Maryland
Department of the Environment

Regulatory Ambient Air Monitoring in Maryland

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Maryland Dept. of the Environment

September 27, 2019

Maryland Vehicle Emissions Inspection Notice

Maryland law requires that the vehicle listed below be tested for emissions between now and:

November 5, 2014

Vehicle Information:

License Plate [redacted]

Vehicle Identification Number [redacted]

Year [redacted]

TOYT

Due By [redacted]

Registered Owner:

[redacted]99

[redacted]

JOHN EDWARD NEWMAN

[redacted]

008815

This vehicle may be tested for emissions as soon as you receive this notice. See enclosed brochure for exact locations of VEIP testing stations.

Hours of Operation:

Monday-Thursday-Friday:	8:30 a.m. - 5:00 p.m.
Tuesday-Wednesday:	7:00 a.m. - 7:00 p.m.
Saturday:	7:00 a.m. - 1:00 p.m.

Thursday and Friday are the least busy days.

All VEIP stations are closed on Sunday and on all State holidays observed by the Motor Vehicle Administration and all other days that the MVA is closed. Please check our website for an up to date listing of closures. www.mva.maryland.gov

Fees:

Inspection Fee..... $14.00

An additional $15 late fee will be assessed the day after the due date, and every four weeks (28) days thereafter.

Payment: Cash, VISA/MasterCard, Travelers Check, American Express, money order, or check (with 2 current ID's) made payable to: *VEIP*

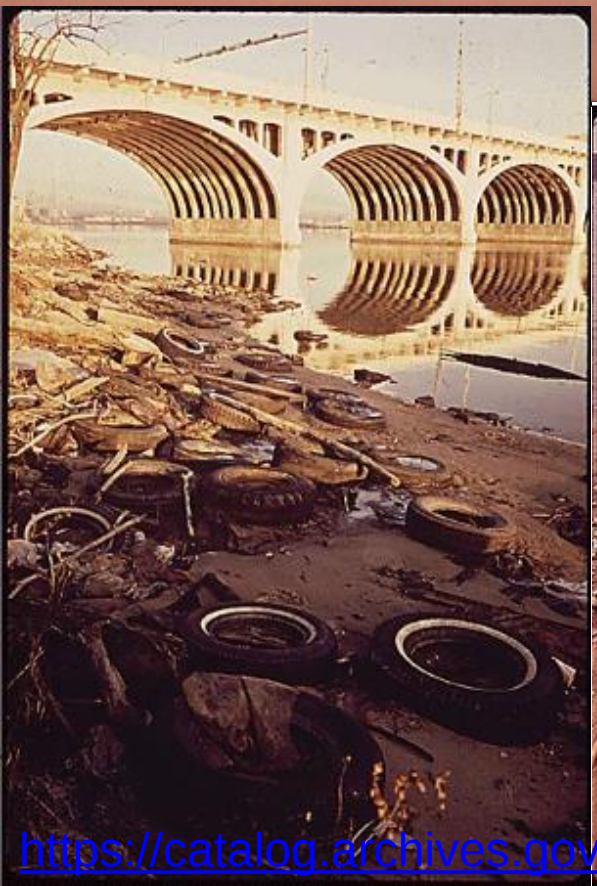
Your vehicle could be exempt from inspection. If you own a diesel/electric vehicle or are requesting an extension, please complete the other side of this notice.

VEIP
Let's Clear The Air

What's Covered:

- History of Air Quality Regulation and pollution
- EPA Criteria Pollutants and National Ambient Air Quality Standards (NAAQS)
- Ambient Air Monitoring and Maryland's Air Monitoring Network
- Monitoring Methods and Instrumentation

EPA documented conditions at its founding



https://catalog.archives.gov

History of Federal Environmental [air] Regulation

- 1955 – Air Pollution Control Act
- 1963 – Clean Air Act
- 1967 – Air Quality Act
- 1970 – Clean Air Act (Created federal government oversight of regulations)
  - First legislation with federally focused control
  - State level monitoring started to be required
- 1990 – Clean Air Act [Targeted acid rain causes but applied to other pollutants as well]

EPA Criteria Pollutants

- Defined by the Clean Air Act (CAA) as: Ground-level Ozone (O_3), Carbon Monoxide (CO), Sulfur Dioxide (SO_2), Particulate Matter (PM), Lead (Pb) and Nitrogen Dioxide (NO_2).
- These are the most common air pollutants and are found throughout the world.
- Considered harmful to public health and the environment , and cause property damage.
- CAA requires EPA to set National Ambient Air Quality Standards (NAAQS) for these six principal pollutants.

NAAQS

- EPA sets, reviews and revises the NAAQS.
- First established in 1971 for O_3, CO, SO_2, PM and NO_2. Pb in 1978.
- Statutory review required every 5 years. May be revised dependent on the latest health science.
- Two types of NAAQS: Primary and Secondary
  - Primary-designed to protect human health with an adequate margin of safety
  - Secondary-designed to protect welfare, including effects on soils, water, crops, vegetation, man-made materials, wildlife, visibility and climate, among other potential effects.

NAAQS

- NAAQS have four elements: the indicator, the averaging time, the level and the form.
  - Indicator- the pollutant, chemical species or mixture to be measured.
  - Averaging Time- period of time over which the measurement is averaged (e.g. annually, 1 hour, 8 hours, 24 hours).
  - Level- concentration or mixing ratio of the NAAQS for a particular pollutant (e.g. ug/m^3, ppm, ppb).
  - Form- metric used to determine whether the NAAQS is attained (e.g. annual mean averaged over 3 years, 98^{th} percentile averaged over 3 years).

Current NAAQS

Current typical values

Pollutant (Indicator)		Primary/ Secondary	Averaging Time	Level	Form
Carbon Monoxide (CO)		primary	8 hours	**9 ppm**	Not to be ex… once per year
			1 hour	**35 ppm**	
Lead (Pb)		primary and secondary	Rolling 3 month average	**0.15 µg/m³**	Not to be exceed…
Nitrogen Dioxide (NO_2)		primary	1 hour	**100 ppb**	98th percentile of 1-hour daily max…mum concentrations, averag…
		primary and secondary	1 year	**53 ppb**	Annual Mean
Ozone (O_3)		primary and secondary	8 hours	**0.070** ppm	Annu… daily maximum 8-hour …eraged over 3 years
Particle Pollution (PM)	$PM_{2.5}$	primary	1 year	12.0 µg/m³	annual mean, averaged … years
		secondary	1 year	15.0 µg/m³	annual mean, aver…ged …
		primary and secondary	24 hours	35 µg/m…	…3 years
	PM_{10}	primary and secondary	24 hours	150 µg/m³	Not to be e…eeded more the… average over 3 year…
Sulfur Dioxide (SO_2)		primary	1 hour	**75 ppb**	99th per…entile of 1-hour daily maxi…um …s, averag…
		secondary	3 hours	**0.5 ppm**	Not to be exceeded more than o…e per year

< 0.5 ppm

< MDL

< 40 ppb (HCNR)

75 ppb

11.5 µg/m³

99% of all obs <20 µg/m³! 3 in last 6 years

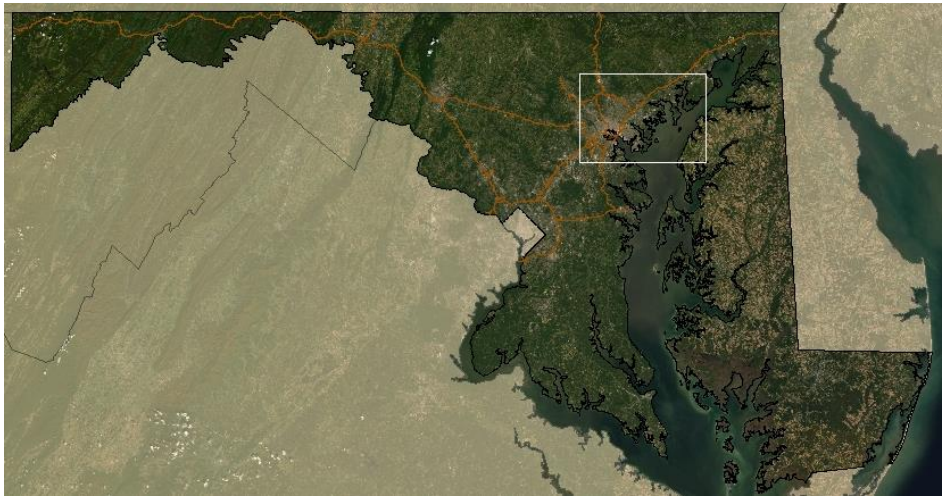
10 µg/m³

209 ppb

<5 ppb

The States' Role

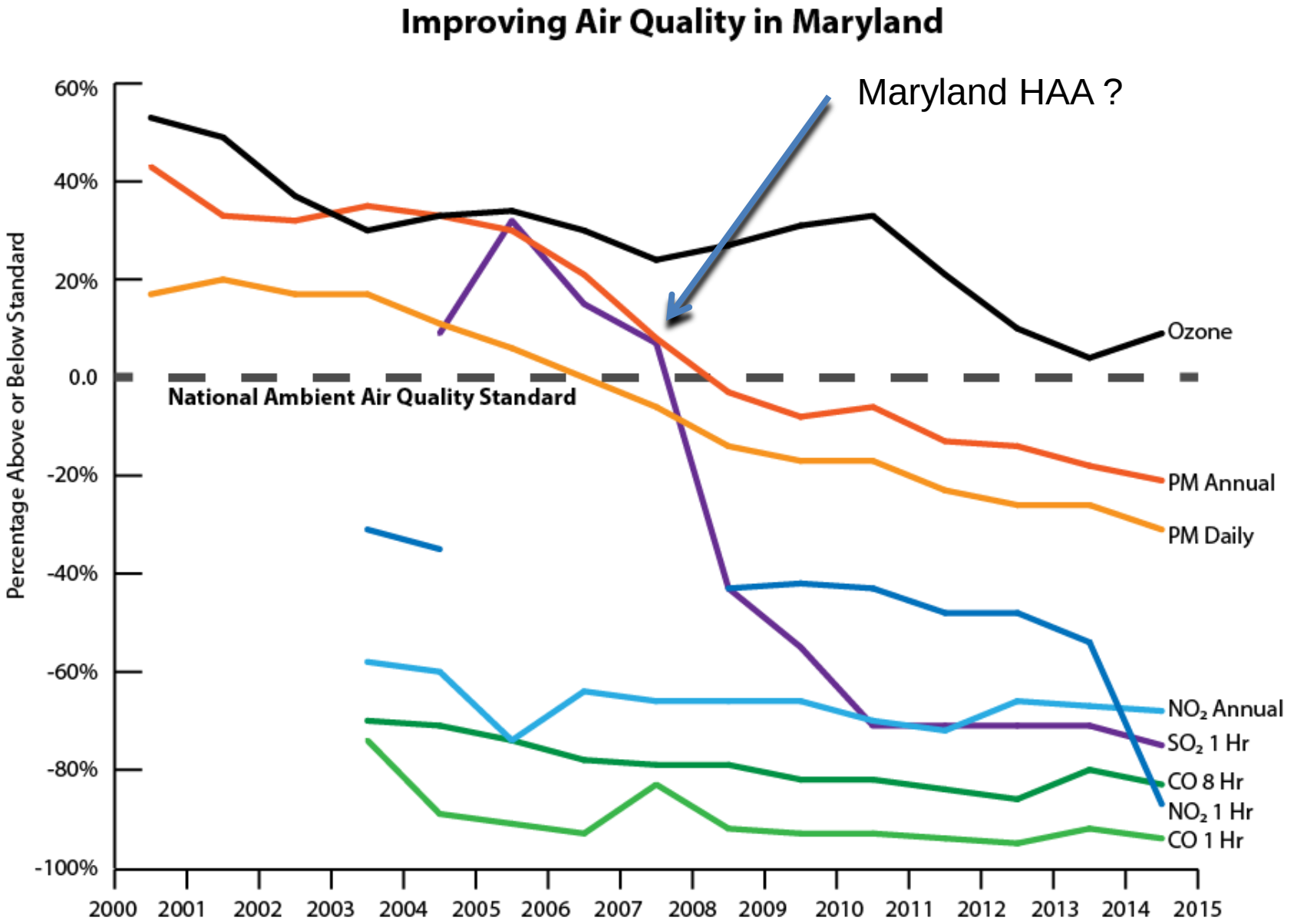
- State Implementation Plans (SIPs) document a state's approach to complying with federal requirements.
- SIPs are composed of adopted laws, regulations, policies, emissions inventories and modeling demonstrations.
- SIP provisions are enforceable under federal and state law
- SIPs are living documents that are periodically revised in response to:
  - Need to protect public health and the natural environment
  - New scientific findings
  - Changes in federal law



2000-2016 Control Programs

- NOx SIP Call (2002-2003)
  - NOx Cap and Trade program mandated for states east of Mississippi
- Power Plants
  - The Maryland Healthy Air Act of 2006
- Cars and Small Trucks
  - The Maryland Clean Cars Act of 2007
- Diesel Trucks
  - Multiple Maryland initiatives
- Climate Change
  - The Greenhouse Gas Emission Reduction Acts of 2009 and 2015

