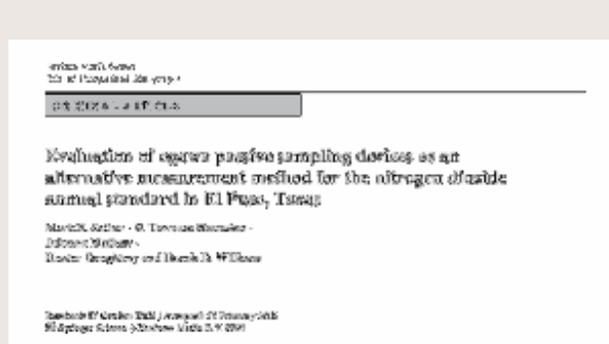


Evaluation of Long-term and Short-term Ogawa Passive, Photolytic, and Federal Reference Method Sampling Devices for Nitrogen Oxides in El Paso and Houston, Texas

- Presented November 8, 2006, at the National Air Monitoring Conference, Las Vegas, Nevada
- Mark Sather, U.S. EPA Region 6, Air Quality Analysis Section, 1445 Ross Avenue, Dallas, TX 75202 (sather.mark@epa.gov; 214-665-8353)
- E. Terrence Slonecker, Landscape Ecology Branch, National Exposure Research Laboratory, U.S. EPA ORD, 12201 Sunrise Valley Drive, Reston, VA 20192
- Johnson Mathew, U.S. EPA Region 6, Houston Laboratory, 10625 Fallstone Road, Houston, TX 77099
- Keith G. Kronmiller, Hunter Daughtrey and Dennis D. Williams, Alion Science and Technology, P.O. Box 12313, RTP, NC 27709

Introduction

- Long-term: comparison of passive and FRM samplers for NO_2 in El Paso; published online 10/3/06 in journal *Environmental Monitoring and Assessment*.



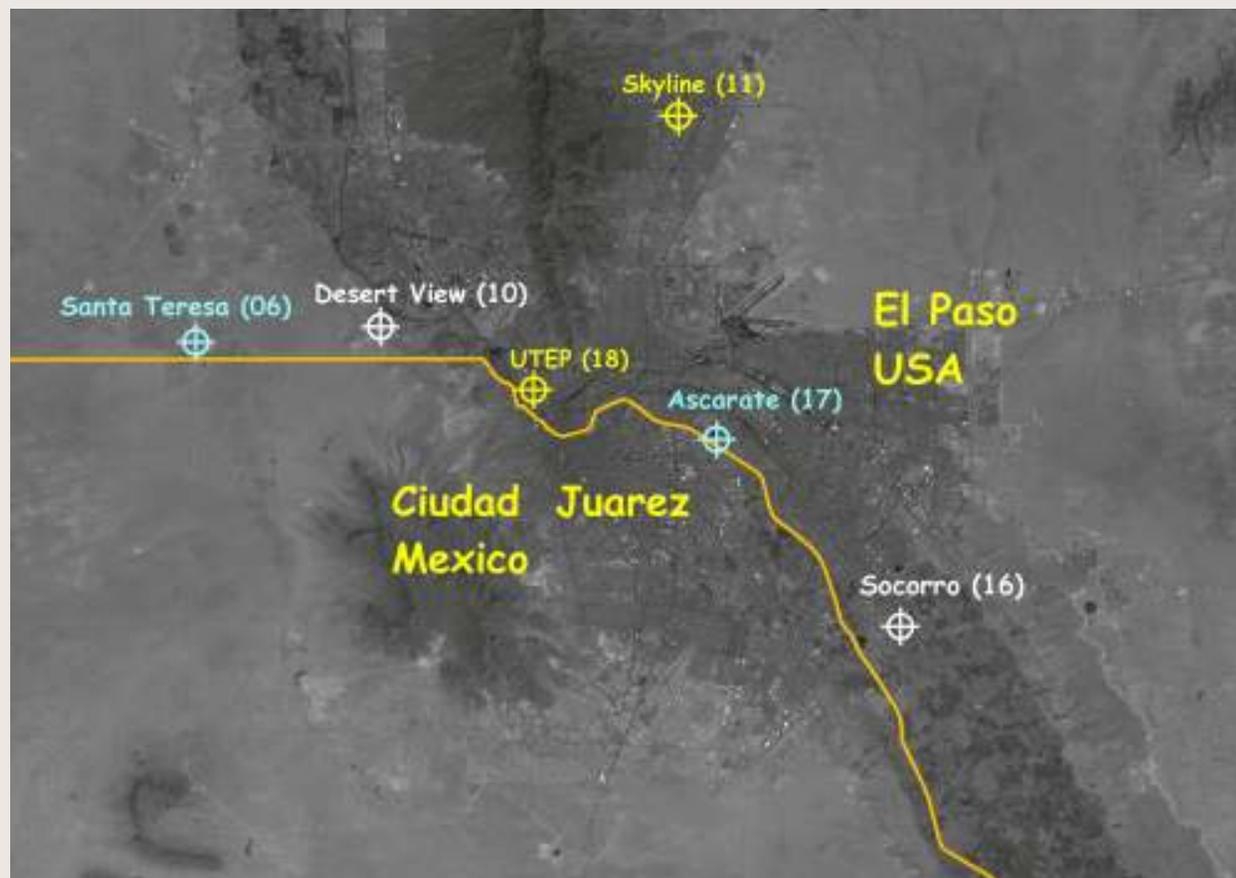
- Short-term: comparison of passive, photolytic, and FRM samplers for NO , NO_2 , NO_x in El Paso and Houston; published 5/06 in *Journal of Environmental Monitoring*



