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OZONE (O_3) AUDIT

by

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CAUTION

Disclaimer: This Standard Operating Procedure has been developed for use by ManTech Environmental Technology, Inc. in support of the National Performance Audit Program (NPAP) under contract to the U.S. Environmental Protection Agency and may not be applicable to the activities of other organizations.

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Effective: When approved

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FIGURES

1.0 SCOPE AND APPLICATION

This procedure includes both the certification and Quick Check of the TECO 165 ozone generator (165) and the ozone generator of the TECO 175 Portable Calibrator (175). These audit devices are used in support of the National Performance Audit Program (NPAP).

Certifications are in the form of multiple run averages against ambient air monitors calibrated with an NIST traceable TECO 49PS Ozone Calibrator. This procedure establishes the working baselines used to check an audit device at zero and three upscale levels of ozone that are generated by different current-controlling potentiometer (pot) settings. The Quick Check is a one-day verification of the device based on the above pre-determined pot settings and baselines.

These two procedures establish the reliability and validity of the audit device's ozone generation. Results from both procedures are traceable to a National Institute of Standards and Technology (NIST) primary standard.

2.0 SUMMARY OF METHOD

The NIST traceability of this method lies in the annual certification of the ManTech Environmental TECO 49PS Ozone Calibrator (49PS) by the NIST Reference Photometer SN#1 at the U.S. Environmental Protection Agency, Research Triangle Park, NC.

The TECO 49 Ozone Analyzer (49) is checked quarterly against the NIST certified 49PS. Using six points (zero and five points between zero and 80% of full scale), a calibration curve equation is constructed by means of a least squares linear regression. The data is evaluated to determine whether direct front panel readings are used or if subsequent data is
to be reduced by the linear regression equation. In addition, a two-point check is performed weekly to verify that the 49 analyzer remains within ±2% of the 49PS calibrator. If not, corrective action is taken, the 49 recalibrated, a new equation determined, and evaluated. This ensures reliability and NIST traceability for the certification of the audit devices.

When the audit device is new or is being recertified, pot settings are established for zero and three upscale points that are measured by the calibrated 49. These settings and the resulting ozone concentrations establish the baseline which is used to check a device each time it is returned from the field. If the Quick Check results are within ±4% or ±4 ppb of the established baseline, the audit device is packed and shipped to the next NPAP participant.
Any data which exceeds the limits set forth above results in a careful and thorough inspection of the complete system. If a question remains involving the reliability of the system, it is not shipped to an audit participant until all questions are resolved.

3.0 DEFINITIONS

TECO: Thermo Environmental Instruments, Inc.

Zero Air: For the 49PS and 49: ambient air scrubbed for O_3, NO_2, SO_2, hydrocarbons, and water.

For Audit devices: ambient air scrubbed for O_3, sulfur, organic compounds, other reactive, low molecular weight compounds, and moisture; CO is converted to CO_2.

4.0 SAFETY PRECAUTIONS

Observe standard safety precautions taken whenever electrical equipment is operated. The instruments contains 120 and 800 volts AC. Use normal precautions when working on the inside of the instrument with the power connected. Under no circumstances should the instruments be operated without an electrical ground. The instruments are supplied with a 3-wire, grounding line cord.

5.0 FACILITIES REQUIREMENTS

This SOP requires a laboratory equipped with electricity, adequate bench space for the equipment, exhaust system, and a continuous source of zero air for the 49 and 49PS.

6.0 INTERFERENCES

Possible interferences include electrical interferences, variable air flow, contamination from leaks, inefficient or exhausted scrubbers, and particulate matter in the air lines or capillaries.

7.0 APPARATUS

TECO Model 49: Ultraviolet Photometric Ambient O_3 Analyzer

TECO Model 49PS:	Ultraviolet Photometric Ambient O_3 Calibrator; traceable	NIST
TECO Model 165:	Ozone generator, capable of producing repeatable ozone concentrations	
TECO Model 175:	Portable audit device/calibrator, capable of producing repeatable ozone concentrations	

Strip chart recorder

8.0 MATERIALS

- Teflon® tubing, 1/4", with Swagelok® compression fittings
- Scrubber train for 165/175:
  - Purafil® to remove sulfur, organic compounds, and other reactive low molecular weight compounds
  - Silica gel indicating, 6-16 mesh; to remove moisture
  - Hopcalite® to convert CO to CO_2 and to remove O_3
- Polypropylene connecting tubing with Swagelok® fittings for the zero air scrubber train
- Pump capable of delivering 4 liters/min at 18 psi
- Hamilton Microliter® cleaning wires, or equivalent

9.0 CALIBRATION

9.1 6-Point Calibration: 49PS versus 49

1. Perform a multi-point calibration every three months, anytime any major disassembly of components is performed (excluding cleaning of photometric cells), or if the span number on the 49 is changed.

