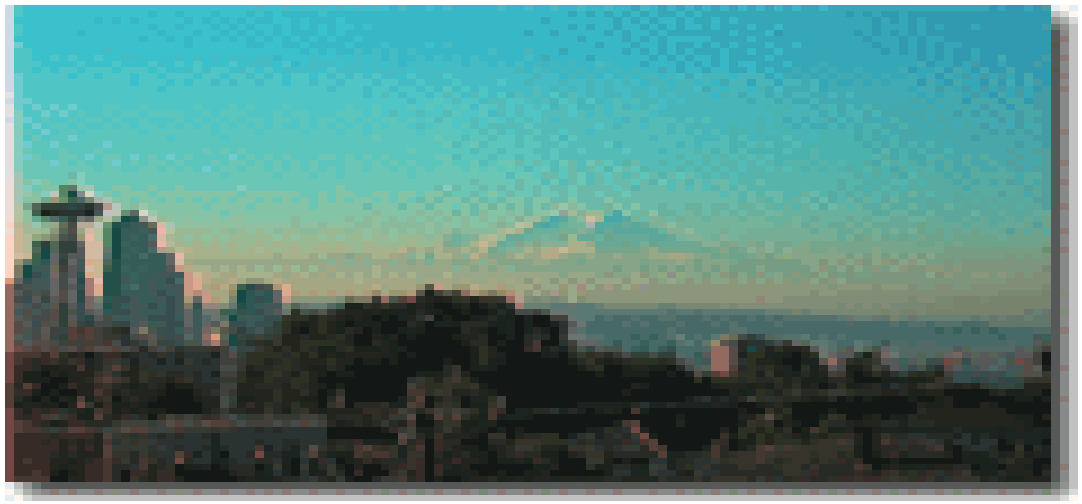
# Monitoring For Ozone



*A review for station operators*


| | |
|---|---|
| Donovan Rafferty | Ecology |
| Ron Cunningham | Oregon DEQ |
| Anthony Reneau | Tanabyte Engineering |

# What we will cover

- The Air Monitoring Station
- The Monitoring Equipment
- Performing Quality Control Checks
- Certifying Ozone Standards

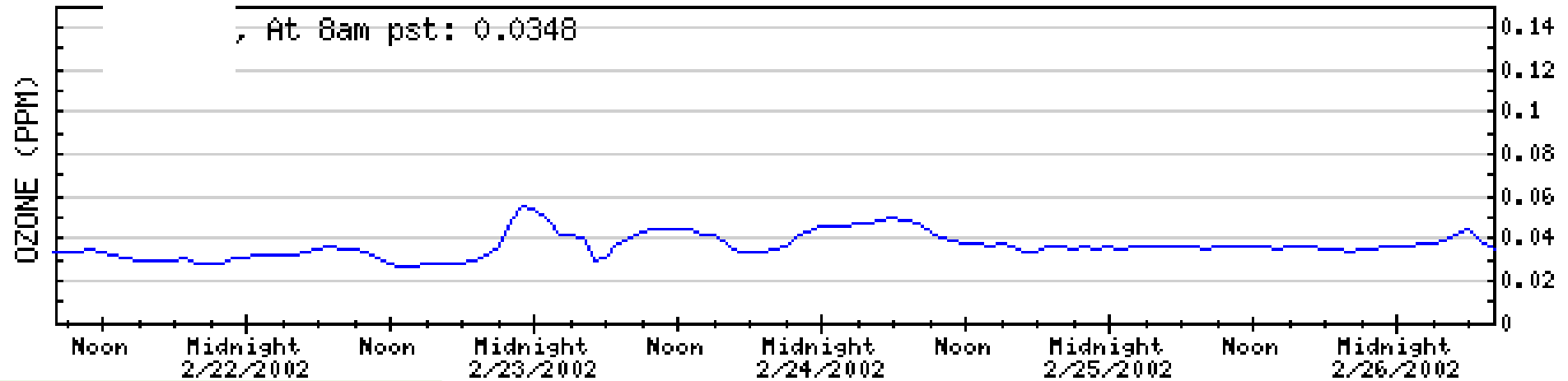
***You will learn…..***

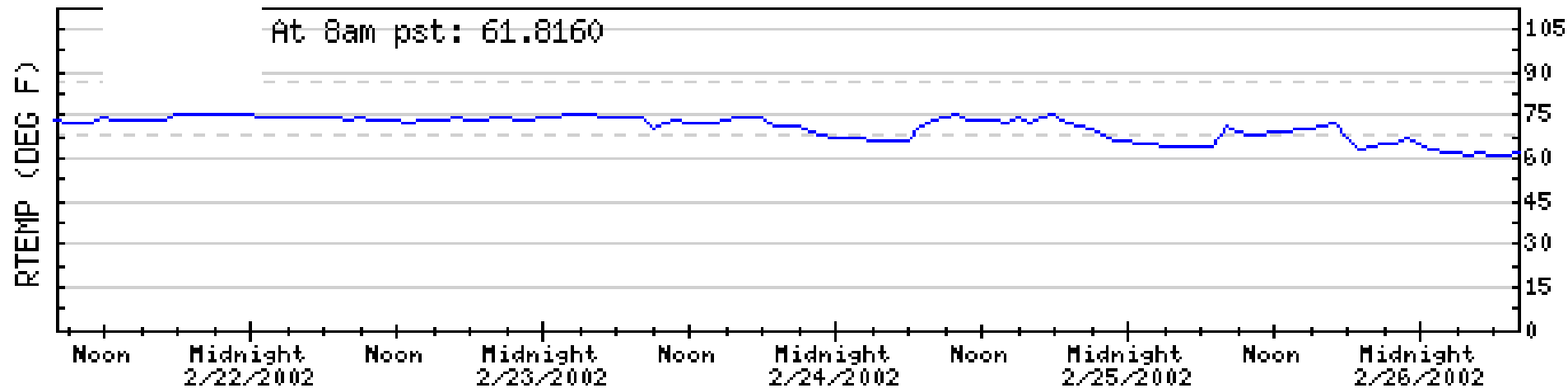
***by making mistakes !***

| Work Tasks - Ozone 2005 | Task Assignment | 1-Mar | 8-Mar | 15-Mar | 22-Mar | 29-Mar | 5-Apr | 12-Apr | 19-Apr | 27-Apr | 3-May |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary bench standard to CARB | RC | | | | | | | | | | |
| Planning meeting- staff assignments | Staff | | | | | | | | | | |
| Review of last season | Staff | | | | | | | | | | |
| Contact with property owners | Alan | | | | | | | | | | |
| Order supplies | RC | | | | | | | | | | |
| Site AC's /check w Paula for service | Alan | | | | | | | | | | |
| Ozone monitors prepped | RC/Lab rat | | | | | | | | | | |
| Zero air sources prepped | RC/Lab rat | | | | | | | | | | |
| Confirm Multorpor as site for summer O3 | JS/BB | | | | | | | | | | |
| Training of Aaron and Chris | KS/MH/Staff | | | | | | | | | | |
| CO equipment down: | STAFF | | | | | | | | | | |
| Repair recorders | RC/Lab rat | | | | | | | | | | |
| Program DL's for O3 | LH/MH/KS | | | | | | | | | | |
| Move and configure XMLPusher PCs | Staff/KS/LH | | | | | | | | | | |
| UPS in place | Staff | | | | | | | | | | |
| Clean manifold - check fan | Staff | | | | | | | | | | |
| Replace probes with new teflon | Staff/RC | | | | | | | | | | |
| Colored exhaust lines | Staff/RC | | | | | | | | | | |
| Shelter cleanup, general site cleanup | Staff | | | | | | | | | | |
| Renew Internet Access accounts | JS | | | | | | | | | | |
| Verify phone line operation | Staff | | | | | | | | | | |
| Verify temp control operation | Staff | | | | | | | | | | |
| DAS setup: | KS | | | | | | | | | | |
| Handling of incoming data | KS/JK | | | | | | | | | | |
| setup hourly report to AirNow | KS/JK | | | | | | | | | | |
| Midway meeting and evaluation | STAFF | | | | | | | | | | |
| Calibrate monitors in lab | RC/Lab rat | | | | | | | | | | |
| Calibrate transfer-std in lab (6x6) | RC/Lab rat | | | | | | | | | | |
| Staff training | MH/Staff | | | | | | | | | | |
| Site Accessories ready for each site | Staff | | | | | | | | | | |
| Setup at each site | Staff | | | | | | | | | | |
| Install met at CJHS site | LH/Staff | | | | | | | | | | |
| Spare monitor & transfer-std | RC | | | | | | | | | | |
| Chart handling prep- QA sheet prep | BB | | | | | | | | | | |
| Start up review meeting | Staff | | | | | | | | | | |
| Celebrate our successes | Staff | | | | | | | | | | |
| List any problems to avoid in future | Staff | | | | | | | | | | |

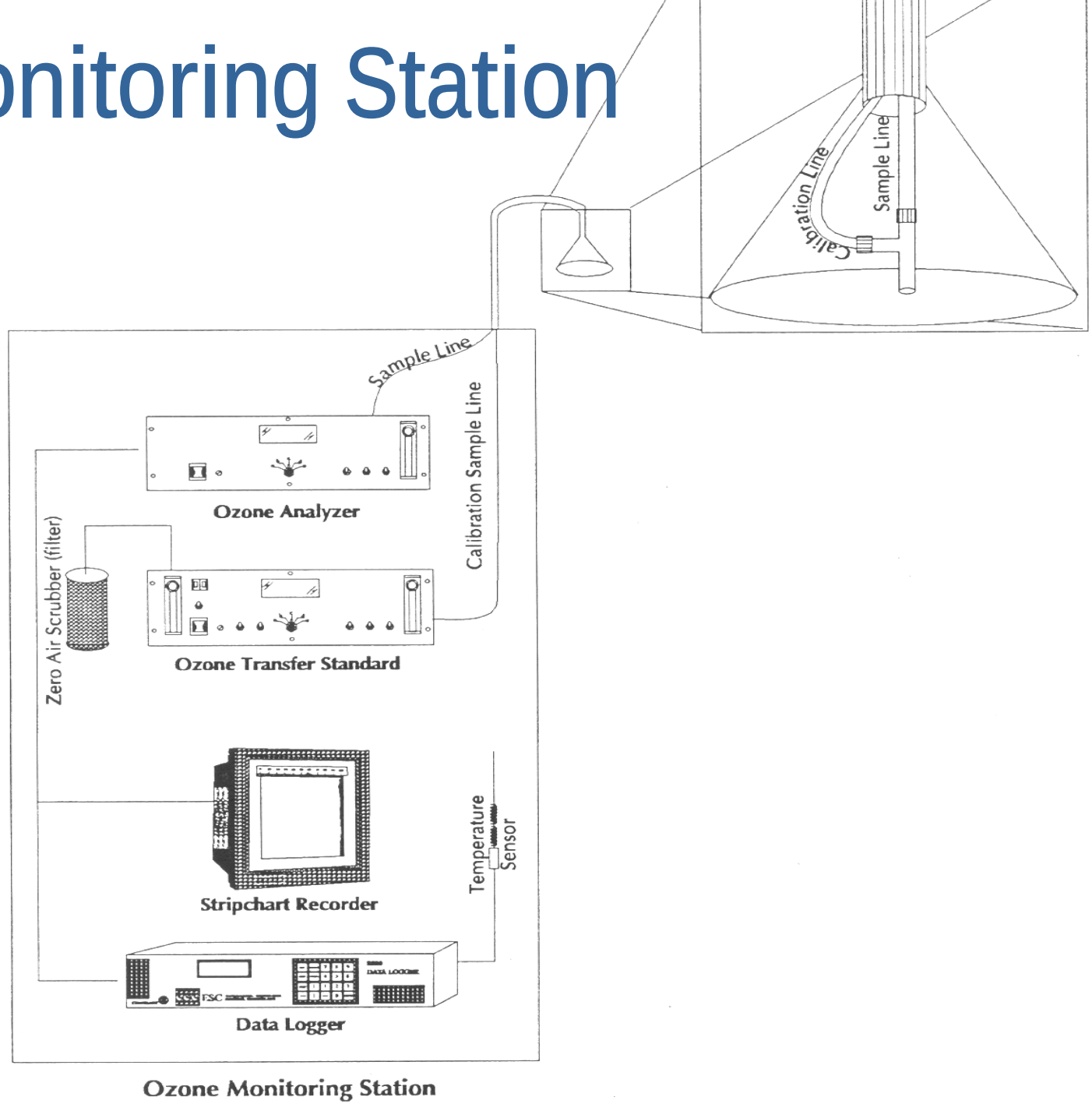
| Ozone sites include: | 3 letter | LASAR # | Network |
|---|---|---|---|
| Spangler Rd., Canby | SPR | 10093 | South |
| Lotspeich residence, Talent | TAL | 10109 | Medford |
| Cascade Jr. High, Turner | CJH | 10130 | South |
| SE Lafayette, Portland | SEL | 10139 | North |
| Sauvie's Island, Portland | SIS | 14152 | North |
| St. John's Church, Milwaukie | MSJ | 23306 | South |
| plus a possible visibility site at Multorpor | | | |

