Meeting of Predictive Model Working Group

April 27, 2006

California Air Resources Board

Agenda

- Introductions and Opening Comments
- Discussion Topics
  - Current Model
  - New Data Sets
  - Permeation
  - Statistical Techniques
  - Emissions Inventory
  - High Emitters
- Presentation by Others
- Open Discussion
- Closing Remarks

Current Predictive Model

- Developed in 1999 in response to Governor's Executive Order for the phase-out of MTBE.
- Models for THC, NOx, and Potency Weighted-Toxics
- Three Technology Groups
- Adjustments for Permeation and CO
- Uses Mixed-Model approach to estimate regression coefficients
- Weighted by EMFAC emission proportions

New Data Sets

- Toyota Data – Effects of Ethanol on Emissions of Gasoline LDVs
- AAM/AIAM/Oil Industry - Low Sulfur and Oxygen Test Program
- CRC E-67 - Exhaust Emissions from Ethanol/Gasoline Blend Fueled Vehicles
- CRC E-60 - The Effect of Fuel Sulfur on NH3 and Other Emissions from 2000-2001 Model Year Vehicles
- ExxonMobil - Oxygen content study
- Mexico - Fuel Properties Study ???

Permeation

- Permeation is when compounds in motor vehicle fuel migrate through soft fuel-system components.
- CRC E-65 demonstrated that ethanol increases permeation emission by about 65%
- Mobile Source Emissions Inventory group is estimating the statewide increase in emissions.
- Expect estimates of increase in evaporative emissions
- Second stage of E-65 underway, expected testing to finished by mid-year.

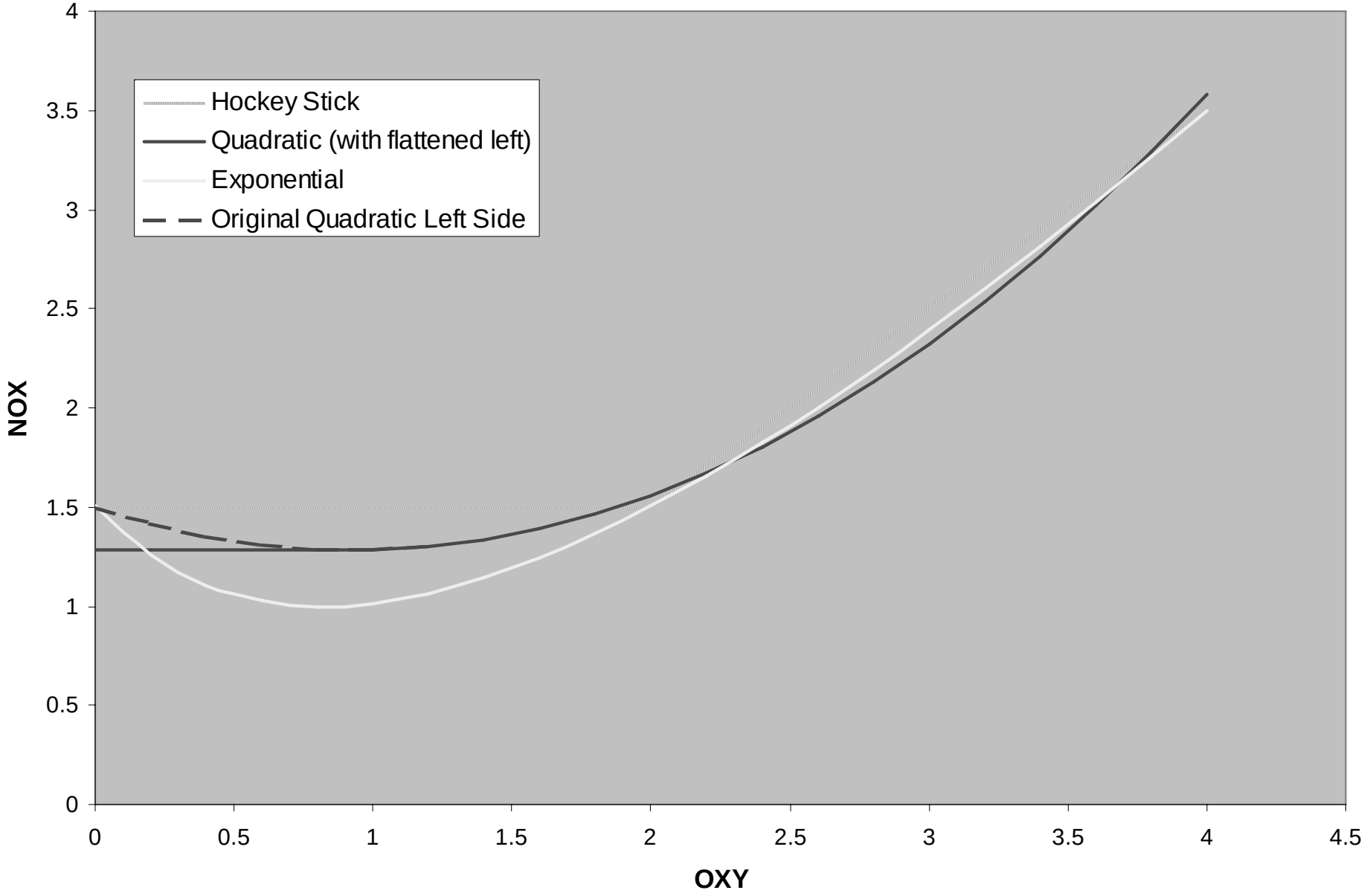
Carbon Monoxide

- VOC Permeation/CO Modeling Final Report Released (March 2006)
  - Staff Report: "The Ozone Impact of Permeation VOC Relative to Carbon Monoxide"
- Report can be found at : www.arb.ca.gov/research/reactivity/reactivity.htm