2. Check that the gain on the 49PS is set at 8.

3. Record the atmospheric pressure in mm Hg.

4. Turn off the zero air to the 49 and connect the port labeled **OZONE** of the 49PS to the **SAMPLE** port of the 49. Do **NOT** cap the vent on the 49PS.

   Note: Maintain both 49 and 49PS with a continuous zero air flow. Equip the tubing to the 49 with a filter and a vent.

5. Check the flowmeters on the front panels of the 49PS and the 49. The flowmeters must register approximately 1 liter/min ± 30% per cell. If not, check for leaks or kinks in the lines, or clean the capillaries. If the problem is not solved, contact the ManTech Quality Assurance Laboratory Repair Service (hereafter called Repair).

6. Record all data in the data logbook entitled Certification Data of TECO 49 Ozone Analyzers by TECO 49PS Ozone Calibrator (NIST Traceable). Each person making an entry into this logbook must sign and initial the first page.

7. Press "A" on the front panel of the 49PS and record the frequency output of cell A; then press "B" and record the frequency output of cell B.

   A. If both the frequencies >70 kHz and within five kHz of each other, proceed to **Step 8**.

   B1. If the difference in the cell frequencies >5 kHz, but both frequencies >70 kHz, increase the light output by rotating the light adjuster on the lamp block (page V-5 in the TECO 49/49PS Instruction Manual).

B2. If either frequency # 70 kHz, follow the procedures in the TECO 49/49PS Instruction Manual to

(1) clean the cells (page V-2)
(2) increase the light output by rotating the light adjuster on the lamp block, (page V-5), and
(3) leak check the instrument (pages V-13 through V-15)

B3. If the frequency remains # 75 kHz, contact Repair for replacement of the UV lamp.

8. Press **P/T** on the front panel once and record the pressure for cell A. Press **P/T** again and record the pressure for cell B. Press **P/T** twice more and record the temperature for both cells. If the pressure difference $ 3 mm Hg or the temperature difference $ 2°C, contact Repair.

9. Press **RUN/PPB** on the front panel. The program has a 20-second waiting period during which time the digital display increases from 1000 to 1050 and then enters the run mode.

10. Repeat **Steps 6 - 8** for the 49.

11. Check that the **OZONE LEVEL** thumbwheel on the 49PS is set at zero. Allow the 49 to stabilize at this setting, as indicated by a straight trace on the strip chart recorder.

A. If the average zero readings of the 49PS and the 49 are within 1 ppb, proceed to **Step 12**.

B. If the average zero reading of the 49PS and the 49 differ by more than 1 ppb, adjust the **OFFSET** thumbwheel of the 49 to obtain agreement within 1 ppb of the 49PS.

12. Take a total of 20 consecutive readings from cell A and cell B (10 readings from each cell) of the 49; concurrently, take corresponding readings from A and B cells of the 49PS. Use **Equation 1** in **Section 11.0 Calculations** to determine the zero reading for each instrument.

13. Increase ozone production of the 49PS by setting the **OZONE LEVEL** thumbwheel to 450. Allow the device to stabilize approximately 30 minutes, as indicated by a straight trace on the strip chart recorder. Adjust the **SPAN** thumbwheel on the 49 to obtain agreement within 1 ppb between the 49 and 49PS.

14. Using the same procedure described in **Step 12**, take a total of 20 readings from each instrument. Use **Equation 1** in **Section 11.0 Calculations** to average the ozone concentration for each instrument. Subtract the respective zero from each average.

15. Repeat **Step 14** for 49PS **OZONE LEVEL** thumbwheel settings of 300, 200, 100, and 50. Use the strip chart recorder to determine when the O_3 output has stabilized at each setting. Average each set of readings and adjust each for the zero.

16. Construct a calibration curve equation by plotting average ozone concentrations from the 49 (x) versus average ozone concentrations of the 49PS (y) by way of a least squares linear regression. See **Equation 2** in **Section 11.0 Calculations**.