# Air Quality
# Site Operator's Page

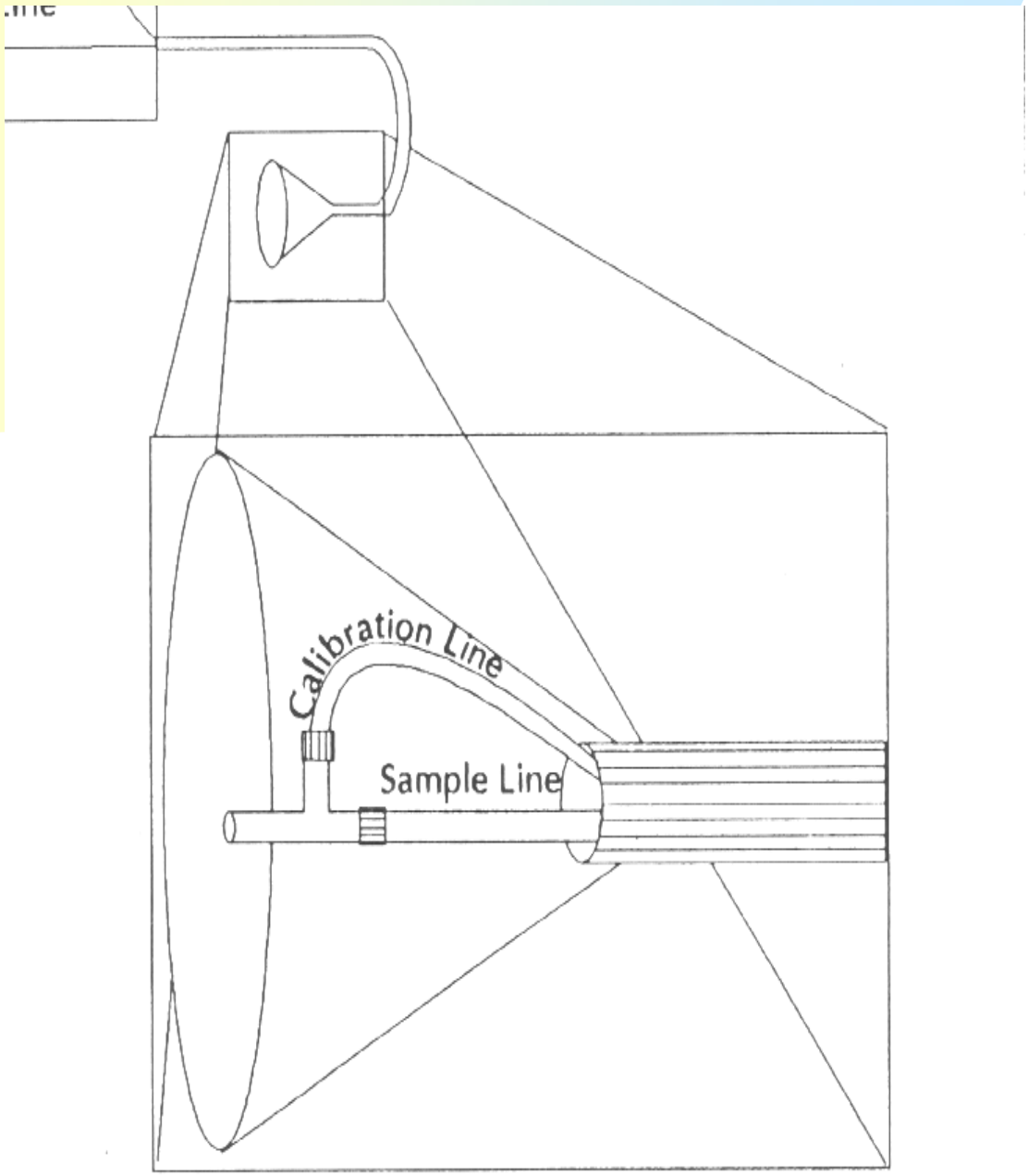


# The Monitoring Station




Ozone Monitoring Station


Calibration Line
Sample Line

# The Probe

- Probe is made of Teflon®.
- The residence time is critical.
- EPA requires a sample residence time of less than 20 seconds.
- At 2.0 LPM the maximum probe length should be less than 170 ft.
- For 10 seconds the maximum probe length should be 84 ft.

# When you arrive at the site…..

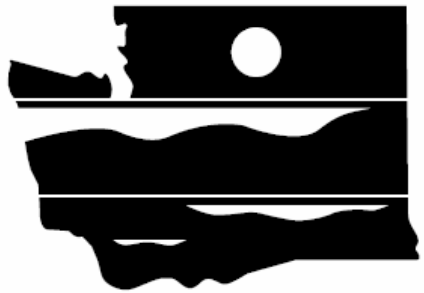
- Survey the structure housing the equipment for weather leaks, safety, and security.
- Perform routine maintenance.
- If you find a problem, you are responsible for seeing it is corrected.
- Record the actions that you took.

# Environmental Controls for Monitoring Equipment

- Instrument vibration (Never “stack instruments”)
- Keep sunlight from “shining” on instruments.
- Electrical voltage
- Temperature
- Security
- Cleanliness

# Standard Operating Procedures

- Data collected using fully documented procedures have much higher credibility.
- Developed using the CFR's and technical assistance documents.



WASHINGTON STATE
DEPARTMENT OF
ECOLOGY

# Ozone Monitoring Procedure

*Air Quality Program*

**July 2004**

**95-201G (rev. 7/04)**

*If you didn't record it ……*

*you didn't do it.*

# Monitoring Checklist

- Developed to help the first time operator or one that does it infrequently.

| STATION CHECKLIST | |
|---|---|
| Site name | |
| Site number | |
| Operator | |
| Record the time the station was entered. | PST |
| Record the date the station inspection. | |
| **THE MONITORING STATION** | |
| **2.**Has any damaged occurred to the station since the last inspection? | |
| Are there any unusual noises or odors? | |
| **THE ANALYZER** | |
| Is the power on? | |
| Is the sample flow set to 2.0 LPM? | |
| Is the selector switch in the "operate" mode? | |
| Is the solenoid valve cycling every 10 seconds? | |
| Has channel 03 on the data logger been disabled? | |
| Has it been noted on the strip chart? | |
| Record the sample chamber temperature. | $^{o}$C |
| Record the unadjusted sample frequency. | KHz |
| Record the sample chamber pressure. | Atm |
| Is the control frequency 50.000?. | |
| Do the analyzer, recorder and data logger all read the same? | |
| Record the analyzer span setting. | |
| **THE TRANSFER STANDARD** | |
| Is the ozone adjust thumbwheels set to 000? | |
| Is the auto/man switch in the "auto" position? | |
| Is the ozone switch in the "off" position? | |
| Is the generator pump switch in the "on" position? | |
| Is the selector switch in the "operate" position? | |
| Is the T/P switch in the "on" position? | |
| Is the valve switch in the "on" position? | |
| Is the sample pump switch in the "on" position? | |

# Quality Control Checks

- Should be performed at least once every two weeks.
- Inspection of the shelter and instruments.
- Zero, Precision and Span Checks
- Adjustments

*Never perform a calibration check on days forecasted to be above 90° F. unless there appears to be a problem with the ozone analyzer.*

*The current ozone standard is 80 ppb/eight hour average. Calibrations should never be performed when ozone values are elevated.*

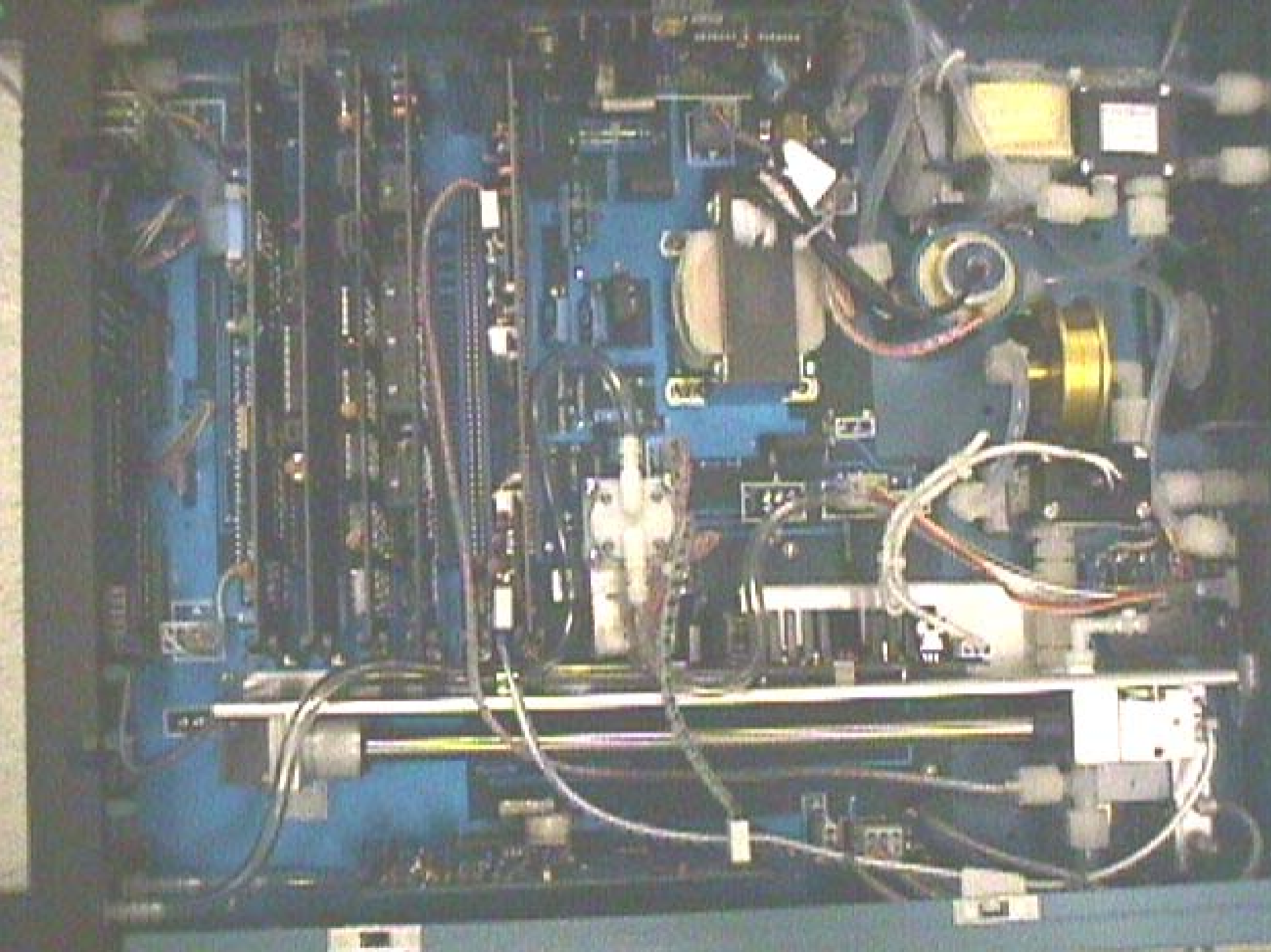
# The Monitoring Equipment

- Ozone analyzers must meet reference method or equivalent method specified by the EPA in Appendix D of 40 CFR Part 50.
- Dasibi 1008PC

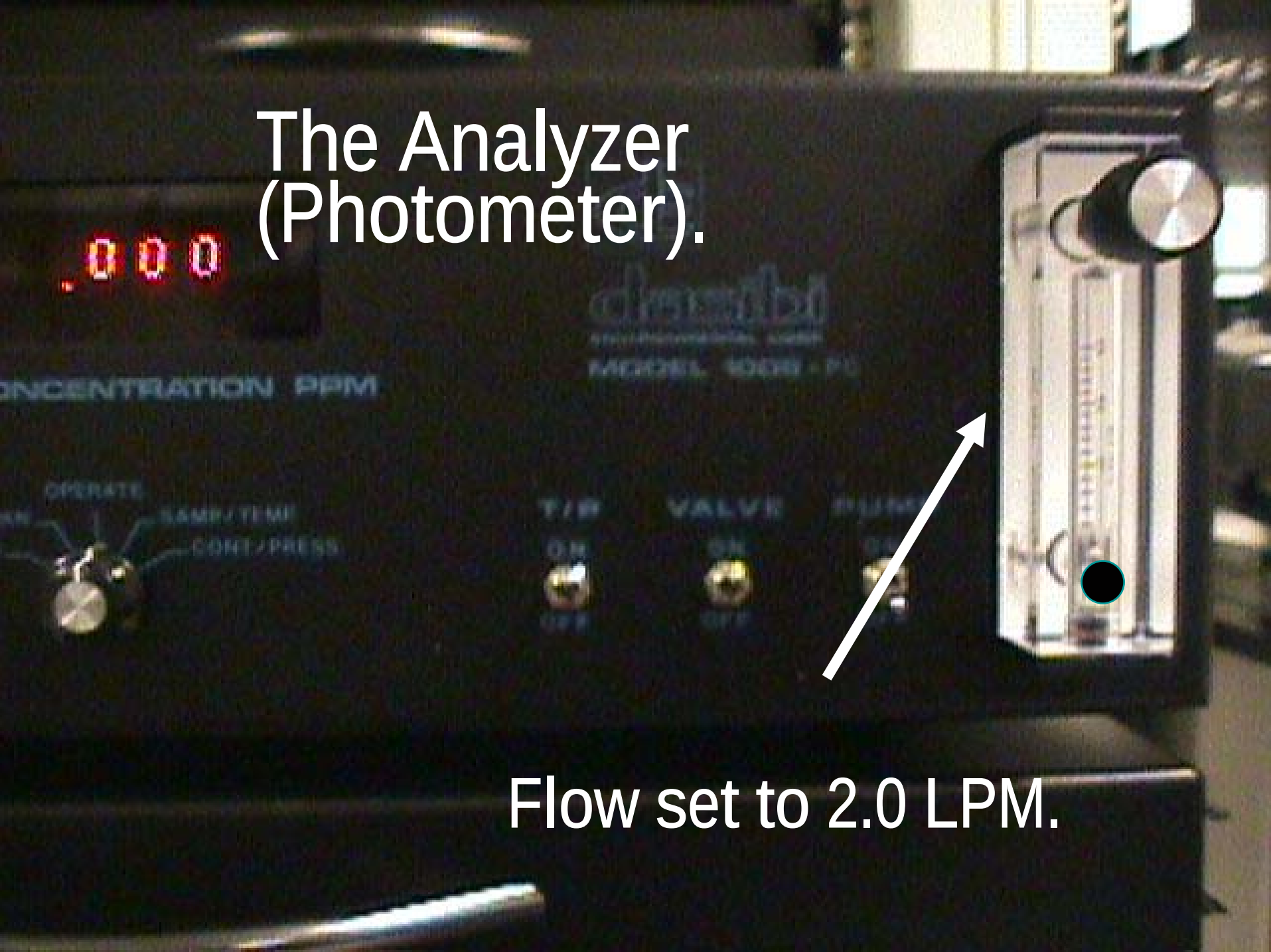
# Dasibi Ozone Analyzers

- Meet EPA designated equivalent method requirements when operated under the following conditions:
  - Concentration range of 0 - .5 ppm
  - Line voltage of 105 -125 vac
  - Temperature of 68°- 86° F
- The analyzers must be operated and maintained according to the Operating and Maintenance Manual to conform to the EPA Designation requirements.