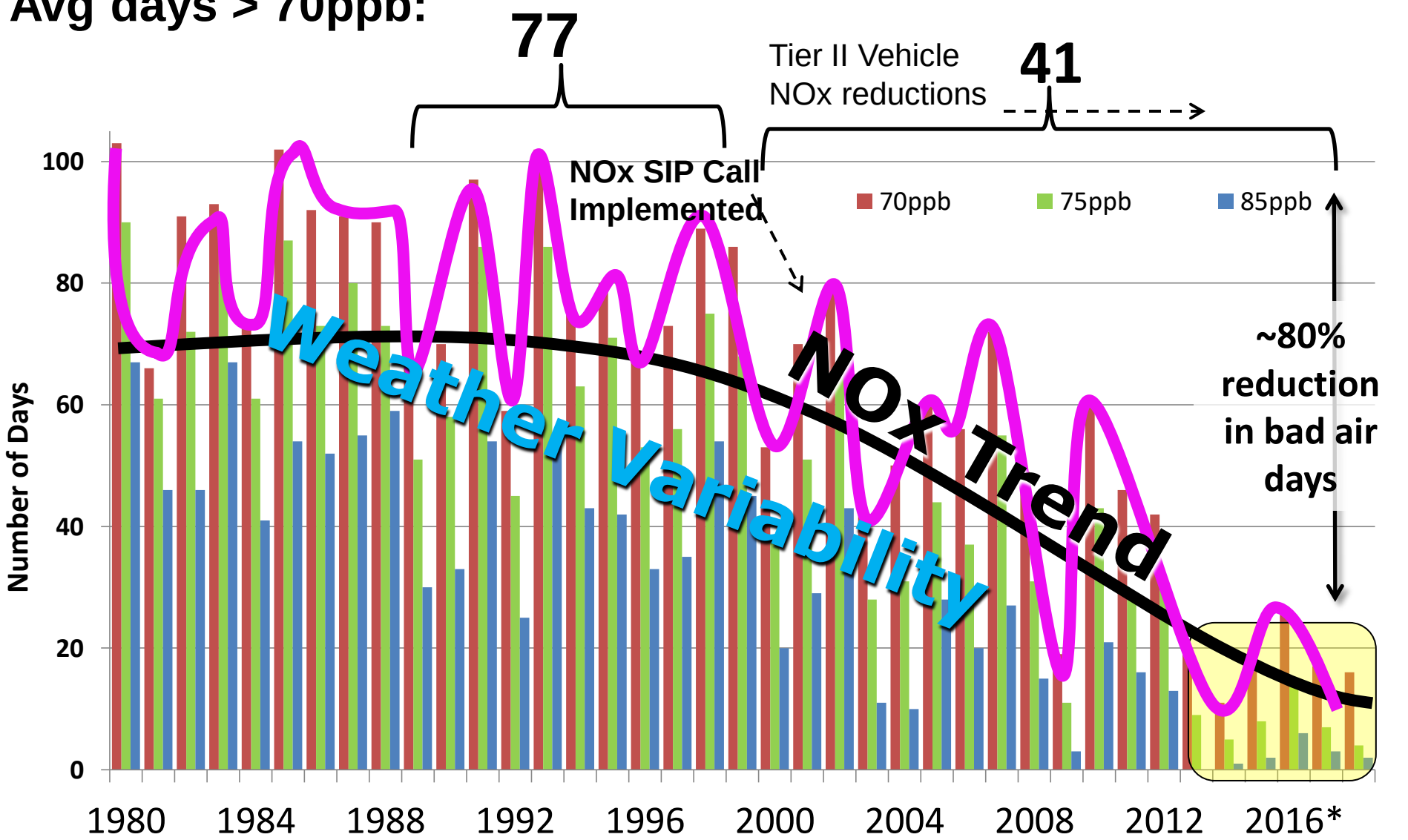
Progress


Improving Air Quality in Maryland
Maryland HAA ?
Percentage Above or Below Standard
60%
40%
20%
0.0
-20%
-40%
-60%
-80%
-100%
National Ambient Air Quality Standard
Ozone
PM Annual
PM Daily
NO₂ Annual
SO₂ 1 Hr
CO 8 Hr
NO₂ 1 Hr
CO 1 Hr
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

Maryland Exceedance Days are Decreasing

Number of days annually when any MD monitor exceeds NAAQS

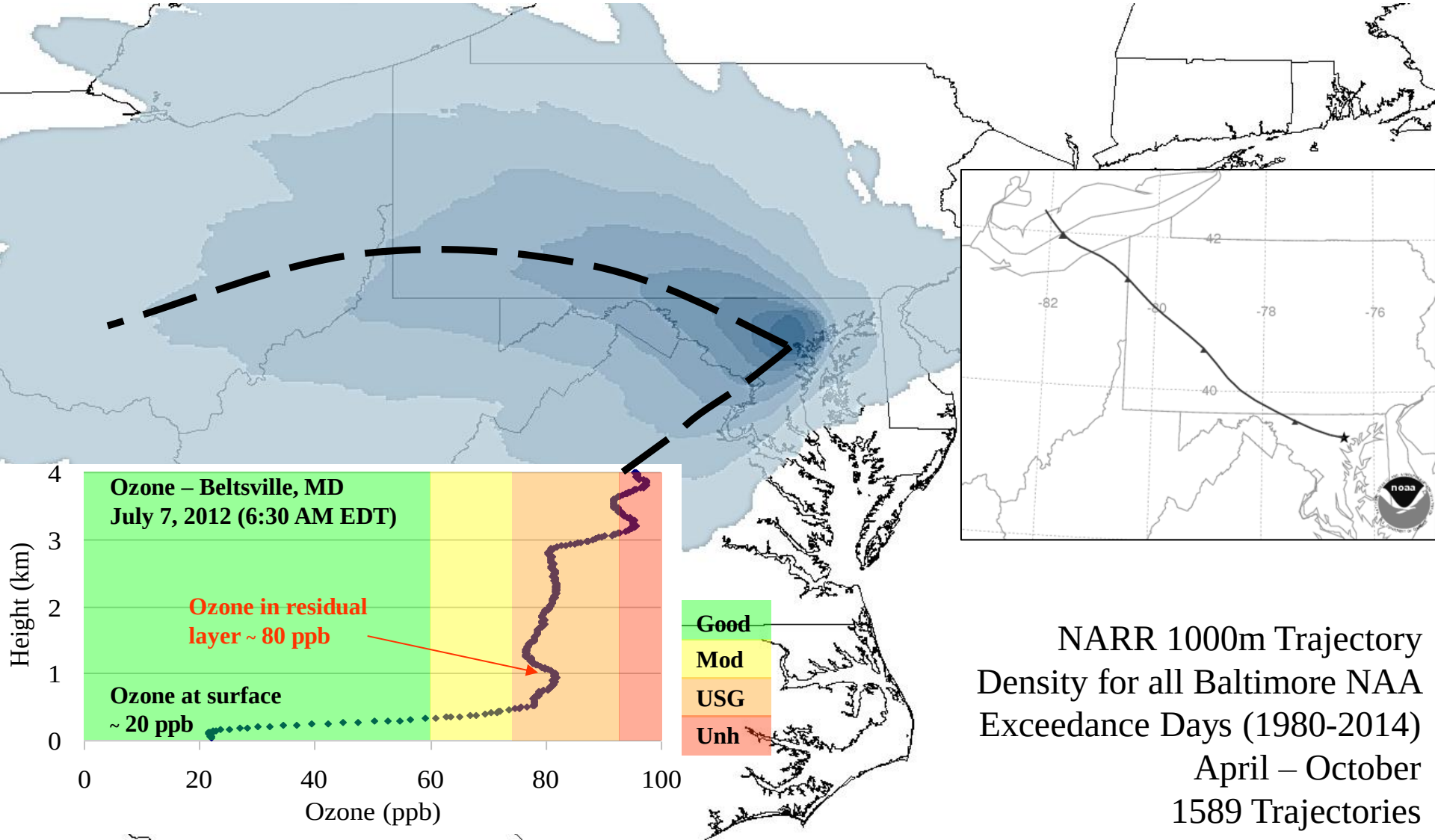
Avg days > 70ppb:



2016-2019 Avg days > 70ppb: 17

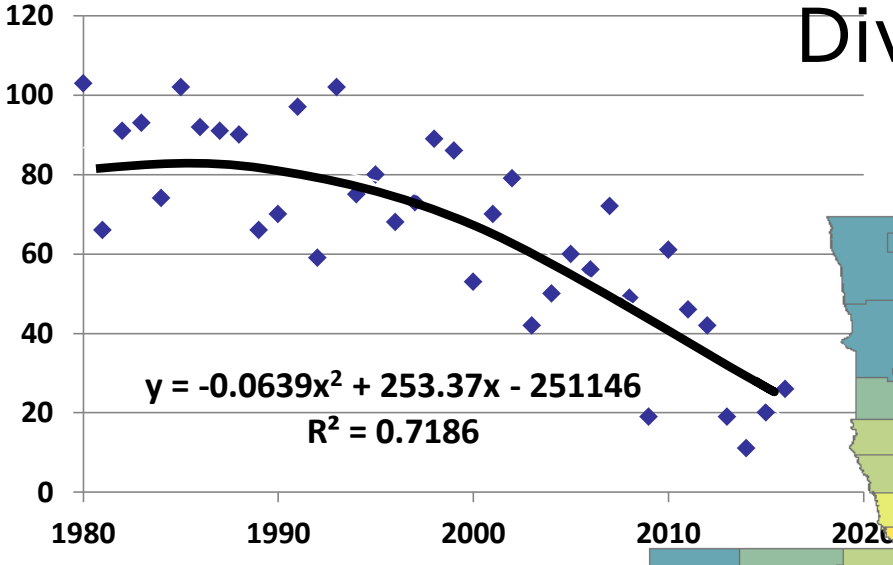
The History of Maryland Exceedances

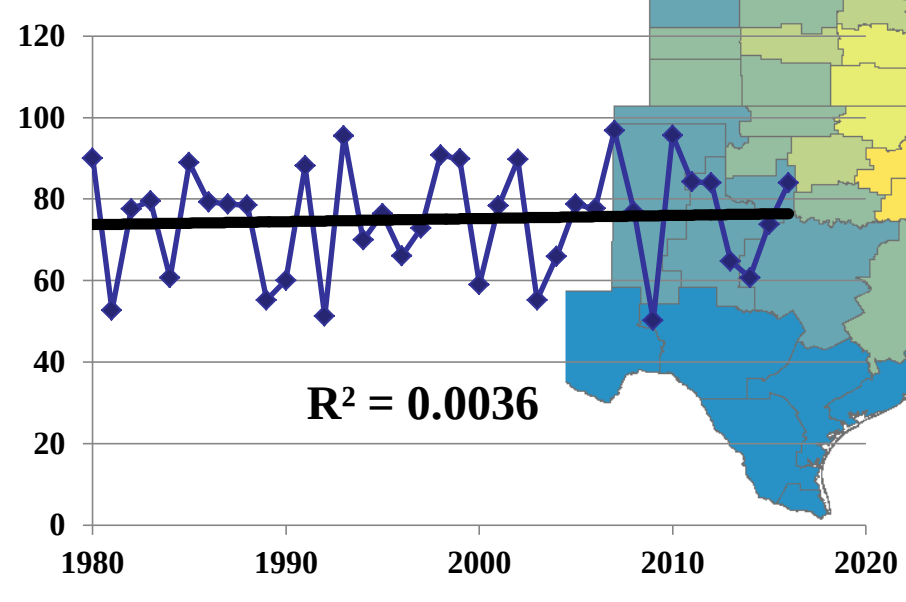
Tremendous number of exceedances over the history of air monitoring; bad for health, good for research

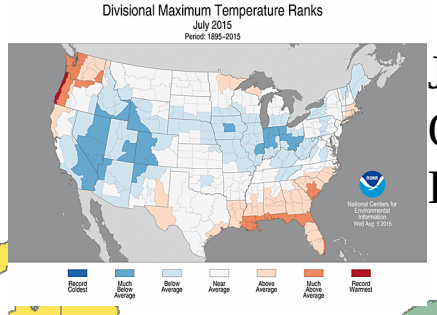


NARR 1000m Trajectory Density for all Baltimore NAA Exceedance Days (1980-2014) April – October 1589 Trajectories

Correlation of Maryland Annual Ozone Exceedance Days (detrended) to Climate Division Cooling Degree Days



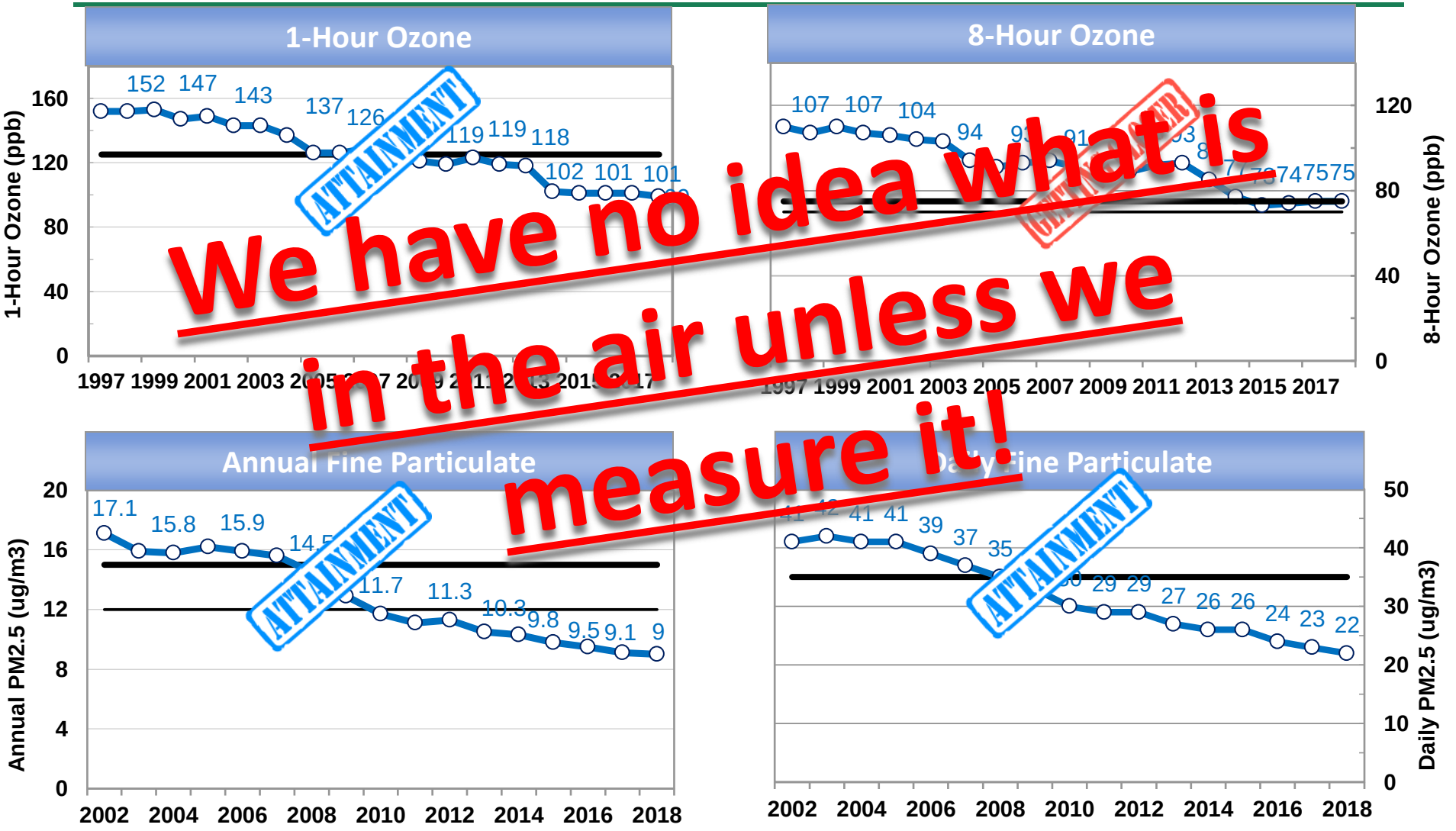




July 2015: Only 1 MD Exceedance

The highest correlation between cooling degree days and Maryland ozone exceedance days is found in the Mid-West (red areas). This suggests that when these states experience a hot summer Maryland is more likely to have a greater than average number of ozone exceedance days. By extension, the cooling degree day (CDD), a proxy for electrical demand, is closely connected to Maryland exceedance day annual variability (as is the area near Baltimore itself). This correlation is likely due to the position of the continental ridge which is stronger in some years than others. This analysis CAN NOT be directly interpreted as showing a higher correlation causing the poor air quality (e.g., contains the actual emissions sources).