17. Complete the EVALUATION TABLE on page 2 of the "Standard Data Form for TECO 165: OZONE CALIBRATION." Use **Equation 3** in **Section 11.0 Calculations** to determine percent difference (% Diff.)

    If the mean percent differences of upscale O_3 concentrations are

    A. # 1.25%, use the front panel readings without application of the calibration equation.

    B. lies in the interval 1.26% to 2.0%, use the calibration equation to reduce data for values increased or decreased to the next whole number by application of the equation.

    C. > 2%, this calibration is invalid and corrective action is required. SEE page IV-19 of the TECO 49/49PS Instruction Manual for possible causes of malfunctions. Corrective action may include cleaning of optical bench, replacement of the UV lamp, or more extensive repair. After repair, repeat the certification procedure.

18. Use the front panel readings or the calibration curve equation to certify or check audit device output (See **10.1 4-Day Certification of Audit Device** and **10.2 Quick Check Procedure**).

9.2 Weekly 2-Point Verification of 49PS versus 49

1. Perform a weekly 2-point check in the interim between multi-point calibrations.

2. Record all data and observations in the 49 Instrument Logbook.

3. Repeat **Steps 2 - 5, 7-12** in **Section 9.1 6-Point Calibration: 49PS versus 49**, but make no adjustments. If the zeros agree within ±2.0 ppb, continue with **Step 4**. If the difference in the zeros >±2.0 ppb, do a complete recertification of the TECO 49.

4. Increase ozone production of the 49PS by adjusting the **OZONE LEVEL** thumbwheel to 400. Allow the device to stabilize until there is a straight trace on the strip chart recorder. This takes approximately 30 minutes.

5. Using the same procedure described in **Step 12** in **Section 9.1 6-Point Calibration: 49PS versus 49** above, take a total of 20 readings from each instrument. Use **Equation 1** in **Section 11.0 Calculations** to average the ozone concentration for each instrument. Subtract from each average the respective zero obtained in **Step 12**.

6. Use **Equation 3** in **Section 11.0 Calculations** to determine percent difference (% Diff.).

   If the resulting percent difference

   A. # 2%, the instrument is within criteria.

   B. > 2%, the 49 does not meet the criteria. First, check all lines for leaks and kinks and then clean the cells (page V-2 in the TECO 49/49PS Instruction Manual).

   Note: It is not necessary to recalibrate either the 49PS or the 49 when the cells are cleaned.

   If the difference still persists, the 49 may require span or offset adjustment. If so, conduct a 6-point recalibration. If the problem is not eliminated by these steps, contact Repair.

10.0 AUDIT DEVICE CERTIFICATION

10.1 4-Day Certification of Audit Device

10.1.1 Setup of the Audit Device

1. After unpacking the device, check for loose fittings or damaged parts.

2. Plug the device into a stable 110 V power source and turn the power switch to the **ON** position. Warm-up the instrument until the heater indicator light comes on. This takes approximately 15 minutes.

3. Replace the zero air scrubber materials as follows:
   A. Silica gel: when it turns pink or white
   B. Purafil II® chemisorbent media: when it turns brown or becomes saturated with moisture
   C. Hopcalite® Catalyst: when it has been in use for one year

10.1.2 165 Setup

1. Use ¼" Teflon® tubing with compression fittings to connect the **OZONE** port of audit device to the **SAMPLE** inlet of the 49. Leave the **VENT** port of the 165 open.

2. Connect the zero air train to a pump and to the 165, as shown in figure 1. Turn on the pump and set the air flow gauge on the 165 at 6 psig using the pressure control knob. If adjustment is needed, reduce the pressure to below 6 psig and then adjust UP to 6 psig. **DO NOT** tap the gauge.

3. Record the rotameter reading, which is read at the TOP of the rotameter float.
   A. For the first run on a new device, record this reading and proceed to **Section 10.1.4 Certification**.

   B. For any device run previously, compare the rotameter reading to past readings:

      (1) If the current reading differs by no more than ±0.5 from past readings, proceed to **Section 10.1.4 Certification.**

      (2) If the difference is greater than ±0.5, clean the capillary, check for leaks, and check for cracks in the rotameter housing.

(3) If the difference persists, or the rotameter is cracked, contact REPAIR.