O3 ADJUST
000
MANUAL
POWER
ANALOG
SPAN
ON
OFF
OZONE
ON
OFF
PUMP
U.S.E.P.A.
DESIGNATED
EQUIVALENT METHOD
EQOA-0383-056
MARCH 10, 1983
APPROVED RANGES:
0.5, 1.0 ppm

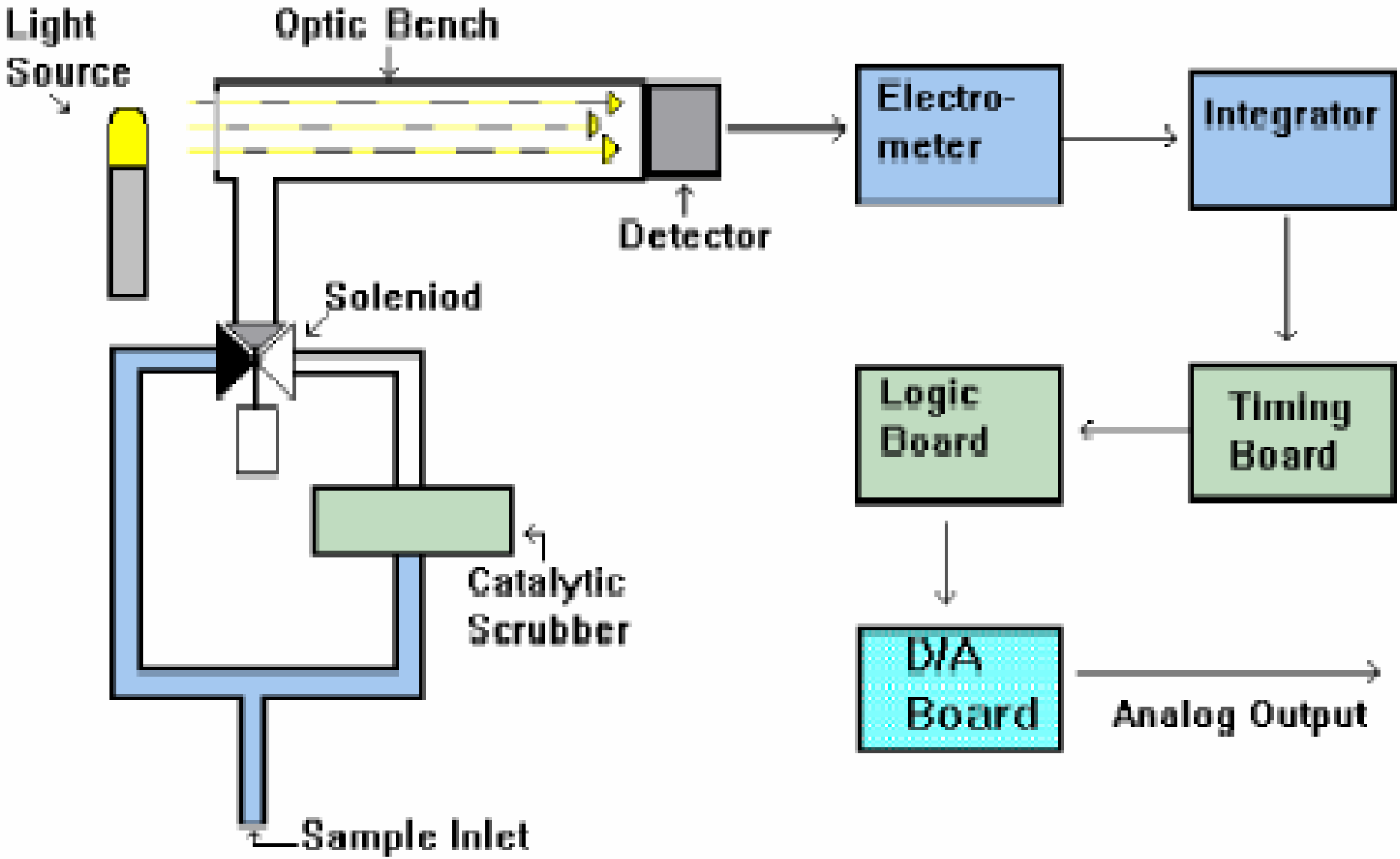


*Think of the instrument as being divided into two components…….*


The Analyzer
(Photometer).
.000
ONCENTRATION PPM
OPERATE
SAMP / TEMP
CONT / PRESS
T / P
VALVE
ON
Flow set to 2.0 LPM.

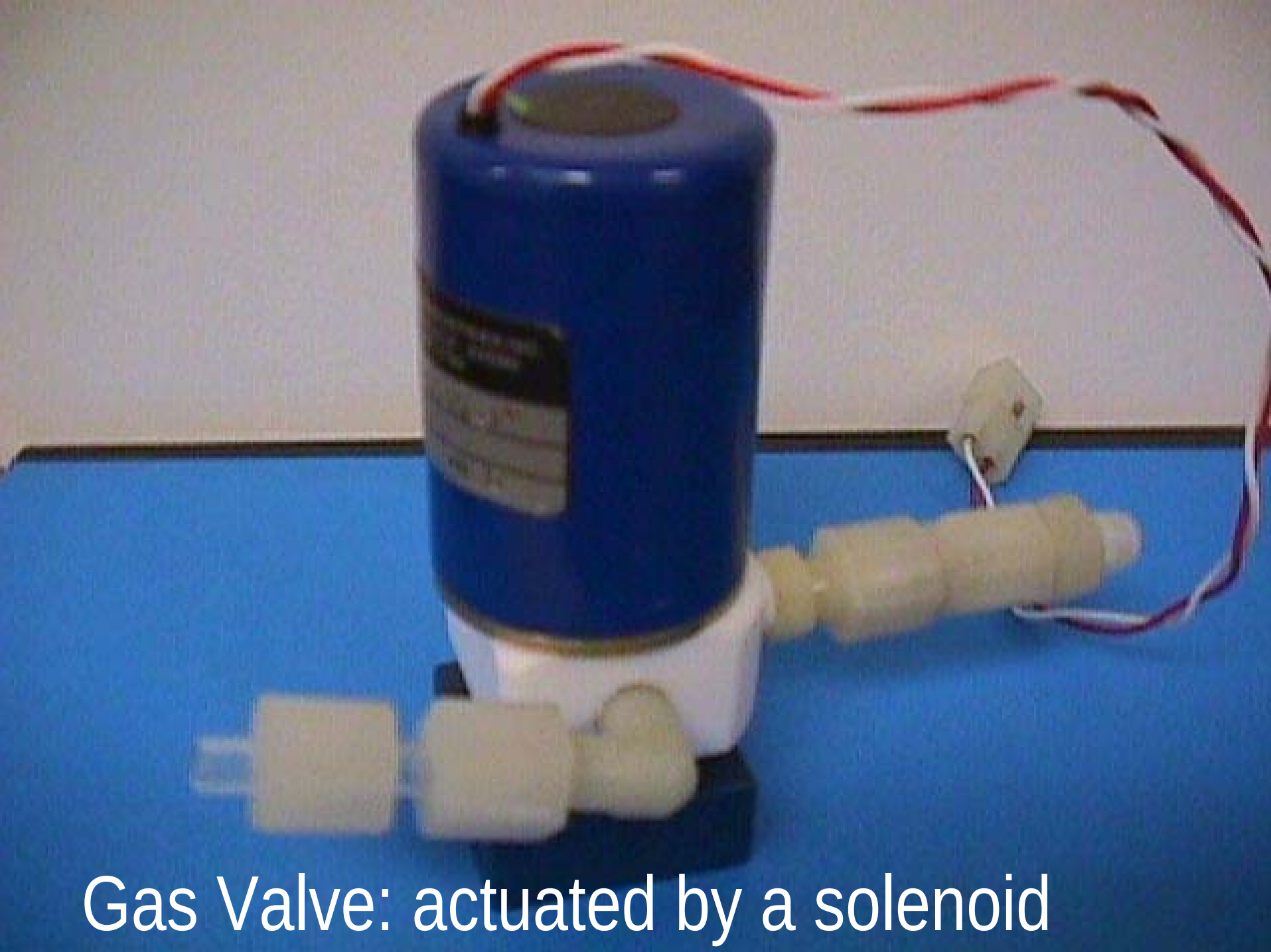
# The Ozone Analyzer Technique

- Based on the principle that ozone molecules absorb UV light (254 nanometers wavelength).
- A column of air is illuminated at one end by an ultraviolet lamp.
- The intensity of the lamp is measured at the opposite end by a detector.
- The measurement is performed within the sample tubes (absorption tubes) of the analyzer.


Light Source
Optic Bench
Detector
Electro-meter
Integrator
Soleniod
Logic Board
Timing Board
Catalytic Scrubber
D/A Board
Analog Output
Sample Inlet

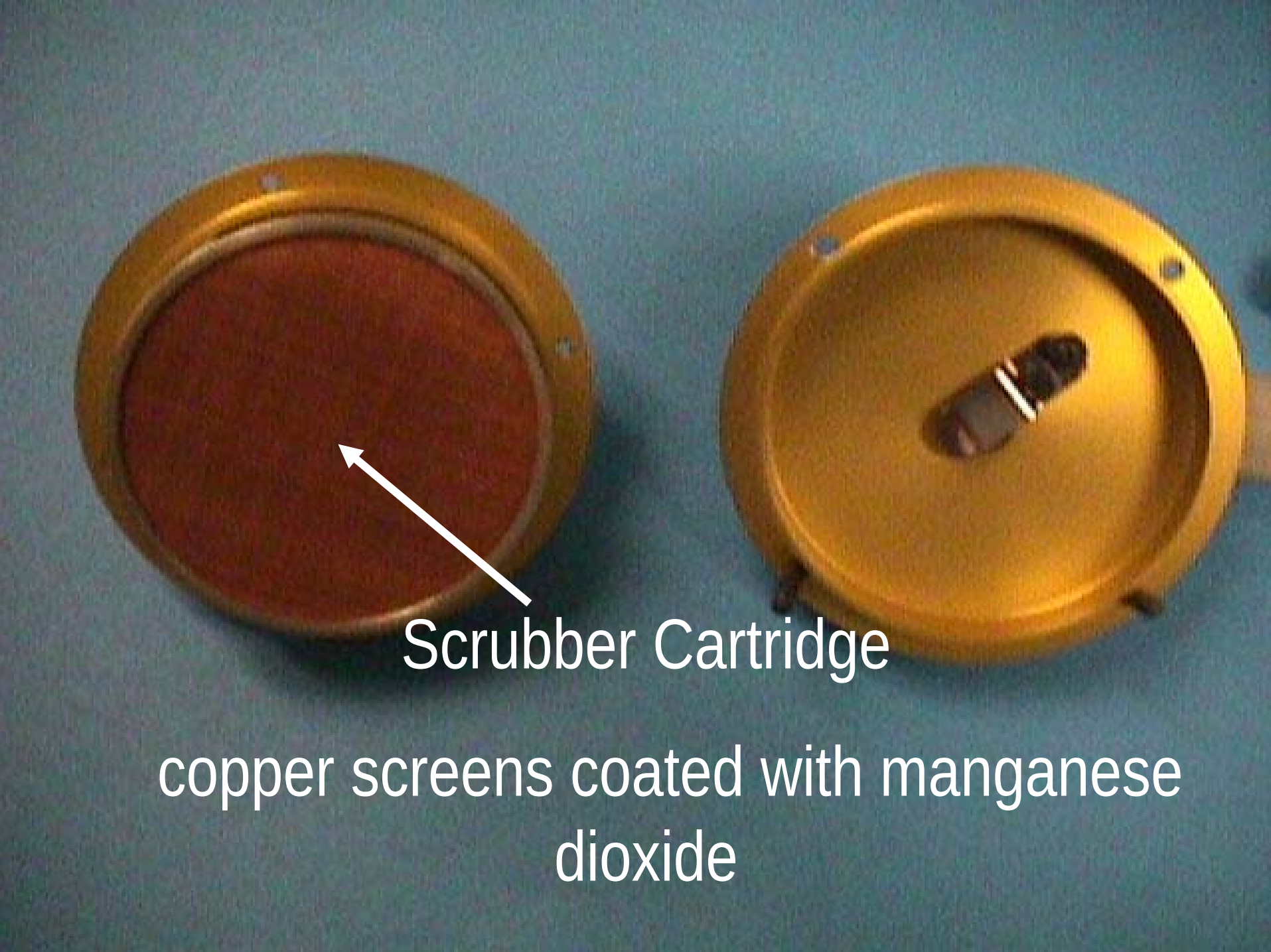
# Critical Components of an Ozone Analyzer (Photometer)

- Solenoid valve
- Ozone to oxygen converter
- Absorption tubes
- Sample pump
- UV lamp source
- Detector



Gas Valve: actuated by a solenoid

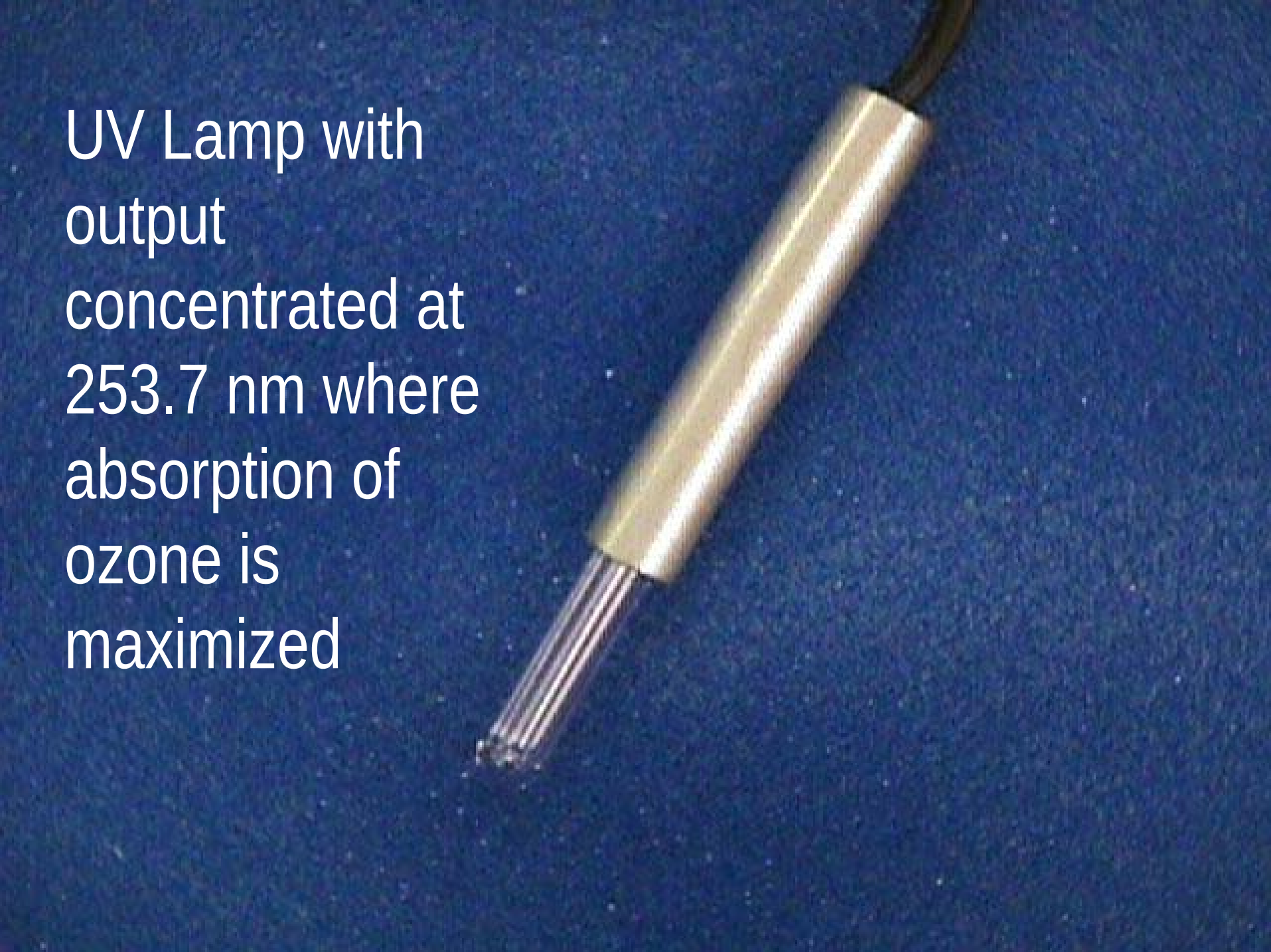

Ozone Scrubber




copper screens coated with manganese dioxide

- The $MnO_2$ catalyzes the reaction of ozone to diatomic oxygen.
- The sample entering the absorption cell after passing through the filter is preserved intact except for the ozone.