Statistical Techniques

- Term Inclusion
- Log functions –vs- quadratics
- Prediction errors
  - Information Criteria
  - Cross Validation
- Non-linear modeling
- New Tech Groupings

Three Data Fits



Emissions Inventory

- The updates are necessary to support the development of the 2007 and 2008 State Implementation Plans (SIPs) for the federal ozone and particulate matter standards.
  - Permeation
  - Commingling
  - Vehicle count
  - Temperature Profiles
  - Fuels composition
- Emissions Inventory Website http://www.arb.ca.gov/msei/msei.htm

Hydrocarbon Model

- Four Parts
  - Exhaust HC% * IWF * RF +
  - Evap HC% * IWF * RF +
  - CO% * IWF *RF +
  - Permeation% * IWF * RF
- Evap - Hot Soak, Diurnal, Resting Loss, and Running Loss
- Very Complicated

NOx High Emitters

Average NOx > 1.0 g/mile

Effect	Estimate	Standard Error	DF	t Value	Pr > |t|
Intercept	0.4360	0.03536	912	12.33	<.0001
RV	-0.00048	0.007215	912	-0.07	0.9475
T5	0.004335	0.007461	912	0.58	0.5614
T9	-0.00482	0.004445	912	-1.08	0.2782
AR	0.005896	0.004886	912	1.21	0.2279
OL	0.02058	0.004374	912	4.70	<.0001
OX	0.004469	0.005714	912	0.78	0.4344
SU	0.01875	0.006143	912	3.05	0.0023
RVOX	0.01835	0.007940	912	2.31	0.0211
T9OL	0.009180	0.003433	912	2.67	0.0076
RVT5	0.006871	0.008663	912	0.79	0.4279
RVSU	0.006600	0.003090	912	2.14	0.0330
RVT9	-0.00668	0.004135	912	-1.62	0.1065
AROX	-0.00358	0.005795	912	-0.62	0.5367
AROL	-0.00791	0.002991	912	-2.64	0.0083
T5OL	0.009696	0.005271	912	1.84	0.0662
RVRV	-0.00624	0.004227	912	-1.48	0.1403

Average NOx > 1.25 g/mile

Effect	Estimate	Standard Error	DF	t Value	Pr > |t|
Intercept	0.7230	0.04289	467	16.86	<.0001
RV	-0.02324	0.01263	467	-1.84	0.0665
T5	0.000850	0.009632	467	0.09	0.9297
T9	-0.00642	0.006814	467	-0.94	0.3467
AR	0.03211	0.008992	467	3.57	0.0004
OL	0.04039	0.01072	467	3.77	0.0002
OX	0.009629	0.009373	467	1.03	0.3048
SU	0.02481	0.009521	467	2.61	0.0095
RVOX	0.02356	0.01272	467	1.85	0.0647
T9OL	-0.00070	0.007370	467	-0.09	0.9246
RVT5	0.008015	0.01057	467	0.76	0.4485
RVSU	0.01200	0.004884	467	2.46	0.0144
RVT9	-0.00650	0.007127	467	-0.91	0.3625
AROX	-0.01317	0.01044	467	-1.26	0.2079
AROL	-0.00333	0.01047	467	-0.32	0.7502
T5OL	0.03259	0.01083	467	3.01	0.0028
RVRV	-0.00666	0.006195	467	-1.07	0.2830

Average NOx > 1.5 g/mile

Effect	Estimate	Standard Error	DF	t Value	Pr > |t|
Intercept	0.8537	0.04325	329	19.74	<.0001
RV	-0.00643	0.02057	329	-0.31	0.7547
T5	0.001534	0.01348	329	0.11	0.9095
T9	-0.00102	0.008496	329	-0.12	0.9042
AR	0.03645	0.01653	329	2.20	0.0282
OL	0.02076	0.01739	329	1.19	0.2334
OX	0.01029	0.01175	329	0.88	0.3819
SU	0.01953	0.01034	329	1.89	0.0598
RVOX	0.02487	0.01491	329	1.67	0.0961
T9OL	-0.00691	0.01020	329	-0.68	0.4988
RVT5	0.002307	0.01644	329	0.14	0.8885
RVSU	0.009858	0.005341	329	1.85	0.0658
RVT9	-0.00157	0.007554	329	-0.21	0.8353
AROX	-0.00050	0.01792	329	-0.03	0.9780
AROL	0.003340	0.02019	329	0.17	0.8687
T5OL	0.01755	0.01501	329	1.17	0.2430
RVRV	0.001086	0.007614	329	0.14	0.8867

Presentations by Others

Open Discussion

Closing Remarks