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Ozone, Nitrogen Dioxide and Sulfur Dioxide Findings in the DEARS

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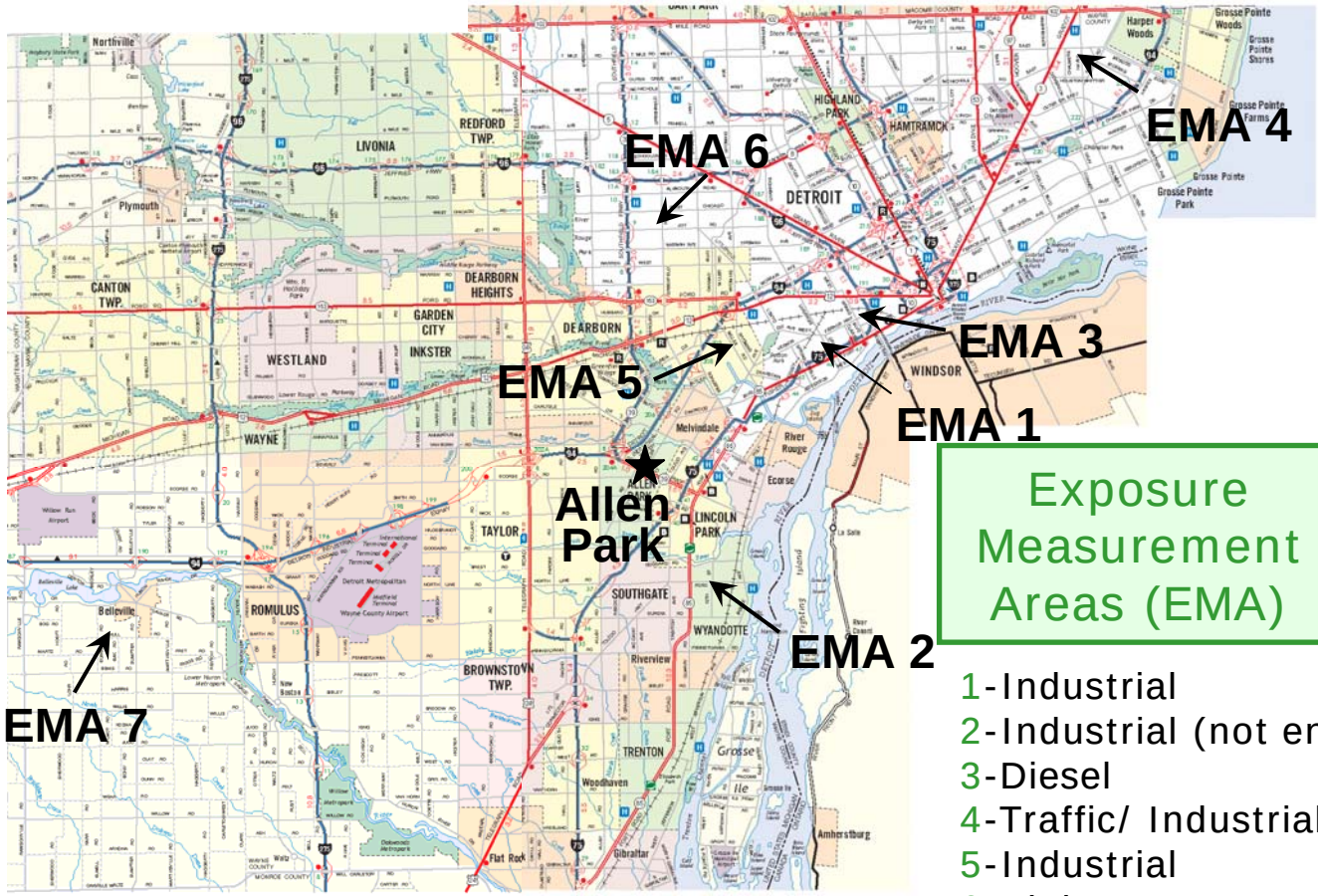
Passive Samplers-What I Will Discuss

- Ones used in the DEARS
- How they work (methodology)
- Where they were used
- Performance evaluations (QA/QC)
- Select preliminary field data
- Summary recommendations of their use

DEARS Study Sites



Exposure Measurement Areas (EMA)

1-Industrial
2-Industrial (not enrolled)
3-Diesel
4-Traffic/ Industrial
5-Industrial
6-Highway
7-Regional

DEARS Measurements

Parameter	Personal	Indoor	Outdoor	Ambient
$PM_{2.5}$ (mass, elements)	X	X	X	X
PM_{coarse} (mass, elements)	--	X	X	X
EC-OC ($PM_{2.5}$)	--	X	X	X
EC ($PM_{2.5}$)	X	X	X	X
Nitrate	--	X	X	X
Gases	X	--	X*	X
Aldehydes	X	X	X	X
VOCs	X	X	X	X
SVOCs	--	X	X	X
PAHs	--	X	X	X
Air Exchange Rate	--	X	--	--

* NO_2 only

Passive Badges

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Ogawa

Monitor Placement

Indoor & Outdoor Monitoring

- Matched to personal and ambient instrumentation

Central Community Site Monitoring

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•Community-based monitoring at Allen Park, an MDEQ air site central to the study area

Continuous Monitors (NC)