Air Quality Progress in Maryland
-Design Values-



We have no idea what is in the air unless we measure it!

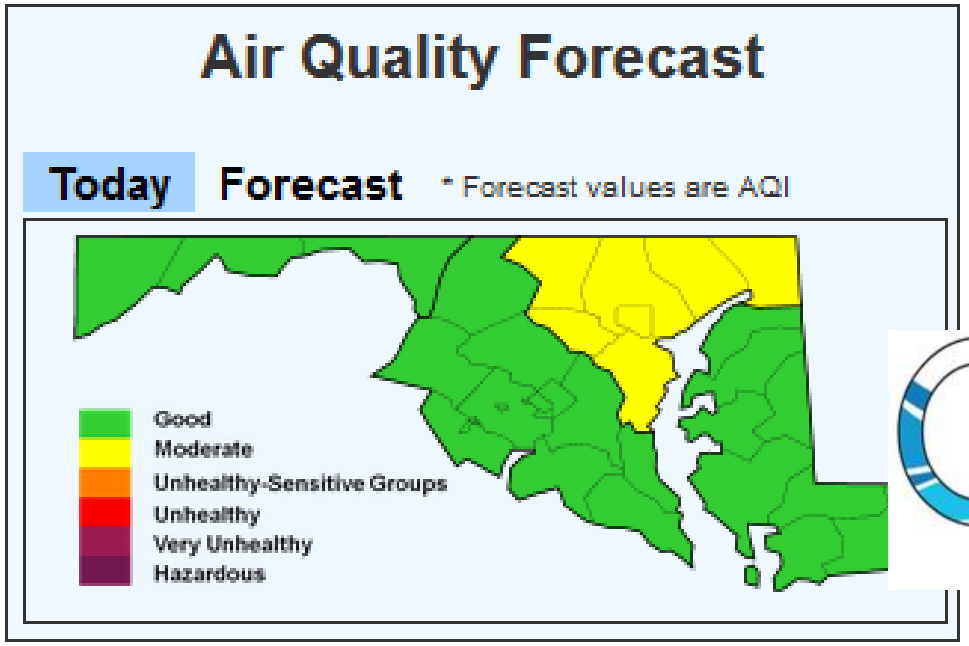
*2018 is Preliminary: Updated through Oct 2018

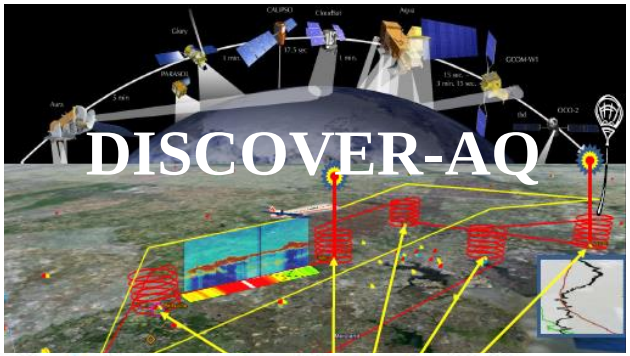
Ambient Air Monitoring

- EPA ambient air monitoring regulations, contained in the Code of Federal Regulations, provide prescriptive requirements for States' ambient air monitoring networks to meet.
- These requirements include:
  - Specific measurement methods for each criteria pollutant (Federal Reference or Equivalent Methods).
  - Minimum number of monitors for each criteria pollutant (based on population and pollutant concentrations)

Ambient Air Monitoring

- Network Design Objectives
  - Provide data to public in timely manner
  - Support compliance with NAAQS and emissions strategy development
  - Support air pollution research studies



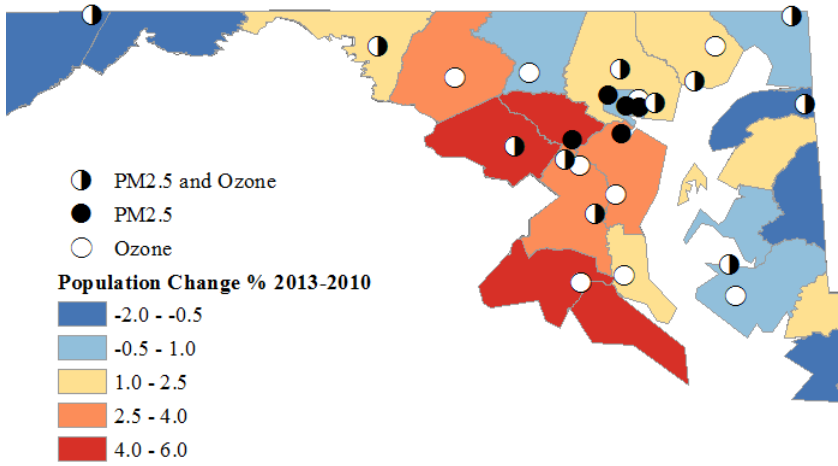


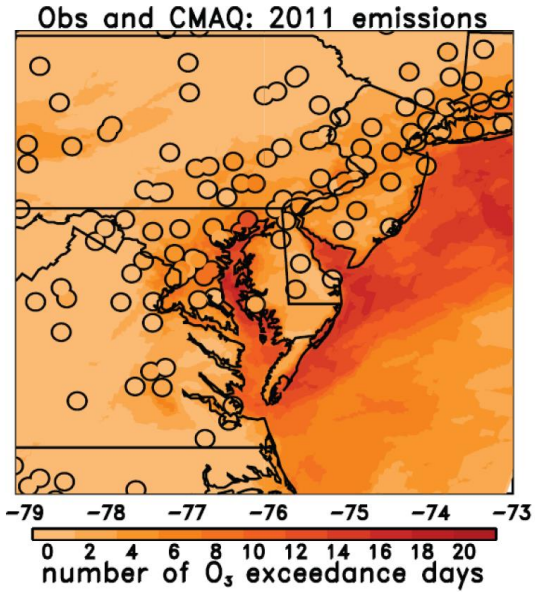
OWLETS-2

Ozone Water-Land Environmental Transition Study

Ambient Air Monitoring

- Network Design Site Types
  - Highest expected concentrations in the network area
  - In high population areas
  - Impact of significant sources or source categories
  - General background concentration levels
  - Extent of regional pollutant transport among populated areas
  - Impacts on visibility, vegetation damage, or other welfare-based impacts



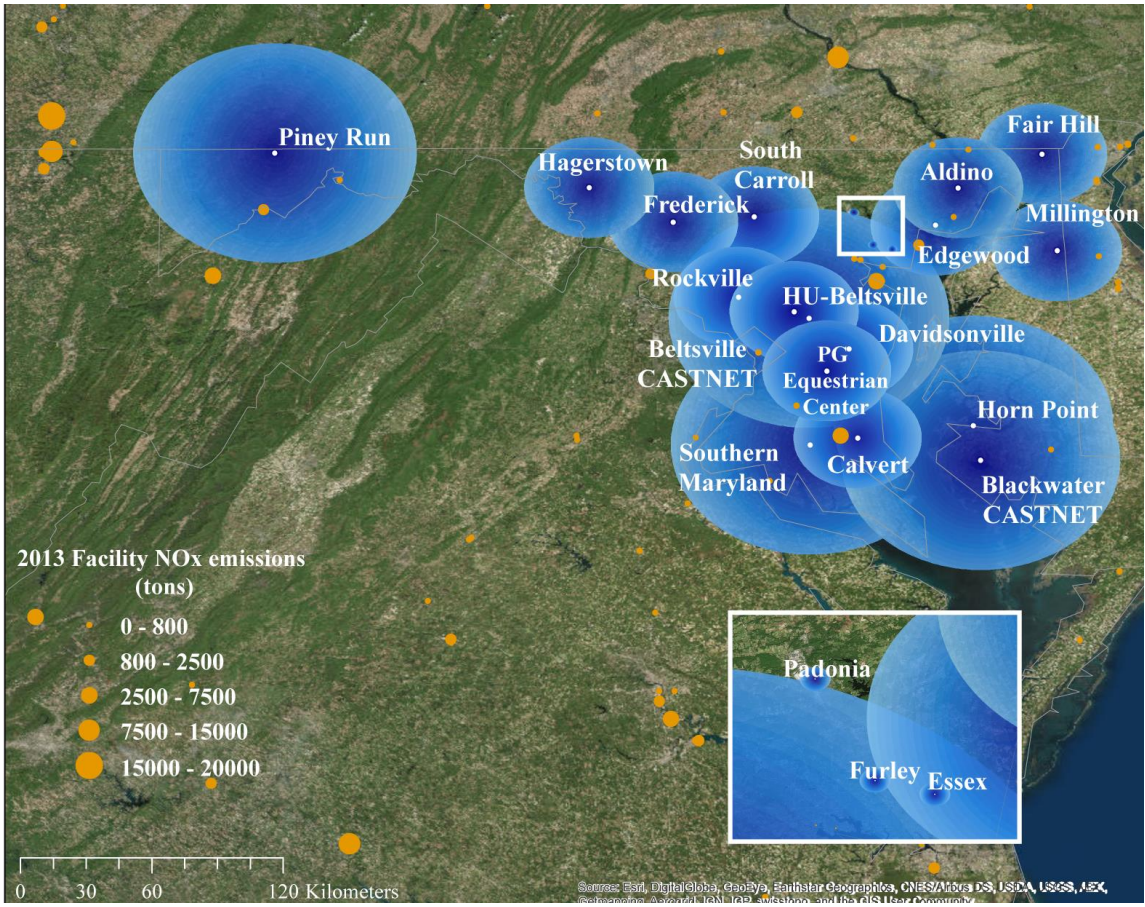


Ambient Air Monitoring

Ambient how?

- Network Design Spatial Scales

- Microscale: 1 – 100 meters
- Middle: 100 – 500 meters
- Neighborhood: 0.5 – 4.0 km
- Urban: city-like dimensions, 4 – 50 km
- Regional: rural homogeneous area 10's – 100's km
- National & Global: characterize nations or the globe

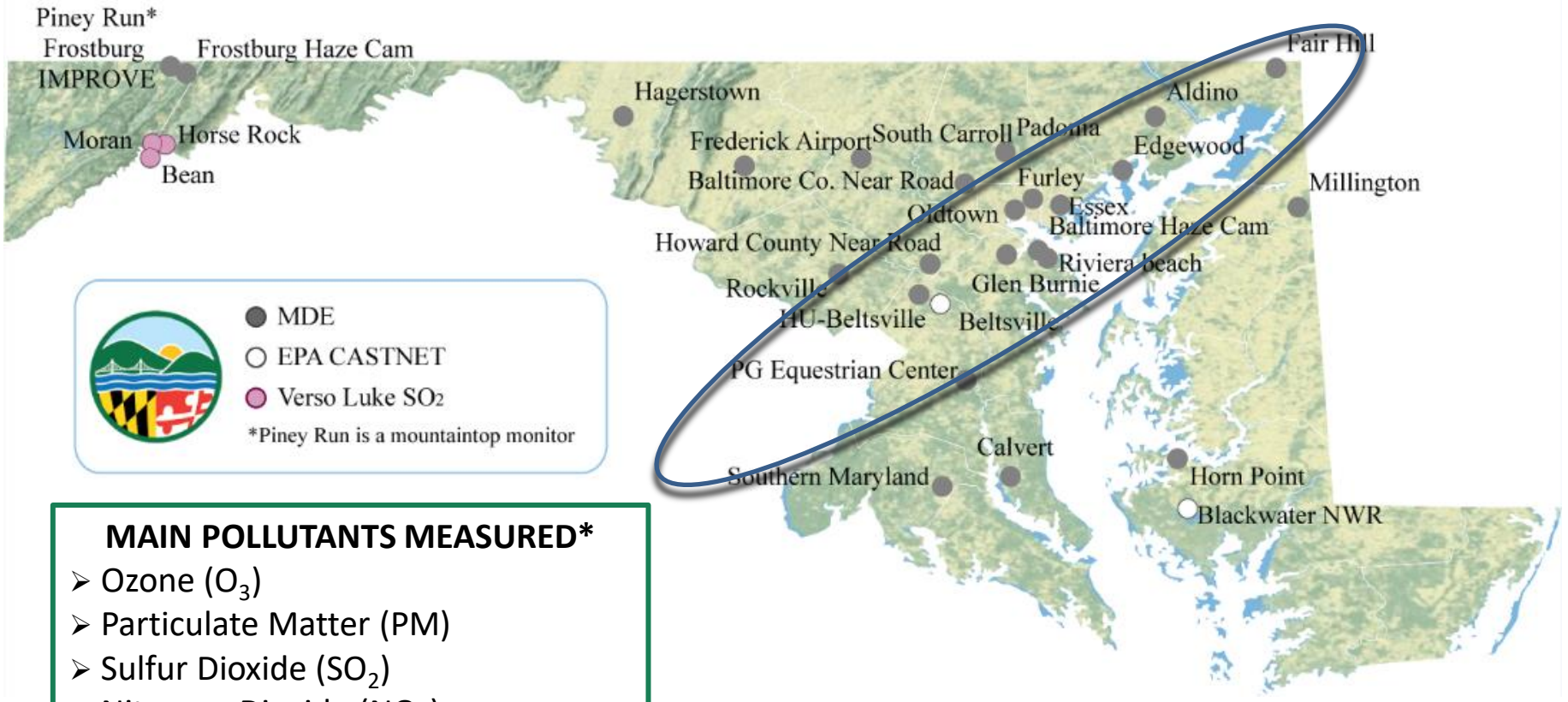


Ambient Air Monitoring

- Other Considerations
  - Minimal interference and perturbation of wind flow by buildings, the tree canopy, or other obstacles
  - Availability of electrical power and telephone line
  - Cost of site lease, relocation or new deployment, site improvements such as road and fence
  - Safety, Security, and Accessibility (access to locked facilities)
  - Finite Resources – Funding, Staff
  - Longevity of site
  - Clear of immediate influence of sources (point, area, mobile) or within influence depending on site type
  - **Who will let us put it there?!?**




