Fuels Workshop on Regulatory and Non-Regulatory Fuels Activities for 2006

September 22, 2006

California Environmental Protection Agency

Air Resources Board

Agenda

- Introductions and Schedule
- California Predictive Model
  - Reactivity of Evaporative and Exhaust Emissions
    - CO Reactivity
  - 2006 Draft Predictive Model
  - Emission Inventory
- Presentations by Others
- Open Discussions
- Closing Remarks

Tentative Future 2006 Workshops

- October 6 9:00 to 12:30 Sher Auditorium
- October 25 9:00 to 12:30 Sher Auditorium

  - The October workshops will be webcast. All meetings will be available by conference call.
  - Next set of workshops will scheduled based on progress

Reactivity of Evaporative and Exhaust Emissions

Reactivity Progress
2006 Update to Draft MIR Values

- 2006 MIR list was presented to the Reactivity Subgroup and used in calculating reactivities
- Data sets for Diurnal, Hot Soak and Exhaust obtained from in-use testing at El Monte
- All speciated data was for E6 fuel
- Running loss was calculated from headspace and liquid fuel profiles (per Dr. Harley, UCB)
- Presented to Reactivity Working Group for review

2006 Draft Specific Reactivity

(applied to speciated data sets from VEDS database)

	2006 Draft Specific Reactivity
Exhaust	3.99
Hot Soak	3.12
Diurnal	2.36
Running Loss	2.54

Updates to Predictive Model Related MIR Information

http://www.arb.ca.gov/fuels/gasoline/premodel/pmdevelop.htm#MIR

CO Reactivity

Reactivity Values for Predictive Model

- Maximum Incremental Reactivity (MIR) values are used in the Predictive Model (PM)
- Consistent with the previous PM assessment
- First developed in early 1990 by Dr. Carter at UCR and updated several times since then
- MIR is deemed most appropriate for scientific and regulatory applications by the Reactivity Research Scientific Committee

MIR (continued)

- The Tables of MIR Values were adopted by ARB in June 2000 and updated in December 2003 to ensure that our regulation is based on the best sound science.
- Required to review the Tables of MIR Values every 18 months to determine if modifications to the values are warranted.
- Used in Low Emission Vehicle and Clean Fuel (LEV/CF) and aerosol coatings regulations, and possibly for other categories

MIR (Continued)

- 3-D airshed model derived reactivity values would be the most appropriate but are available only for a limited number of VOCs (~30) due to computational demands
- Comparison study between 3-D and box model derived reactivity values indicates that the correlation is high
- The MIR-based California aerosol coatings regulation was approved by the U.S. EPA in January 2005

MIR (Continued)

- U.S. EPA publishes an interim guideline in September 2005 on VOC reactivity and encourages all states to consider it in development of ozone SIPs
- Other agencies are using MIR scale as VOC control strategies
- Working with Reactivity Research Working Group to develop other reactivity metrics
- MIR is the most scientifically sound reactivity scale available for ~800 VOCs

CO Reactivity

- Treated as a VOC in SAPRC99 mechanism and listed in the Tables of MIR Values
- Is a slow reacting chemical so the box model derived MIR value for CO may be an underestimation
- Included in the comparison study and its relative reactivity is consistent in terms of rankings
- Inappropriate to use different reactivity scales for any reactivity applications (MIR-3D for CO vs. MIR for others)
- The MIR value (0.06) for CO is appropriate for the predictive model.

2006 Draft Predictive Model

2006 Draft Predictive Model

The 2006 Draft Predictive Model includes several major revisions:

- Draft statistical models for exhaust THC, NOx and CO.
- The 2010 vehicle emission weights from the EMFAC 2007 working draft model, including permeation estimates, using California 8-hour temperature profile and relative humidity.
- Updated Maximum Incremental Reactivity (MIR) values :
  - Based on the 2006 list of MIR of total organic gaseous compounds.
  - Used to calculate reactivities of exhaust and evaporative processes
  - Ethanol permeation reactivity was based on the CRC E-65 study.