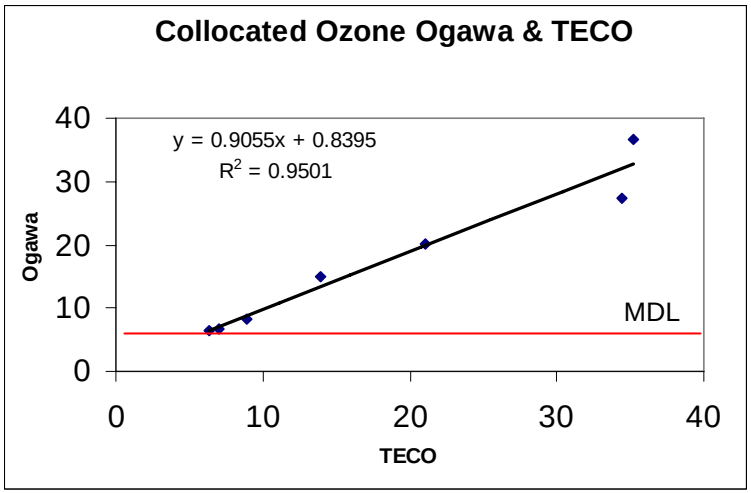
Field Deployment Rates (%)

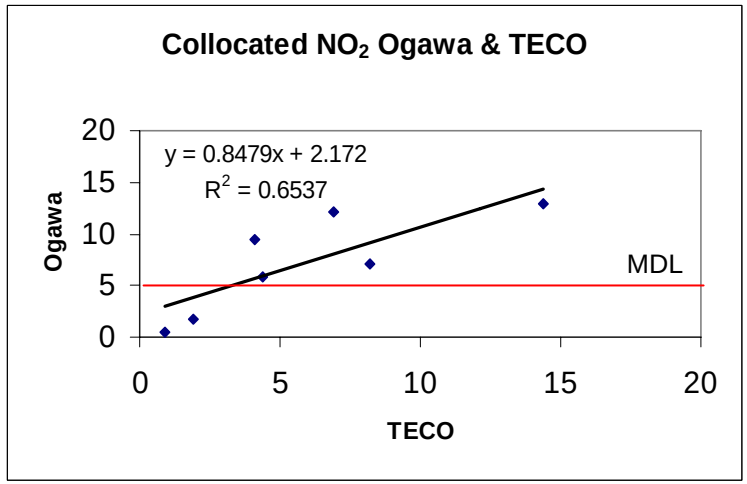
Metric	~Nominal Attempts/ season	Summer ‘04	Winter ‘05	Summer ‘05	Winter ‘06	Summer ‘06	Winter ‘07
Gases	650-1240	100	99	99	99	98	95

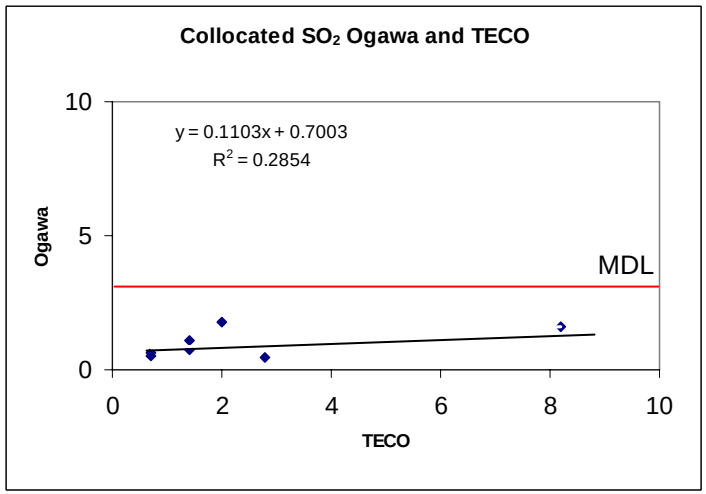
Ogawa-Criteria Gases

- Alternative to rack-mounted FRMs
- Diffusion samplers involving coated filter substrates
- Nominal sampling rates of 9.2, 9.6, 7.3 ml/min respectively for NO_2, O_3 and SO_2 @25 ^oC
- Filter recovery followed by DI-H_20 extraction
- Extract analyzed by IC for specific ions
- NO_2, O_3 and SO_2 LODs of 5.0, 4.5, and 3.1 ppb, respectively

Collocated Ogawa and Continuous Measurements







NC collections

SO2 Comparison (Allen Park Ogawas Versus Dearborn TECO)

