Effectiveness of PAMS Network Based on Analysis of 14 Years of PAMS Data in San Joaquin Valley

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By

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PRESENTATION OUTLINE

- Background
- Observations
  - Precursors trending down over the 14 years; but PAMS species did not correlate well with the ozone level
  - Many PAMS species were below or near detection limits
  - PAMS species accounted for as little as 20% of NMHC
  - In the high ozone areas, the afternoon canister samples were very useful
  - The temporal resolution of 3-hr canister samples were inadequate

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BACKGROUND

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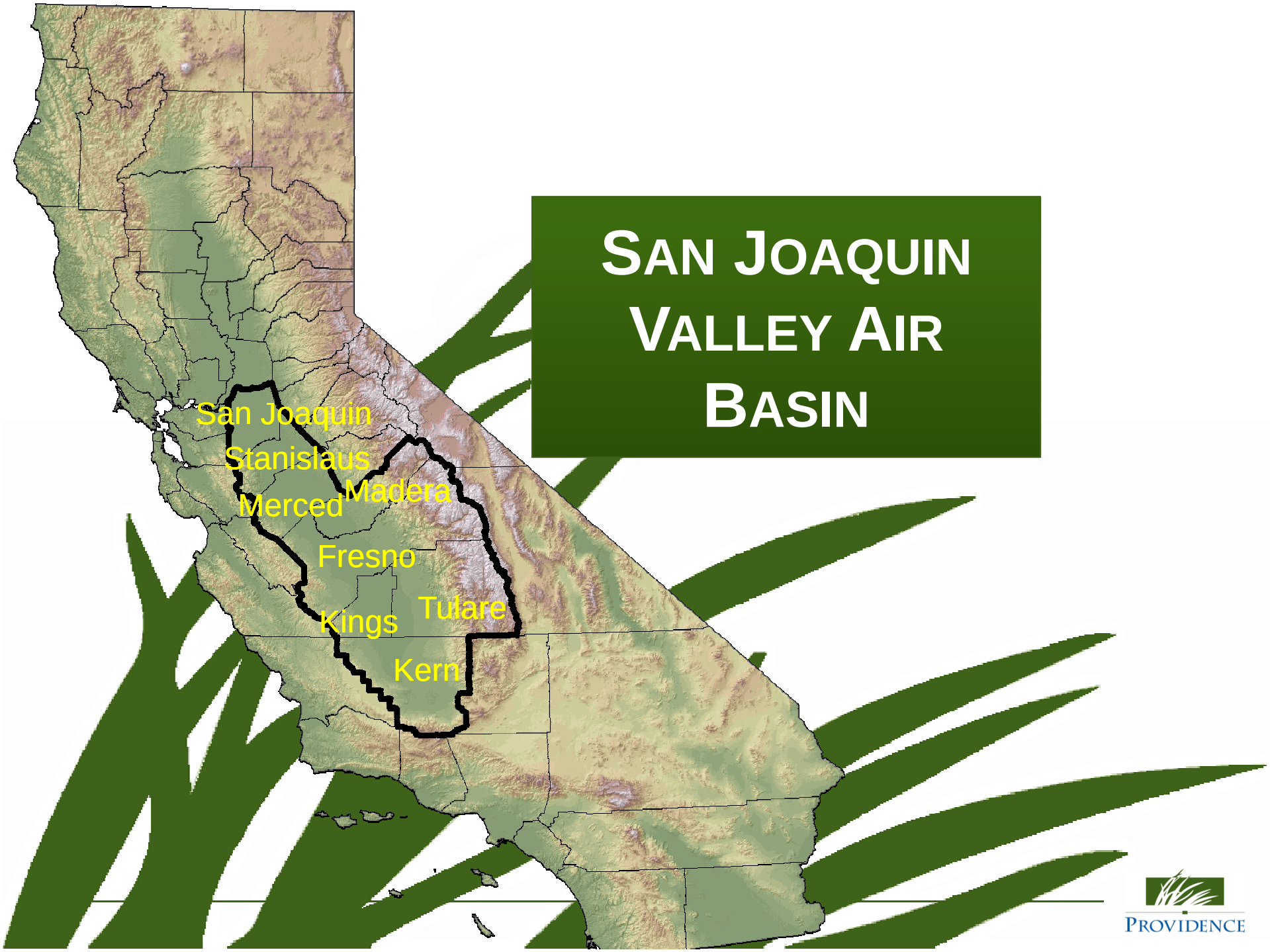
San Joaquin Valley Air Basin



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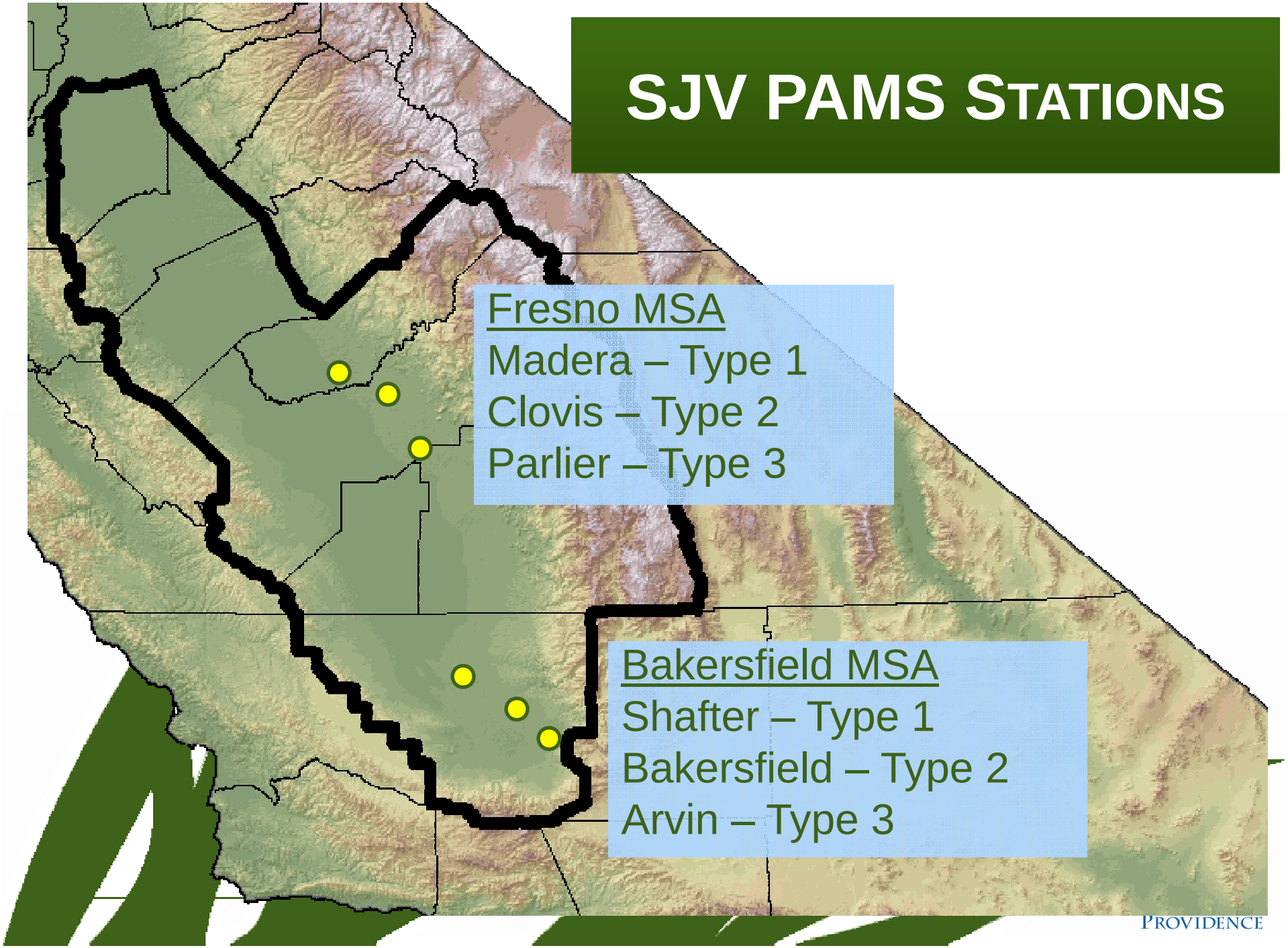
SJV PAMS STATIONS



