Calibrator and Monitor Response during span cycles is erratic at first but will stabilize</p> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p style="text-align: center; font-weight: bold;">4A Calibrate O3 Coeff Display Screen</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td colspan="2" style="text-align: center;">Calibrate O3:</td></tr> <tr><td style="text-align: center;">O3:</td><td style="text-align: center;">Reading</td></tr> <tr><td style="text-align: center;">Span Conc</td><td style="text-align: center;">00000225?</td></tr> </table> </div> <div style="border: 1px solid black; padding: 5px; margin-bottom: 10px;"> <p>4B The SPAN CONC: should be 00000225</p> <p>4C If "SPAN CONC: is NOT 00000225 proceed below</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>Press </td><td>Or</td><td></td><td>To Highlight SPAN CONC:</td></tr> <tr><td>Press </td><td>Or</td><td></td><td>To Select Digit</td></tr> <tr><td>Press </td><td>Or</td><td></td><td>To Set Value Up/Down</td></tr> </table> <p>4D Return to Step 20</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p># 5 The 49i Ozone Monitor is now Password protected and is in the Sample Mode</p> </div> <div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center; font-weight: bold;">Operator Notes</p> <p><i>Envidas/Envista new nomenclature as of Mar. 1, 2017</i></p> <p>Span=225 ppb</p> <p>Span 3=Level 3=120 ppb</p> <p>Span 1=Level 2=65 ppb</p> <p>Span 2 = Level 1 = 50 ppb</p> <p>Span 5 = Level 5 = 300 ppb (not curr. in use)</p> <p>O3 Man = O3 other on old Cal. Program</p> <p>Zero = Zero, but on Calibrator it is Level 6 (new)</p> </div>	Calibrate O3:		O3:	Reading	Span Conc	00000225?	Press	Or		To Highlight SPAN CONC:	Press	Or		To Select Digit	Press	Or		To Set Value Up/Down
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Appendix 1

Comment on new Time(s) Recording Procedures

Download and ReLaunch Hobo computer time (required 1/month)

You will now record not only the DAS (i.e. Envidas) time reflected on the computer monitor, but also record Analyzer time (from the 49i face) and HOBO time. You will also check and record NIST time. This can be acquired from <https://time.gov>. This is very important since we no longer have the datalogger to compare to and NIST should be primary and DAS should be in agreement with NIST. The Analyzer, 49i, should be in agreement with DAS. If not, contact ECB! Additionally, you should check and record the HOBO time when the HOBO is relaunched at your monthly visit. We are also mandating that you download the HOBO temperature data and save in a secured site/share since this is/will be the back-up temperature data for the site in the event of an Envidas/Envista/computer failure. Hence, you must record all **4 times; DAS, Analyzer, HOBO, and NIST.** (Note: The HOBO time will merely be a reflection of the time you ReLaunched the HOBO data following the required monthly data recovery and storage.)

Appendix 2

Reference Guidelines for Envista/Envidas procedures

Multiple Envista Procedural Guidelines have been added to the SOP's for 2018/2019. Due to the dynamic nature of the software updates, the documents have been referenced and placed into the Sharepoint data share located at the following address:

NCDAQ Ambient Monitoring >>Documents>>EnVista-EnviDas>>RCO Guidance Documents

The Guidelines include but are not limited to the following Documents:

- 1. Displaying Real Time Graph and Minute Data**
- 2. Exporting Data from HOBO Temperature Data Logger**
- 3. Importing Data using Envista**
- 4. Marking Data Channels Down/Up**
- 5. Remote Desktop User Instructions**
- 6. Probe/line drying Procedures for Thermo 49i Ozone Monitor**

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