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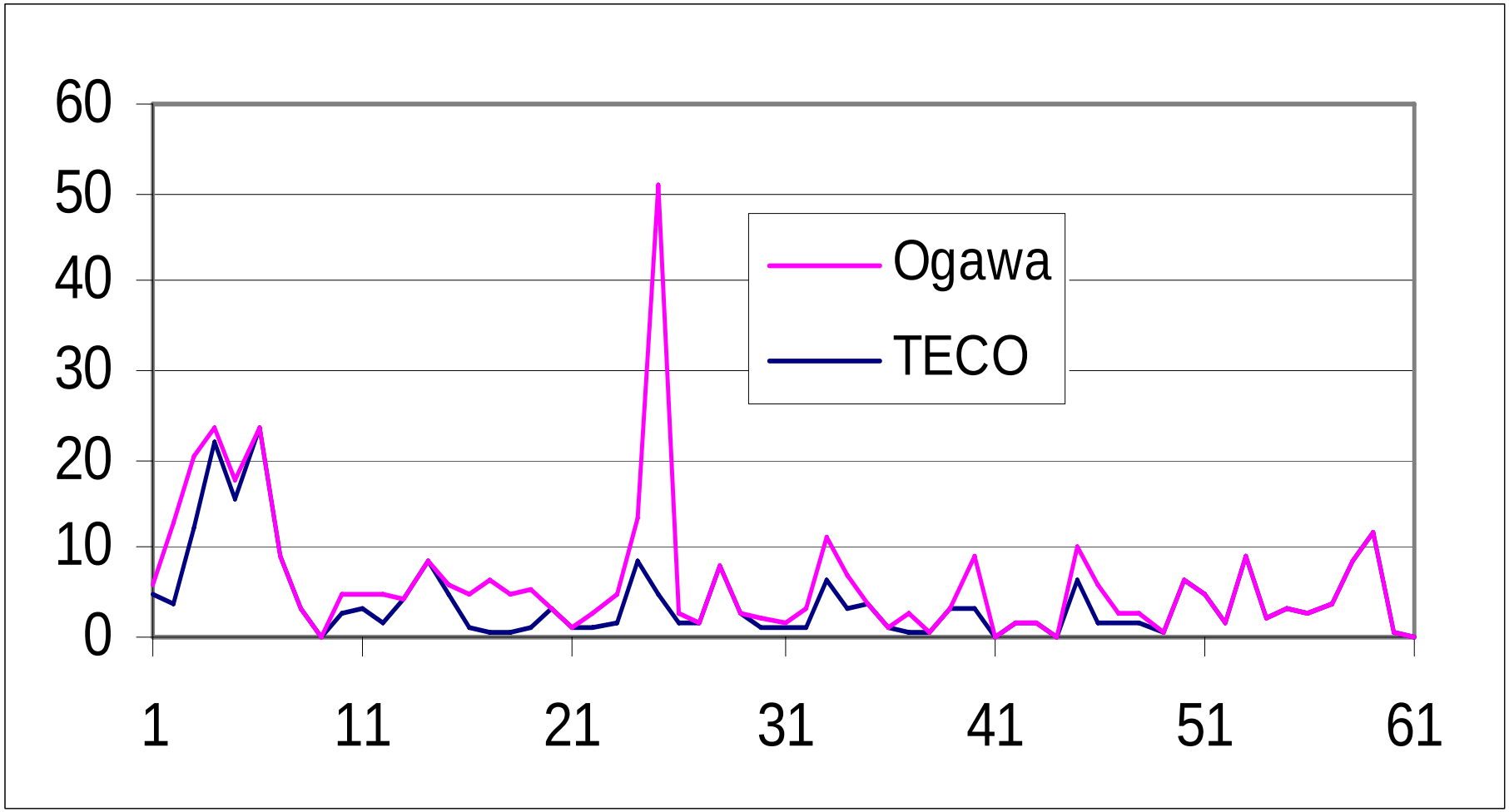


Feb-March 2005

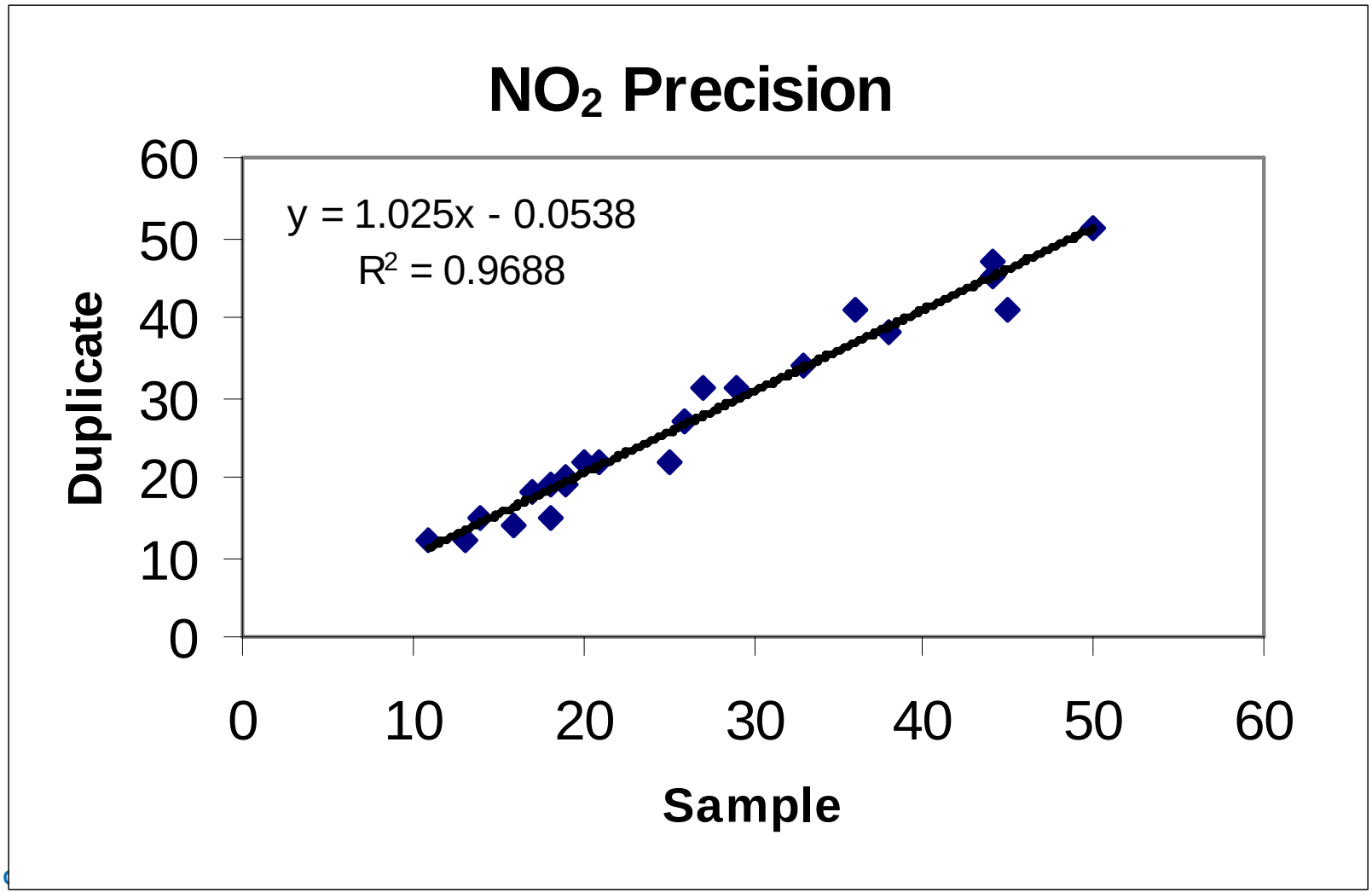
Percentage of Total Detects (All Samples- All Locations*)