SJV PAMS Species Dataset

	Fresno MSA			Bakersfield MSA		
	Madera	Clovis	Parlier	Shafter	Bakersfield	Arvin
1994	0	29	0	0	27	0
1995	0	36	34	0	33	35
1996	0	33	32	0	34	32
1997	19	33	31	0	32	30
1998	31	31	31	31	31	31
1999	31	31	31	31	31	31
2000	31	27	28	24	27	26
2001	2	32	32	2	32	32
2002	3	33	33	3	33	33
2003	8	36	36	8	36	36
2004	4	33	33	8	35	35
2005	6	33	33	6	33	33
2006	8	35	35	8	35	35
2007	4	32	33	4	36	34
TOTAL	147	454	422	125	455	423

- All 3-hr canister samples, analyzed by GC for 54 species
- 2,026 sample days
- 3 – 4 samples per day per site
- 7,178 valid samples used in this study

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STUDY PERFORMED BY PROVIDENCE

- Analyses focused on days when canister samples were analyzed (but analyses included NMOC, NOx, ozone, and met parameters)
- Analyses conducted:
  - Numerous trending analyses for ozone and precursors
  - Event-based analyses
  - Source apportionment
  - Trends for air toxics/hazardous air pollutants
  - Implications of efficiency of PAMS network
- MPCD contract managers:
  - Joe Cohen, Jon Klassen

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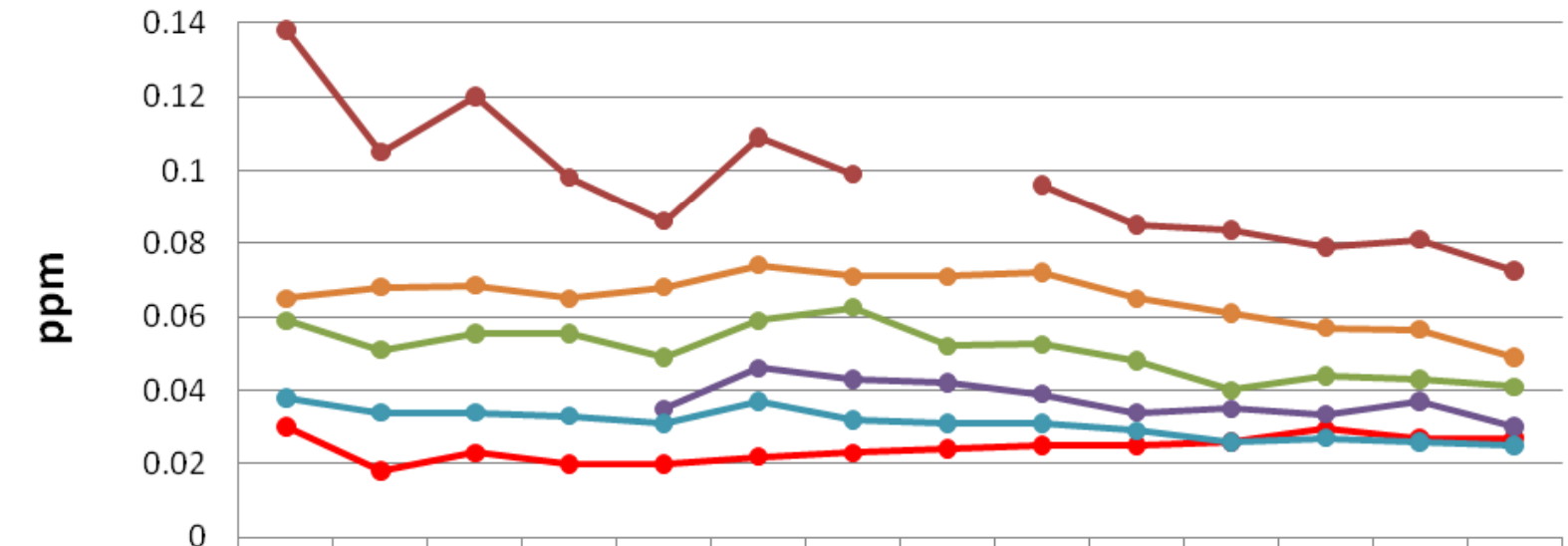
PRECURSORS TRENDING DOWN OVER THE 14 YEARS (1/2)



	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Arvin	0.03	0.018	0.023	0.02	0.02	0.022	0.023	0.024	0.025	0.025	0.026	0.0295	0.027	0.027
Bakersfield	0.138	0.105	0.12	0.098	0.086	0.109	0.099		0.096	0.085	0.0835	0.079	0.081	0.0725
Clovis	0.059	0.051	0.0555	0.0555	0.049	0.059	0.0625	0.052	0.0525	0.048	0.04	0.044	0.043	0.041
Madera					0.035	0.046	0.043	0.042	0.039	0.034	0.035	0.0335	0.037	0.03
Parlier	0.038	0.034	0.034	0.033	0.031	0.037	0.032	0.031	0.031	0.029	0.026	0.027	0.026	0.025
Shafter	0.065	0.068	0.0685	0.065	0.068	0.074	0.071	0.071	0.072	0.065	0.061	0.057	0.0565	0.049