2018 Maryland Air Monitoring Network - 27 sites

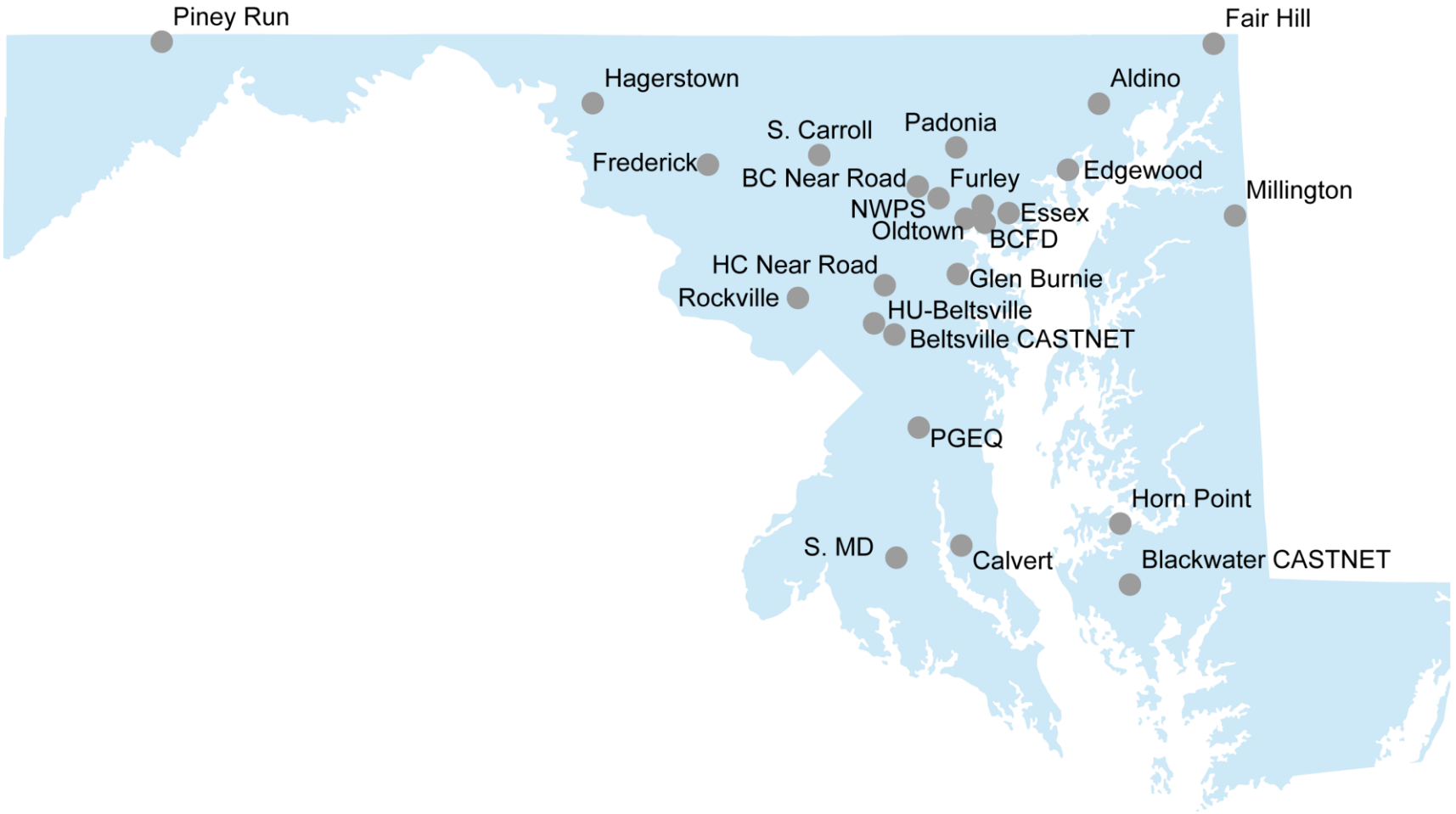


MAIN POLLUTANTS MEASURED*

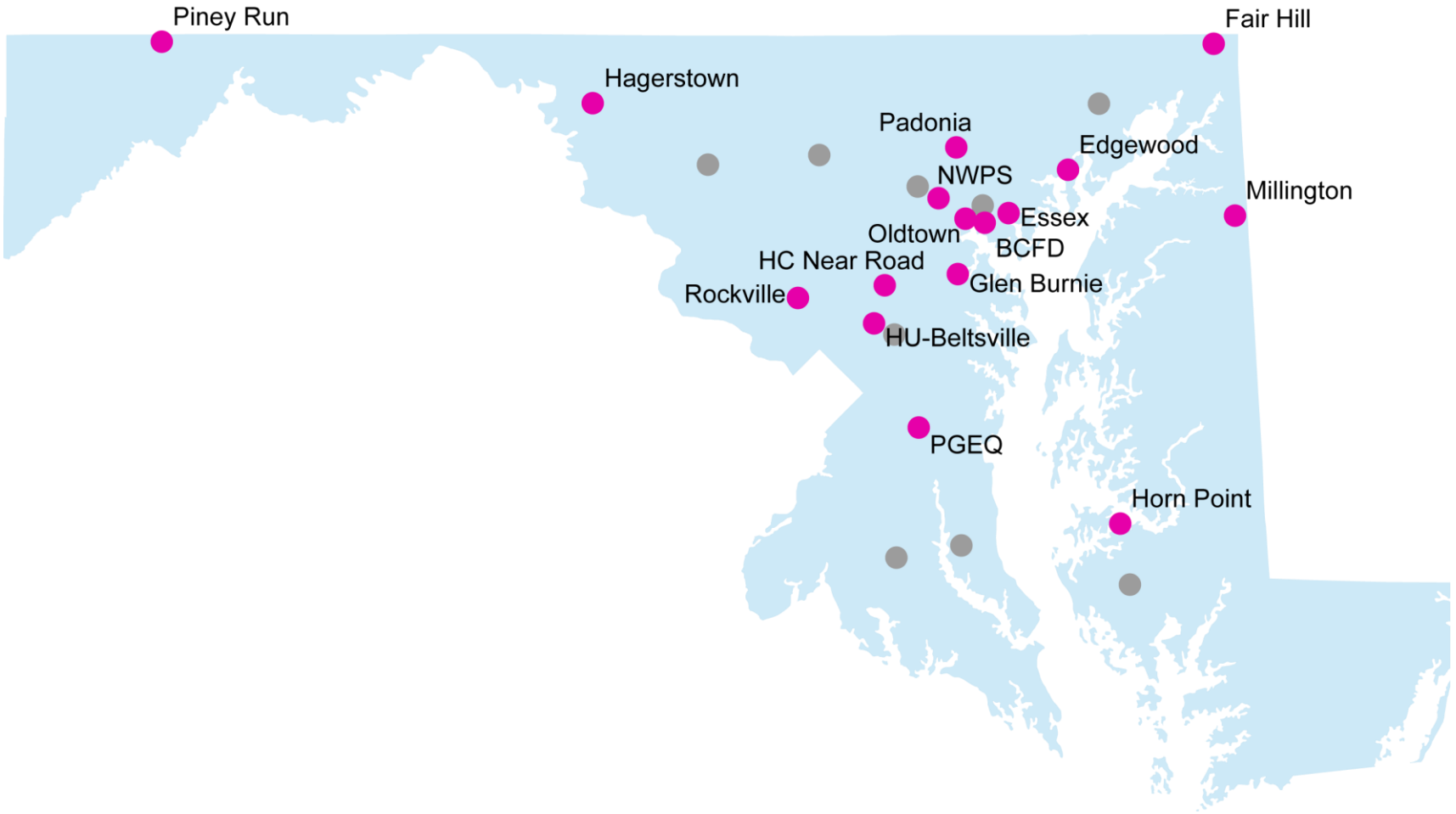
- Ozone (O_3)
- Particulate Matter (PM)
- Sulfur Dioxide (SO_2)
- Nitrogen Dioxide (NO_2)
- Carbon Monoxide (CO)
- Volatile Organic Compounds (VOCs)
- Hazardous Air Pollutants (HAPs)

*Not all monitors measure all pollutants.

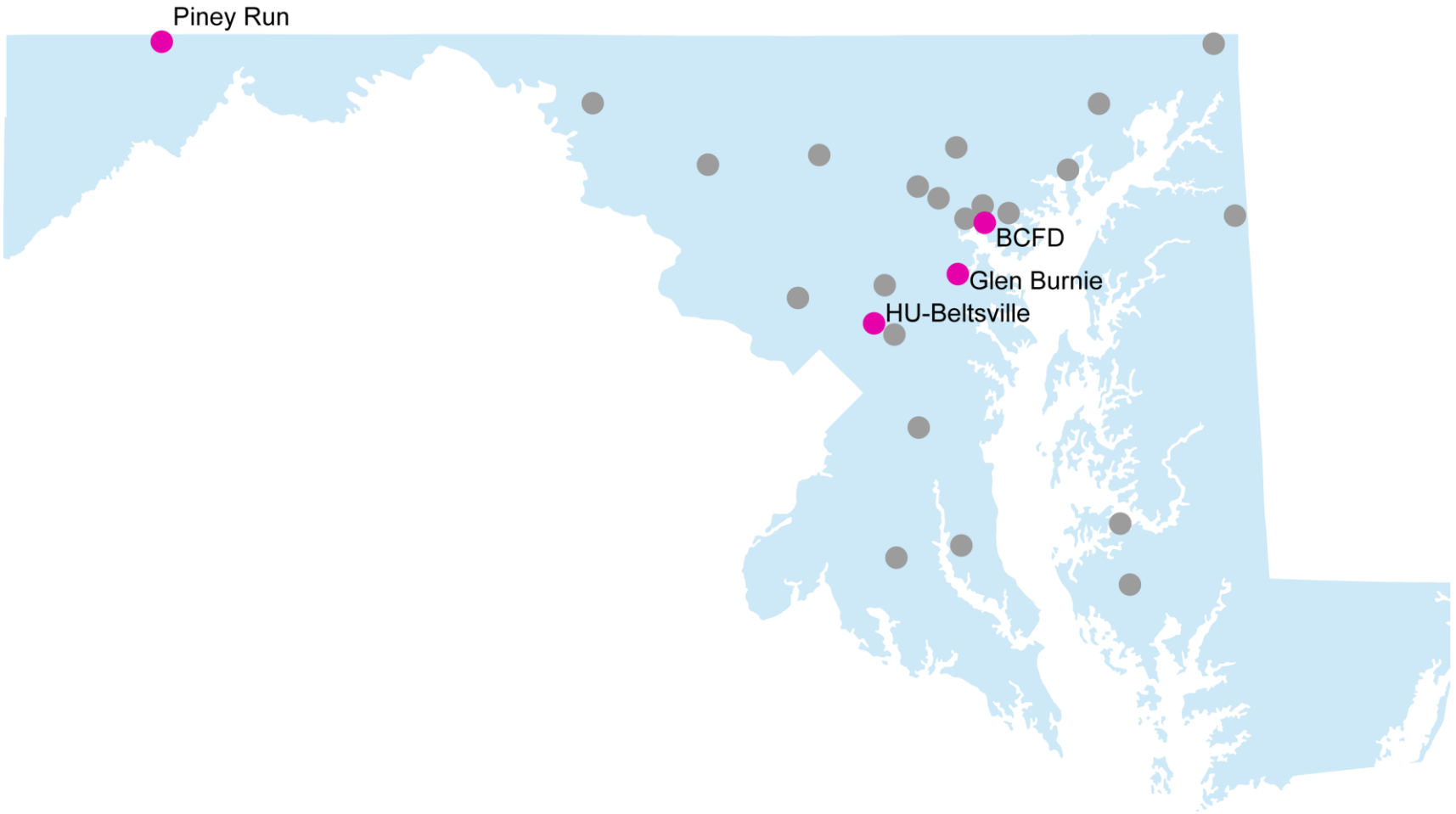
2016 Maryland Network-26 sites



$PM_{2.5}$ Network-16 sites

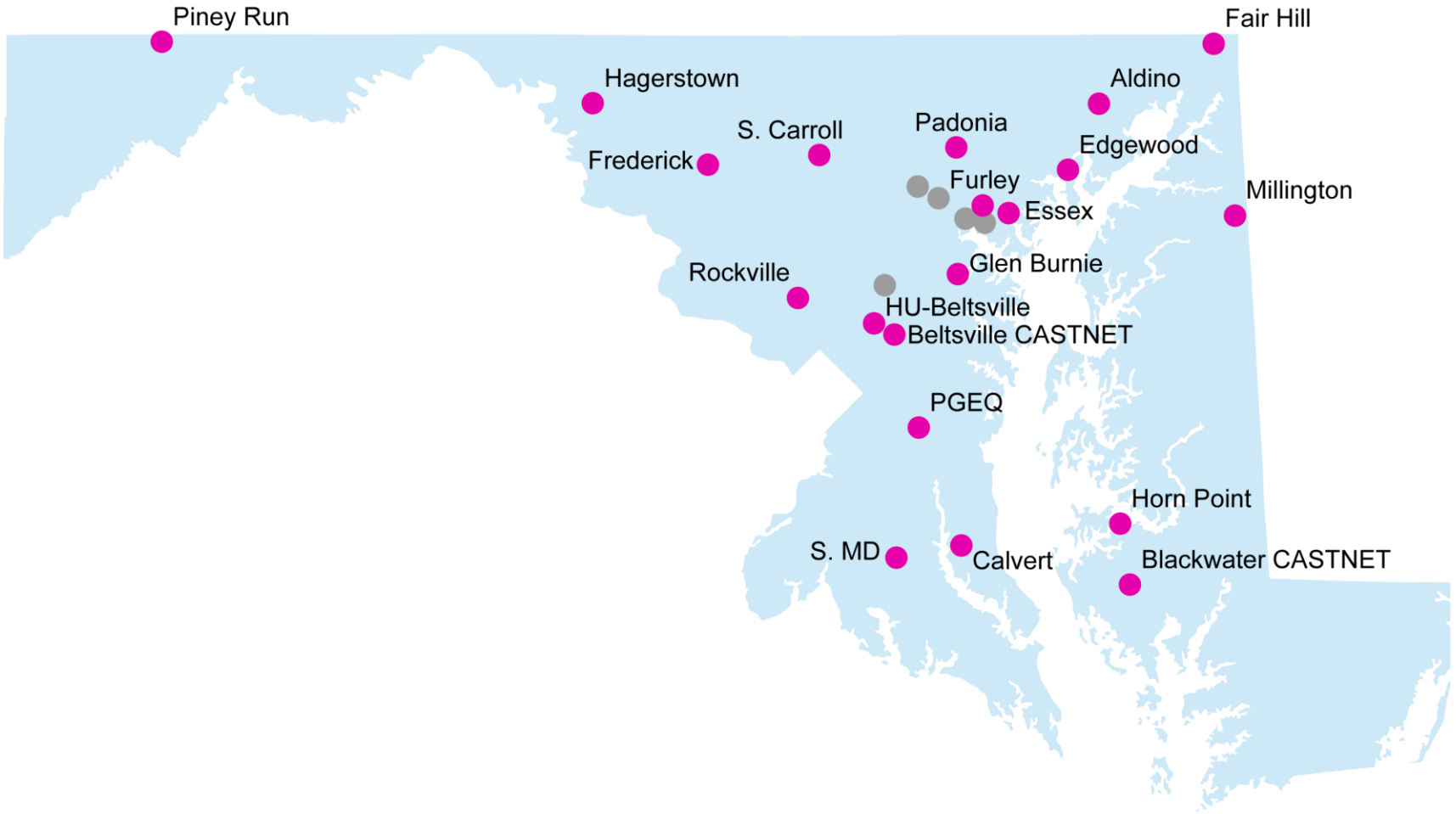


PM_{10} Network-4 sites



Lead Network-1 site

Ozone Network-20 sites



Non-Criteria Pollutant Monitoring

- Air Toxics- 188 Hazardous Air Pollutants (HAPs) listed in the Clean Air Act
- Photochemical Assessment Monitoring (PAMS)- 56 volatile organic compounds that are ozone precursors
- PM-2.5 Chemical Speciation- nitrate, sulfate, metals, organic and elemental carbon

All these done right here at HU-Beltsville!!