The Sample Pump


UV Lamp with output concentrated at 253.7 nm where absorption of ozone is maximized

Detector: Measures the intensity of the lamp

# The Measurement

- Each measurement cycle is completed within 10 to 20 seconds.
- Each measurement contains two half cycles.

# The First Measurement Half-Cycle

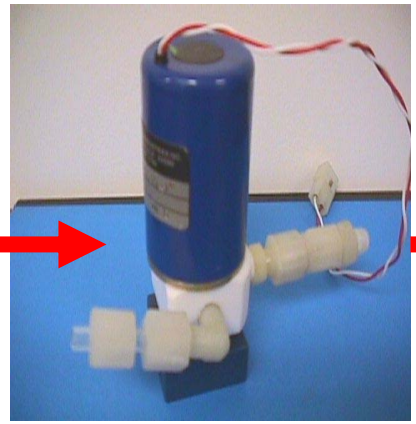
- Ambient air is directed by the analyzer's solenoid valve to the scrubber where any ozone present is converted to oxygen.
- The ozone-free sample is directed through the absorption tubes.

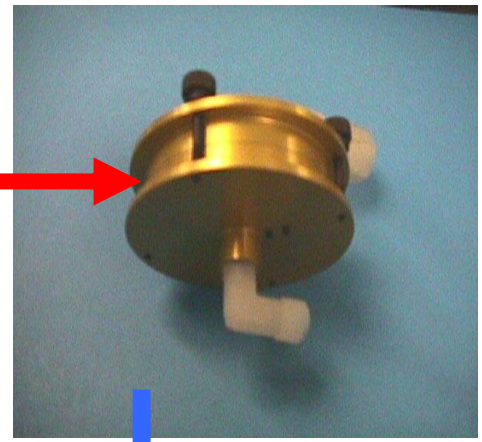
- The UV source lamp illuminates the sample and the transmitted intensity is measured by the detector.
- The analyzer stores the intensity value.

# The First Measurement Half Cycle

Scrubber

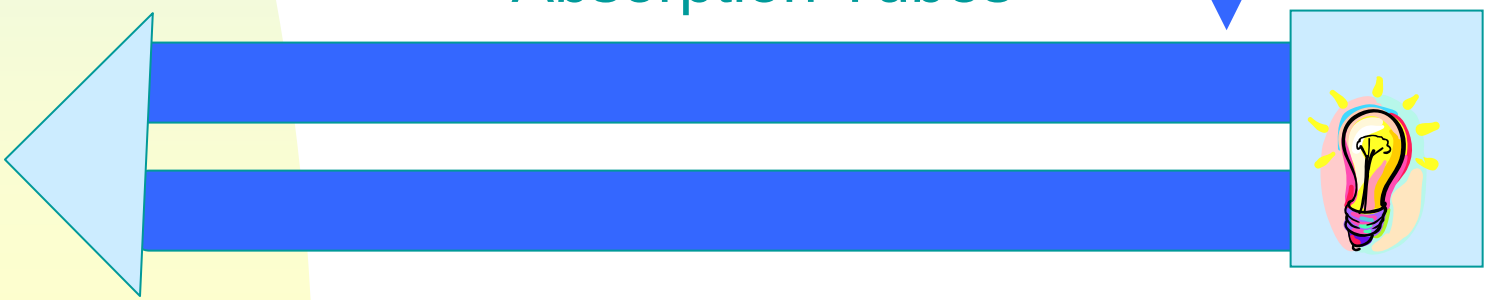
Sample





Solenoid

Absorption Tubes



Zero (reference) gas with the ozone “scrubbed”

# Absorption Tubes

- The optical path length through the sample.
- Transmittance of the sample at a wavelength of 253.7 nm

- The temperature and pressure of the sample

# The Second Measurement Half-Cycle

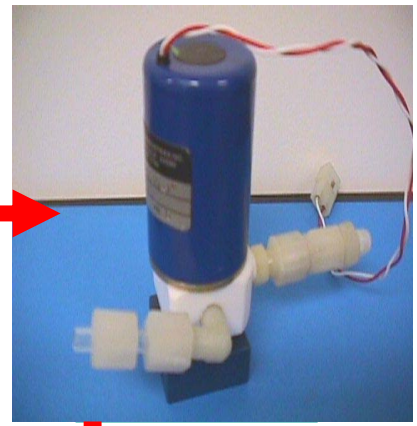
- The sample is directed to the absorption tubes.
- The UV source lamp illuminates the sample.
- The detector measures the transmitted intensity.

# The Second Measurement Half-Cycle

- Any ozone present in the sample absorbs some UV light resulting in a lower intensity value as measured by the detector.
- This value is subtracted from the previously stored value and the resulting difference is the amount of ozone in the ambient sample.

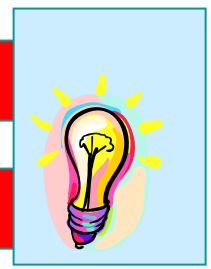
# The Second Measurement Half Cycle

Solenoid



Sample

Absorption Tubes



Sample without the ozone “scrubbed”

# At the end of The Measurement Cycle

- The measured result is displayed on the instrument as a concentration.
- Presented as an electrical signal to the data logger and the strip chart recorder.

***Since ozone is a highly reactive gas, accurate concentration of the gas cannot be made and stored for any length of time.***

***To calibrate the analyzer, various concentrations of ozone must be made and measured on site.***

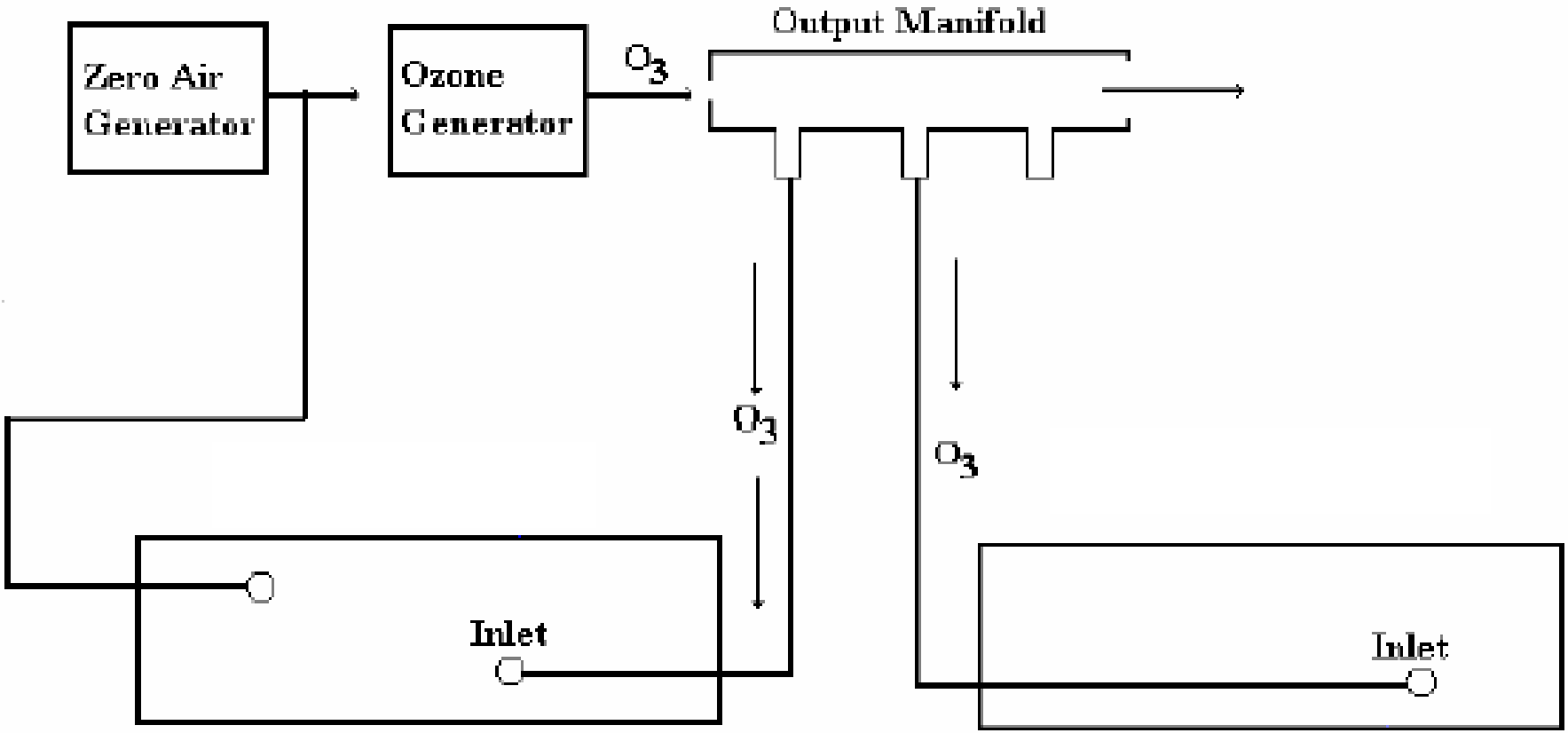
***Specific protocols have been developed to generate and measure accurate concentrations of ozone on site.***

# The Ozone Transfer Standard

- Think of as two instruments.
- One half makes ozone.
- The other half measures the sample.
- Capable of generating and measuring accurate ozone concentrations.

# Critical Components of an Ozone Transfer Standard

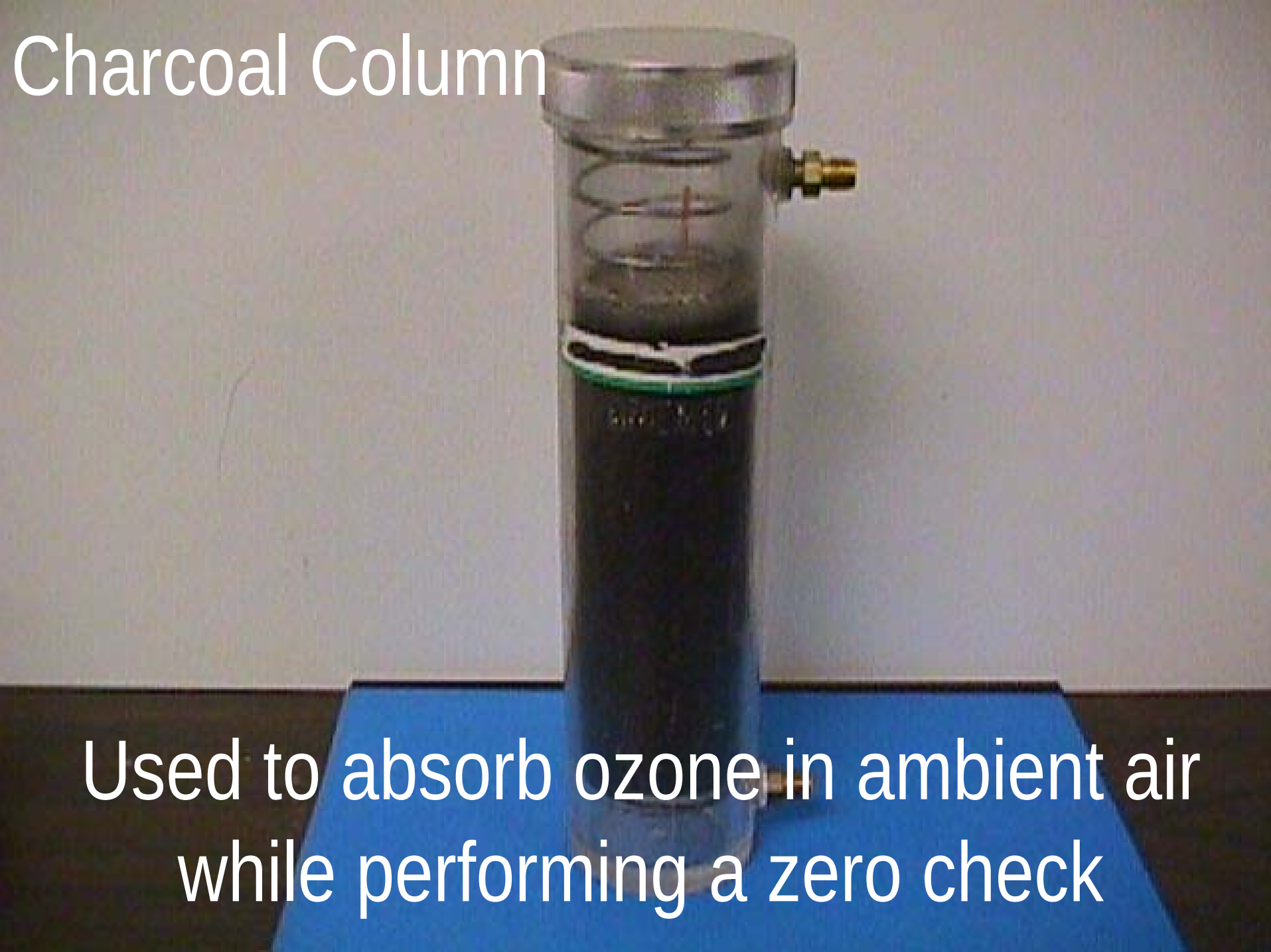
- Zero air source.
- Pump
- Flow controller
- Ozone generator
- Manifold