Many Thanks

- City of El Paso – Henry Del Rio
- NMED – Rhett Putman, Abel Ramirez, Tim Booker, Josephine Ball
- TCEQ El Paso – Jon Williams, Joe Saenz, Kevin Smith
- City of Houston – Patricia Beltz
- EPA Region 6 – Dr. Doug Lipka, Rick McMillin, Dr. Melvin Ritter, Donna Ascenzi, John Lay, Nghia Nguyen
- EPA ORD – Dr. Jerry Varns and Jim Mulik

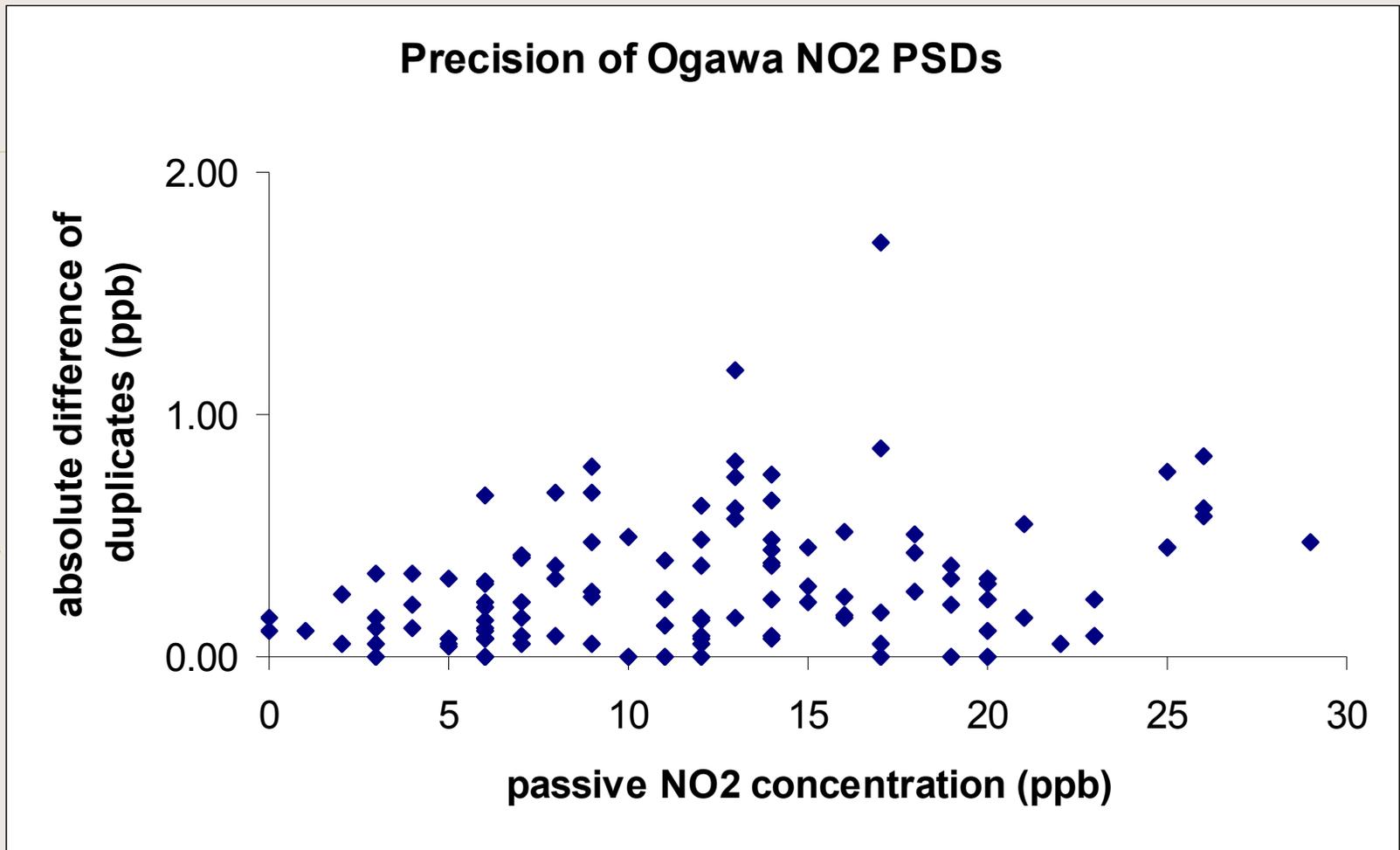
Long-term Study in El Paso



2002 NO₂ Annual Means in Parentheses

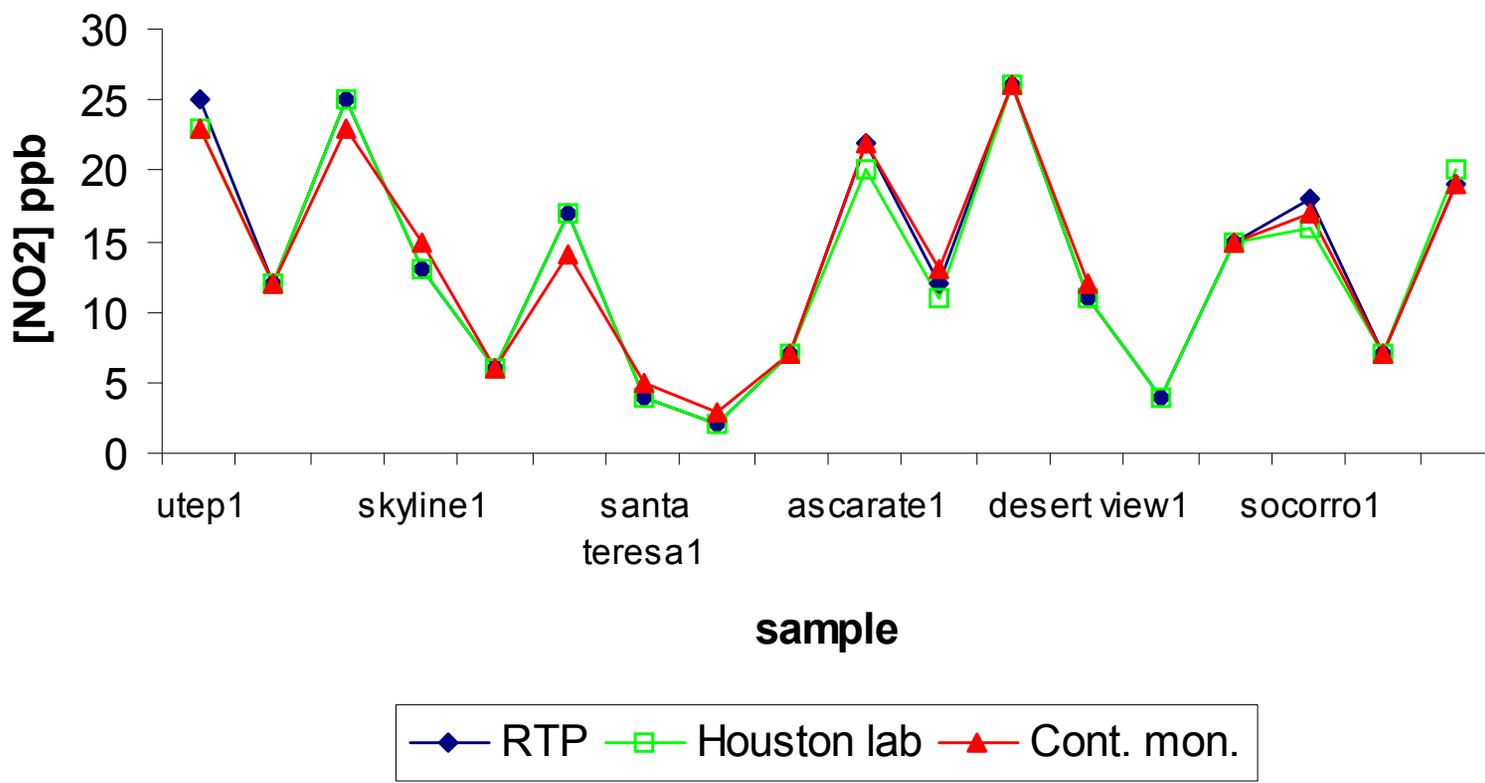


NO₂ PSD pole setup at the Ascarate Site

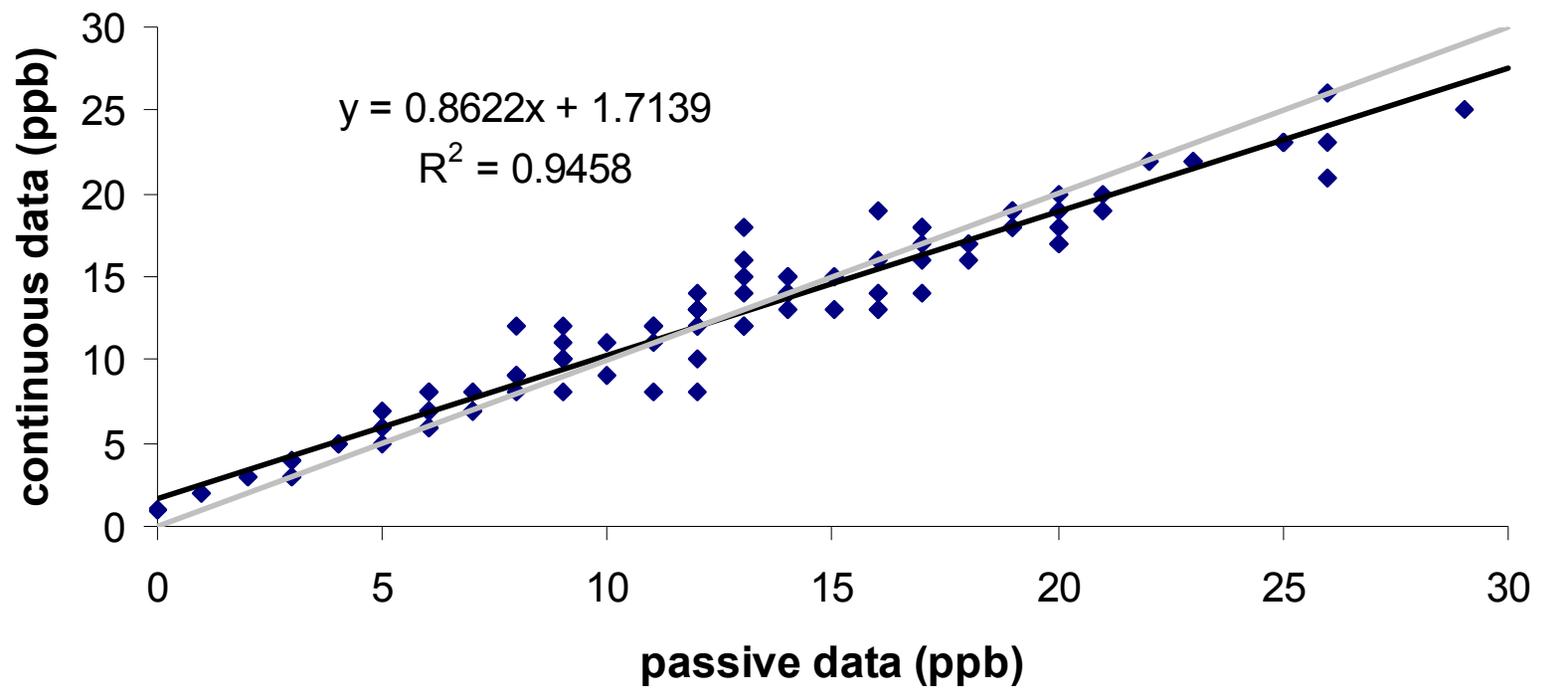


Two, three, and four week integrated sampling