Percentage of all sample above the MDL

	O_3	NO_2	$S0_2$
Summer 2006	52	98	20
Winter 2007	64	99	20

*includes field and laboratory blanks. Personal O_3 concentrations were ~ 10% of ambient

Sample and Duplicate Field Comparison (All Seasons)



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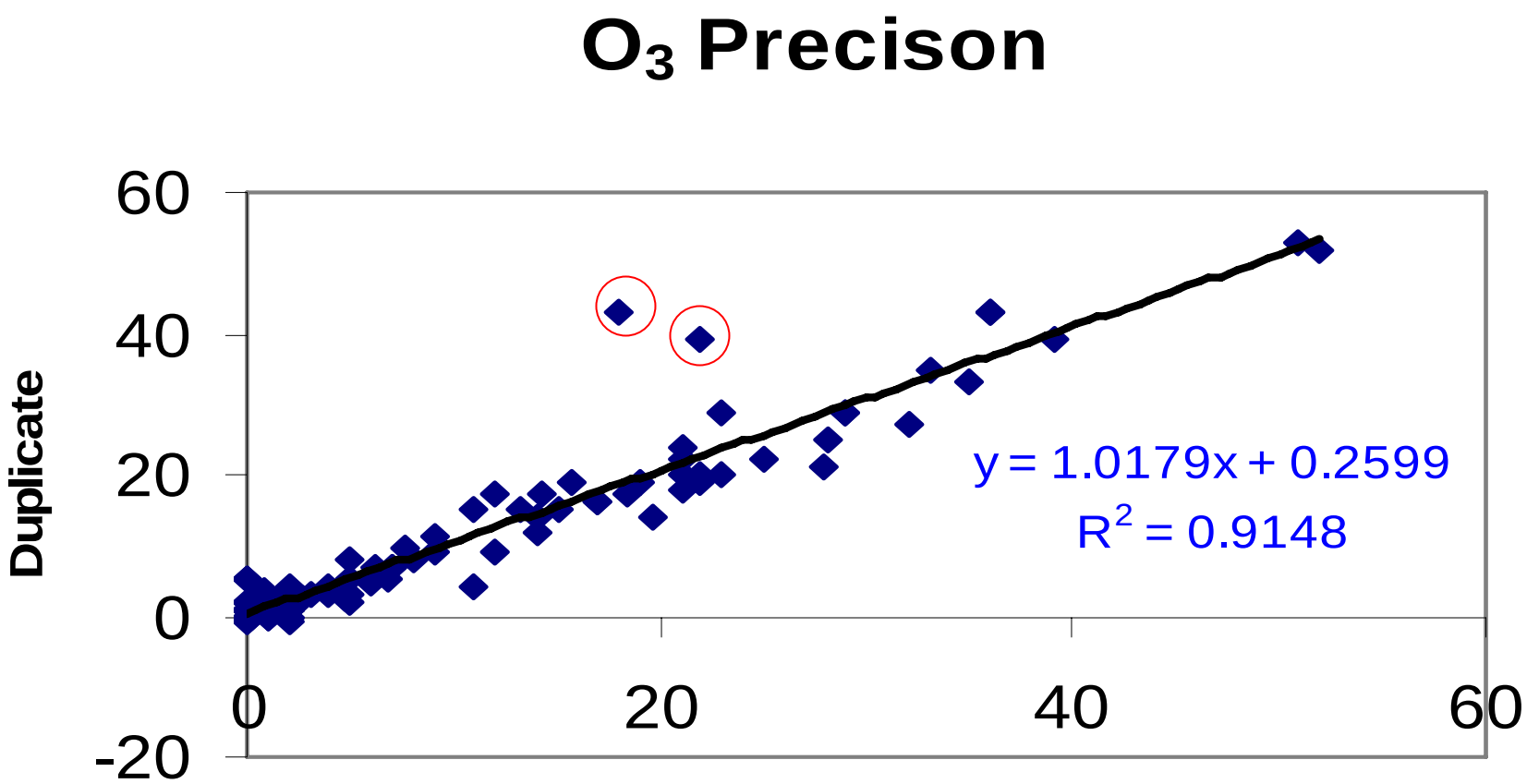