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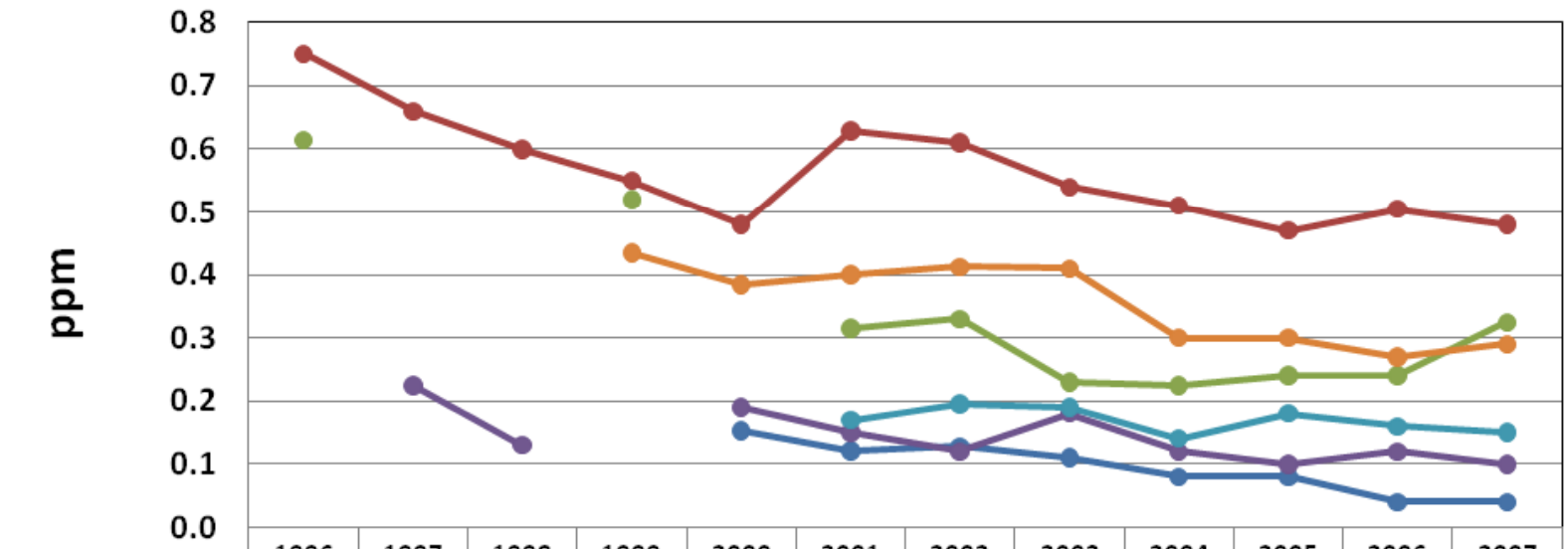
PRECURSORS TRENDING DOWN OVER THE 14 YEARS (2/2)



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Arvin					0.153	0.121	0.128	0.110	0.080	0.080	0.040	0.040
Bakersfield	0.750	0.660	0.600	0.550	0.480	0.629	0.610	0.540	0.510	0.470	0.505	0.480
Clovis	0.615			0.520		0.315	0.330	0.230	0.225	0.240	0.240	0.325
Madera		0.225	0.130		0.190	0.150	0.120	0.180	0.120	0.100	0.120	0.100
Parlier						0.170	0.195	0.190	0.140	0.180	0.160	0.150
Shafter				0.435	0.384	0.400	0.413	0.410	0.300	0.300	0.270	0.290

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BUT PAMS SPECIES DID NOT CORRELATE WELL WITH THE OZONE LEVEL

Correlation coefficients between ozone 8-hr daily maximum and levels of morning (5-8 am) precursors and ratios of precursors

	Clovis	Parlier	Bakersfield	Arvin
With NO	0.156	0.117	0.074	0.037
With NO_2	0.476	0.535	0.499	0.286
With VOC	0.473	0.471	0.381	0.142
With NO/NO_2	-0.051	-0.115	-0.180	-0.235
With VOC/NOx	0.355	0.221	0.279	0.089