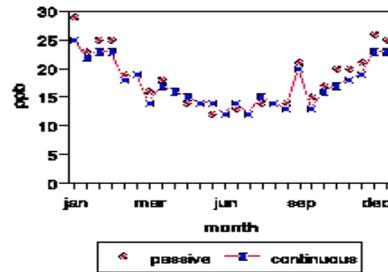
Interlab [NO2] Comparison



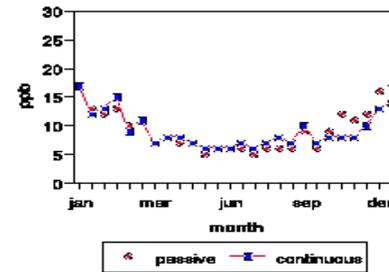
NO2 method comparison in El Paso Area



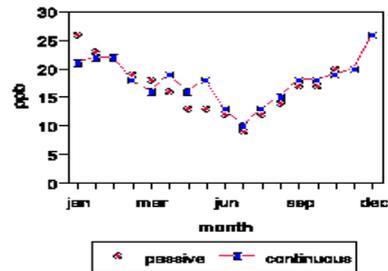
UTEP NO2
2 week samples
r-square = 0.95



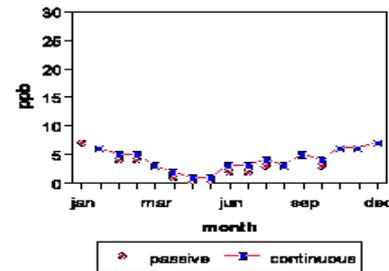
Skyline NO2
2 week samples
r-square = 0.82