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NAAQS

Gas	Primary Std	Averaging time	Secondary Std
Nitrogen Dioxide	53 ppb	Annual (arithmetic mean)	Same as primary
Ozone	80 ppb	8-hour	Same as primary
Ozone	120 ppb	1-hour (select areas)	Same as primary
Sulfur oxides	30 ppb	Annual (arithmetic mean)	--------
Sulfur oxides	140 ppb	24-hr	--------
Sulfur oxides	-------	3-hr	500 ppb

DEARS Ozone ppb Concentrations (24 hr Means)

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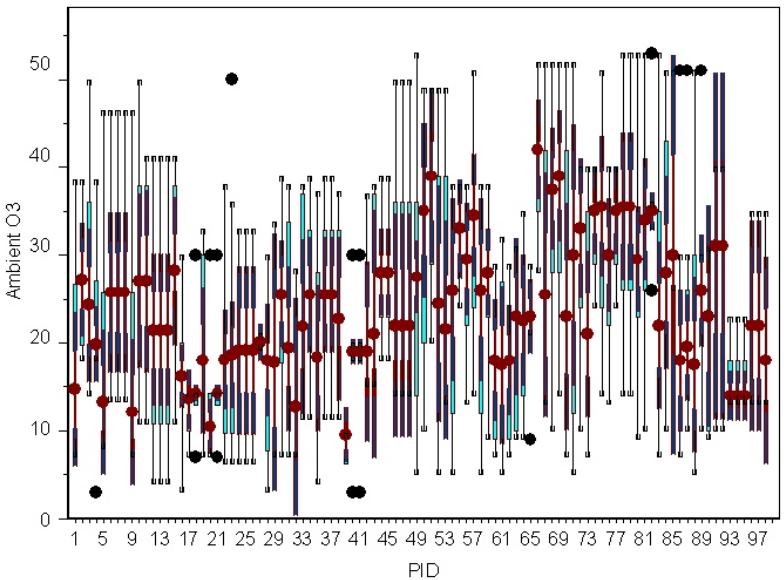
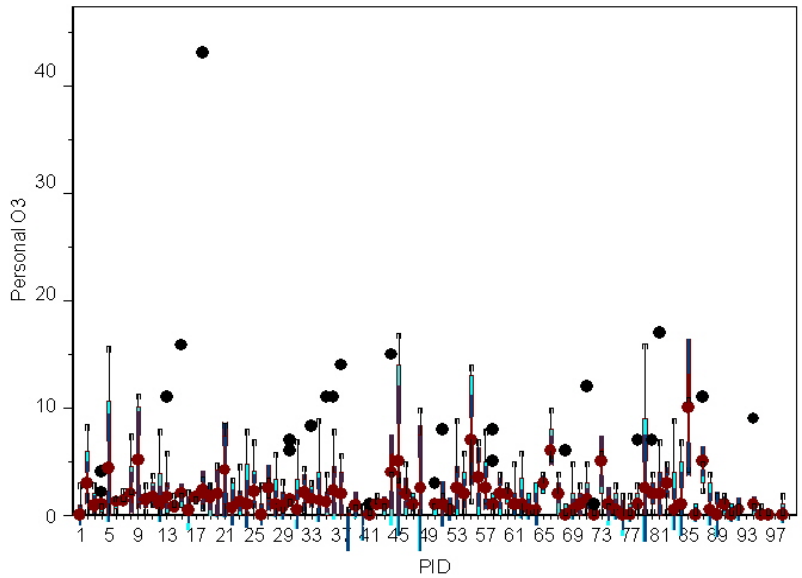
Ambient



Personal



Findings for ~ 100 participants (2 summers & 2 winters)

DEARS Nitrogen Dioxide ppb Concentrations (24 hr Means)