Predictive Model Fundamental Eqn

$$\%ChangeinMassEmission = \frac{(Emission_{Cand} - Emission_{Ref})}{Emission_{Ref}} x100\%$$

- This fundamental equation has never changed since the Predictive Model adopted by the Board
- The equation also applies to permeation
- The MIR is used to provide flexibility for refiners to offset exhaust hydrocarbon emissions with evaporative hydrocarbon emissions.

Gasoline

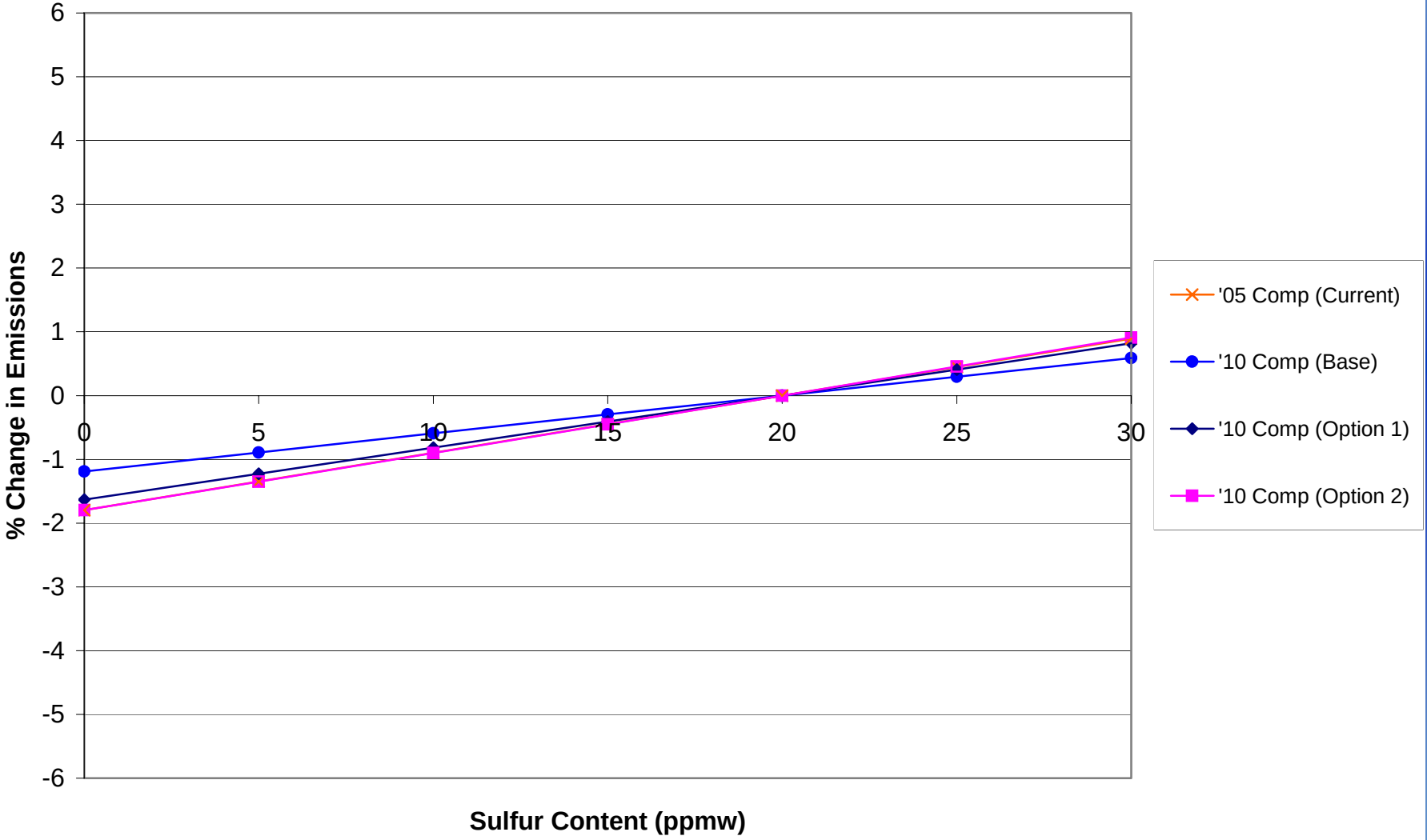
2006 Draft Predictive Model

(2010 Base Year)