Ozone transfer standard

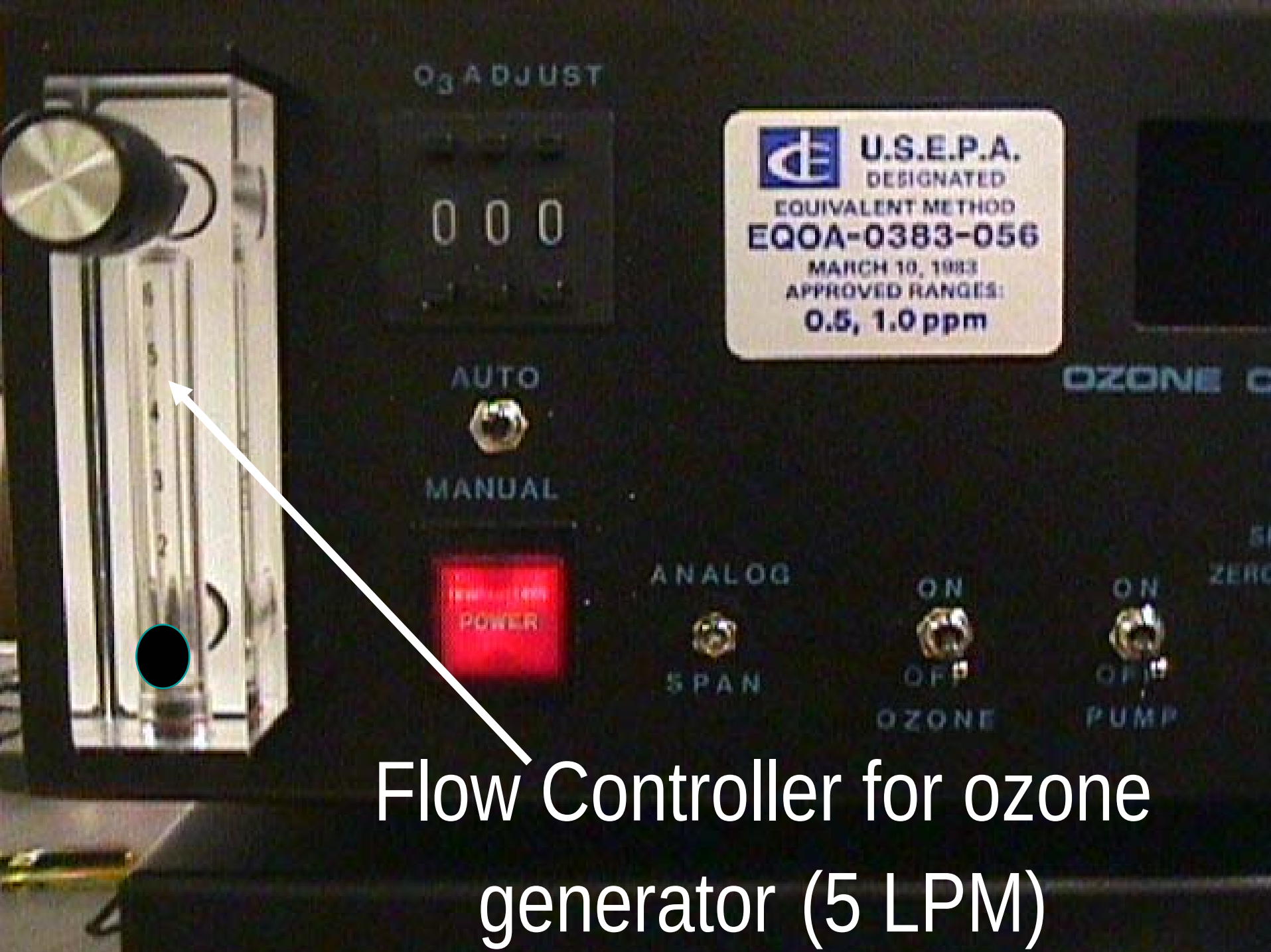
Ozone analyzer

# Charcoal Column

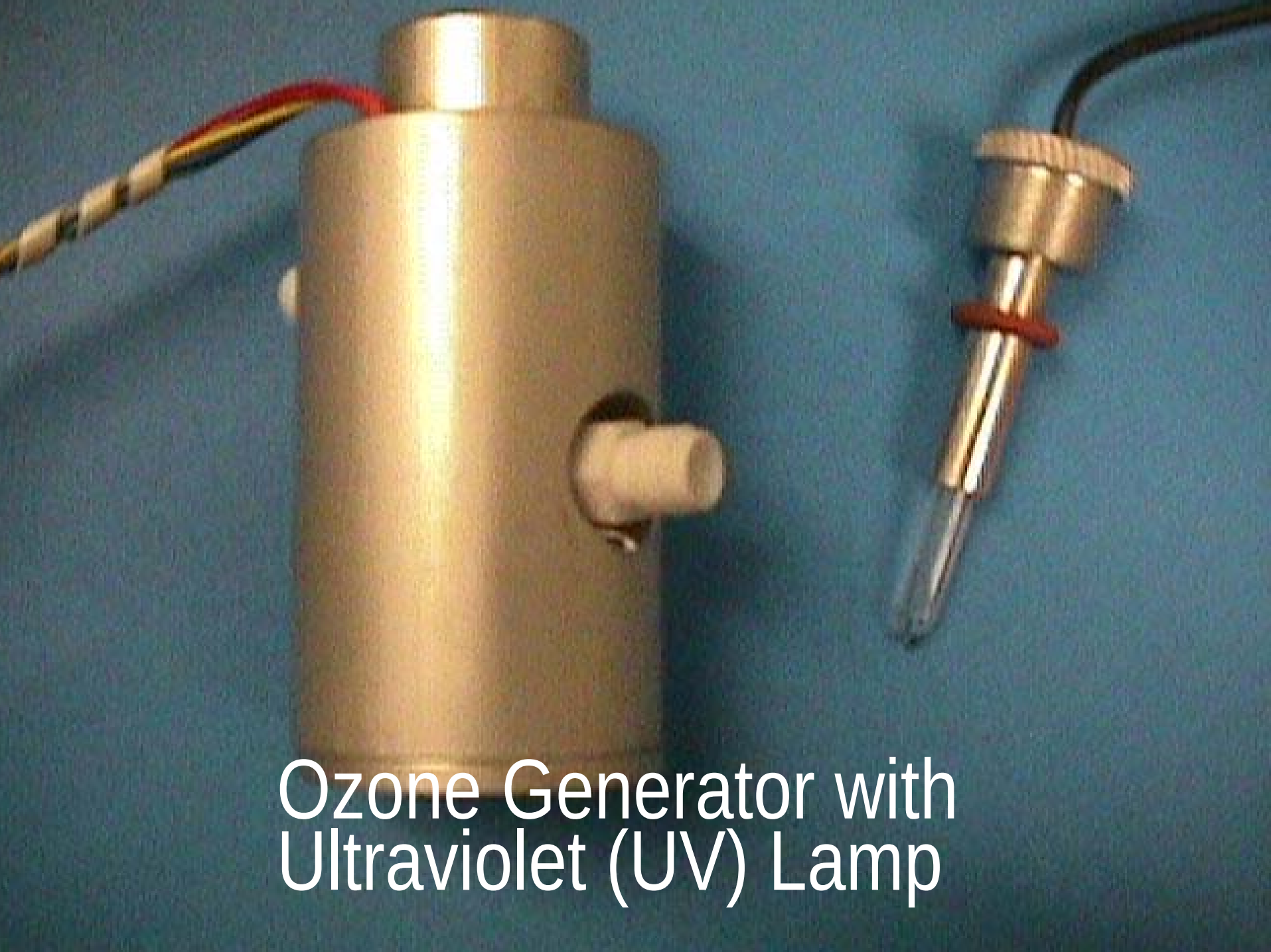


Used to absorb ozone in ambient air while performing a zero check

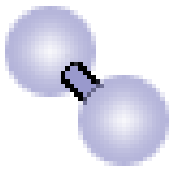
# Generator Pump


O3 ADJUST
000
U.S.E.P.A.
DESIGNATED
EQUIVALENT METHOD
EQOA-0383-056
MARCH 10, 1993
APPROVED RANGES:
0.5, 1.0 ppm
AUTO
MANUAL
POWER
ANALOG
SPAN
ON
OFF
OZONE
ON
OFF
PUMP
OZONE
Flow Controller for ozone generator (5 LPM)


Ozone Generator:
produces ozone for calibration check

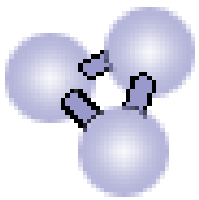

Ozone Generator with
Ultraviolet (UV) Lamp

# The Ozone Generator



$O^2$

Oxygen molecules have two oxygen atoms.



$O^3$

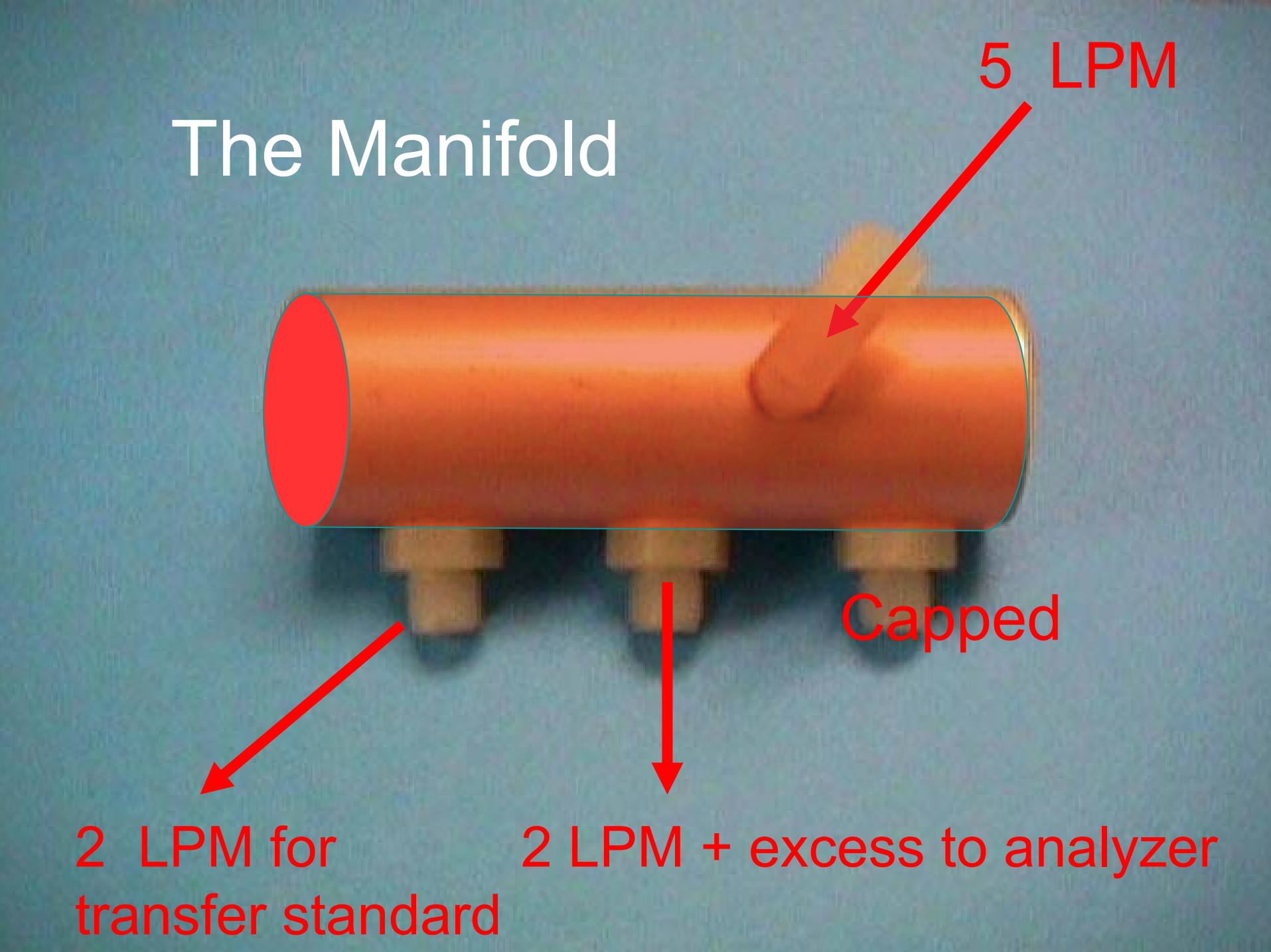
Ozone molecules have three oxygen atoms.

- Incoming air is subjected to ultraviolet radiation from a mercury vapor lamp.
- The oxygen absorbs the UV light.
- To dissipate the resulting gain in energy, the irradiated $O_2$ molecules split into two negatively charged oxygen atoms.
- These atoms combine with unsplit oxygen to form $O_3$.

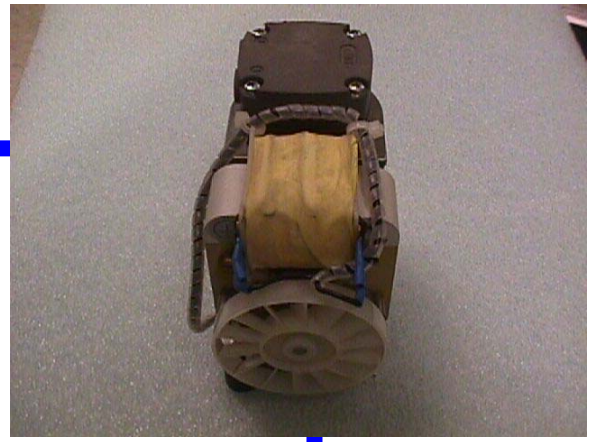
# The Manifold

- A specific volume of ozone or zero air enters the manifold.
- The calibrator pulls a “sample” from the manifold.
- The instrument that is being check also pulls a “sample” from the manifold.
- The excess is allowed to vent.