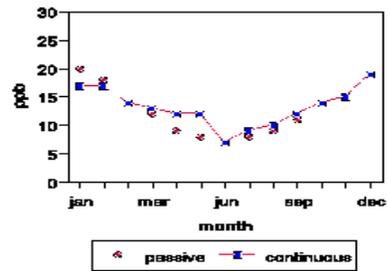
Ascarate NO2
3 week samples
r-square = 0.82



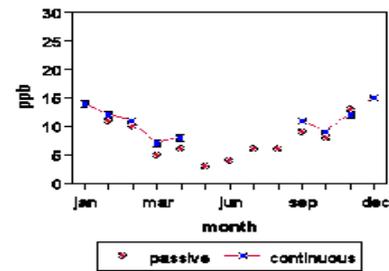
Santa Teresa NO2
3 week samples
r-square = 0.98



Socorro NO2
4 week samples
r-square = 0.88



Desert View NO2
4 week samples
r-square = 0.96



Annual NO₂ Standard Comparisons

- Skyline 2-week: 9 ppb for psd and frm
- Ascarate 3-week: 18 ppb for psd and frm
- Socorro 4-week: 13 ppb for psd and frm
- UTEP 2-week: 18 ppb for psd, 17 ppb for frm
- Santa Teresa 3-week: 3 ppb for psd, 4 ppb for frm
- Desert View 4-week: 10 ppb for psd, 11 ppb for frm

Potential Cost Savings for New Site (Using Contractor Laboratory)

<i>Sampling Duration</i>	<i>NO₂ FRM Cost</i>	<i>NO₂ PSD Cost</i>	<i>Cost Savings with NO₂ PSD</i>
1 year	\$69,000	\$6,000	91%
5 years	\$89,000	\$30,000	66%
10 years	\$137,000	\$60,000	56%

Potential Cost Savings for New Site (Using Local Laboratory)

<i>Sampling Duration</i>	<i>NO₂ FRM Cost</i>	<i>NO₂ PSD Cost</i>	<i>Cost Savings with NO₂ PSD</i>
1 year	\$69,000	\$1,000	99%
5 years	\$89,000	\$5,000	94%
10 years	\$137,000	\$10,000	93%

Potential Cost Savings for using NO₂ PSD in place of continuous NO₂ box at existing site: Around 50%, assuming PSD annual cost of \$1,000, and assuming annual outlays of \$1,000 for gas cylinders/regulators/shipping/postage and \$1,000 for air technician salary (2 hours/80 hours at \$40,000/yr).

Opportunity with New National Monitoring Regulations

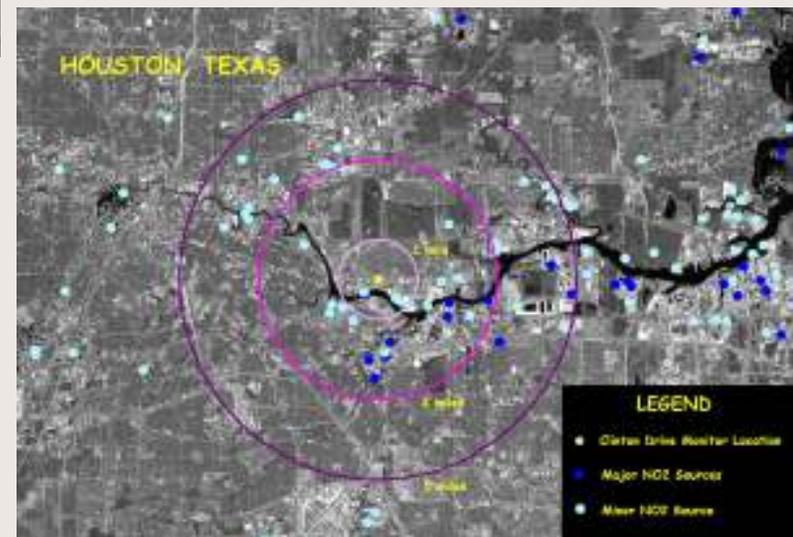
- No longer required minimum # of monitors for NO₂ outside of serious and above ozone nonattainment areas (PAMS areas) and NCore requirements.
- States/Locals/Tribes could site long-term NO₂ PSDs as SPM monitors as a cheaper alternative method for annual ambient NO₂ monitoring in attainment areas after satisfying NCore requirements.