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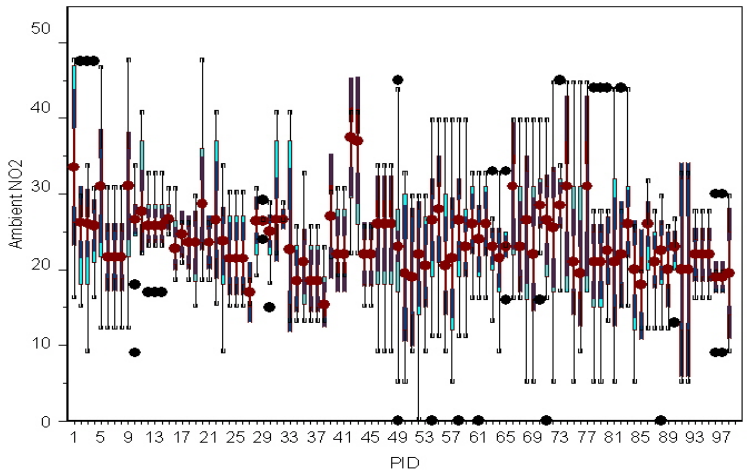
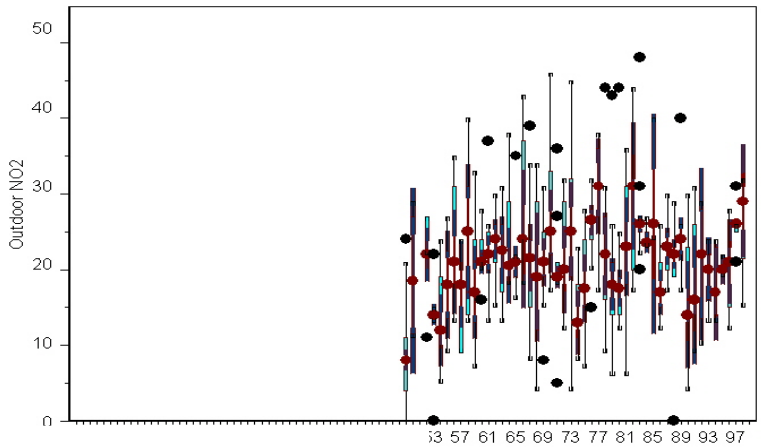
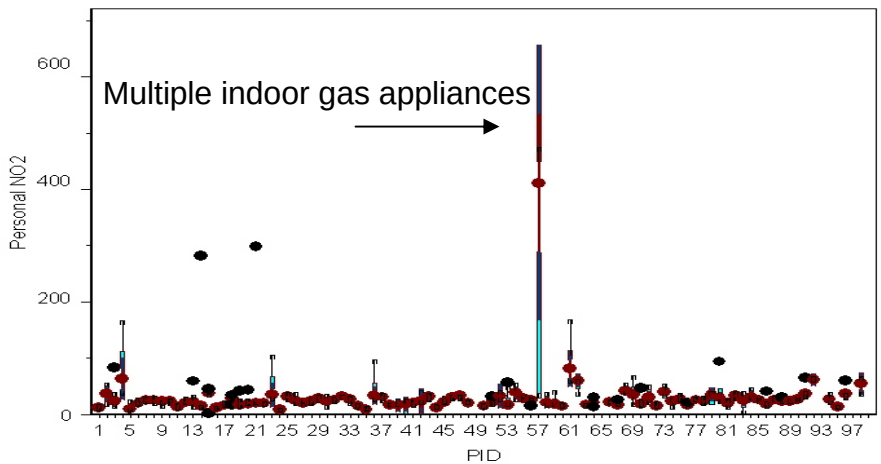
Ambient