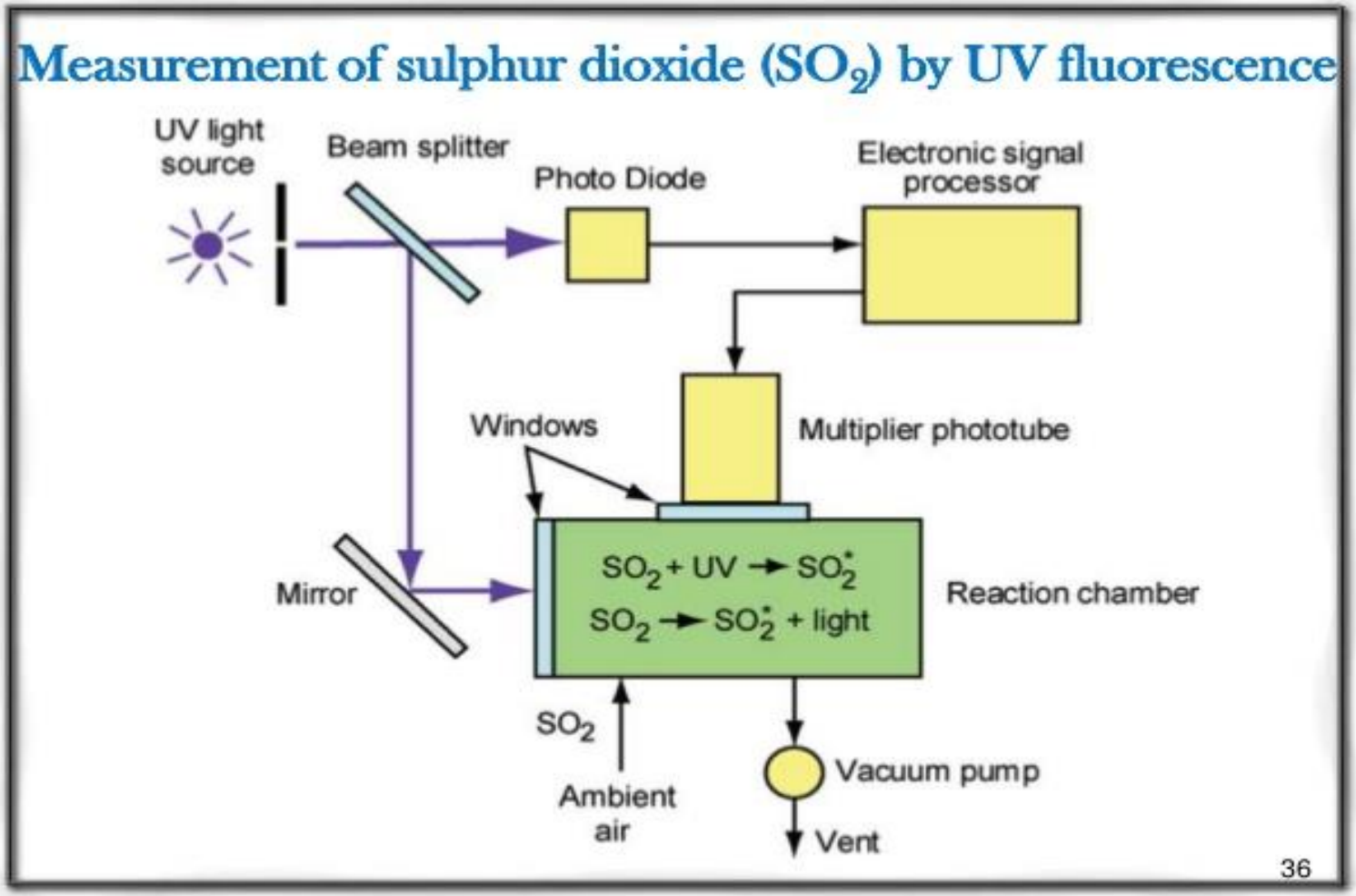
Monitoring Methods & Instrumentation

- Federal Reference Methods (FRMs) & Federal Equivalent Methods (FEMs)
  - FRMs
  - FEMs
  - Link to complete list of FRMs & FEMs: https://www.epa.gov/sites/production/files/2019-08/documents/designated_reference_and-equivalent_methods.pdf

Monitoring Methods & Instrumentation

- Carbon Monoxide - Non-dispersive infrared photometry / Gas Filter Correlation (Beer's Law)
- Ozone - UV photometry
- Nitrogen Dioxide - chemiluminescence, UV photolytic, cavity attenuated phase shift spectroscopy (CAPS)
- Sulfur dioxide - fluorescence
- PM-gravimetric, beta attenuation, light scattering
- Toxics – TO-11, TO-15, PAMS