Short-term Study in El Paso and Houston



El Paso: Jan. 18-Feb. 28, 2005

Houston: Nov. 1-Dec. 17, 2004



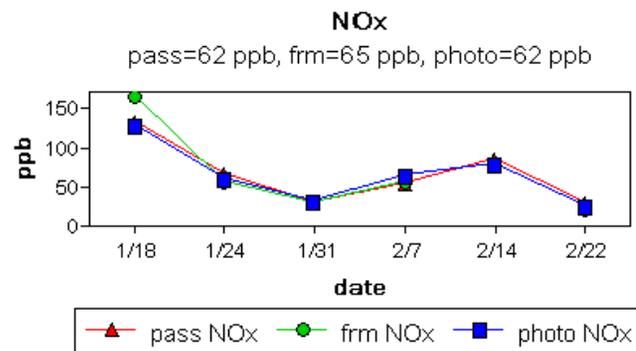
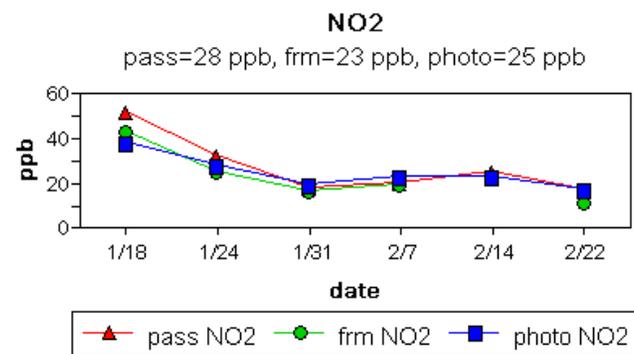
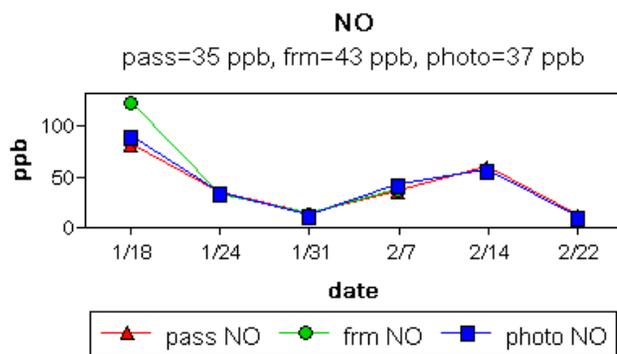
Precision Results (24-hour Sampling)

<i>Site</i>	<i>Pollutant</i>	<i>Mean of the absolute difference between duplicates</i>	<i>Standard Deviation</i>	<i>% < 4 ppb difference between duplicates</i>
Ascarate	NO ₂	1.6 ppb	2.2 ppb	91%
Clinton	NO ₂	1.9 ppb	3.7 ppb	88%
Ascarate	NO	3.9 ppb	3.7 ppb	59%
Clinton	NO	8.5 ppb	17.1 ppb	54%
Ascarate	NO _x	2.6 ppb	3.6 ppb	77%
Clinton	NO _x	8.9 ppb	17.7 ppb	58%

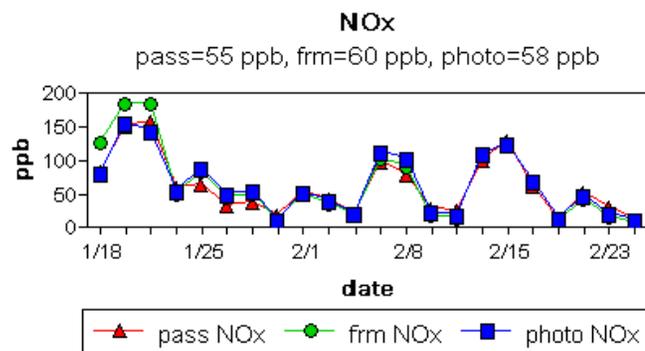
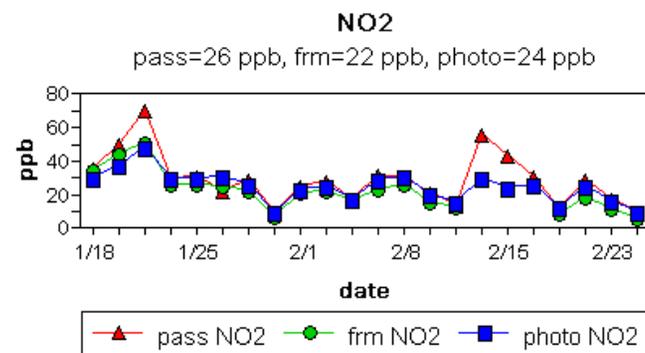
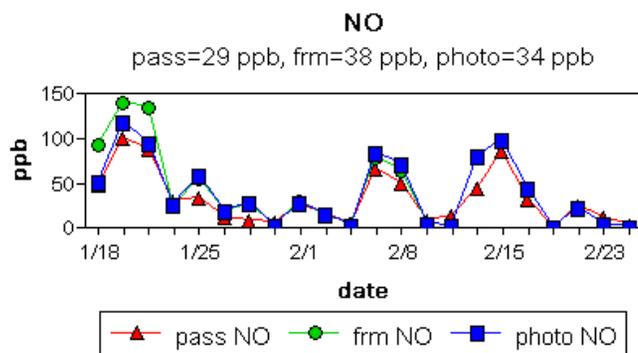
El Paso Correlations

