

On-Road Motor Vehicle Emissions including Ammonia, Sulfur Dioxide and Nitrogen Dioxide

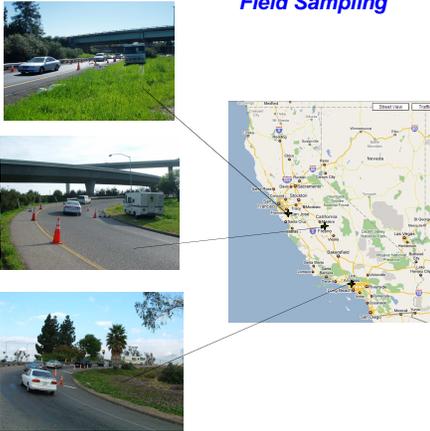
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Overview

- $\text{NO}_2, \text{SO}_2, \text{NH}_3$ are PM precursors; NO_2 is an ozone forming pollutant.
- Measures: CO_2 , CO, HC, NO, $\text{NO}_2, \text{SO}_2, \text{NH}_3$, speed, acceleration, license plate
- Over 55,000 vehicle measurements
- Project Timeline: 2007 – 2009
- Fuel-based emissions (g/kg of fuel) are much less dependent upon driving mode than are emissions per km.
- Will help develop or improve emissions inventory and understand regional variation of emissions

Field Sampling



Regulated emissions g/kg of fuel and exhaust conc. corrected for water and excess air

	San Jose	Fresno	West LA
CO g/kg	17	20	21.4
% CO	0.13	0.16	0.17
HC g/kg	1.5	2.9	1.8
ppm C3	38	72	50
NO g/kg	2.6	2.9	3.8
ppm NO	186	202	265
Mean MY	2000.6	1999.8	2001.2

1999-2008 Emission Reductions*

	San Jose	West LA
CO	65%	67%
HC	60%	61%
NO	40%	41%

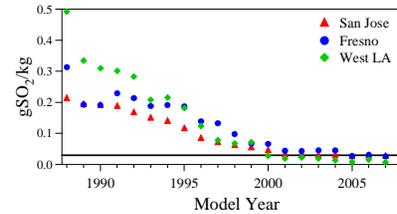
*1999 measurements in San Jose and West L.A. were sponsored by the Steven and Michelle Kirsch Foundation and the IM Review Committee. The results are available on the www.feat.biochem.du.edu web site

Unregulated emissions g/kg of fuel and exhaust conc. corrected for water and excess air

	San Jose	Fresno	West LA
SO_2 g/kg	0.06	0.09	0.07
ppm	2	3	2
NH_3 g/kg	0.5	0.5	0.8
ppm	61	62	99
NO_2 g/kg	0.05	0.14	0.08
ppm	2	7	4
Mean MY	2000.6	1999.8	2001.2

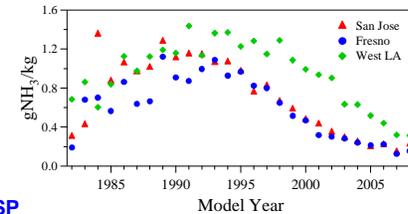
Sulfur Dioxide:

Should be 0.03 g/kg for all model years based upon 15ppm S in the fuel
We suspect a spectroscopic interference combined with increasing oil consumption



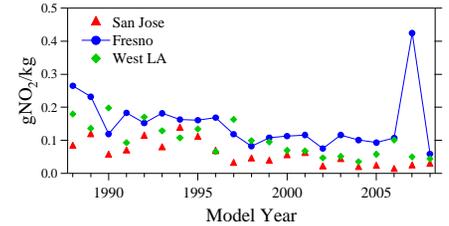
Ammonia:

Highest emissions in about 15 yr old cars
The West LA fleet has higher accelerations



Nitrogen dioxide:

Less than 5% of the NO_x BUT with an outstanding peak for the 2007 MY in Fresno



Fresno 2007 Sprinter Ambulances

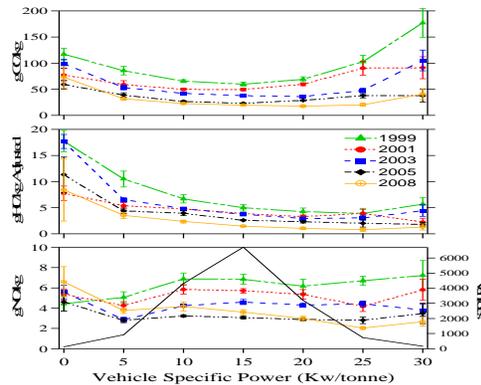
	NO_x gm/kg	NO_2/NO by moles
57 2007 Dodge Sprinter Measurements	7.99	2.4
865 other measurements in the 2007 MY	0.42	0.06

CARB On-Road Measurements

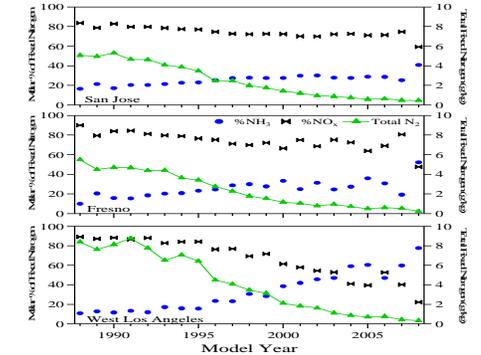
	San Jose	Fresno	West LA
2008 March	4-7	8-14	17-21
Hits	27,567	15,048	22,072
Valid with plates	24,978 90.5%	13,372 89%	17,953 81.6%

Compare to Older Fleet Emissions

The vehicles MY 1982 and older were 0.5% of the fleet and emitted 5% of the CO, 4.6% of the HC and 2.6% of the NO_x emissions.



Newest fleet has lower emissions with less effect of VSP



Conclusions

Very significant emissions reductions of regulated emissions 1999-2008. Less dependence upon VSP.
Sulfur dioxide: new vehicles as expected from the fuel, older vehicles unexpected interference?
Ammonia: Largest % of the NO_x in accelerating newest vehicles, up to 80% in West LA, MY 2008.
Ammonia: largest emissions in ~15 yr old vehicles.
Nitrogen dioxide: less than 5% of NO_x except the Fresno fleet containing the 2007 Sprinter ambulances.