# The Manifold



Ozone Scrubber



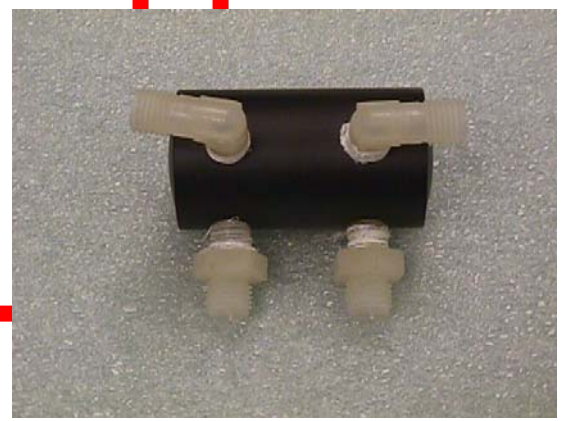
Analyzer

To transfer standard

capped

Flow Controller

Ozone Generator



Manifold

# The Ozone Generator

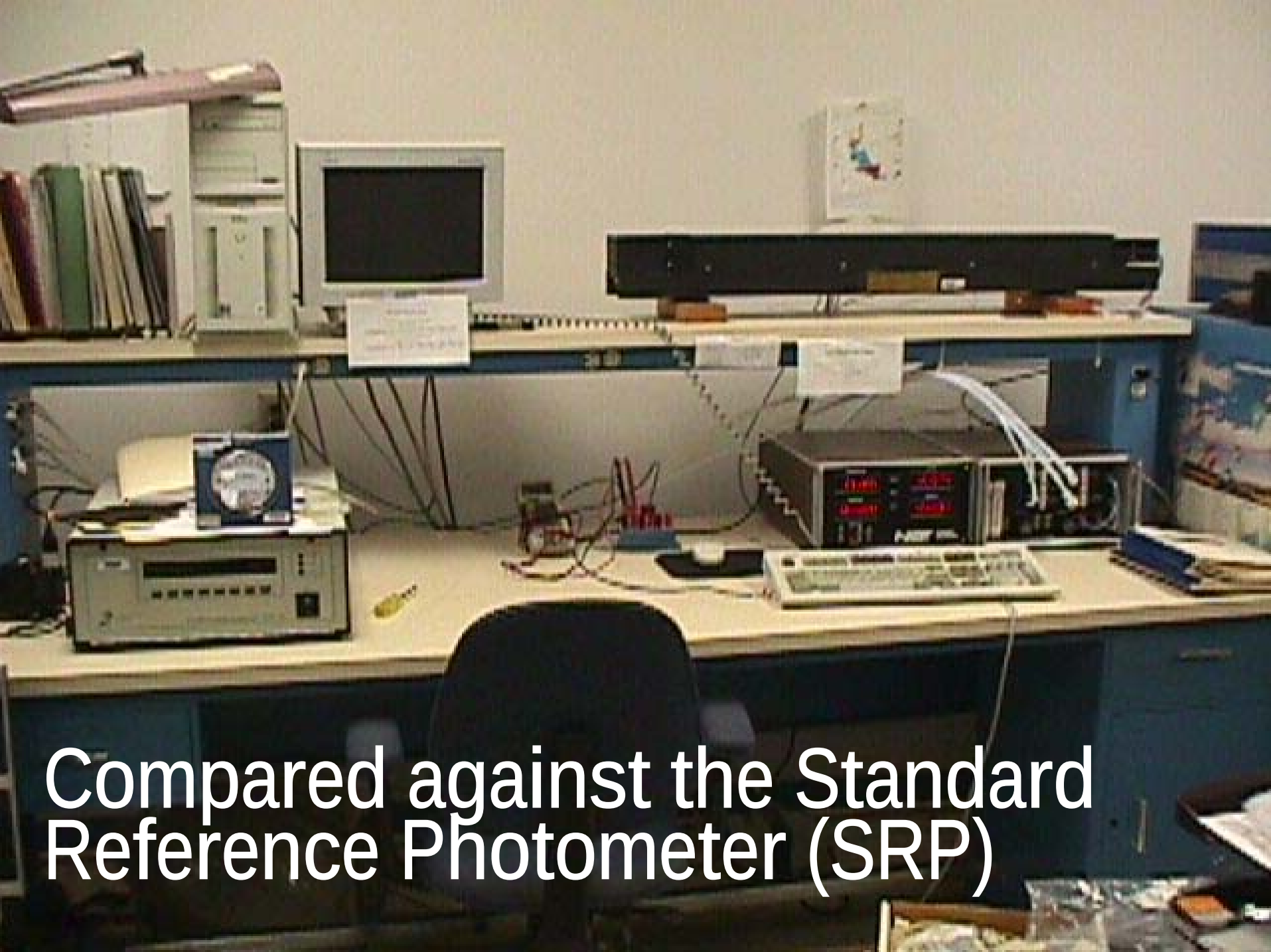
# Primary Standards and Transfer Standards

- Are used to verify the accuracy of the instrument.
- Primary Standards have the highest authority.

# Primary Standards

- Located at a central laboratory where it can remain stationary, protected from the physical shocks of transportation, operated by an experienced analyst under optimum conditions.
- Serves as a common standard for all analyzers in a network.
- Compared against other primary standards.


AIR RESOURCES BOARD


Compared against the Standard
Reference Photometer (SRP)

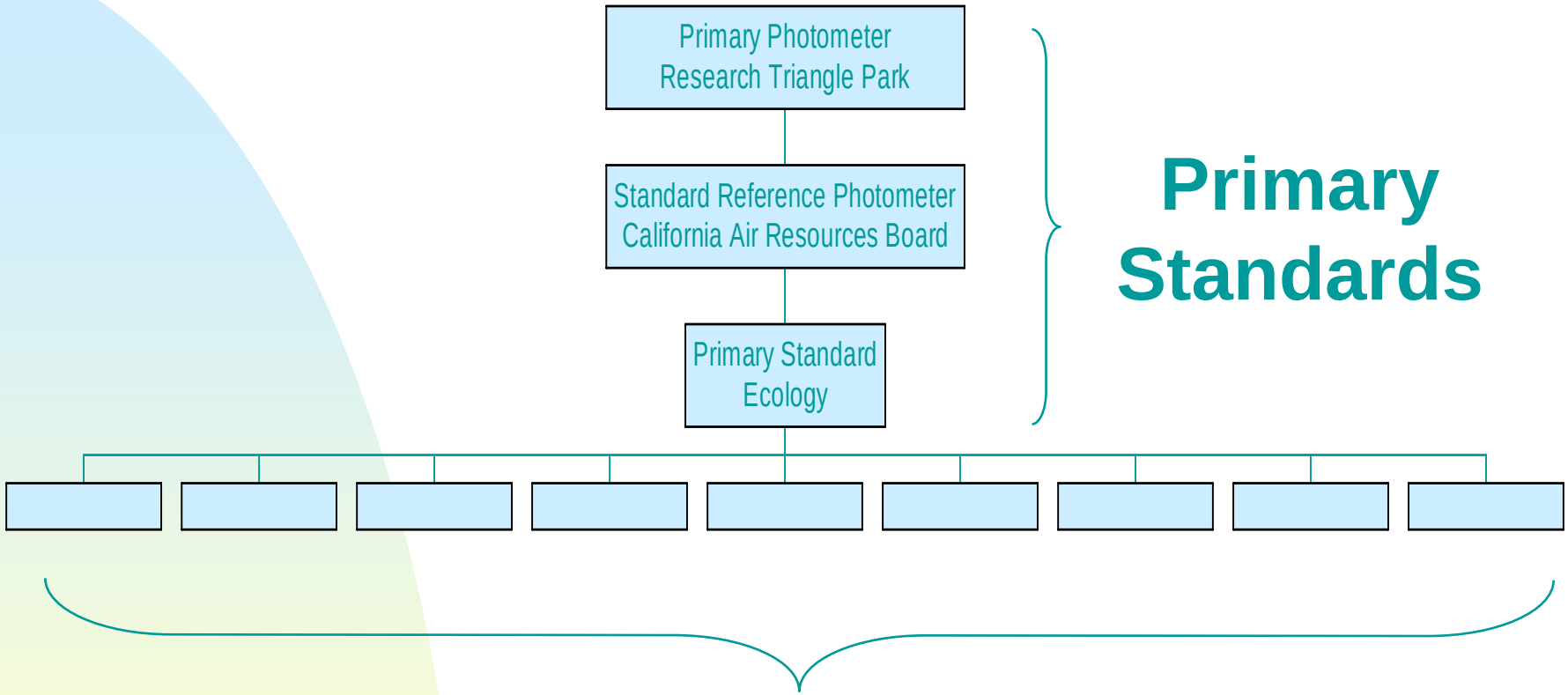
# Primary standards have the highest authority.

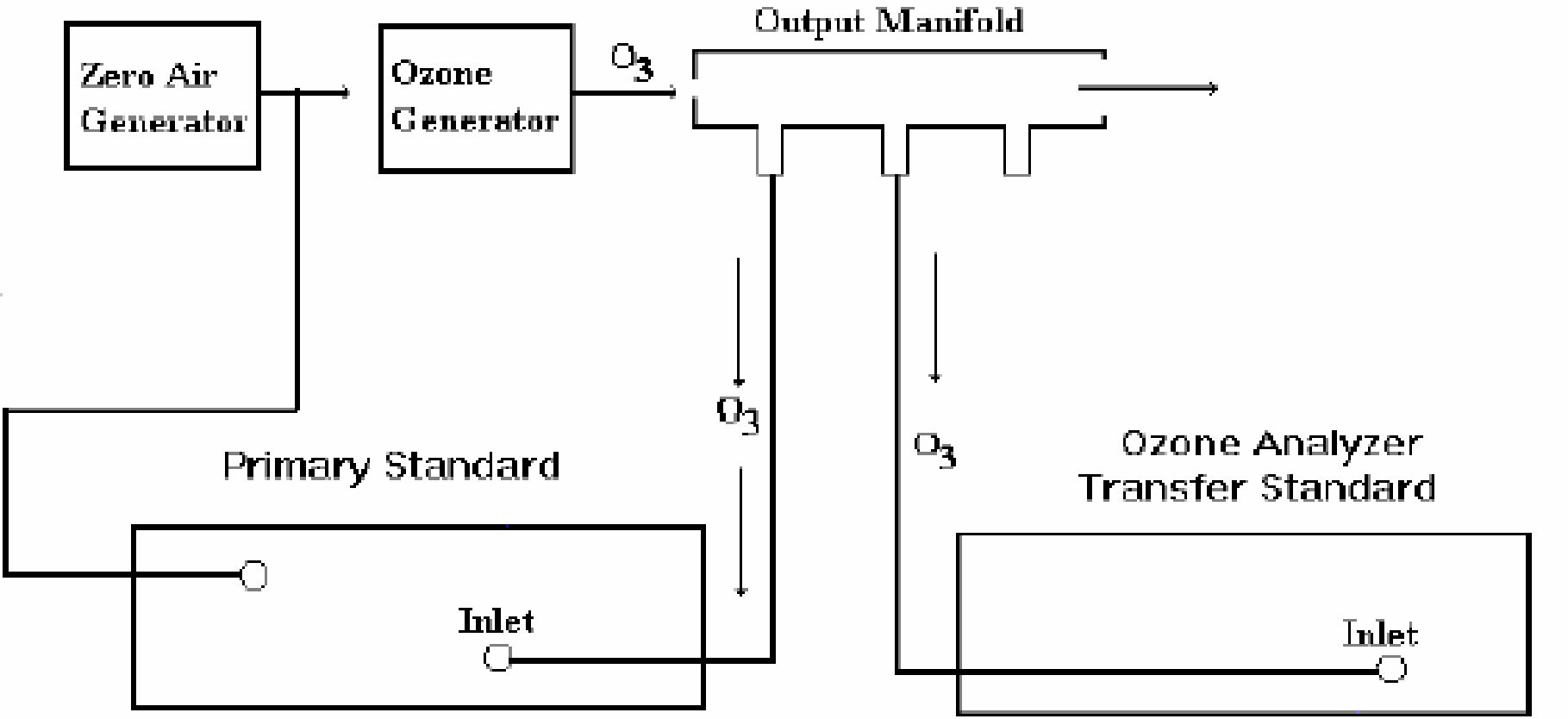
# Participants of the SRP Program
(SRP #4)

- Arizona DEQ
- Ecotech LTD (Australia)
- California, Arizona,Hawaii, Utah
- EMPAC (China)
- Alaska,Oregon,Wash,Idaho
- Lawrence Livermore Labs
- National Park Service
- Vandenberg AFB
- Westinghouse Hanford Company