10.1.3 175 Setup

1. Use ¼" Teflon® tubing with the Swagelok® union cross to connect the **OUTLET** port on the back panel of the 175 device to the **SAMPLE** inlet on the 49. See figure 2.

2. Set the four-way valve on the front panel to the **ZERO** position.

3. Connect the zero air train to a pump and the other end to the **AIR IN** port of the 175, as shown in figure 2. Turn on the pump.

   a. Set the air flow of the 175 at 9 psig using the pressure control knob. If adjustment is needed, reduce the pressure to below 9 psig and then adjust UP to 9 psig. **DO NOT** tap the gauge.

   b. After five minutes, check the gauge setting. If it has shifted, reset it to 9 psig using the above sequence.

   c. Check the pressure prior to recording a reading. Reset to 9 psig. if necessary.

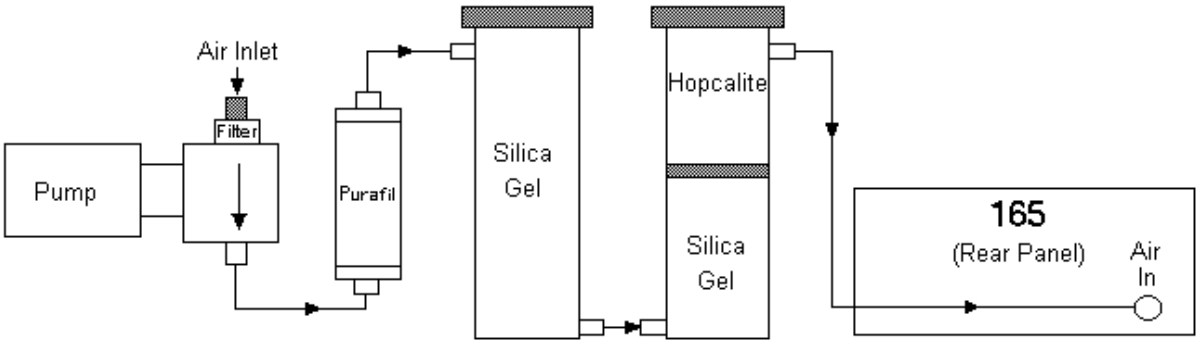
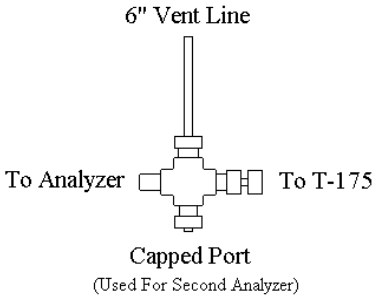