SO2 Method – Pulsed Fluorescence



NOx Method – Chemiluminescence

$$NO + O_3 \rightarrow NO_2^* + O_2$$

$$NO_2^* \rightarrow NO_2 + h\nu$$

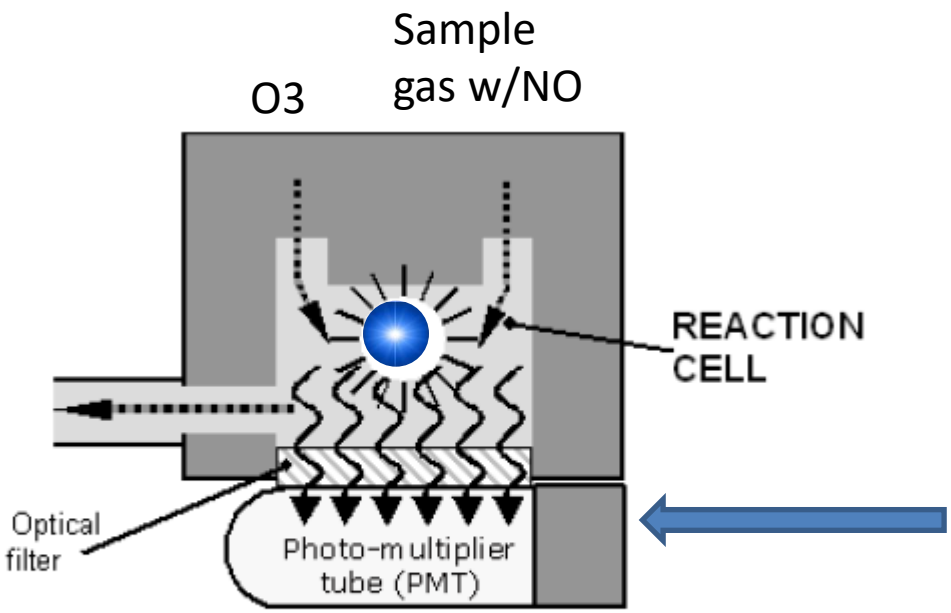


Figure 10-3: Reaction Cell with PMT Tube

Light leaks can impact measurement

PMTs are sensitive and can be damaged by light

NOx Analyzer – Internal Components

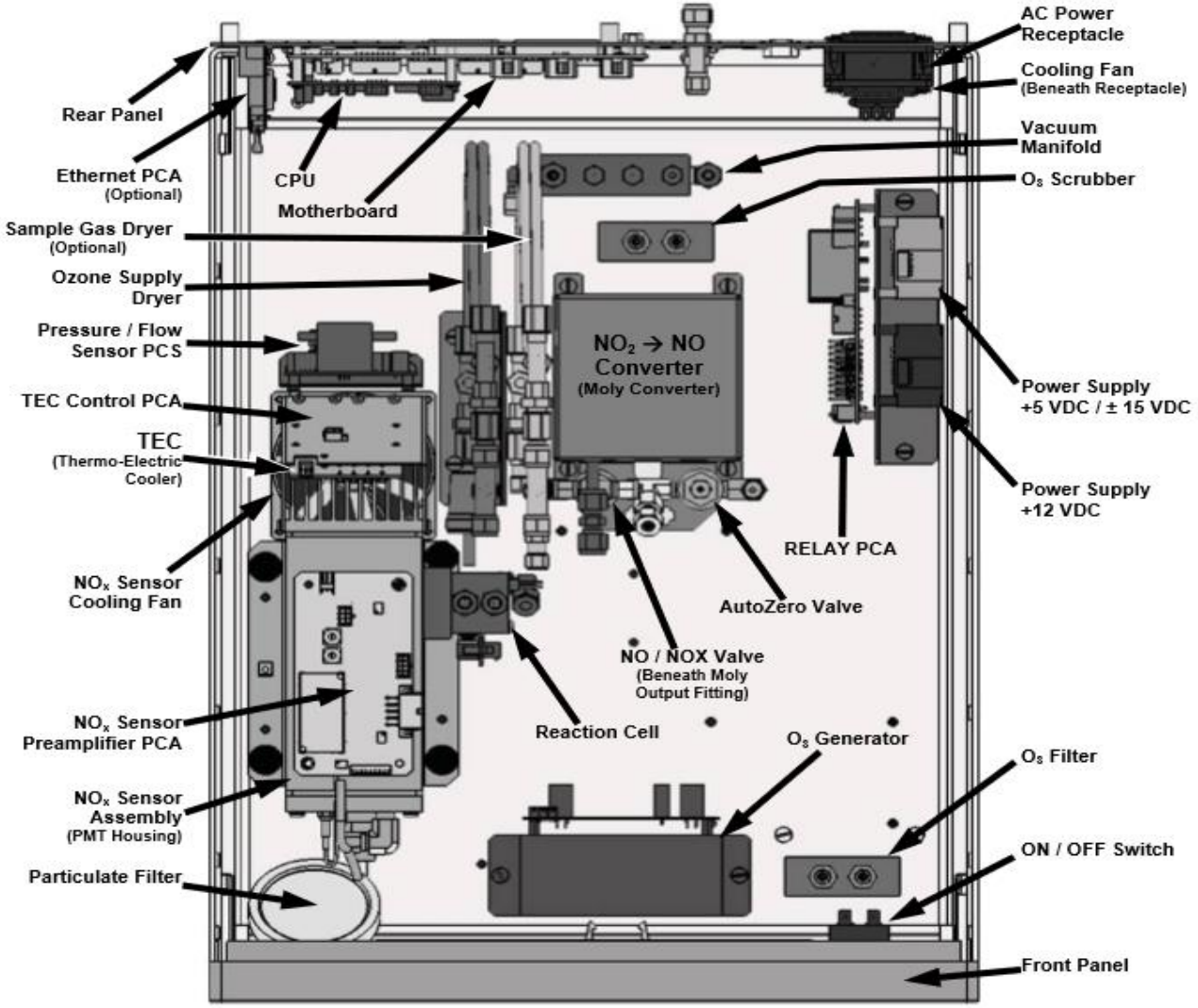


Figure 3-3: Internal Layout – Top View with IZS Option

Ozone Analyzer – Internal Components

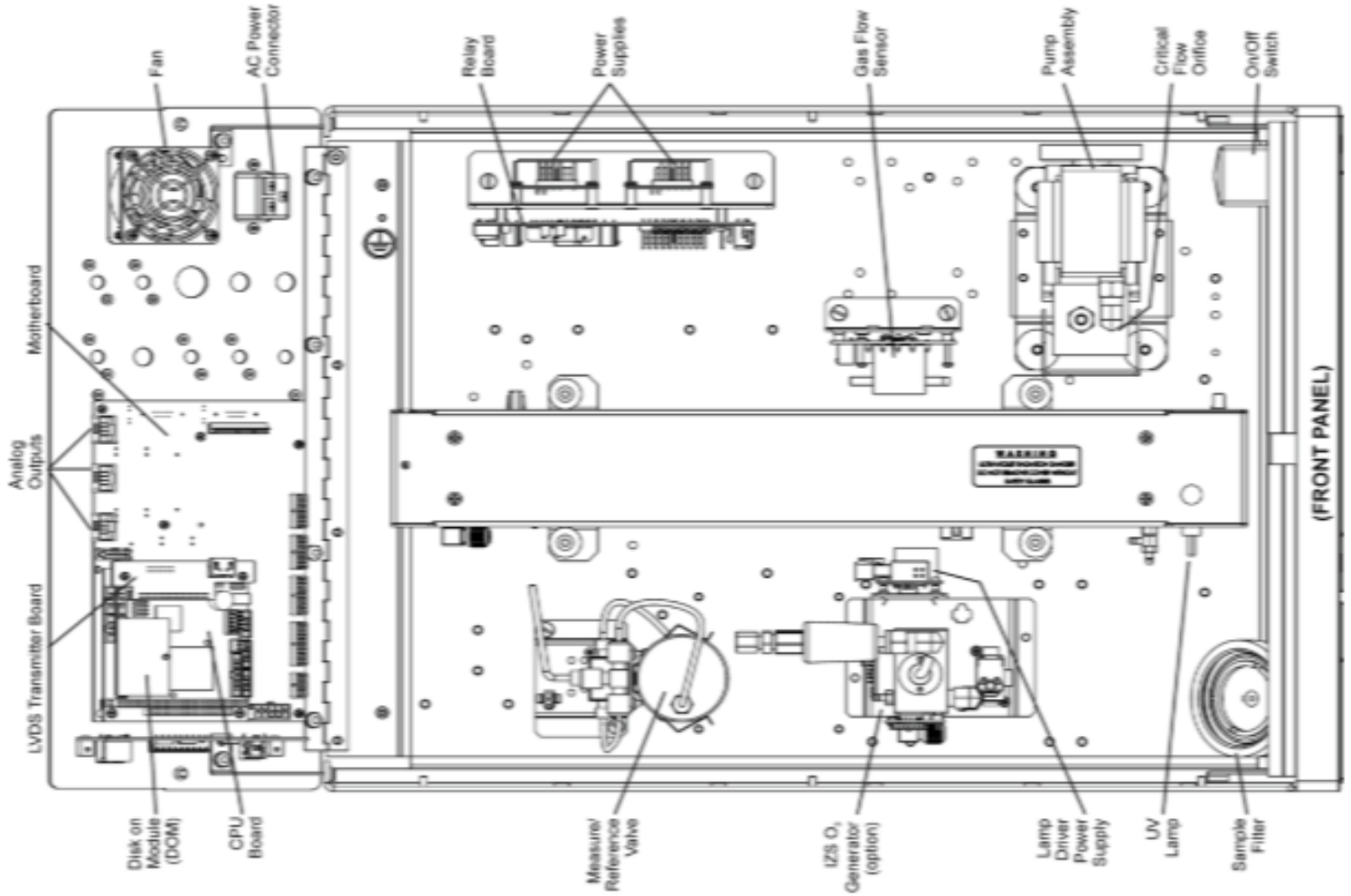


Figure 3-5: T400 Internal Layout – Top View with IZS Option

Ozone Analyzer Flow Path

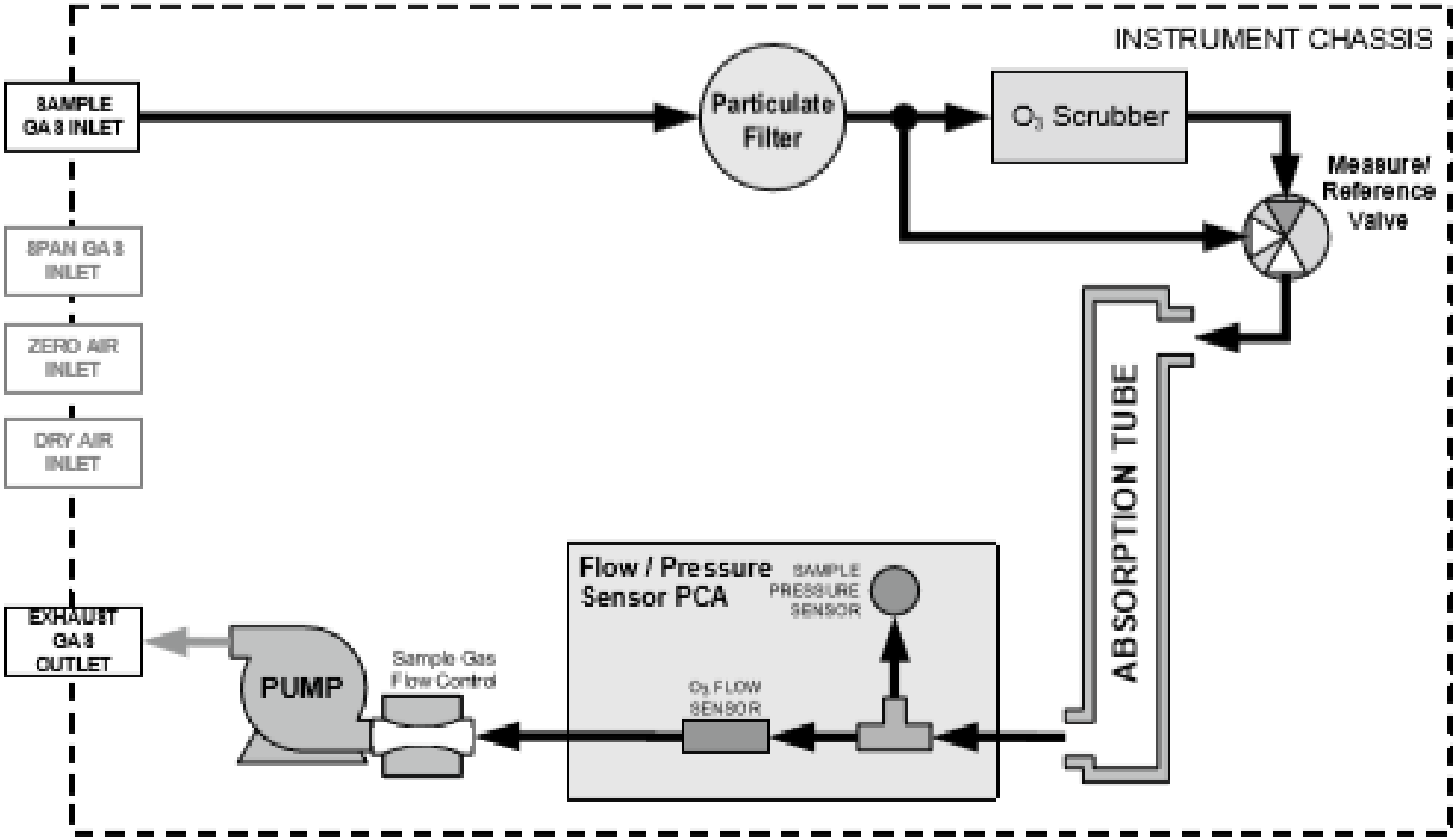


Figure 3-16: T400 Pneumatic Diagram – Basic Unit

SO2 Analyzer Flow Path

3.3.2.2. **PNEUMATIC LAYOUT FOR BASIC CONFIGURATION**

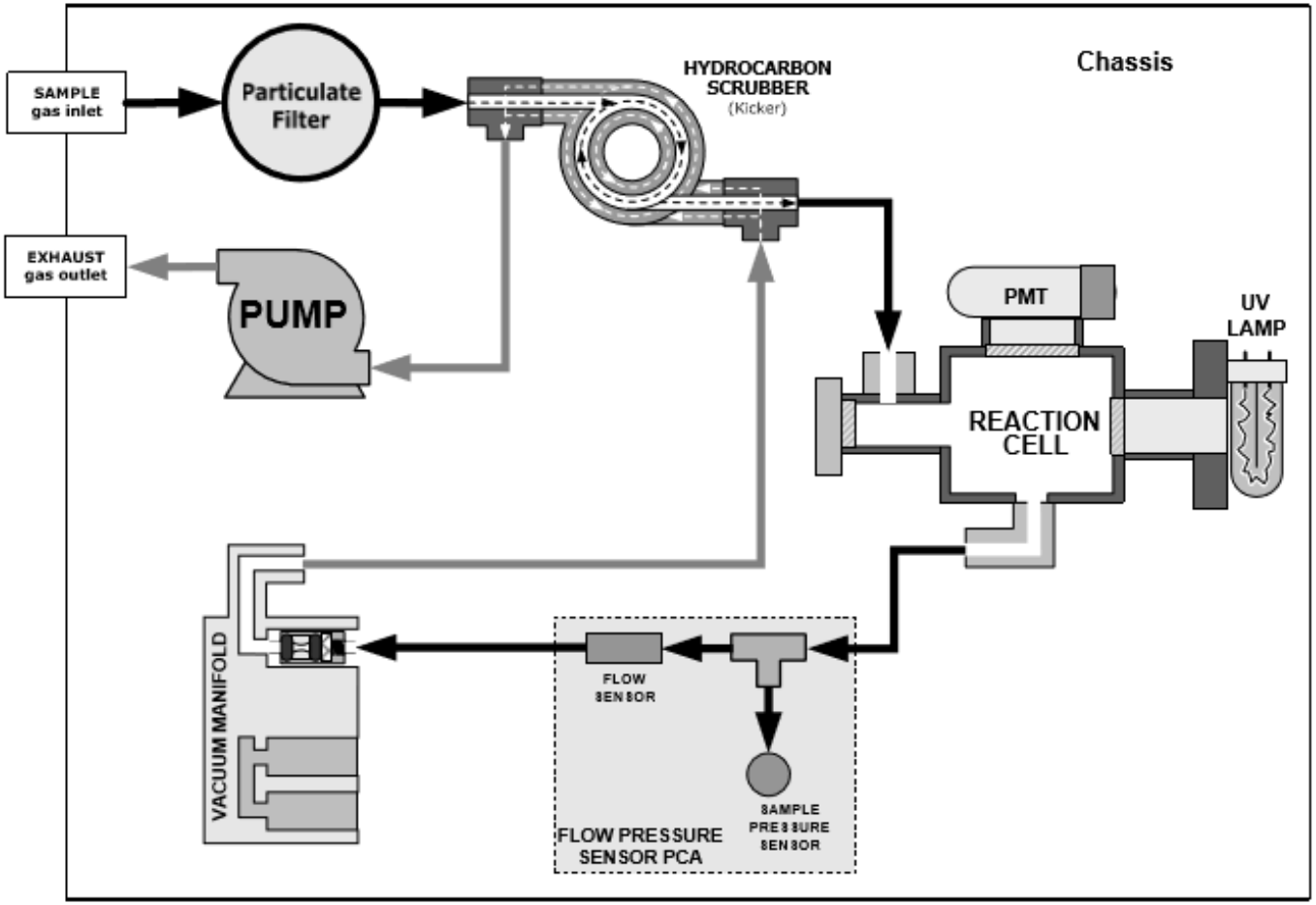
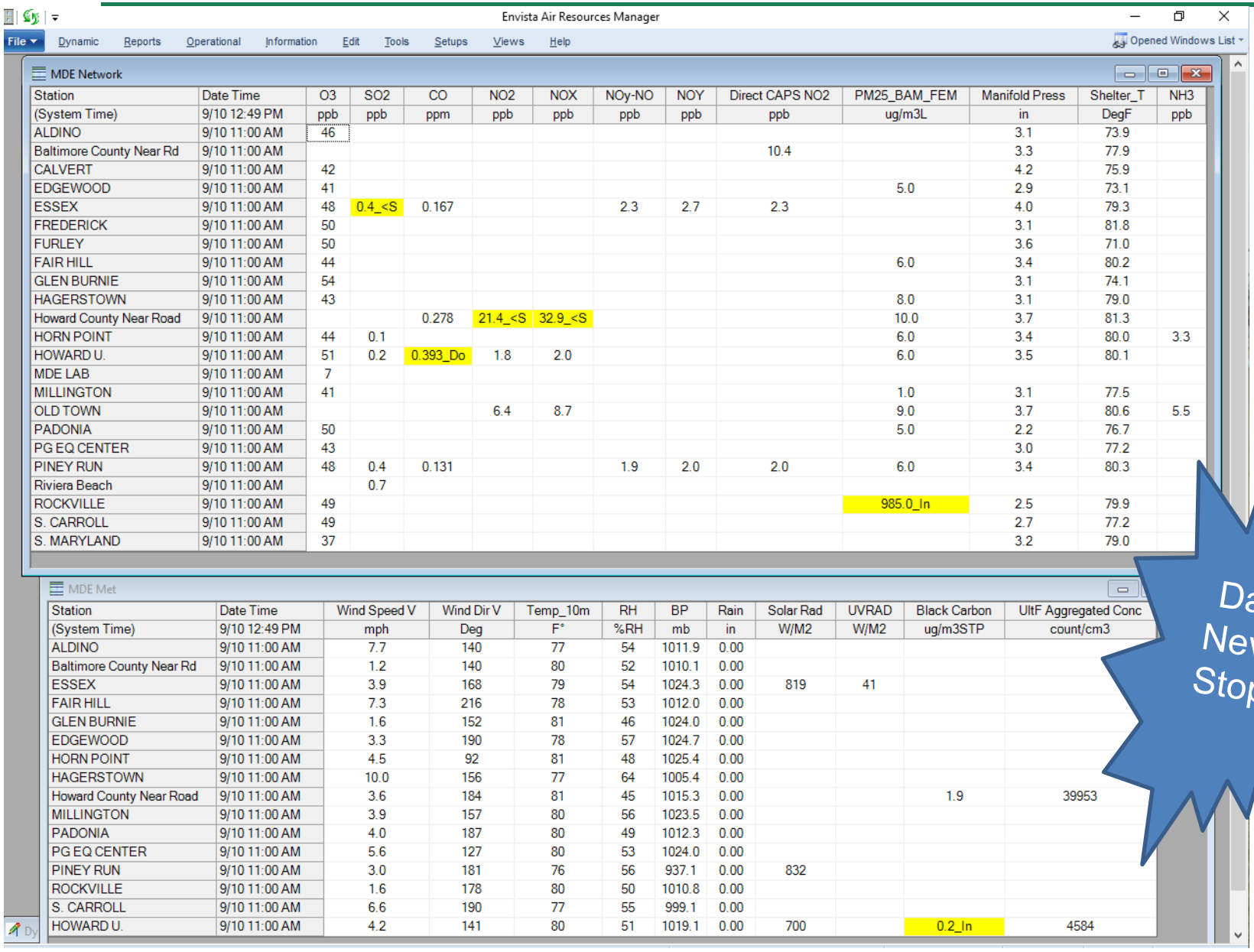


Figure 3-18: T100 Gas Flow, Basic Configuration

Central Data Logging System



MDE Network

Station	Date Time	O3	SO2	CO	NO2	NOX	NOy-NO	NOY	Direct CAPS NO2	PM25_BAM_FEM	Manifold Press	Shelter_T	NH3
(System Time)	9/10 12:49 PM	ppb	ppb	ppm	ppb	ppb	ppb	ppb	ppb	ug/m3L	in	DegF	ppb
ALDINO	9/10 11:00 AM	46									3.1	73.9	
Baltimore County Near Rd	9/10 11:00 AM								10.4		3.3	77.9	
CALVERT	9/10 11:00 AM	42									4.2	75.9	
EDGEWOOD	9/10 11:00 AM	41								5.0	2.9	73.1	
ESSEX	9/10 11:00 AM	48	0.4_<S	0.167			2.3	2.7	2.3		4.0	79.3	
FREDERICK	9/10 11:00 AM	50									3.1	81.8	
FURLEY	9/10 11:00 AM	50									3.6	71.0	
FAIR HILL	9/10 11:00 AM	44								6.0	3.4	80.2	
GLEN BURNIE	9/10 11:00 AM	54									3.1	74.1	
HAGERSTOWN	9/10 11:00 AM	43								8.0	3.1	79.0	
Howard County Near Road	9/10 11:00 AM			0.278	21.4_<S	32.9_<S				10.0	3.7	81.3	
HORN POINT	9/10 11:00 AM	44	0.1							6.0	3.4	80.0	3.3
HOWARD U.	9/10 11:00 AM	51	0.2	0.393_Do	1.8	2.0				6.0	3.5	80.1	
MDE LAB	9/10 11:00 AM	7											
MILLINGTON	9/10 11:00 AM	41								1.0	3.1	77.5	
OLD TOWN	9/10 11:00 AM				6.4	8.7				9.0	3.7	80.6	5.5
PADONIA	9/10 11:00 AM	50								5.0	2.2	76.7	
PG EQ CENTER	9/10 11:00 AM	43									3.0	77.2	
PINEY RUN	9/10 11:00 AM	48	0.4	0.131			1.9	2.0	2.0	6.0	3.4	80.3	
Riviera Beach	9/10 11:00 AM		0.7										
ROCKVILLE	9/10 11:00 AM	49								985.0_In	2.5	79.9	
S. CARROLL	9/10 11:00 AM	49									2.7	77.2	
S. MARYLAND	9/10 11:00 AM	37									3.2	79.0	