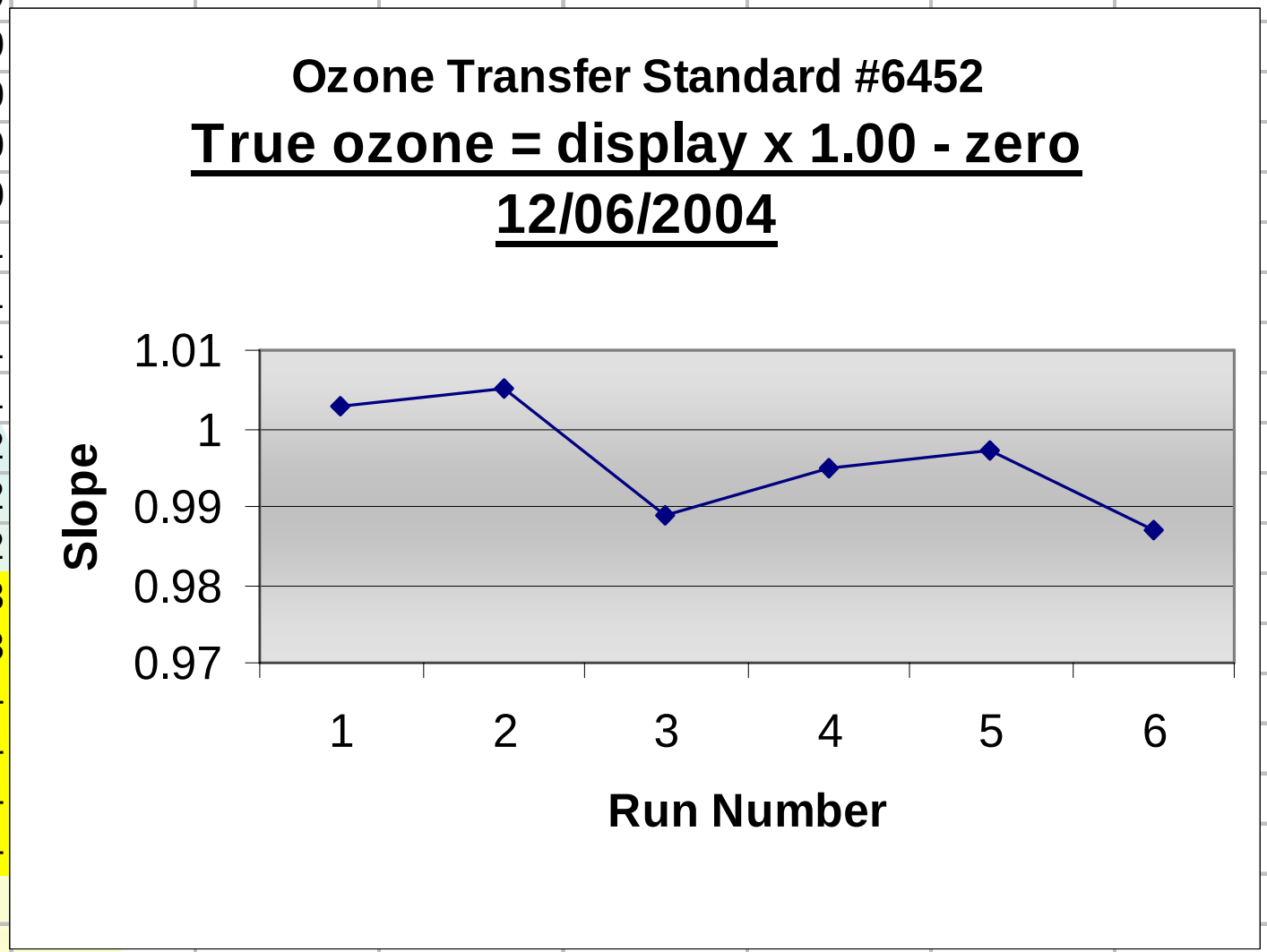
# Ozone Transfer Standards

- Transportable instrument
- Contains an ozone analyzer and generator.
- Together with the associated operational procedures, can accurately reproduce ozone concentration standards that are related to an authoritative primary or master standard.


Primary Photometer
Research Triangle Park
Standard Reference Photometer
California Air Resources Board
Primary Standard
Ecology
Primary
Standards
Transfer Standards


Zero Air Generator
Ozone Generator
$O_3$
Output Manifold
$O_3$
$O_3$
Primary Standard
Ozone Analyzer Transfer Standard
Inlet
Inlet

| | |
|---|---|
| 1.035 | 11/2/1999 |
| 1.036 | 1/30/2000 |
| 1.036 | 3/20/2000 |
| 1.042 | 6/20/2000 |
| 1.04 | 9/4/2000 |
| 1.04 | 11/2/2000 |
| 1.039 | 1/20/2001 |
| 1.012 | 4/20/2001 |
| 1.017 | 4/26/2001 |
| 1.014 | 7/17/2001 |
| 1.015 | 4/15/2002 |
| 0.993 | 4/24/2002 |
| 1.009 | 7/15/2002 |
| 1.003 | 4/7/2003 |
| 1.005 | 8/2/2003 |
| 0.989 | 4/27/2004 |
| 0.995 | 4/28/2004 |
| 0.997 | 8/30/2004 |
| 0.987 | 12/6/2004 |



# Data Loggers and Telemetry

- Before performing any calibration checks, disable the ozone channel.
- Joan Kiely  (360) 407-6839

# Performing the Zero Check

- Make sure the Transfer Standard has warmed up.
- Set the ozone adjust thumbwheels to 000.
- Set the ozone switch to the off position.
- Turn the generator pump on.

# Zero Check

- Record the values using the form provided.
- Check the data logger and recorder to make sure they are reading zero.
- Allow @15 minutes to sample zero air.
- Record the values using the ten count.
- Remember to subtract the zero offset from all readings to obtain the true ozone reading.

# The Precision Check

- Turn the ozone lamp switch on.
- Set the lamp to AUTO.
- Set the thumbwheels to 090.
- Allow 15 minutes after the trace plateaus.
- Record the values using the ten count.

Figure 5.1: Calibration Data Form

# Ecology Calibration Check For Continuous Ozone Analyzers

**Site Name** _____ **AIRS #**_____ **Date**_____ **Disabled at:**_____ **PST**
**Operator**_____ **Enabled at:**_____**PST**

| | | | |
|---|---|---|---|
| **Ozone Tr Standard SN**_____ | **Correction Factor** _____ | **Ozone Analyzer SN**_____ | |
| Sample Flow:_____LPM | Bar. Pres._____Atm. | Sample Flow:_____LPM | Bar. Pres._____Atm. |
| Generator Flow:_____LPM | Inst Temp._____C | Inst Temp._____C | |
| Sample Freq:_____KHz | Cntrl Freq:_____KHz | Sample Freq:_____KHz | Cntrl Freq:_____KHz |

| **Thumbwheel settings** | | | | **Analyzer Response** | | |
|---|---|---|---|---|---|---|
| **000** | **090** | **400** | **Reading #** | **Point 1** | **Point 2** | **Point 3** |
| | | | 1 | | | |
| | | | 2 | | | |
| | | | 3 | | | |
| | | | 4 | | | |
| | | | 5 | | | |
| | | | 6 | | | |
| | | | 7 | | | |
| | | | 8 | | | |
| | | | 9 | | | |
| | | | 10 | | | |
| | | | **Average** | | | |
| | | | **True ozone** | | | |
| | | | **Difference** | | | |

*True Ozone = (Average Display) x Factor – Average zero*

$$\textit{Difference} = \frac{\textit{Analyzer average} - \textit{True ozone}}{\textit{True ozone}} \times 100$$

*The difference must be within ± 10%*

WASHINGTON STATE DEPARTMENT OF ECOLOGY

# The Span Check

- Set the thumb wheels to 400.
- Allow for the trace to plateau.
- Record the values using the ten count.
- Multiply
- Match output of analyzer to data logger and chart recorder

# Determining the Precision of the Instrument

- The precision of the instrument is the difference between the "**actual**" or true ozone value (measured by the Ozone Transfer Standard) and the "**indicated value**" (measured by the analyzer).

# Percent Difference

$$\frac{\text{Indicated - Actual}}{\text{Actual}} \times 100 = \text{Percent Difference}$$

# Percent Difference

$$\frac{\text{Analyzer - Standard}}{\text{Standard}} \times 100 = \text{Percent Difference}$$

**Figure 6.1: Completed Monthly Precision Check Summary Form**

## Monthly Precision Check Summary

**AIRS NUMBER:** 530010001

**PARAMETER:** Ozone **YEAR:** 2004 **MONTH:** July

**STATE TAG OR ID #:** E120444

**LOCATION:** Mt. Washington **OPERATOR:** Dave Davies

| DATE | | | ACTUAL CONC. | INDICATED CONC. | UNITS | *PASSED? Y or N | COMMENTS |
|---|---|---|---|---|---|---|---|
| Month | Day | Year | | | | | |
| 7 | 4 | 2004 | .090 | .091 | ppm | Y | Manual Check |
| 7 | 12 | 2004 | .089 | .090 | ppm | Y | Automated Check |
| 7 | 18 | 2004 | .091 | .091 | ppm | Y | Manual Check |
| 7 | 25 | 2004 | .088 | .090 | ppm | Y | Automated Check |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |

*Shaded area to be completed by QA Personnel

**PRECISION CHECK EQUIPMENT:**

Gas Cylinder Serial #: _____

Calibrator Model: Dasibi 1008PC

Calibrator Serial #: 5310

Permeation Tube #: _____

| Decimal Placement: | |
|---|---|
| CO | 2 |
| SO2 | 3 |
| NO2 | 3 |
| O3 | 3 |
| NEPH | 3 |

COMMENTS:

# After the Calibration Check

- Record the sample chamber temperature.
- Record the unadjusted sample frequency.
- Record the sample chamber pressure.
- Record the control frequency 50.000.

# Performance Checks

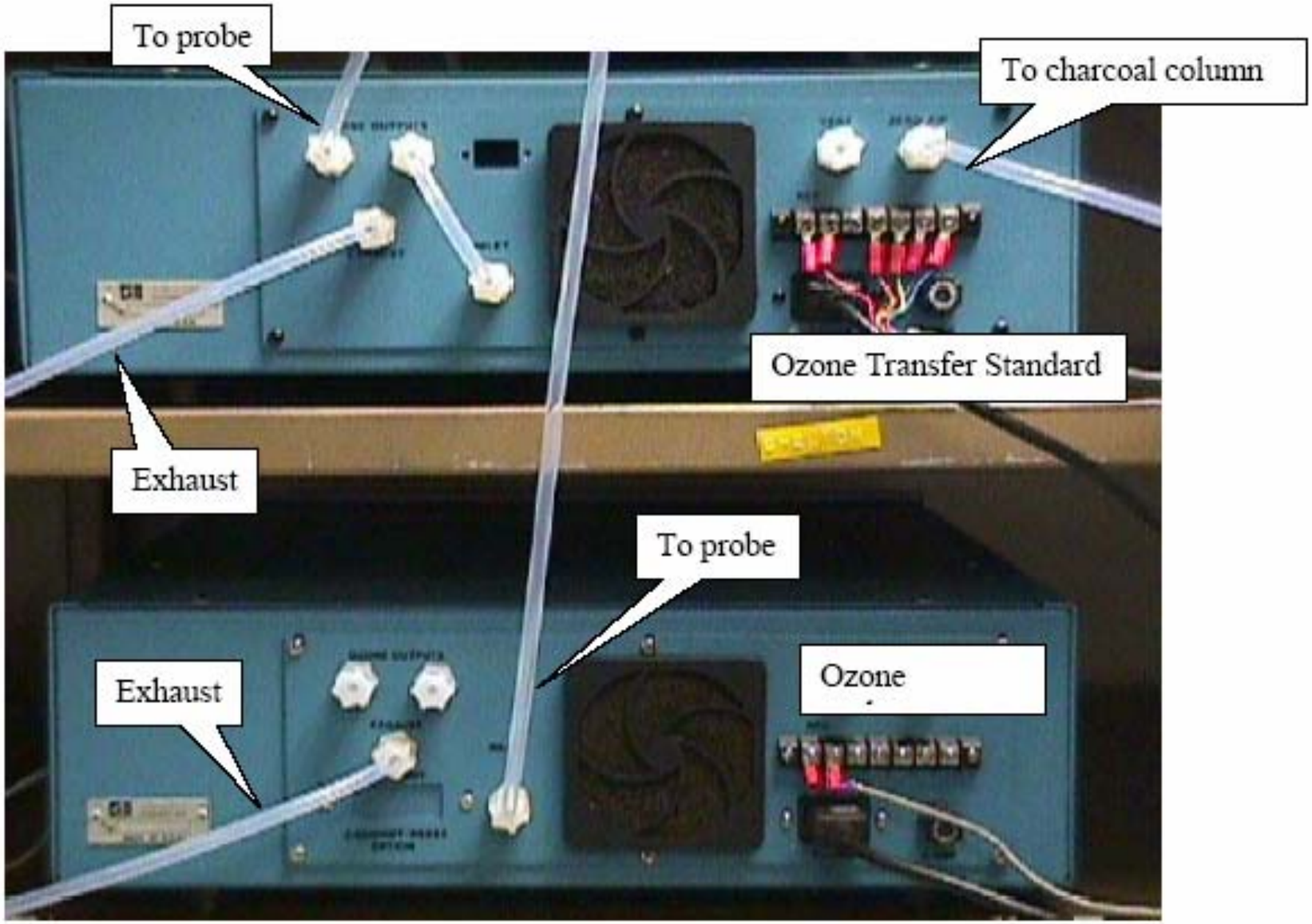
- Sample Flow  Check
- Span Check
- Control Frequency Check
- Sample Frequency Check

# Sample Flow Check


- Tap the flow meter to make sure the float is not stuck.
- Should read @ 2.0 L/min.
- Adjust if less than 1.8 L/min or greater than 2.2 L/min.
- Never lower than 1.5 or higher than 3.5 L/min

# Span Check

- Turn mode switch to SPAN.
- Should read 30.8xx
- Set in lab. Do not adjust.
- If it does not read 30.8xx, contact David at the lab.


To probe
To charcoal column
Ozone Transfer Standard
Exhaust
To probe
Exhaust
Ozone

# Control Frequency Check

- Should always be 50.000 on the display
- If not, contact David.

# Sample Frequency Check

- Should not be below 410 KHz.
- Track the degradation.
- Large drops indicate dirty optics.
- Adjust frequency between 460 KHz and 410 KHz.

# To adjust the sample frequency

- Set mode selector switch to SAMP/TEMP with T/P off.
- Loosen the dual screws on the Light Source Block.
- Push lamp in to increase, pull out to decrease the lamp intensity, or rotated. Small movements needed.
- Tighten screws when done.