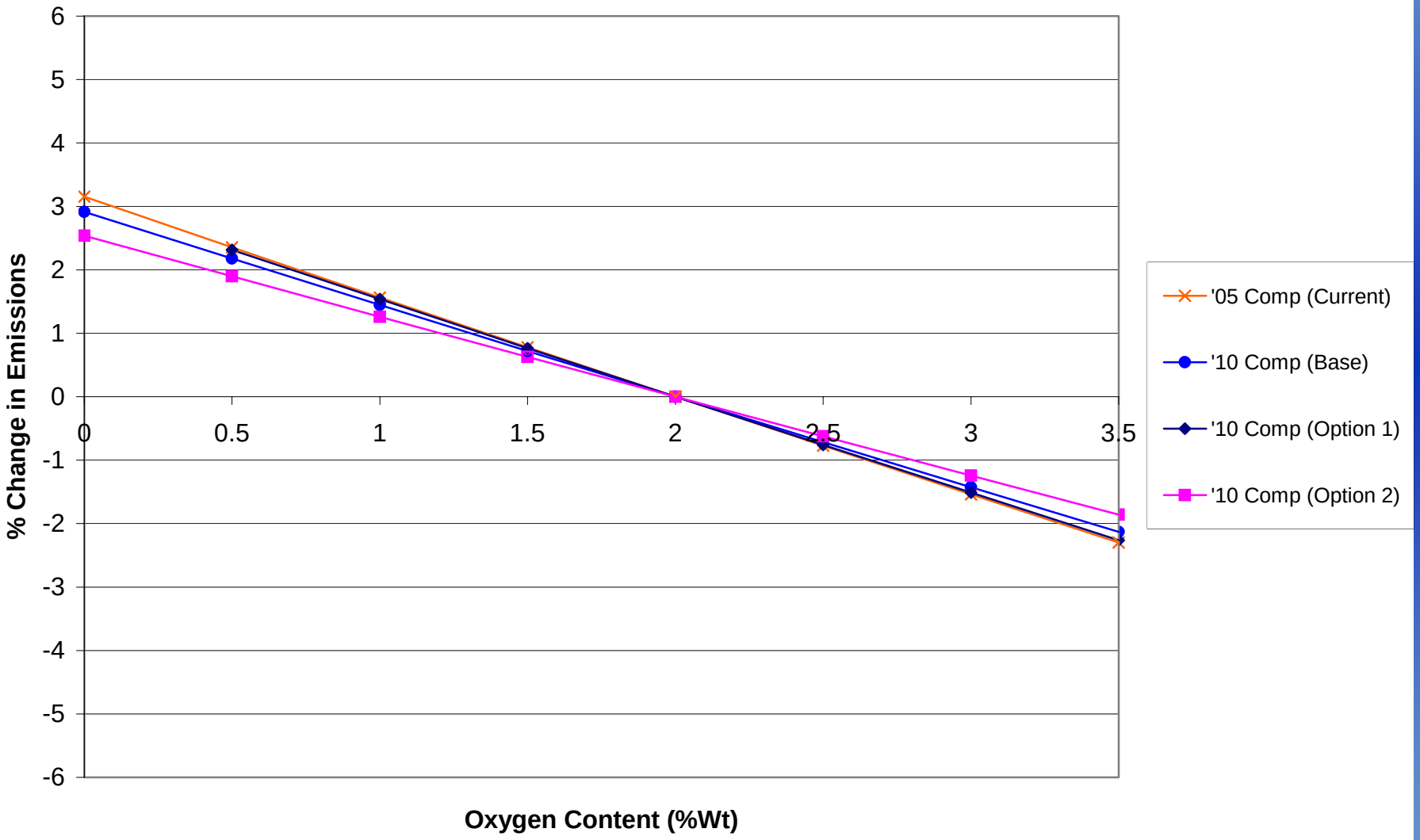
Pollutant	Emission (tpd)	MIR	OFP (tpd)	OFP (%)
Exh TOG	249	3.99	994	43.6
CO	4378	0.06	263	11.5
Evap TOG				
DI/RT	118	2.36	278	12.2
HS	64	3.12	200	8.8
RL	170	2.76	469	20.6
Perm	23	3.27	75	3.3