<i>Pollutant</i>	<i>Sampling duration</i>	<i>pass/frm r²</i>	<i>pass/photo r²</i>	<i>frm/photo r²</i>
NO	96-hours	0.98	0.98	0.97
NO ₂	96-hours	0.97	0.96	0.98
NO _x	96-hours	0.98	0.98	0.97
NO	24-hours	0.94	0.93	0.93
NO ₂	24-hours	0.92	0.78	0.93
NO _x	24-hours	0.96	0.95	0.93

El Paso Ascarate Site
Passive/FRM/Photolytic NO/NO₂/NO_x Comparison
96-hour Samples (Mon. 10 AM - Fri. 10 AM LST); January-February, 2005



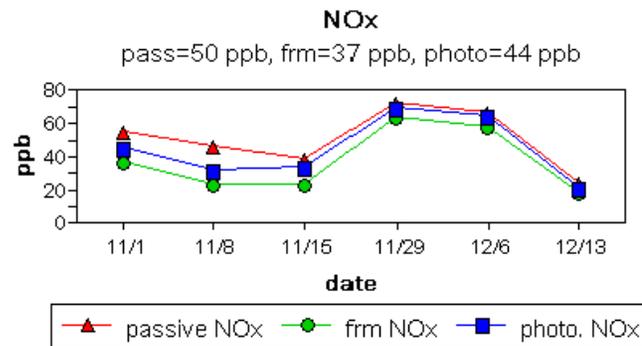
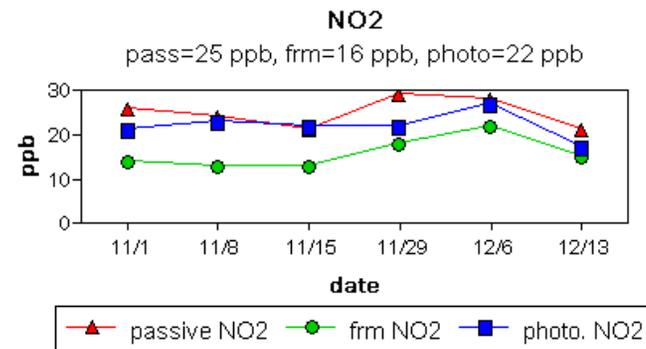
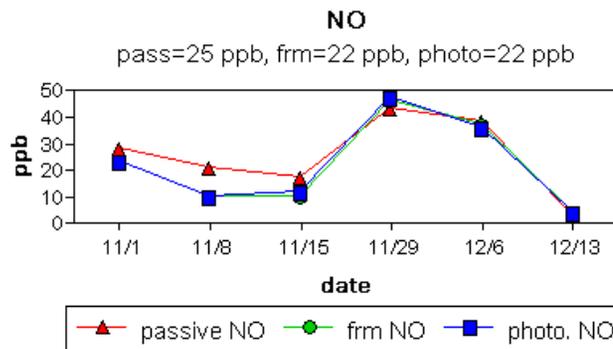
El Paso Ascarate Site Passive/FRM/Photolytic NO/NO₂/NO_x Comparison 24-hour Samples (10 AM - 10 AM LST); January-February, 2005