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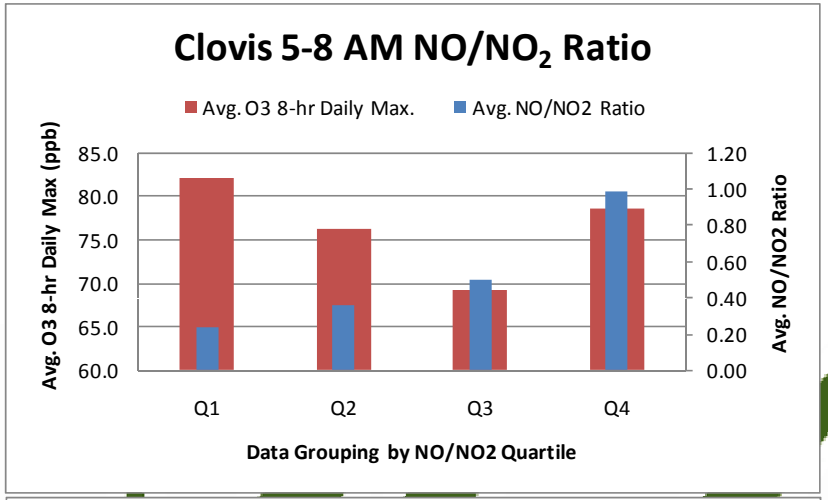
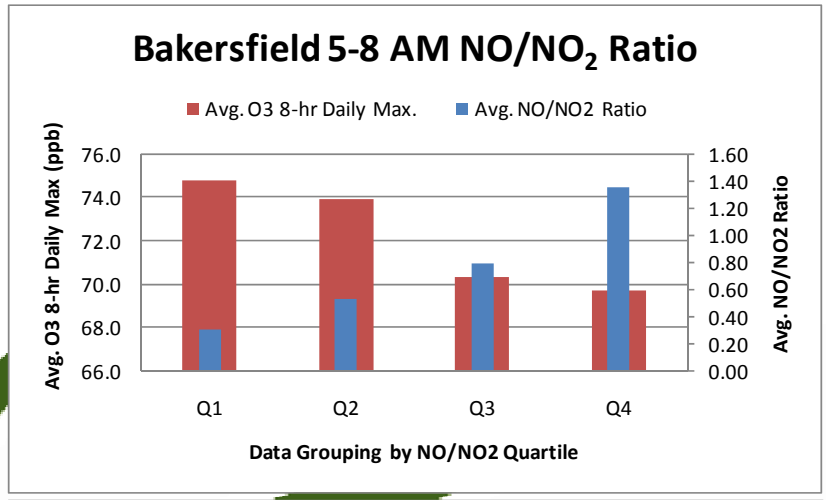
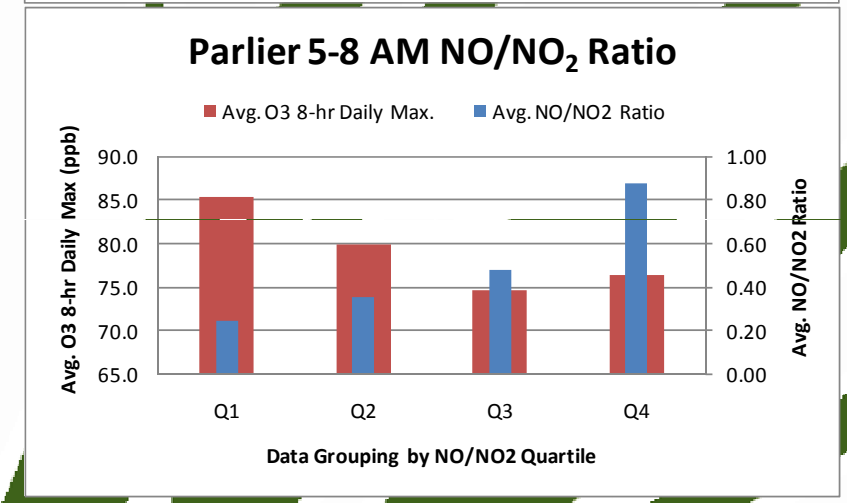
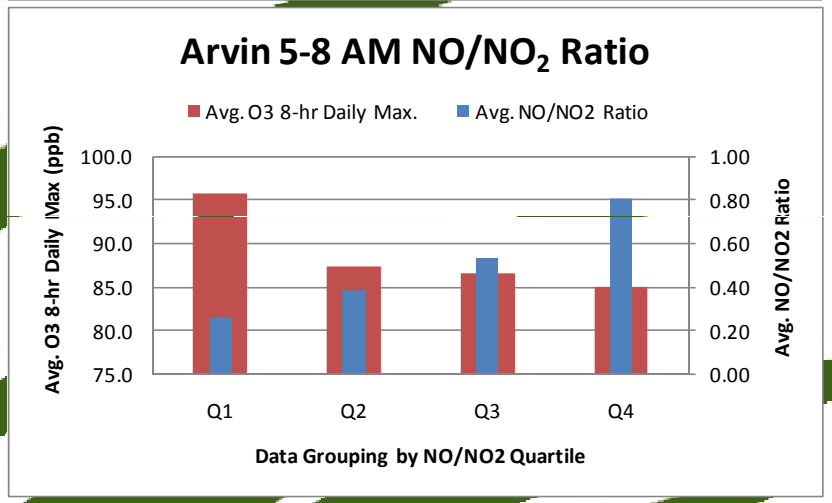
SOME RELATIONSHIP CAN BE OBSERVED IF THE DATA IS GROUPED (1/2)









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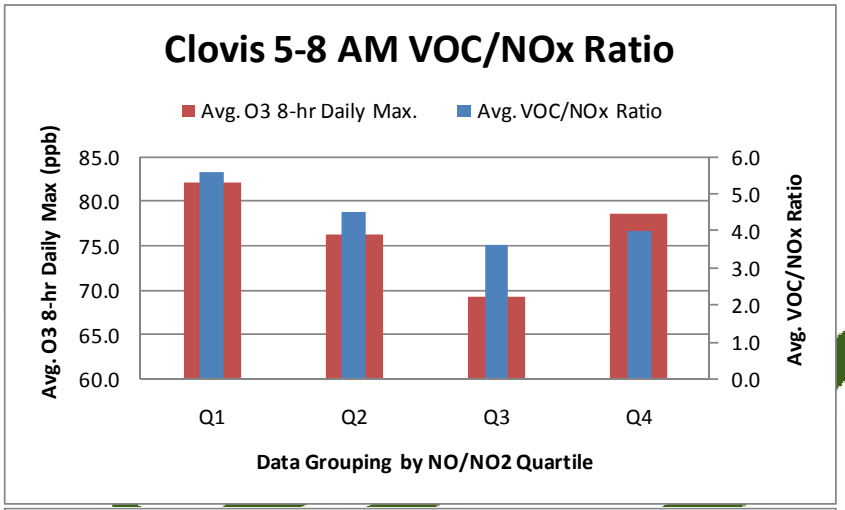
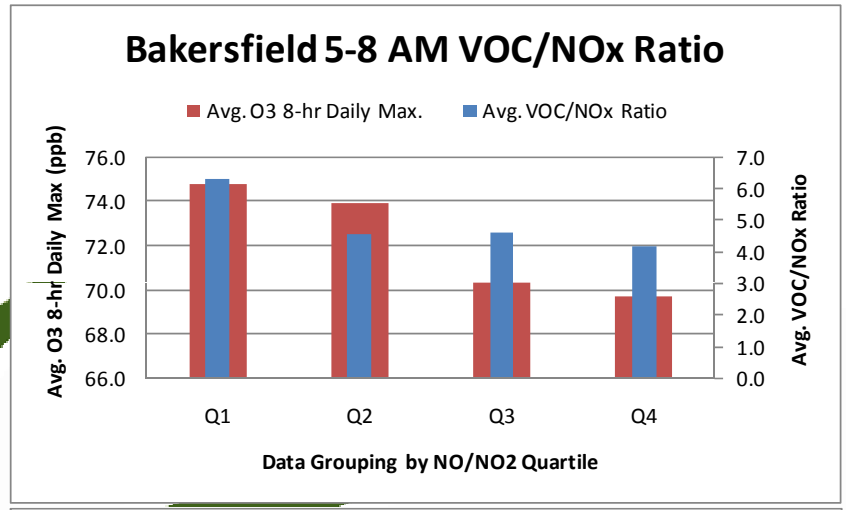
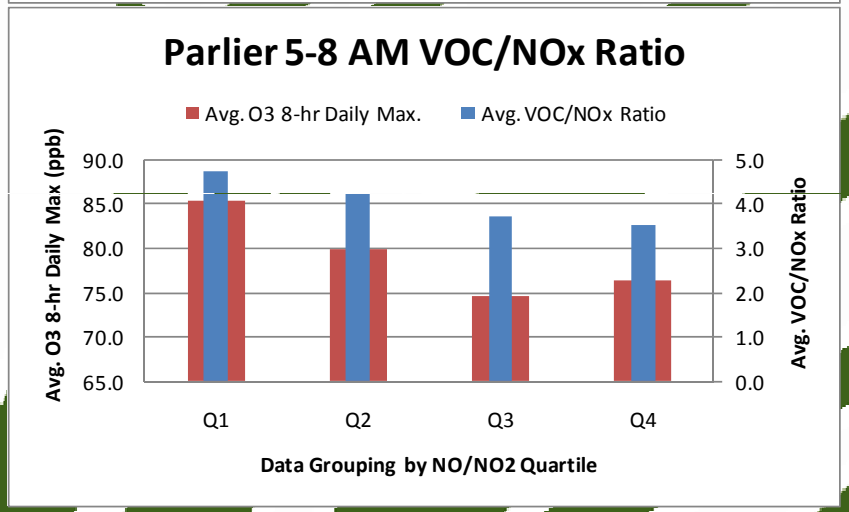
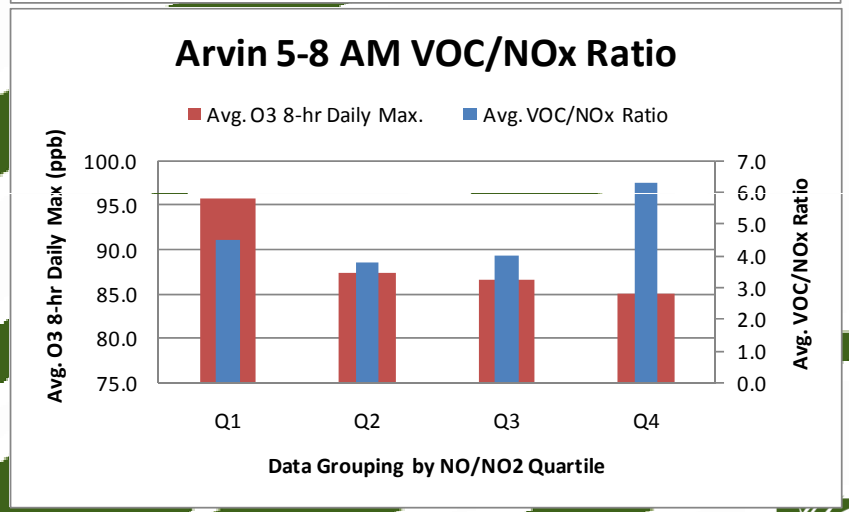
SOME RELATIONSHIP CAN BE OBSERVED IF THE DATA IS GROUPED (2/2)