MDE Met

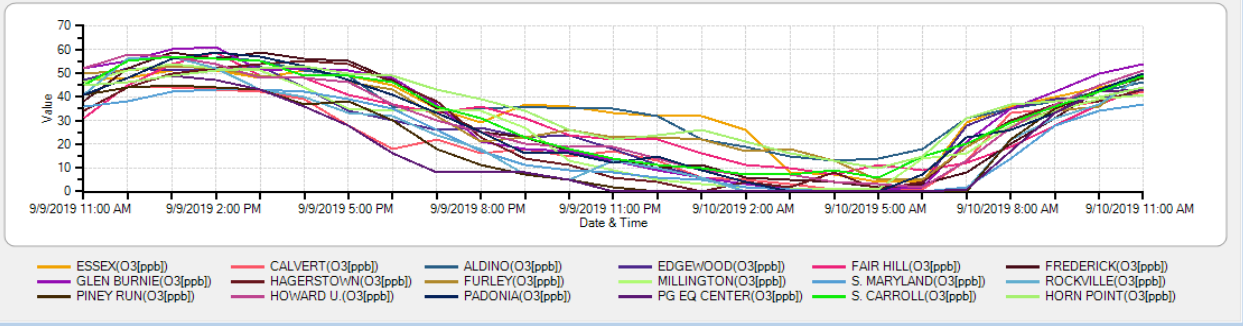
Station	Date Time	Wind Speed V	Wind Dir V	Temp_10m	RH	BP	Rain	Solar Rad	UVRAD	Black Carbon	UltF Aggregated Conc
(System Time)	9/10 12:49 PM	mph	Deg	F°	%RH	mb	in	W/M2	W/M2	ug/m3STP	count/cm3
ALDINO	9/10 11:00 AM	7.7	140	77	54	1011.9	0.00				
Baltimore County Near Rd	9/10 11:00 AM	1.2	140	80	52	1010.1	0.00				
ESSEX	9/10 11:00 AM	3.9	168	79	54	1024.3	0.00	819	41		
FAIR HILL	9/10 11:00 AM	7.3	216	78	53	1012.0	0.00				
GLEN BURNIE	9/10 11:00 AM	1.6	152	81	46	1024.0	0.00				
EDGEWOOD	9/10 11:00 AM	3.3	190	78	57	1024.7	0.00				
HORN POINT	9/10 11:00 AM	4.5	92	81	48	1025.4	0.00				
HAGERSTOWN	9/10 11:00 AM	10.0	156	77	64	1005.4	0.00				
Howard County Near Road	9/10 11:00 AM	3.6	184	81	45	1015.3	0.00			1.9	39953
MILLINGTON	9/10 11:00 AM	3.9	157	80	56	1023.5	0.00				
PADONIA	9/10 11:00 AM	4.0	187	80	49	1012.3	0.00				
PG EQ CENTER	9/10 11:00 AM	5.6	127	80	53	1024.0	0.00				
PINEY RUN	9/10 11:00 AM	3.0	181	76	56	937.1	0.00	832			
ROCKVILLE	9/10 11:00 AM	1.6	178	80	50	1010.8	0.00				
S. CARROLL	9/10 11:00 AM	6.6	190	77	55	999.1	0.00				
HOWARD U.	9/10 11:00 AM	4.2	141	80	51	1019.1	0.00	700		0.2_In	4584

Parameter Data Network Wide

Dynamic Multi Station - Ozone

Date & Time	ESSEX	CALVERT	ALDINO	EDGEWOOD	FAIR HILL	FREDERICK	GLEN BURNIE	HAGERSTOWN	FURLEY	MILLINGTON
	O3	O3	O3	O3	O3	O3	O3	O3	O3	O3
	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb	ppb
9/10/2019 11:00 AM	48	42	46	41	44	50	54	43	50	41
9/10/2019 10:00 AM	44	38	42	40	37	43	50	38	36	39
9/10/2019 9:00 AM	40	35	38	39	28	31	42	37	34	34
9/10/2019 8:00 AM	36	33	35	35	19	20	35	30	29	28
9/10/2019 7:00 AM	29	13	31	28	12	8	21	19	19	16
9/10/2019 6:00 AM	4	1	18	3	9	3	2	4	5	14
9/10/2019 5:00 AM	4	0	14	1	11	2	1	1	5	1
9/10/2019 4:00 AM	7	1	13	1	7	4	1	8	13	1
9/10/2019 3:00 AM	8	3	15	1	10	5	1	2	18	1
9/10/2019 2:00 AM	26	5	19	3	11	6	3	4	17	2
9/10/2019 1:00 AM	32	6	22	6	16	11	6	0	22	3
9/10/2019 12:00 AM	32	13	32	11	22	10	9	4	23	5
9/9/2019 11:00 PM	33	17	35	18	22	14	13	6	23	9
9/9/2019 10:00 PM	36	15	35	24	24	17	17	11	26	13

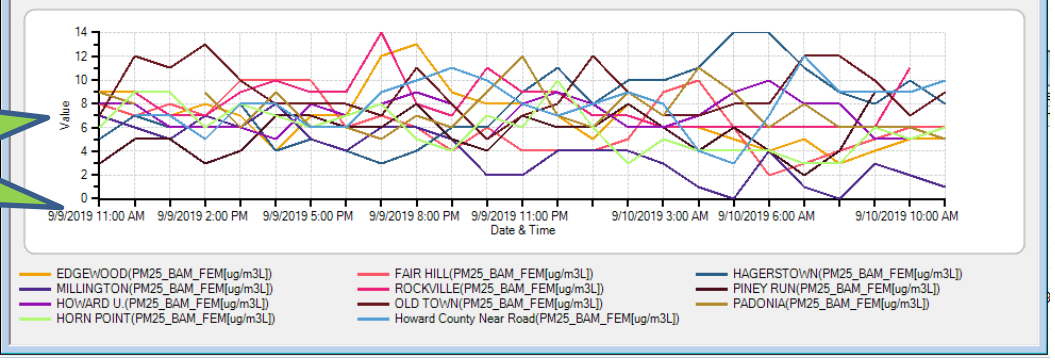
Invalid Alarm Instantaneous Data Warning



Ozone

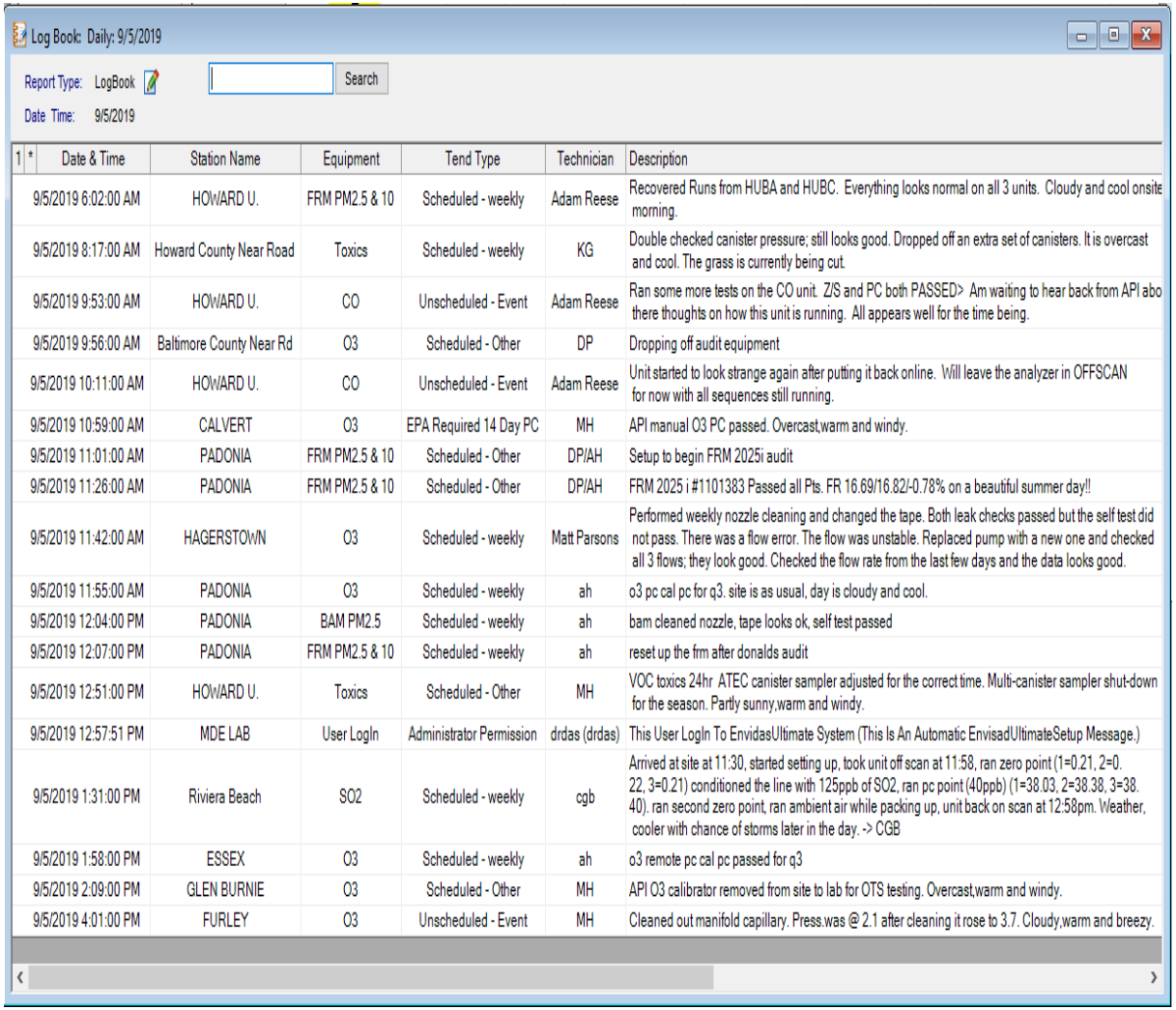
HAGERSTOWN	MILLINGTON	ROCKVILLE	PINEY RI
PM25_BAM_FEM	PM25_BAM_FEM	PM25_BAM_FEM	PM25_BAM
ug/m3L	ug/m3L	ug/m3L	ug/m3L
8.0	1.0	InVld	6.0
10.0	2.0	11.0	InVld
8.0	3.0	6.0	9.0
9.0	0.0	6.0	4.0
11.0	1.0	6.0	2.0
14.0	4.0	6.0	4.0
14.0	0.0	6.0	6.0
11.0	1.0	6.0	4.0
10.0	3.0	6.0	6.0
10.0	4.0	7.0	8.0
8.0	4.0	7.0	6.0
11.0	4.0	9.0	6.0
9.0	2.0	9.0	7.0
6.0	2.0	11.0	4.0
6.0	5.0	7.0	5.0