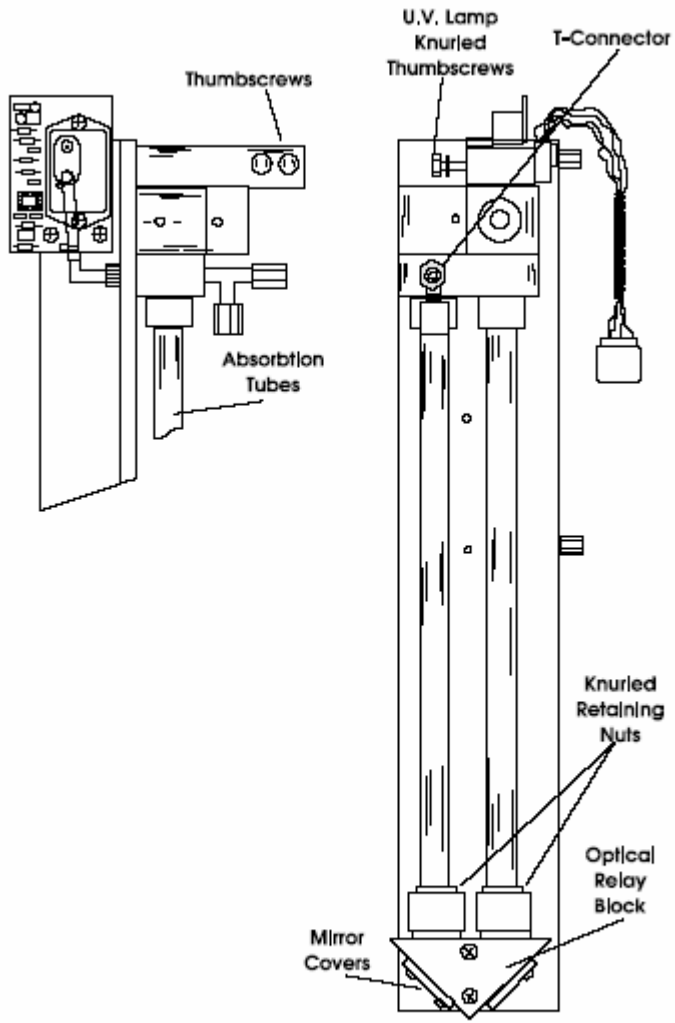



**Figure A-6: Thumbscrew Location**

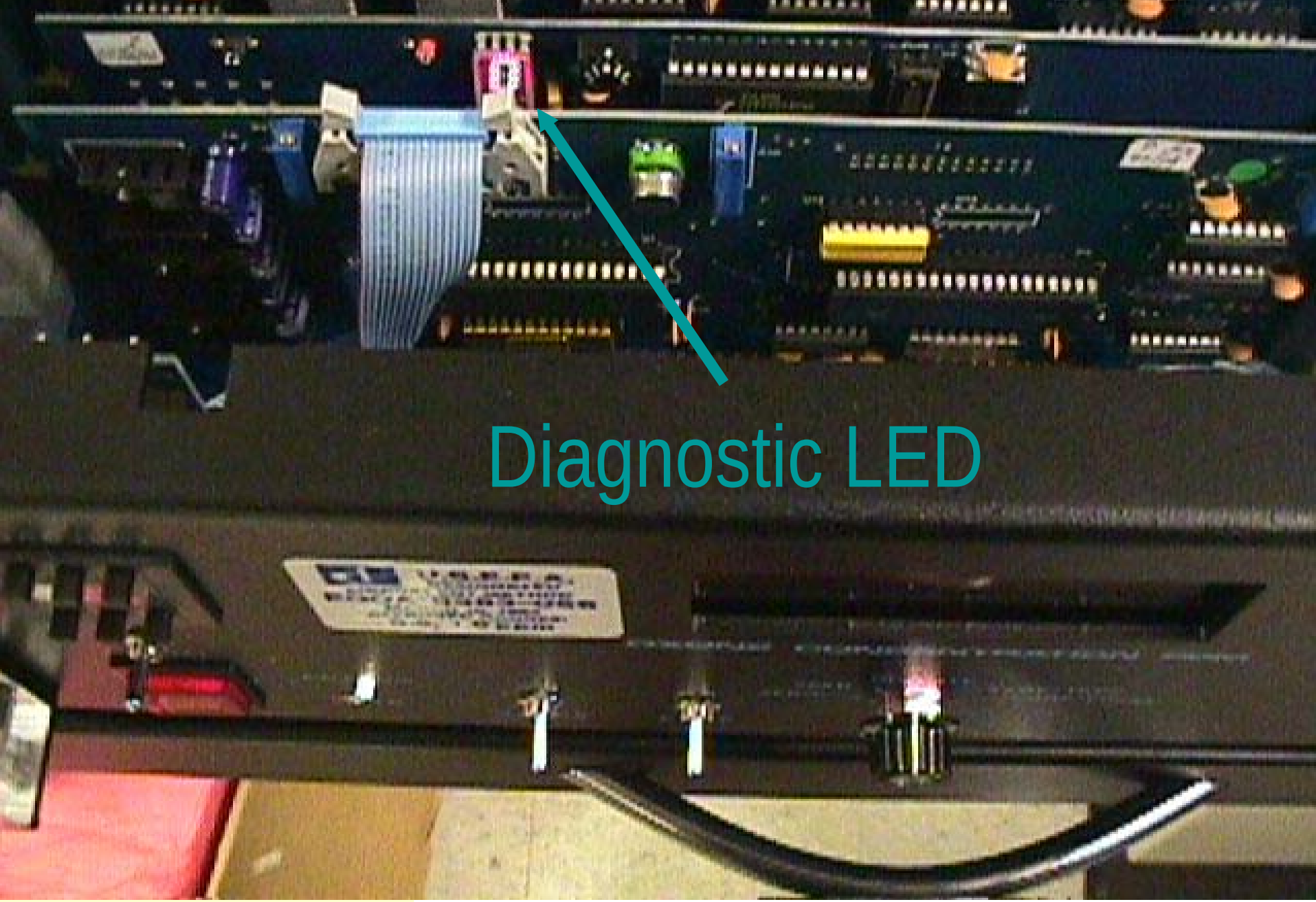
# Pressure Check

- Check the analyzer pressure against a certified barometer.

# 0.5-micronTeflon® Filter

- Installed before entering the analyzer.
- Will not degrade the ozone concentration.
- Change filters regularly.

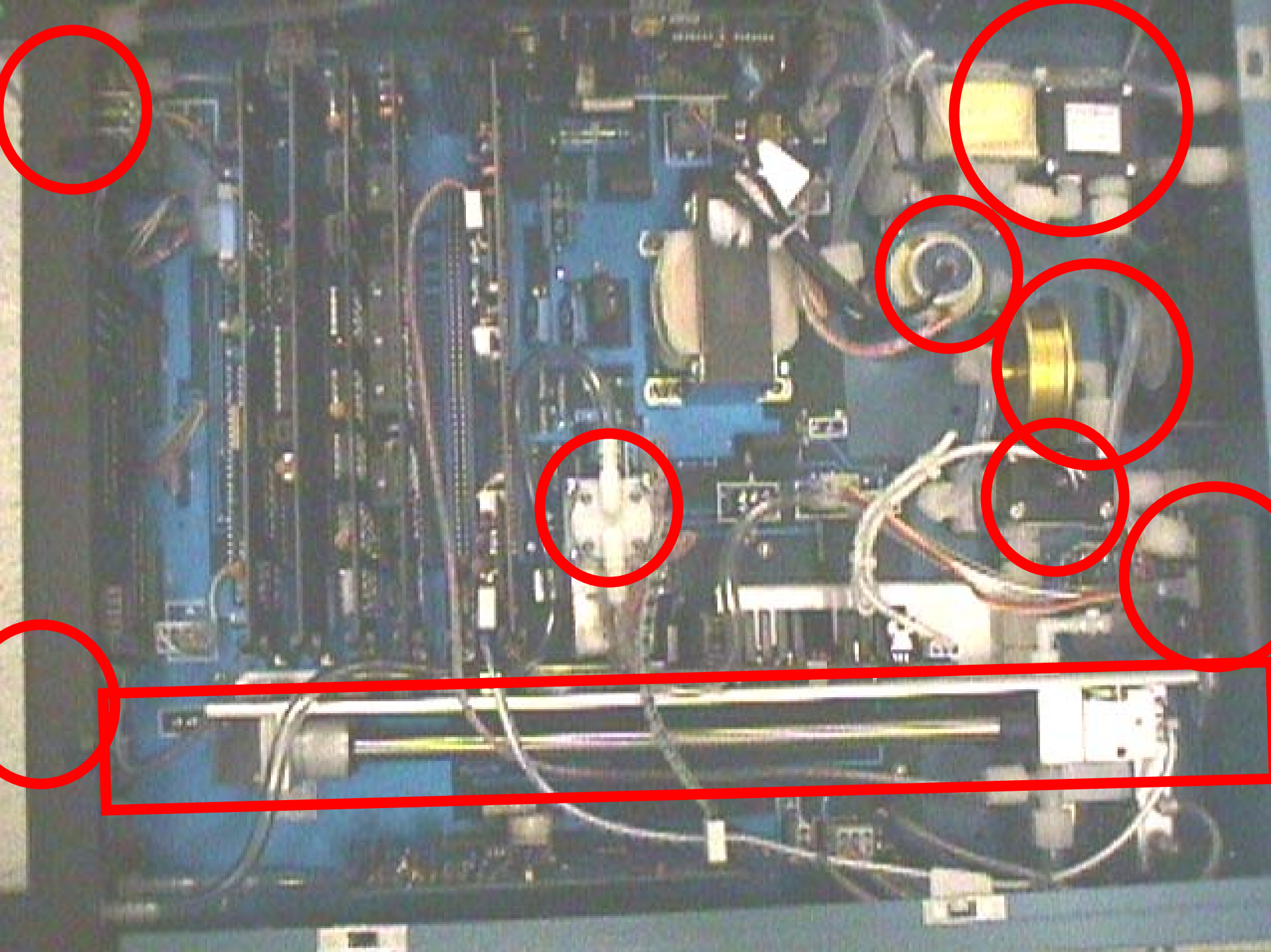

The .5 micron Teflon® filter holder
Remember to change filter when dirty


Diagnostic LED

# Diagnostic LED

- 0 = No faults
- 1 = Not used yet
- 2 = Sample Frequency is not above 300 KHz, or is not below 480 KHz.
- 3 = Control Frequency is not at 500 KHz.
- 4 = Lamp heater voltage is incorrect.
- 7 = CPU reset occurrence.
- 8 = Displayed whenever any front panel switch not in the correct position for proper operation.

| PROBLEM | POSSIBLE CAUSE | CORRECTIVE ACTION |
|---|---|---|
| Analyzer is on but lamp is not lit. | Lamp bulb is blown | Replace the lamp bulb. |
| Analyzer is not operating | Blown fuse | Replace the blown fuse. |
| | Power cord is loose or disconnected | Reinsert power cord. |
| Analyzer operating without digital display | 200 VDC Power Supply inoperative | Contact the Air Monitoring Unit. The problem may be in the voltage or in the plug in display. |
| Zero ozone output when monitoring ambient air. | Pump stopped | Check the power to the pump or change the pump if necessary. |
| Low sample flow | Flowmeter may be adjusted wrong | Adjust the flowmeter to the correct setting. |
| | Dirty sample line filter | Replace the filter. |
| | Leak in the system | Refer to Section 6.5.9 of Manual. |
| Recorder trace erratic when analyzer is sampling | Loose absorption tubes | Tighten the absorption tube checking the O-rings for proper seal. Refer to Section 6.7 |
| Recorder trace periodically goes to zero and remains there for a period of time, and then returns to ambient ozone reading. | Solenoid not switching | Contact the Air Monitoring Unit. The problem may be in the solenoid driver card or the solenoid may be defective. |
| Excessive temperature drift | Temperature sensor may be out of adjustment. | Adjust the trimpot on the Temperature Circuit Board. Refer to Section 6.5.7. |
| Low sample control frequency readings. | U.V. lamp out of adjustment | Adjust the U.V. lamp. Refer to Section 3.4.2.2.1 |
| | Dirty optics | Clean the optics. Refer to Section 6.7. |
| Loss of the sample control frequency. | Faulty detector | Replace the electrometer assemble. Contact the Air Monitoring Unit. |
| Unstable sample control frequency. | Loose lamp or detector | Tighten the set screws holding the lamp and detectors. |



# Patience is a Virtue

- Allow yourself enough time.
- How fast you can do it means nothing.
- If you rush you are bound to make mistakes.
- Mistakes usually cost lost data, time and money.
- The best operators take their time, are methodical and thorough.

# Before Leaving the Station……

- Record the results of the calibration check and any changes that were made to the instruments.
- Make sure that the analyzer is running and that all the switches are in their correct positions.
- Enable the data logger.
- Make sure that the station is secured.

# Before you leave……..

- Check to see if the power is on.
- Is the sample flow set to 2.0 LPM?
- Is the selector switch in the “operate mode”?
- Can you hear the solenoid valve cycling?
- Has channel 03 on the data logger been disabled?

# Strip Charts

- Before performing any calibration checks, annotate the strip chart.
- Make your entry into the logbook.
- Sean Lundblad  (360) 407-6843

# Quarterly Quality Assurance Audits

- A Quality Assurance representative visits the site quarterly.
- Challenges the station analyzer with concentrations generated by the QA transfer standard.
- Checks for the accuracy of the analyzer.
- Discusses issues that arise during the audit.

# The Critical Criteria Table

| OZONE CRITICAL CRITERIA TABLE | | | |
|---|---|---|---|
| **Criteria** | **Acceptable Range** | **Frequency** | **40 CFR Reference** |
| **Standard Reporting Units** | ppm | All data | 40 CFR, Pt 50.9 |
| **Completeness** (seasonal)<br>Maximum 1-hour concentration | 75% values from 9:01 AM to 9:00 PM (LST) | Daily | 40 CFR, Pt 50, App H, S 3 |
| **Precision**<br>Single analyzer | None<br>**(See note A below)** | 1/2 weeks for seasonal sites or sites where manual QC checks are performed.<br>1/4 weeks at year round automated sites.<br>**(See note B below)** | 40 CFR, Pt 58, App A |
| Reporting organization | 1/3 months | 95% CI < +/-15% | EPA-600/4-83-023<br>Vol II, App 15, S 6 |
| **Accuracy**<br>Single analyzer | None<br>**(See note C below)** | 25 % of sites | 40 CFR, Pt 58, App A |
| Annual accuracy | 95% CI < +/-20% | quarterly (all sites yearly) | EPA-600/4-83-023<br>Vol II, App 15, S 6 |
| **Quality Control Check** | | | |
| Zero/span check -level 1<br>If Cal updated at each zero/span | Zero Drift < +/- 20 to 30 ppb<br>Span Drift < +/- 20 to 25% | 1/ 2 weeks | Vol II, S 12.6 |
| Zero/span check -level 1<br>If fixed Cal used to calculate data | Zero Drift < +/- 10 to 15 ppb<br>Span Drift < +/- 15% | | Vol II, S 12.6 |

# Data Validation Tables

- Critical — precision and accuracy
- Operational — shelter temperature
- Systematic — certified ozone standard or SRP comparison

*Bad data…*

*is worse than no data at all.*

# Maintaining Your Monitoring Equipment

- Break to the Technical Assistance Lab.
- Calibration Lab (360) 407-6030