Figure 1. Set-up of TECO 165, pump, and scrubber train



Close-up of Swagelok® union cross

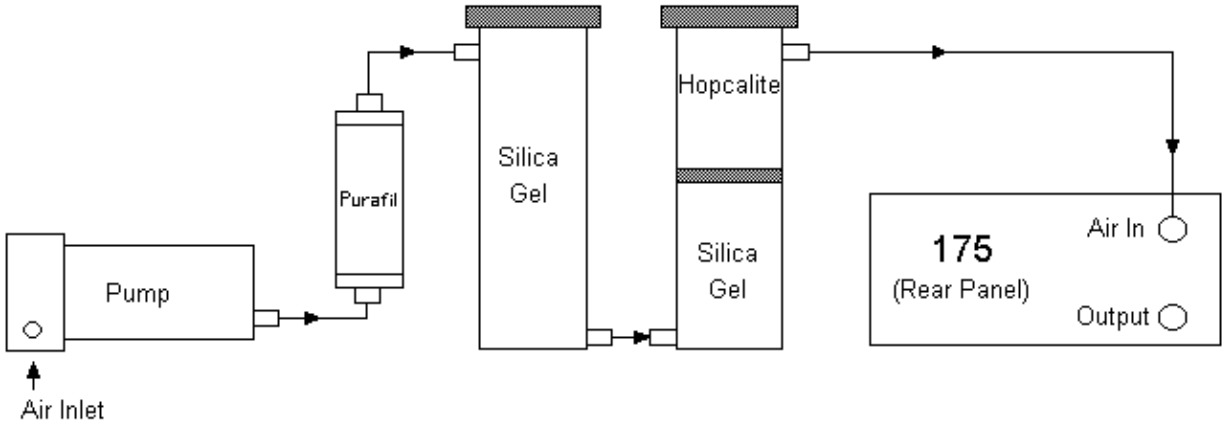


Figure 2. Set-up of TECO 175, pump, and scrubber train

10.1.4 Certification

1. Record the atmospheric pressure and the serial number of the 49 in the instrument logbook.

2. With the ozone lamp switch in the **OFF** position, let the 165/175 stabilize at zero as indicated by a straight line on the strip chart recorder. Record the ozone concentration for the zero setting from the front panel of the 49 analyzer. If the reading from cell A differs from cell B, average the values and round to nearest whole number to determine the ozone concentration. If this value is greater than 5 ppb, replace the Silica gel, Hopcalite® and Purafil® cartridges in the zero air scrubber train. If the zero point is still greater than 5.0 ppb, contact Repair.

3. Determine the setting needed to achieve an ozone concentration between 350 and 450 ppb by adjusting the pot. Allow the device to stabilize for 30 to 45 minutes; a stable reading will be indicated by a straight trace on the strip chart recorder. The ozone concentration is averaged as in **Step 2**. Record the pot setting and ozone concentration in the 165/175 instrument logbook.

4. Repeat **Step 3** to establish the pot settings needed to achieve ozone concentrations in the following ranges: 150-200 ppb and 30-80 ppb. The device generally stabilizes at these lower settings in five to ten minutes.

5. Repeat this procedure using zero and the upscale settings determined in **Steps 3 and 4** for three additional working days (not necessarily consecutive) to certify the device.

    A. If the coefficient of variation for the set of four readings at each ozone level is within ±4%, average the four readings to determine the initial baseline.

    B. If the four readings are not within this acceptable range, repeat the procedure a maximum of nine times to see if the device will stabilize. If stabilization does not occur, send the device to Repair. Always use the readings from the last four days to determine the baseline.

6. Note any relevant observations in the audit device logbook.

7. Record the device number, date, pot settings, and O_3 Baseline Values on the Shipping Form.

   165: Send the device and the Shipping Form to Shipping.
   175: Send the device and folder to the CO, SO_2, NO bench or to Shipping, as indicated.

10.2 Quick Check Procedure

Use this procedure once pot settings and ozone concentration baselines are established by the 4-day certification procedure. This provides a quick turnaround time for the 165/175 devices.

10.2.1 165 Audit Devices

1. Repeat **Steps 1 - 3** in **Section 10.1.1 Setup of the Audit Device**.

2. Repeat **Steps 1 and 2** in **Section 10.1.2 165 Setup**

3. Compare the current rotameter reading to previous readings.

   A. If the difference # 0.5, Record the reading in the logbook. Continue with the Quick Check.

   B. If the difference >0.5, record the reading in the Ozone Device Logbook.

      (1) Check the device setup for leaks and possible cracks in the rotameter.

      (2) Clean the capillary with a Hamilton Microliter® cleaning wire, or the equivalent. Place the capillary in the device, tighten the fitting, and recheck the reading.

         Note: If a device does not meet acceptance criteria at any time during this procedure due to a clogged capillary, the device "fails" the Quick Check. However, if it meets acceptance criteria after cleaning the capillary, recertification is not required and the device can be shipped.

      (3) If the rotameter difference persists, contact Repair.

10.2.2 175 Audit Devices

Follow **Steps 1-3** in **Section 10.1.3 175 Setup**.

10.2.3 Quick Check 165/175

1. With the UV lamp **OFF**, record the zero once the device has stabilized. The ppb difference between the pre-established zero baseline and the current reading must not exceed 4 ppb. If the difference exceeds this limit, check the system for leaks and replace scrubbers. If the difference remains, contact Repair.

2. Turn the UV lamp **ON**. Adjust the pot to the predetermined "high" setting. Allow the device to stabilize, this generally requires about 20 to 30 minutes for 165s and 45 to 60 minutes for 175s. Record the front panel reading. Average the front panel readings or rejust by the calibration equation for the 49 as determined in **Step 16** of **Section 9.1 6-Point Calibration: 49PS versus 49**. Record the pot setting and the ozone generated.

3. Repeat **Step 2** of this section for the established "med" and "low" pot settings. Time required for the device to stabilize at these settings is less than for the high setting.

10.3 Verification/Quick Check Data Base Entry

1. Access the NPAP Data base. The database is menu driven. Follow the screen instructions to move from one screen to the next.