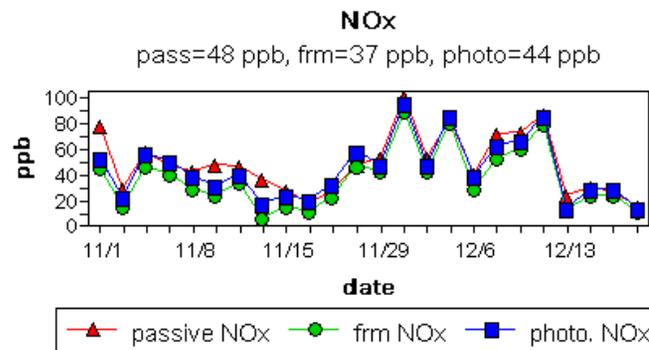
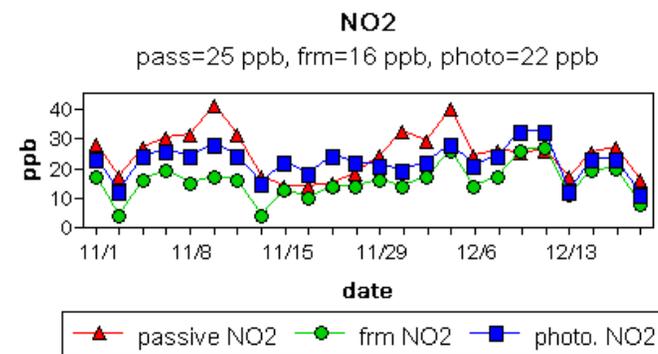
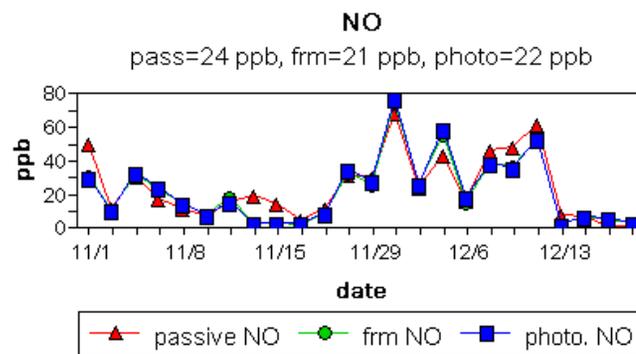
Houston Correlations

<i>Pollutant</i>	<i>Sampling duration</i>	<i>pass/frm r²</i>	<i>pass/photo r²</i>	<i>frm/photo r²</i>
NO	96-hours	0.91	0.91	0.996
NO ₂	96-hours	0.50	0.36	0.35
NO _x	96-hours	0.89	0.93	0.98
NO	24-hours	0.86	0.84	0.996
NO ₂	24-hours	0.37	0.35	0.79
NO _x	24-hours	0.89	0.89	0.99

Houston Clinton Site Passive/FRM/Photolytic NO/NO₂/NO_x Comparison 96-hour Samples (Mon. 10 AM - Fri. 10 AM LST); November-December, 2004



Houston Clinton Site Passive/FRM/Photolytic NO/NO₂/NO_x Comparison 24-hour Samples (10 AM - 10 AM LST); November-December, 2004



FRM/Photolytic NO_x Comparison in El Paso

Mean NO_x Diurnal Profiles
El Paso Ascarate Site
January 18 - February 28, 2005

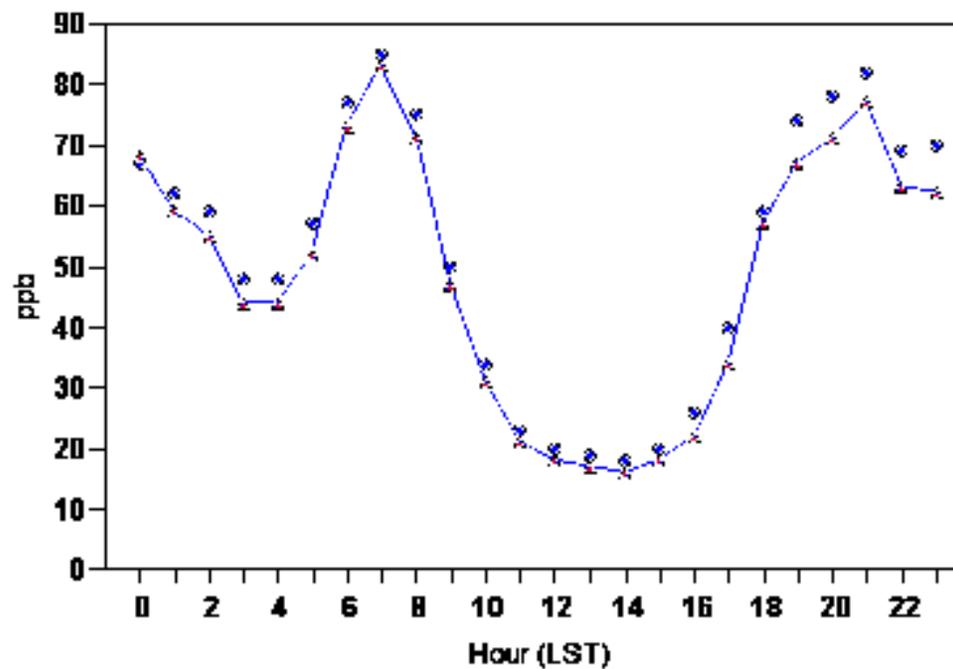


photo nox
frm nox

Short-term NO/NO₂/NO_x Study Conclusions

- Good agreement between all three monitor types for 96-hour and 24-hour sampling.
- Less costly large multi-site episodic saturation screening studies for NO/NO₂/NO_x could be done using PSDs.