Invalid Alarm Instantaneous Data Warning



Particulate Matter

Daily Log Notes



Log Book: Daily: 9/5/2019

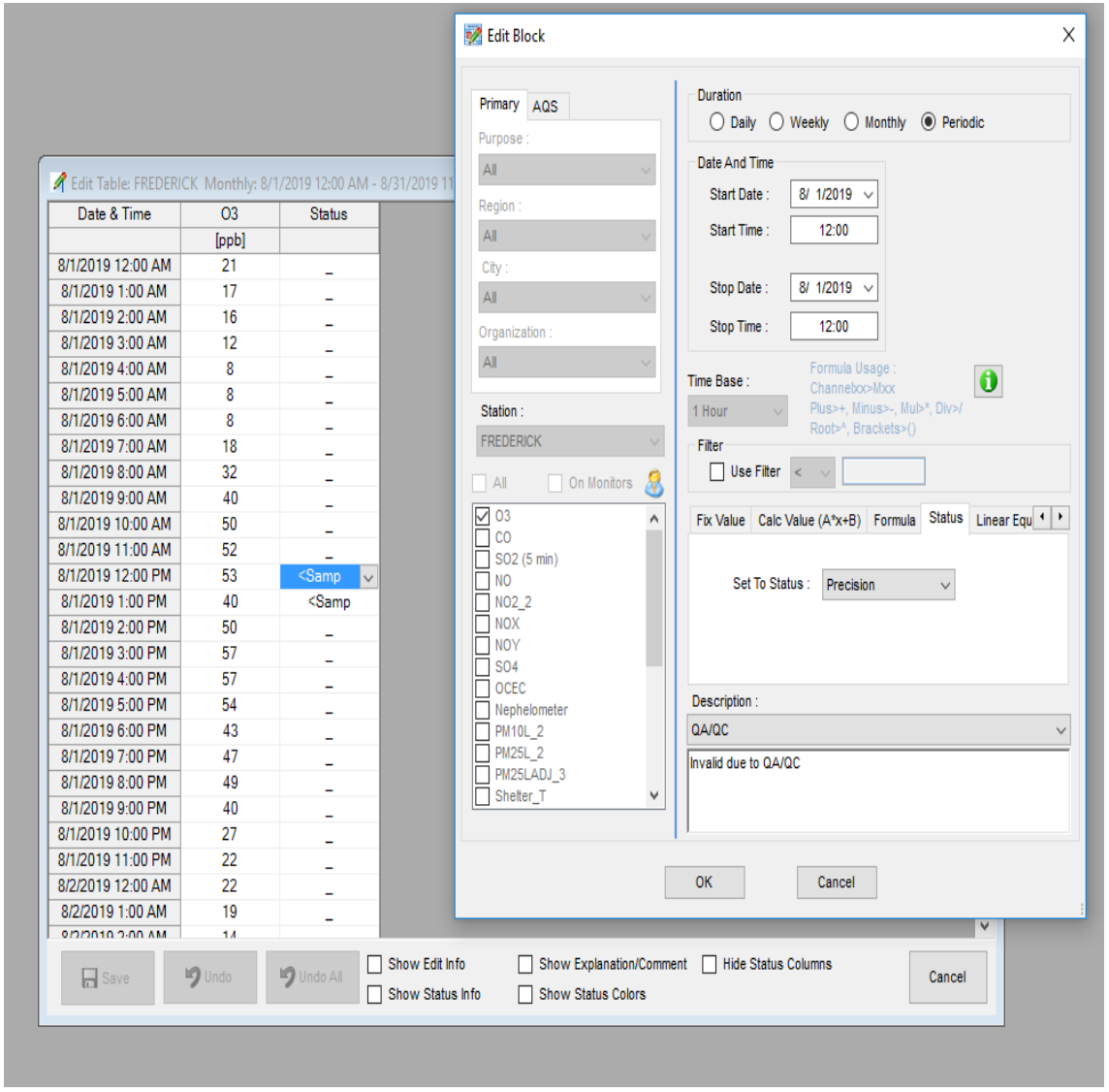
Report Type: LogBook Search

Date Time: 9/5/2019

Date & Time	Station Name	Equipment	Tend Type	Technician	Description
9/5/2019 6:02:00 AM	HOWARD U.	FRM PM2.5 & 10	Scheduled - weekly	Adam Reese	Recovered Runs from HUBA and HUBC. Everything looks normal on all 3 units. Cloudy and cool onsite morning.
9/5/2019 8:17:00 AM	Howard County Near Road	Toxics	Scheduled - weekly	KG	Double checked canister pressure; still looks good. Dropped off an extra set of canisters. It is overcast and cool. The grass is currently being cut.
9/5/2019 9:53:00 AM	HOWARD U.	CO	Unscheduled - Event	Adam Reese	Ran some more tests on the CO unit. Z/S and PC both PASSED> Am waiting to hear back from API abo there thoughts on how this unit is running. All appears well for the time being.
9/5/2019 9:56:00 AM	Baltimore County Near Rd	O3	Scheduled - Other	DP	Dropping off audit equipment
9/5/2019 10:11:00 AM	HOWARD U.	CO	Unscheduled - Event	Adam Reese	Unit started to look strange again after putting it back online. Will leave the analyzer in OFFSCAN for now with all sequences still running.
9/5/2019 10:59:00 AM	CALVERT	O3	EPA Required 14 Day PC	MH	API manual O3 PC passed. Overcast,warm and windy.
9/5/2019 11:01:00 AM	PADONIA	FRM PM2.5 & 10	Scheduled - Other	DP/AH	Setup to begin FRM 2025i audit
9/5/2019 11:26:00 AM	PADONIA	FRM PM2.5 & 10	Scheduled - Other	DP/AH	FRM 2025 i #1101383 Passed all Pts. FR 16.69/16.82/-0.78% on a beautiful summer day!!
9/5/2019 11:42:00 AM	HAGERSTOWN	O3	Scheduled - weekly	Matt Parsons	Performed weekly nozzle cleaning and changed the tape. Both leak checks passed but the self test did not pass. There was a flow error. The flow was unstable. Replaced pump with a new one and checked all 3 flows; they look good. Checked the flow rate from the last few days and the data looks good.
9/5/2019 11:55:00 AM	PADONIA	O3	Scheduled - weekly	ah	o3 pc cal pc for q3. site is as usual, day is cloudy and cool.
9/5/2019 12:04:00 PM	PADONIA	BAM PM2.5	Scheduled - weekly	ah	bam cleaned nozzle, tape looks ok, self test passed
9/5/2019 12:07:00 PM	PADONIA	FRM PM2.5 & 10	Scheduled - weekly	ah	reset up the frm after donalds audit
9/5/2019 12:51:00 PM	HOWARD U.	Toxics	Scheduled - Other	MH	VOC toxics 24hr ATEC canister sampler adjusted for the correct time. Multi-canister sampler shut-down for the season. Partly sunny,warm and windy.
9/5/2019 12:57:51 PM	MDE LAB	User LogIn	Administrator Permission	drdas (drdas)	This User LogIn To EnvidasUltimate System (This Is An Automatic EnvisadUltimateSetup Message.)
9/5/2019 1:31:00 PM	Riviera Beach	SO2	Scheduled - weekly	cgb	Arrived at site at 11:30, started setting up, took unit off scan at 11:58, ran zero point (1=0.21, 2=0. 22, 3=0.21) conditioned the line with 125ppb of SO2, ran pc point (40ppb) (1=38.03, 2=38.38, 3=38. 40). ran second zero point, ran ambient air while packing up, unit back on scan at 12:58pm. Weather, cooler with chance of storms later in the day. -> CGB
9/5/2019 1:58:00 PM	ESSEX	O3	Scheduled - weekly	ah	o3 remote pc cal pc passed for q3
9/5/2019 2:09:00 PM	GLEN BURNIE	O3	Scheduled - Other	MH	API O3 calibrator removed from site to lab for OTS testing. Overcast,warm and windy.
9/5/2019 4:01:00 PM	FURLEY	O3	Unscheduled - Event	MH	Cleaned out manifold capillary. Press.was @ 2.1 after cleaning it rose to 3.7. Cloudy,warm and breezy.

- Provides timestamp of QC checks / Maintenance that occurs at the site
- Also tracks ‘non-monitoring activities’ around the site

DATA QAQC Procedures



- Daily 1 min, 5 min and 60 min data reviews looking for missing data, outliers, etc.
- PC's, Calibrations, Audits
- Zero / Span checks
- Multi-site and Historical comparisons
- Station data – manifold flows, shelter temperatures, log notes
- EPA Data Validation templates

QA Validation Criteria

- Critical criteria are needed to maintain the integrity of a sample or a group of samples. Observations not meeting each and every criterion should be invalidated unless there are compelling reasons and justifications for not doing so.

- Operational criteria are important for maintaining and evaluating the quality of data collection system. Violation of one of these criteria may or may not be used for invalidating data (this is a decision call of the QA staff).

- Systematic criteria are important for the correct interpretation of the data but do not usually impact the validity of a sample or group of samples. These include data quality objectives.

QA Validation Templates

Ozone Validation Template

1) Requirement (O_3)	2) Frequency	3) Acceptance Criteria	Information /Action
CRITICAL CRITERIA-OZONE			
Monitor	NA	*Meets requirements listed in FRM/FEM designation*	1) 40 CFR Part 58 App C Sec. 2.1 2) NA 3) 40 CFR Part 53 & FRM/FEM method list
One Point QC Check Single analyzer	*Every 14 days*	< ±7.1% (percent difference) or < ±1.5 ppb difference whichever is greater	1 and 2) 40 CFR Part 58 App A Sec. 3.1 3) Recommendation based on DQO in 40 CFR Part 58 App A Sec. 2.3.1.2. QC Check Conc range 0.005 - 0.08 ppm and 05/05/2016 Technical Note on AMTIC
Zero/span check	Every 14 days	Zero drift < ± 3.1 ppb (24 hr) < ± 5.1 ppb (>24hr-14 day) Span drift < ± 7.1 %	1 and 2) QA Handbook Volume 2 Sec. 12.3 3) Recommendation and related to DQO
OPERATIONAL CRITERIA -OZONE			
Shelter Temperature Range	Daily (hourly values)	20.0 to 30.0° C. (Hourly avg) or per manufacturers specifications if designated to a wider temperature range	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2 Generally, the 20-30.0° C range will apply but the most restrictive operable range of the instruments in the shelter may also be used as guidance. FRM/FEM list found on AMTIC provides temp. range for given instrument. FRM/FEM monitor testing is required at 20-30° C range per 40 CFR Part 53.32
Shelter Temperature Control	Daily (hourly values)	< 2.1° C SD over 24 hours	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
Shelter Temperature Device Check	Every 182 days and 2/ calendar year	<± 2.1° C of standard	1, 2 and 3) QA Handbook Volume 2 Sec. 7.2.2
Annual Performance Evaluation Single analyzer	*Every site every 365 days and 1/ calendar year within period of monitor operation,*	Percent difference of audit levels 3-10 < ±15.1% Audit levels 1&2 < ± 1.5 ppb difference or <± 15.1%	1 and 2) 40 CFR Part 58 App A Sec. 3.1.2 3) Recommendation- 3-audit concentrations not including zero. AMTIC guidance 2/17/2011 AMTIC Technical Memo
Federal Audits (NPAP)	*20% of sites audited in calendar year*	Audit levels 1&2 < ± 1.5 ppb difference all other levels percent difference < ± 10.1%	1 and 2) 40 CFR Part 58 App A Sec. 3.1.3 3) NPAP QAPP/SOP
Verification/Calibration	Upon receipt/adjustment/repair/ installation/moving and repair and recalibration of standard of higher level Every 182 day and 2/ calendar year if manual zero/span performed biweekly Every 365 day and 1/ calendar year if continuous zero/span performed daily	All points < ± 2.1 % or ≤ ±1.5 ppb difference of best-fit straight line whichever is greater and Slope 1 ± .05	1) 40 CFR Part 50 App D 2) Recommendation 3) 40 CFR Part 50 App D Sec 4.5.5.6 Multi-point calibration (0 and 4 upscale points) Slope criteria is a recommendation
Zero Air/Zero Air Check	Every 365 days and 1/calendar year	Concentrations below LDL	1) 40 CFR Part 50 App D Sec. 4.1 2 and 3) Recommendation
Ozone Level 2 Standard			

QA Validation Templates

1) Requirement (O_3)	2) Frequency	3) Acceptance Criteria	Information /Action
Certification/recertification to Standard Reference Photometer (Level 1)	Every 365 days and 1/calendar year	single point difference < ± 3.1%	1) 40 CFR Part 50 App D Sec. 5.4 2 and 3) Transfer Standard Guidance EPA-454/B-10-001 Level 2 standard (formerly called primary standard) usually transported to EPA Regions SRP for comparison
Level 2 and Greater Transfer Standard Precision	Every 365 days and 1/calendar year	***Standard Deviation less than 0.005 ppm or 3.0% whichever is greater***	1) 40 CFR Part 50 Appendix D Sec. 3.1 2) Recommendation, part of reverification 3) 40 CFR Part 50 Appendix D Sec. 3.1
(if recertified via a transfer standard)	Every 365 days and 1/calendar year	Regression slopes = 1.00 ± 0.03 and two intercepts are 0 ± 3 ppb	1, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001
Ozone Transfer standard (Level 3 and greater)			
Qualification	Upon receipt of transfer standard	< ±4.1% or < ±4 ppb (whichever greater)	1, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001
Certification	After qualification and upon receipt/adjustment/repair	RSD of six slopes ≤ 3.7% Std. Dev. of 6 intercepts ≤ 1.5	1, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001 1
Recertification to higher level standard	Beginning and end of O3 season or every 182 days and 2/calendar year whichever less	New slope = ± 0.05 of previous and RSD of six slopes ≤3.7% Std. Dev. of 6 intercepts ≤ 1.5	1, 2 and 3) Transfer Standard Guidance EPA-545/B-10-001 recertification test that then gets added to most recent 5 tests. If does not meet acceptability certification fails
Detection (FEM/FRMs) Noise and Lower Detectable Limits (LDL) are part of the FEM/FRM requirements. It is recommended that monitoring organizations perform the LDL test to minimally confirm and establish the LDL of their monitor. Performing the LDL test will provide the noise information.			
Noise	Every 365 days and 1/ calendar year	***≤ 0.0025 ppm (standard range)*** ***≤ 0.001 ppm (lower range)***	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) Recommendation- info can be obtained from LDL 3) 40 CFR Part 53.20 Table B-1
Lower detectable limit	Every 365 days and 1/calendar year	***≤ 0.005 ppm (standard range)*** ***≤ 0.002 ppm (lower range)***	1) 40 CFR Part 53.23 (b) (definition & procedure) 2) Recommendation 3) 40 CFR Part 53.20 Table B-1
SYSTEMATIC CRITERIA-OZONE			
Standard Reporting Units	***All data***	***ppm (final units in AQS)***	1, 2 and 3) 40 CFR Part 50 App I Sec. 2.1.1
Rounding convention for design value calculation	***All routine concentration data***	***3 places after decimal with digits to right truncated***	1, 2 and 3) 40 CFR Part 50 App I Sec. 2.1.1 The rounding convention is for averaging values for comparison to NAAQS not for reporting individual hourly values.
Completeness (seasonal)	***3-Year Comparison***	***≥ 90% (avg) daily max available in ozone season with min of 75% in any one year.***	1) 40 CFR Part 50 App I 2) 40 CFR Part 50 App I Sec. 2.3 3) 40 CFR Part 50 App I Sec. 2.3 (b)
	8- hour average	***≥75% of hourly averages for the 8-hour (6 of 8 hours)***	1) 40 CFR Part 50 App I 2 and 3) 40 CFR Part 50 App I Sec. 2.1.1
	Valid Daily Max	***≥ 75% of the 24, valid 8 hour averages (18 of 24 8-hour averages***	1) 40 CFR Part 50 App I 2) 40 CFR Part 50 App I Sec. 2.1.2 3) 40 CFR Part 50 App I Sec. 2.1.2 (b)

QA Validation Templates

1) Requirement (O_3)	2) Frequency	3) Acceptance Criteria	Information /Action
Sample Residence Time Verification	Every 365 days and 1/calendar year	***≤ 20 Seconds***	1) 40 CFR Part 58 App E, Sec. 9 (c) 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 9 (c)
Sample Probe, Inlet, Sampling train	***All sites***	***Borosilicate glass (e.g., Pyrex®) or Teflon®***	1) 40 CFR Part 58 App E, Sec. Sec. 9 (a) 2) Recommendation 3) 40 CFR Part 58 App E, Sec. Sec. 9 (a) FEP and PFA have been accepted as an equivalent material to Teflon. Replacement or cleaning is suggested as 1/year and more frequent if pollutant load or contamination dictate
Siting	Every 365 days and 1/calendar year	***Meets siting criteria or waiver documented***	1) 40 CFR Part 58 App E, Sec. 2-6 2) Recommendation 3) 40 CFR Part 58 App E, Sec. 2-6
EPA Standard Ozone Reference Photometer (SRP) Recertification (Level 1)	Every 365 days and 1/calendar year	Regression slope = 1.00 ± 0.01 and intercept < 3 ppb	1, 2 and 3) Transfer Standard Guidance EPA-454/B-10-001 This is usually at a Regional Office and is compared against the traveling SRP
Precision (using 1-point QC checks)	***Calculated annually and as appropriate for design value estimates***	**90% CL CV < 7.1%**	1) 40 CFR Part 58 App A 2.3.1.2 & 3.1.1 2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.2
Bias (using 1-point QC checks)	***Calculated annually and as appropriate for design value estimates***	**95% CL < ± 7.1%**	1) 40 CFR Part 58 App A 2.3.1.2 & 3.1.1 2) 40 CFR Part 58 App A Sec. 4 (b) 3) 40 CFR Part 58 App A Sec. 4.1.3