2. Select the current year from the **NPAP Main Menu**.

3. Enter your password at the **PassWord Utility Program** screen.

4. Select **Enter Data** from the **NPAP Main Menu**.

5. Select **Enter Standards Data** from the **Enter Data Section** screen.

6. Select **"Ozone"** from the **Entering Standards Data Section**.

7. To enter data:

   A. Select **Enter/List O_3 Device Calibration** from the **Standards Data Entry Section**.

B. Select **Enter New Calibration Data** from the next submenu of the **Standards Data Entry Section**.

C. Enter the 165/175 audit device number in the selection box of the third screen of the **Standards Data Entry Section**.

D. A message will appear on the same screen: **Start a new calibration sequence?**

(1) If this data entry is the first entry of a four-day calibration sequence, press **Y** on the keyboard. The computer displays the data entry screen. On the remaining days of the calibration sequence, the computer will automatically display the data entry screen after the 165/175 number is entered.

(2) If this is Quick Check data, press **ENTER** to progress to the data entry screen (**N** is the default).

E. Check the 165/175 device number on the screen.

(1) If it is correct, proceed to **Step C**.

(2) If it is incorrect, press **ESC**. Highlight the computer message **"ABORT & ESCAPE."** Press **ENTER**. The computer returns to the **Standards Data Entry Section/Ozone O_3** menu screen. Press **1** on the numeric keyboard and reenter the 165/175 number or press **0** on the numeric keyboard to exit the screen.

F. Enter the **Calibration Date** in the format MM/DD/YY. Enter the **Barometric pressure**.

G. Enter the high pot setting, the med setting, and the low setting under **POT Setting**.

Note: The pot settings are displayed by the computer after the first day of a calibration. A new calibration set must be entered to change the pot settings in the computer.

H. Enter the zero ozone value under **Analyzer O_3**. Press **ENTER**. Enter the high ozone value. **DO NOT** press **ENTER**. Enter the med ozone value. **DO NOT** press **ENTER**. Enter the low ozone values and press **ENTER**. The computer calculates percent difference and the new baseline for each setting.

Note: Enter NO_2 Quick Check Data after entering the O_3 data (175s).

1. If data has been entered correctly, copy the differences and the new O_3 baseline in the 165/175 instrument logbook.

   a. If the difference for any point is not greater than 4% or 4 ppb, complete the SHIPPING FORM

      - **165:** Send the completed SHIPPING FORM and the audit device to shipping.

      - **175**: Place the SHIPPING FORM in the folder for that device. When all pollutants have been verified, send the folder to shipping.

      - Press **ENTER** to return to the previous screen, and follow the screen prompts to either enter data for another device or to exit.

   b. If **only one** difference exceeds the ±4% or ±4 ppb criteria, check the device for leaks and loose fittings. Repeat the Quick Check. Accept the Quick Check if the acceptance criteria is met.
      - If one or more differences exceed the acceptance criteria on this recheck, the device fails. The device is inspected for possible causes and repaired. If the problem is not determined or cannot be remedied by laboratory personnel, the device is sent to Repair and recertified after repair.

   c. If more than one O_3 concentration fails the ±4% or ±4 ppb criteria, the device fails the Quick Check. The device is inspected for possible causes and repaired. If the problem is not determined or cannot be remedied by laboratory personnel, the device is sent to Repair and recertified after repair.

2. Correct incorrectly entered data by using the arrow keys to move the cursor to the incorrect data. Use the arrow key to return to the message

box **STORE THIS DATA** and press **ENTER** and complete as in **Step 1** of this section.

3. Use the arrow key to highlight **ABORT THIS DATA** if the data is not to be stored. Press **ENTER**. The computer returns to the previous screen. Press **1** to enter more data or **0** to exit and follow the screen menus to exit the NPAP Database System.

11.0 CALCULATIONS

Equation 1:

average O_3 generated $= \dfrac{\sum_{i=1}^{10} A_n + \sum_{i=1}^{10} B}{20}$

where A = reading from A cell
B = reading from B cell

Equation 2:

$$y = mx + b$$

where m = slope
b = y-intercept
x = averaged front panel ozone value
y = corrected ozone value

Equation 3:

$$\% \ Difference = \frac{actual\ conc. - baseline}{baseline} \times 100$$

12.0 METHOD PRECISION AND ACCURACY

A 4-day certification sequence is conducted on all 165/175 devices to establish reliable baselines at a zero and three up-scale ozone levels. A "running average" is maintained as devices are checked to account for ultraviolet lamp degradation.