Outdoor

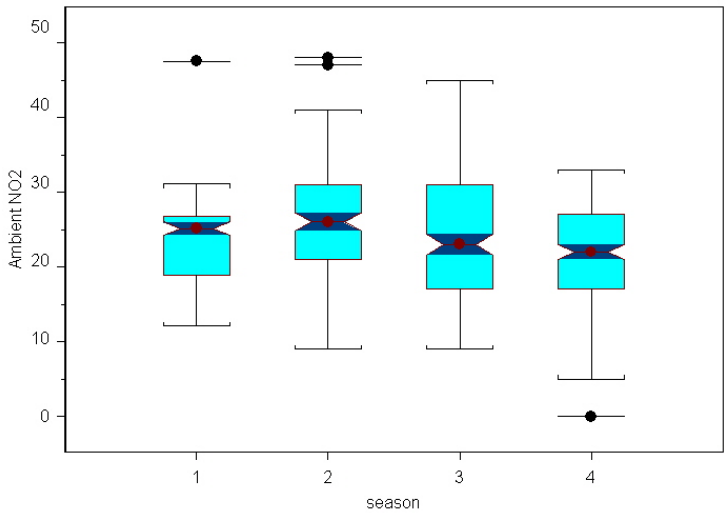


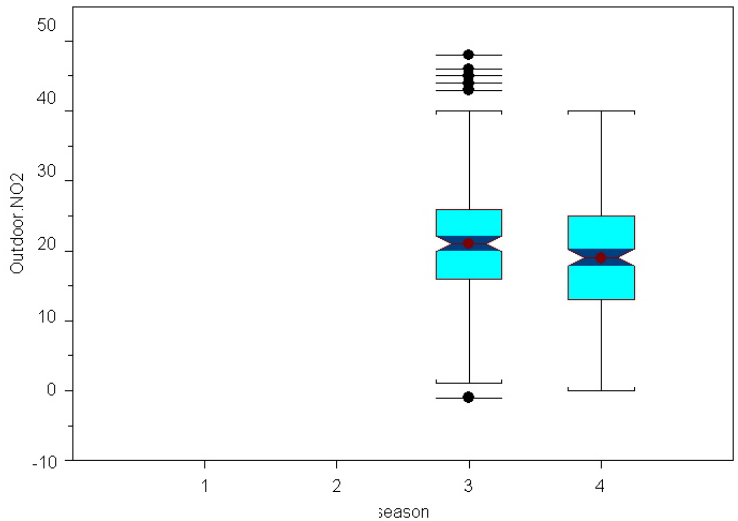
Personal

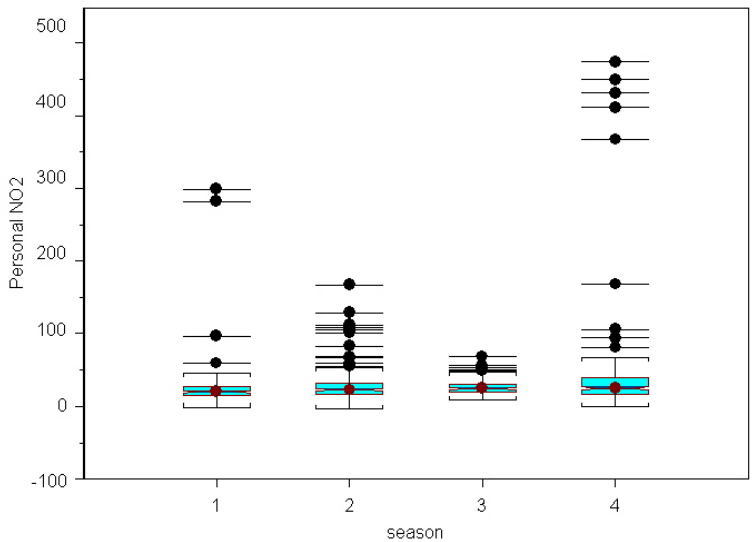


Findings for ~ 100 participants (2 summers & 2 winters)

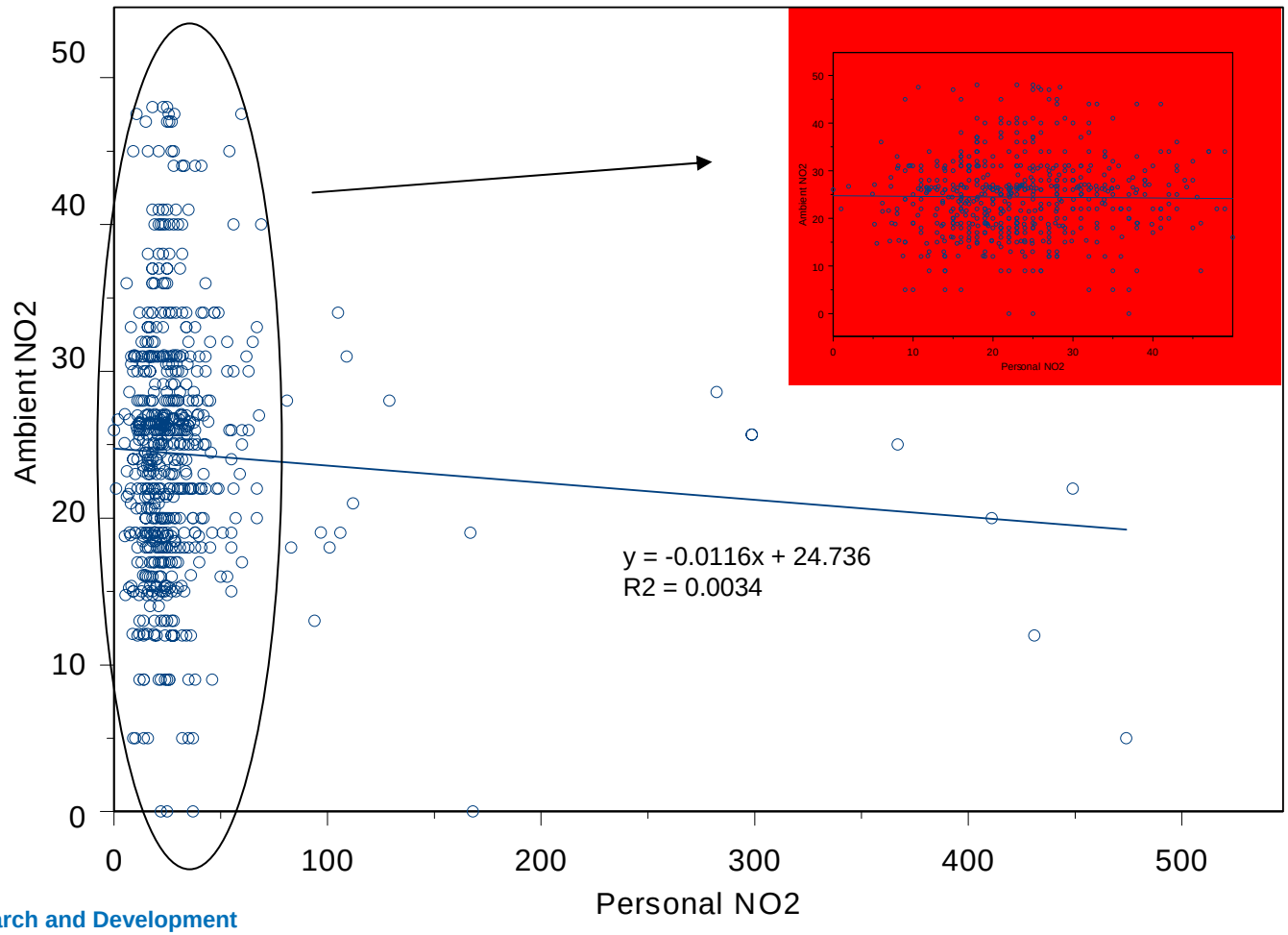
NO_2 Variability by Season and Spatiality