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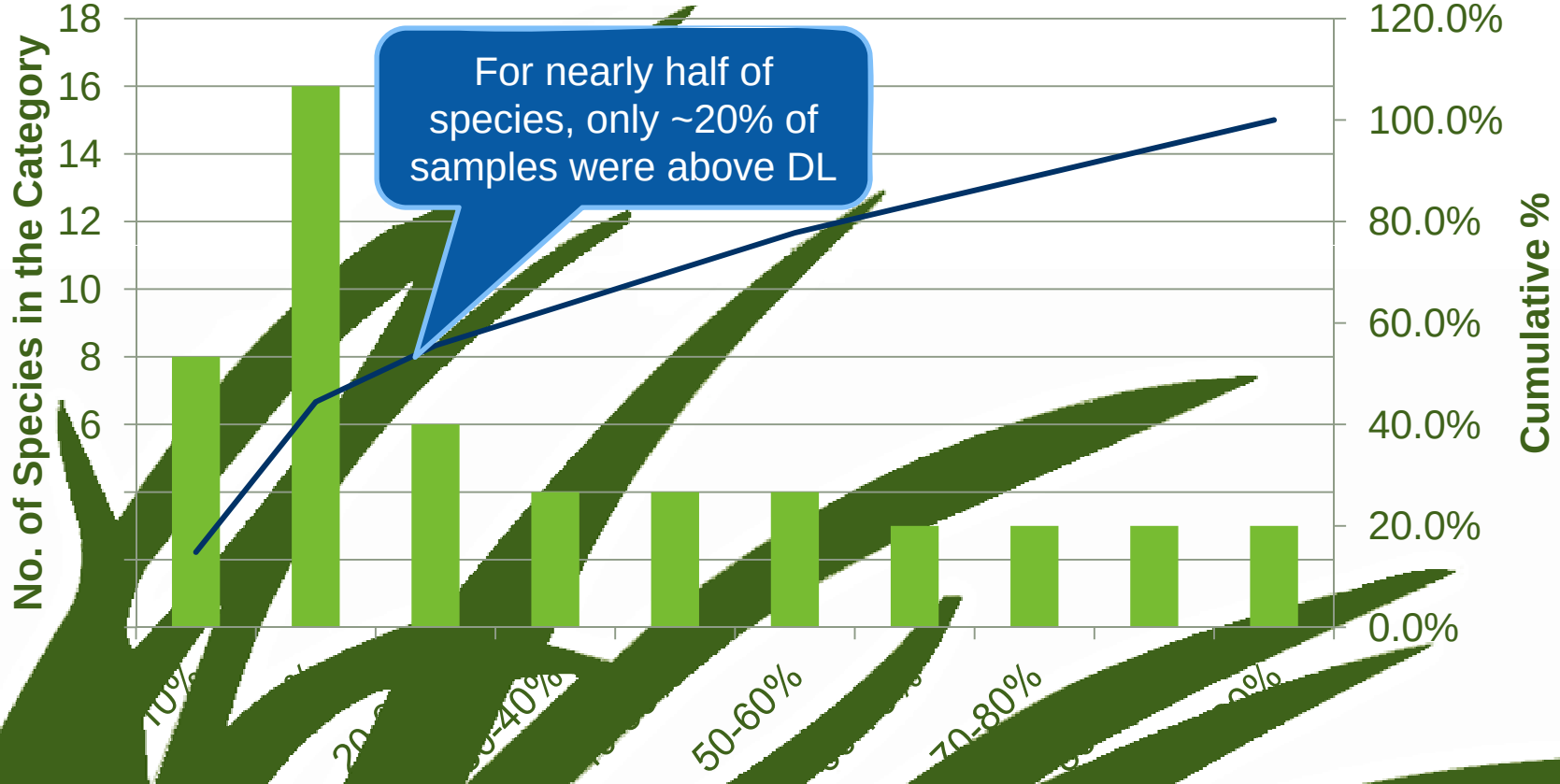
MANY PAMS SPECIES WERE BELOW OR NEAR DETECTION LIMIT (1/2)



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MANY PAMS SPECIES WERE BELOW OR NEAR DETECTION LIMIT (2/2)

- Making PAMS program more flexible and allowing monitoring agencies to select PAMS species.
- On the other hand, incremental cost to include these non-detectable species in GC analysis may be low.
- Consider ozone forming potential of each species, max incremental Reactivity