The QA Laboratory has established that based on the instruments used in this procedure, a percent difference of ±4% or ±4 ppb provides a realistic range for optimal accuracy of data.

13.0 QUALITY ASSURANCE

INSTRUMENT CONTROL LIMITS	
INSTRUMENTS	**DIFFERENCE**
TECO 49 vs TECO 49PS	±2%
165/175: Certification	±4% or ±4 ppb of 4 day average
165/175: Quick Check	±4% or ±4 ppb of established baseline

Anytime that Quick Check data exceeds the QC check limits listed above or that the air flow (rotameter) varies significantly, a careful and thorough inspection is made of the device including air lines, capillaries, UV lamp, and the zero air system. If the reliability of the device is still in question, the device is checked by Repair prior to use in the audit program.

Control charts are maintained on the weekly checks of each 49 versus the 49PS. Control charts are also maintained on each audit device for zero and the upscale pot settings.

An overall procedural control is the annual certification of the 49PS against the NIST Reference Photometer SN#1, located at the Environmental Protection Agency, Research Triangle Park, NC. Four to six ozone devices per quarter are also audited by the EPA NPAP Coordinator.

14.0 CORRECTIVE ACTION

Note: Accuracy can be affected by careless setting of the pot, not maintaining the air pressure at 6 psig for the 165 or 9 psig for the 175, or not allowing sufficient time for each pot setting to stabilize before recording the reading.

14.1 49/49PS

1. Front Panel Flowmeters

   A. Air Flow is 1 L/min ± 30%
      - Clean capillaries
      - Check for leaks
      - Check pump
      - Contact Repair

   B. Air Flow is significantly different between cells
      - Clean capillaries
      - Check air lines for leaks

2. Noisy or unstable trace on strip chart recorder

   A. Zero pot setting
      - Check zero air supply
      - Clean optical bench

   B. Upscale pot setting
      - Check zero air supply
      - Clean optical bench
      - Contact Repair

14.2 165

1. Low or high rotameter reading

    - Clean capillary.
    - Check air lines for leaks.

2. Low or high ozone concentration generated

    - Check that the cover is on the 165 device.
    - Check that air flow is 6 psig.
    - Check that the current rotameter reading agrees with previous readings (See 1 above).
    - Check 165 zero air scrubbers .
    - Check that the insulating foam is on the UV lamp.
    - Send the devive to Repair.

14.3 175

Low or high ozone generated

- Check that air flow is 9 psig
- Check that 4-way valve is set at ZERO
- Check that vent on Swagelok® union cross is unobstructed
- Check that all connections and the cap on Swagelok® union cross are tight.

15.0 SHIPPING

1. Select the next participant from the audit list.
2. Record which audit kit is being sent to which participant.
3. Prepare a data packet with the following:

    - Cover letter
    - Instructions for conducting the audit
    - Data sheets
    - Return instructions with return address labels
    - Data return envelope
    - Questionnaire
4. Check the audit kit for completeness of parts.
5. Enclose the packet in the shipping box with the audit kit.

6. Apply the participant address label to the shipping box and ship using the appropriate carrier
7. Enter the shipment into the NPAP data base.

16.0 DATA REPORTING

Audit data is sent directly to the Data Entry personnel and handled according to **NPAP-SOP-005: Computer Data Entry, Report Printing, and System Maintenance for the NPAP.**

17.0 REFERENCES

1. *NPAP-SOP-005: Computer Data Entry, Report Printing, and System Maintenance for the NPAP*.

2. Model 49/49PS U.V. Photometric Ambient O_3 Analyzer/Calibrator Instruction Manual. Thermo Environmental Instruments, Inc. (No date given)

3. Paur, R. J. and F. F. McElroy. *Technical Assistance Document for the Calibration of Ambient Ozone Monitors*. EPA-600/4-79-057, U.S. Environmental Protection Agency, Research Triangle Park, NC, 1979.

4. Model 165 Ozone Generator Instruction Manual. Thermo Environmental Instruments, Inc. October, 1991

5. Model 175 Portable Calibrator Instruction Manual. Thermo Environmental Instruments, Inc. 8/25/92.