Personal and Ambient NO2 Mass Concentration Relationships (ppb)



Effect of Outdoor Location Versus Ambient Measurement

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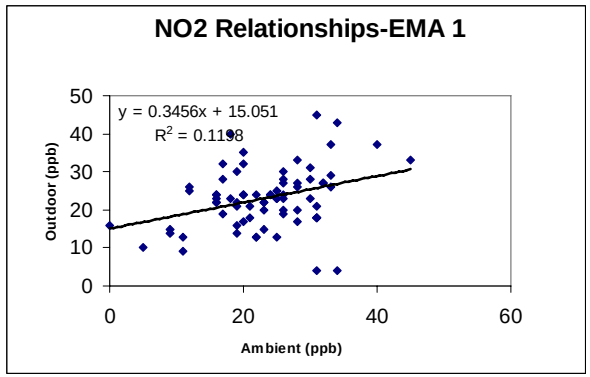

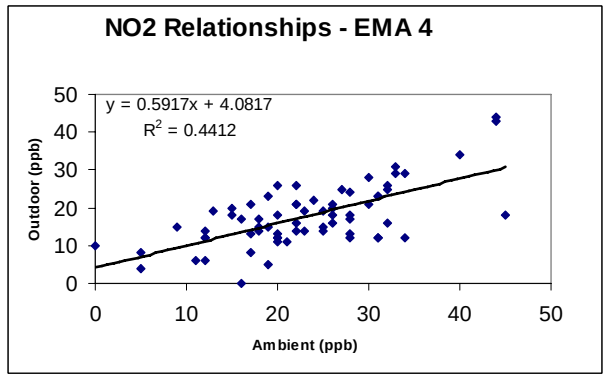

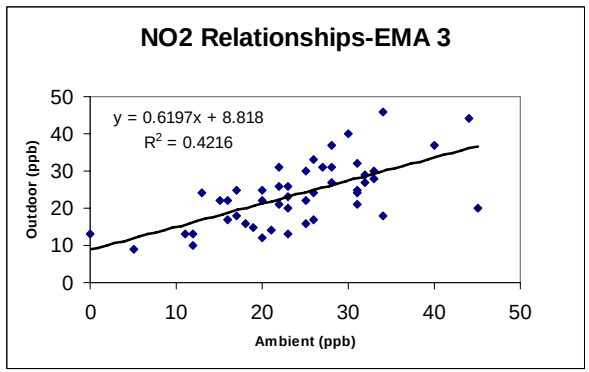

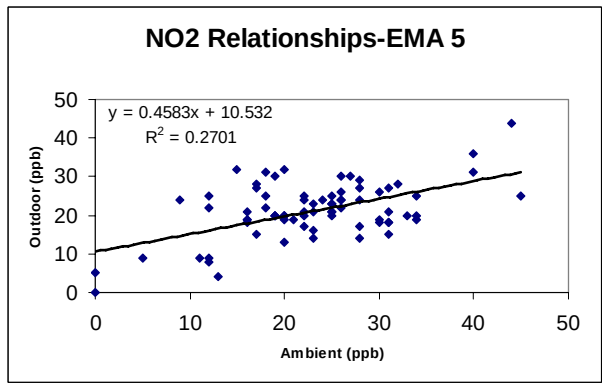

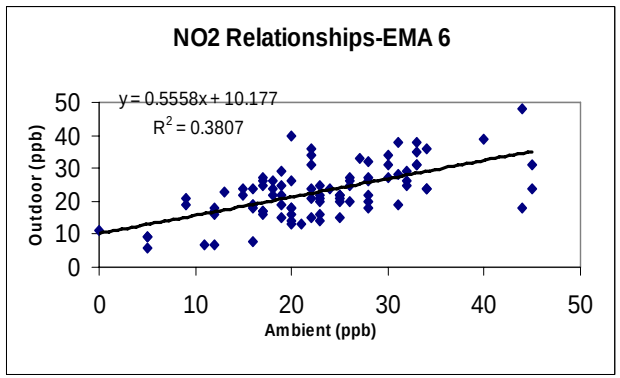

DEARS Spearman Gaseous Co-pollutant Correlations

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	P 2.5	A 2.5	P O3	A O3	P NO2	A NO2	O NO2	P SO2	A SO2
P 2.5		0.40	0.14	0.22	0.28	0.07	0.01	0.06	- 0.03
A 2.5			0.04	0.11	0.10	0.28	0.37	- 0.10	- 0.01
P O3				0.20	0.07	- 0.02	0.03	0.09	- 0.07
A O3					0.08	- 0.33	- 0.16	- 0.07	0.05
P NO2						0.09	0.04	0.13	- 0.03
A NO2							0.39	0.04	0.20
O NO2								- 0.10	- 0.07
P SO2									0.15
A SO2									

N= 269-826 $P < 0.05$

Ogawas - Lessons Learned

- Ogawas represent a robust method for detection of criteria gases
- Laboratories using such devices need to be free of artifacts
- Need to use fresh substrate and keep media from heat and light. Adequate use of field and laboratory blanks is essential
- NO_2 and O_3 (outdoor) are routinely above limits of detection. $S0_2$ measures suffer from low environmental levels
- O_3 and NO_2 highly comparable to FRMs.

Disclaimer

Although this work was reviewed by EPA and approved for publication, it may not necessarily reflect official Agency policy.

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