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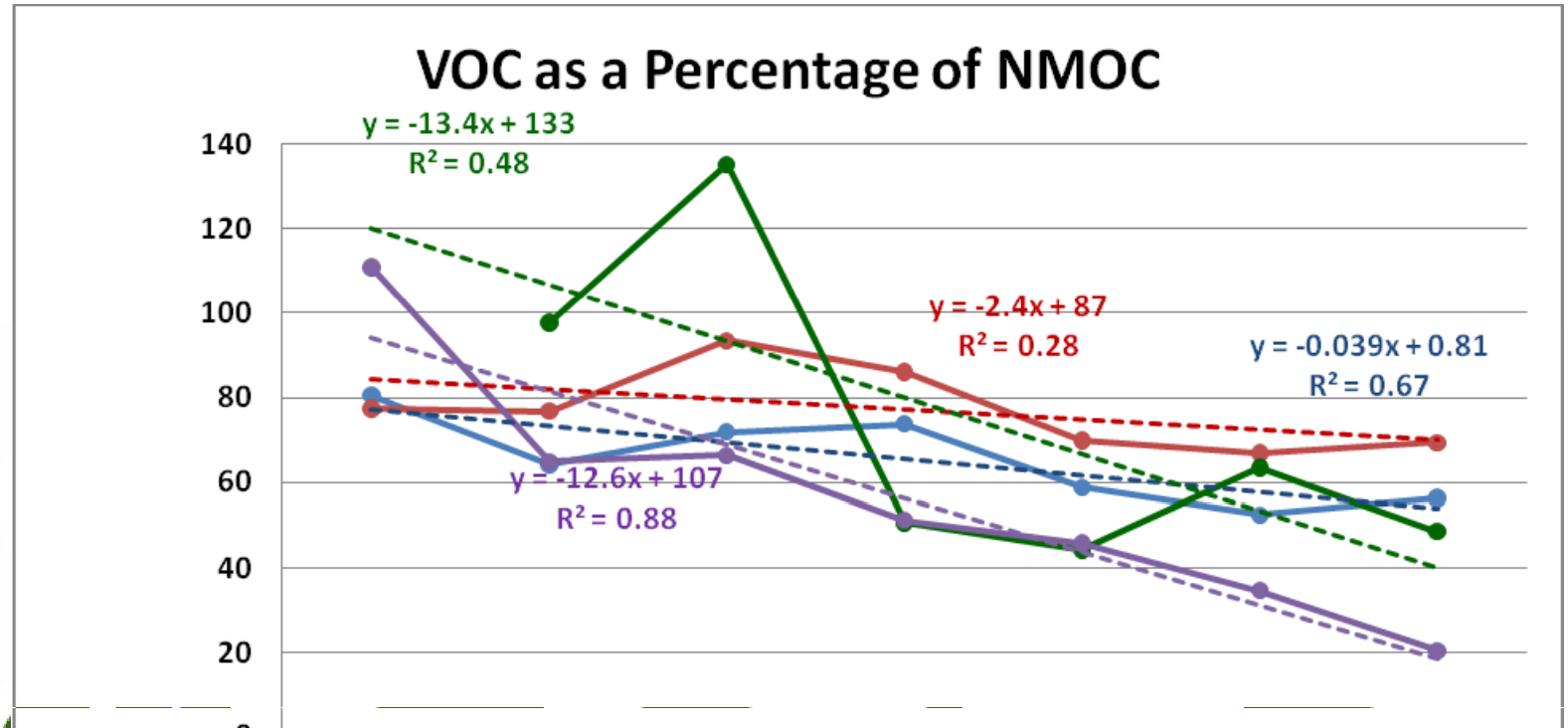
PAMS SPECIES ACCOUNTED FOR AS LITTLE AS 20% OF NMOC (1/3)



	2001	2002	2003	2004	2005	2006	2007
Arvin	81	64	72	74	59	52	56
Bakersfield	77	77	94	86	70	67	69
Clovis		98	135	51	44	63	49
Parlier	111	65	66	51	46	35	20

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PAMS SPECIES ACCOUNTED FOR AS LITTLE AS 20% OF NMOC (2/3)

- Additional species, particularly species with high ozone forming potential, should be considered
  - For example:
    - Formaldehyde (MIR=9.24)
    - Acetaldehyde (MIR=6.3
- Issue: these species are not detectable by the current GC configuration; new measurement method should be considered

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PAMS SPECIES ACCOUNTED FOR AS LITTLE AS 20% OF NMOC (3/3)

- Alternative: shift focus to NMOC (or another aggregate VOC parameter) as a surrogate, and coupled with much more comprehensive but much less frequent speciation analysis
  - Trade off between composition and temporal resolution/cost
- Issues with current NMOC monitors
  - At some site (e.g., Arvin), ambient NMOC has decreased to levels close to DL – need more sensitive monitor
  - Complicated due to FID responses to different species. Is instrument that converts NMOC to CO_2 measuring CO_2 (expressed as mC)?

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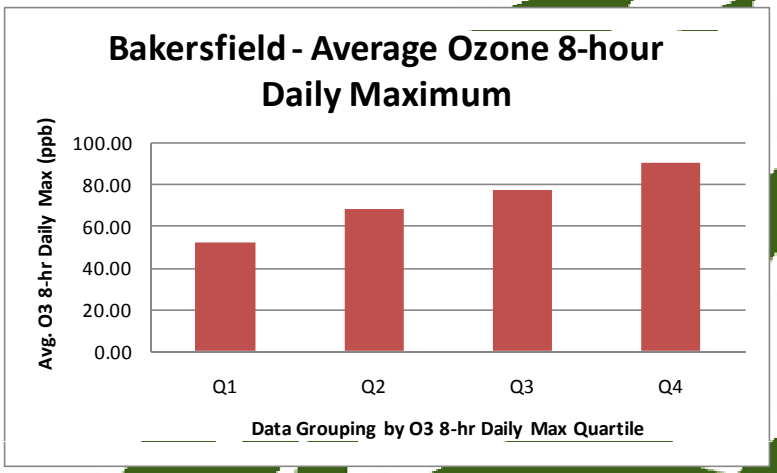

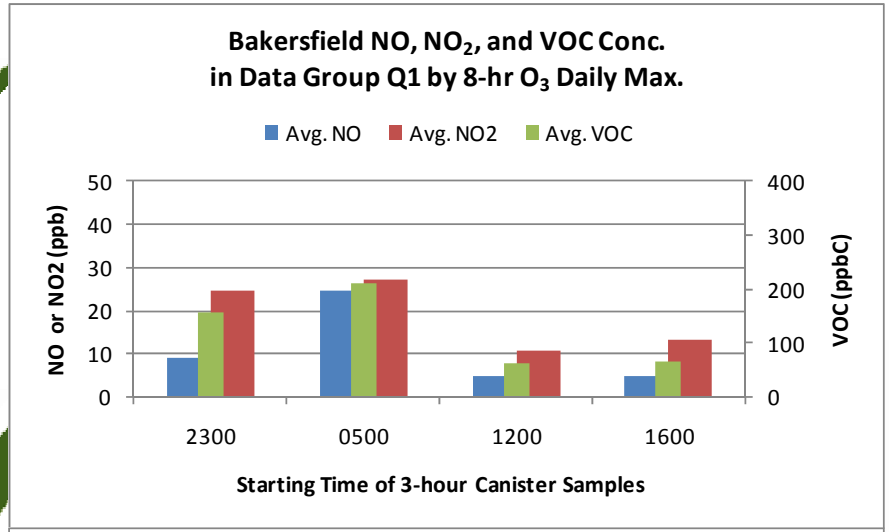

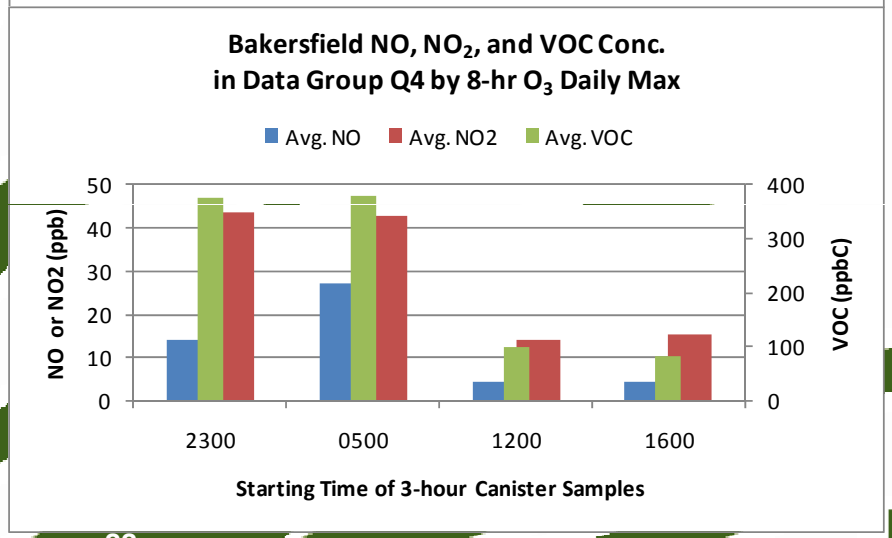

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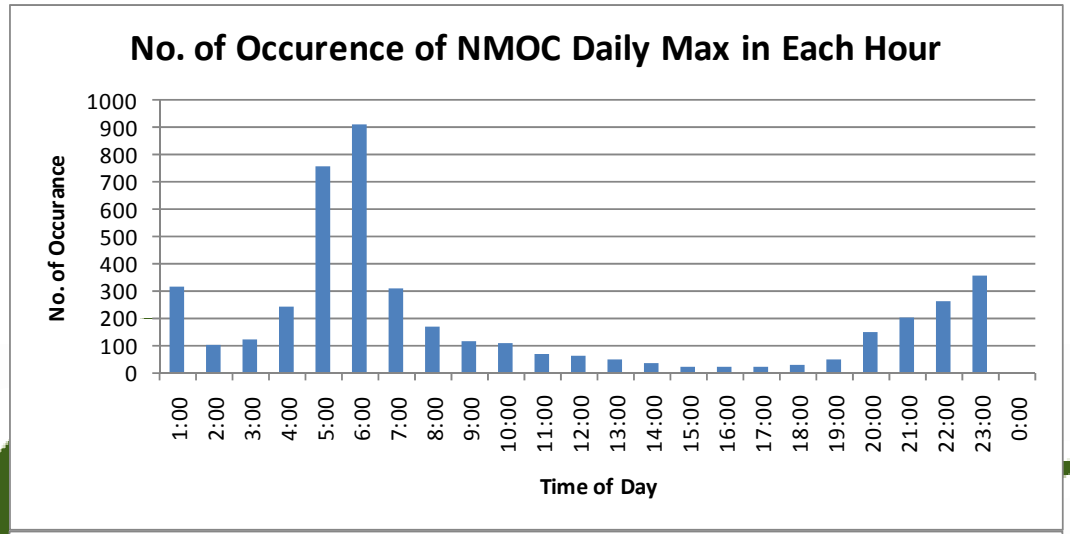
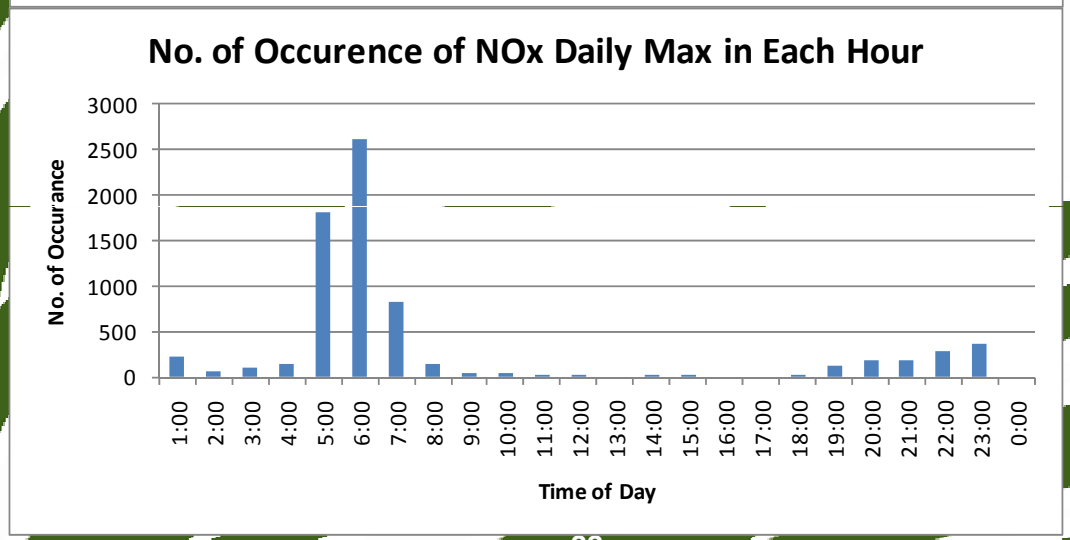
IN THE HIGH OZONE AREAS, THE AFTERNOON CANISTER SAMPLES WERE NOT VERY USEFUL (2/2)





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  - T[illegible]em[illegible]olution [illegible] 3-hr [illegible] samples [illegible]nec[illegible]quate

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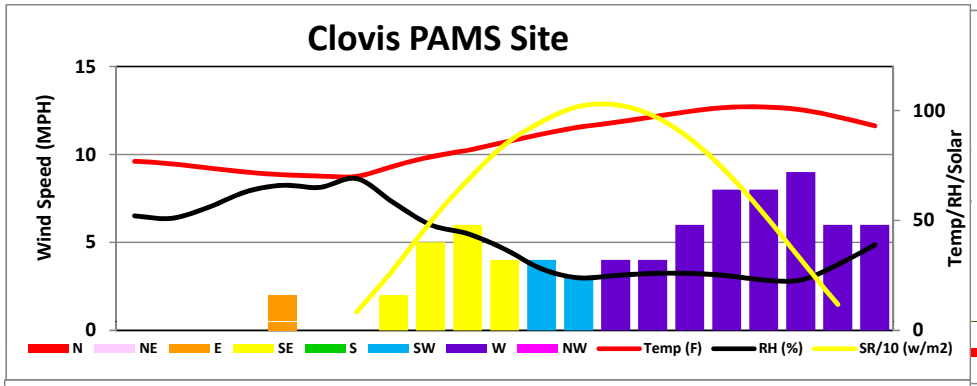
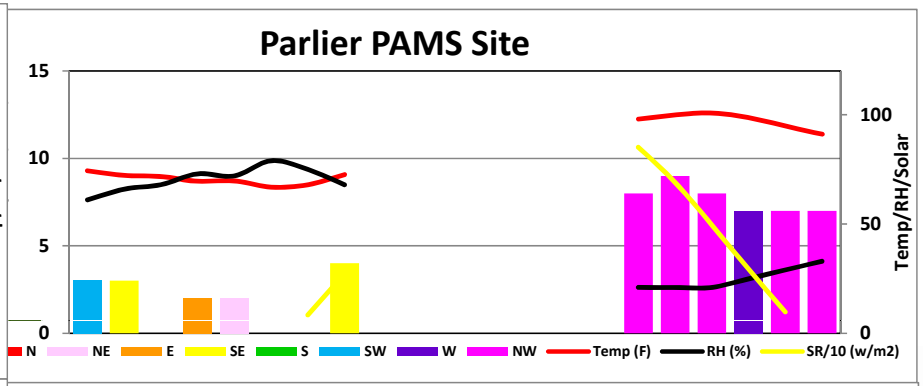
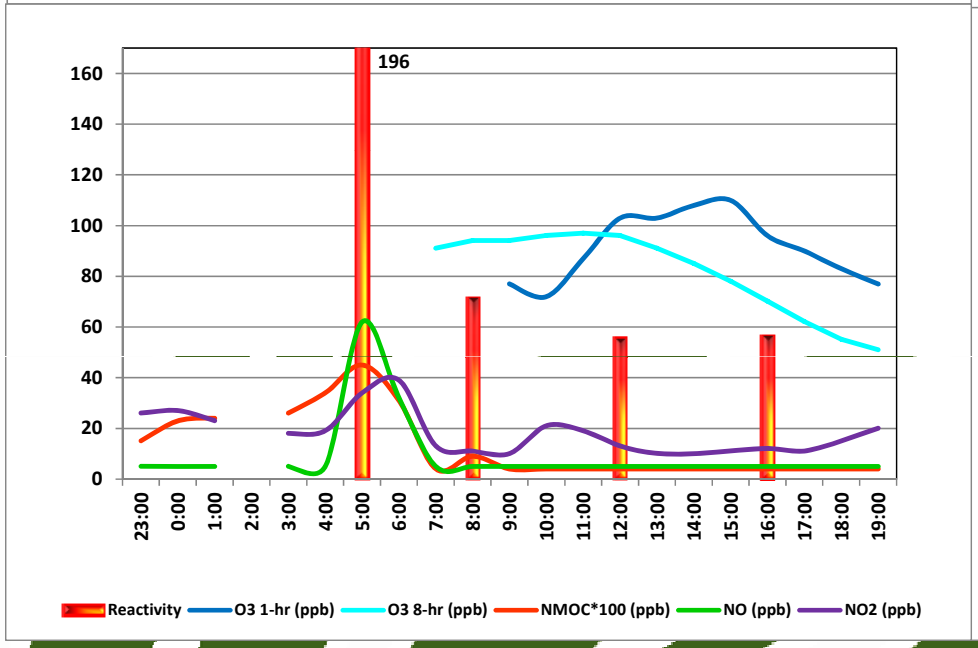
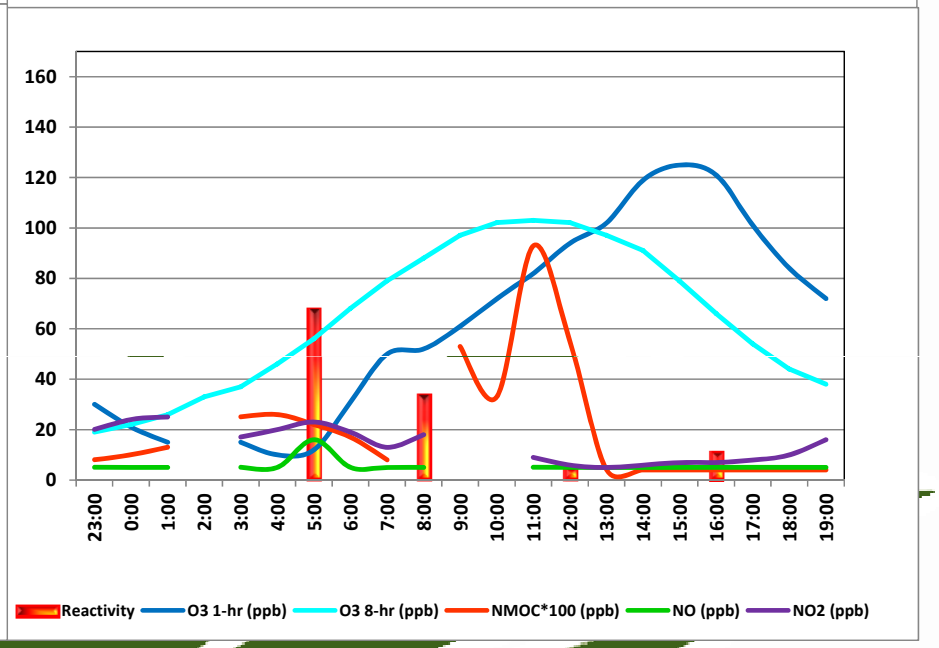
THE TEMPORAL RESOLUTION OF 3-HR CANISTER SAMPLES SEEMED INADEQUATE (1/2)









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THE TEMPORAL RESOLUTION OF 3-HR CANISTER SAMPLES SEEMED INADEQUATE (2/2)

- Auto-GC seems better alternative, especially GC designed for ambient monitoring as opposed to current version adopted from a GC intended for lab use

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ACKNOWLEDGEMENT AND ADDITIONAL INFORMATION

- Funding for this study was provided by SJVUAPCD under contract # 03-10-07

- Full report, "Analysis of PAMS Data 1994-2007", available online
  - www.providenceeng.com/P/Downloads/otherinfo.html
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