THC Response to Fuel Properties

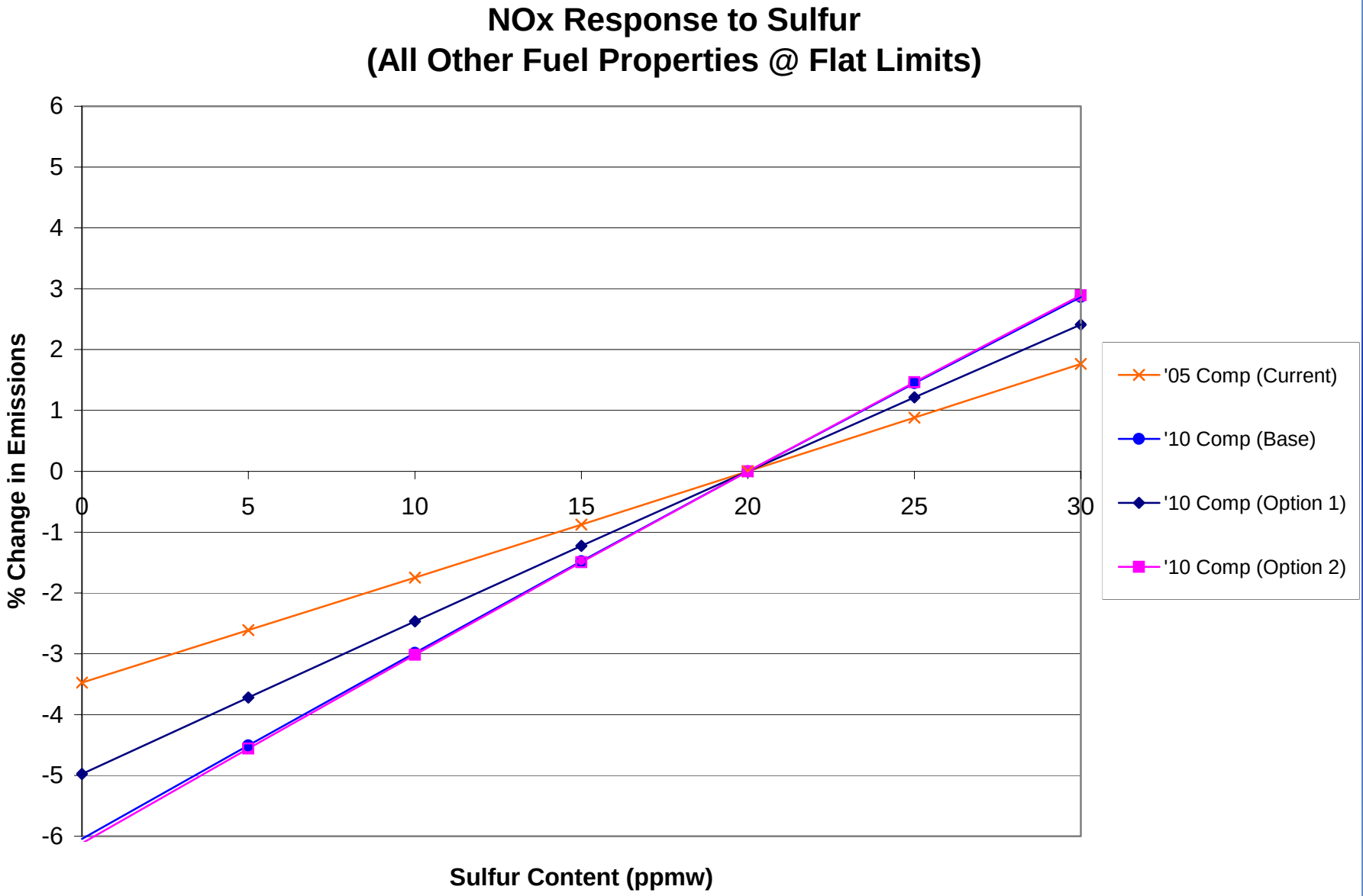
THC Response to Sulfur
(All Other Fuel Properties @ Flat Limits)

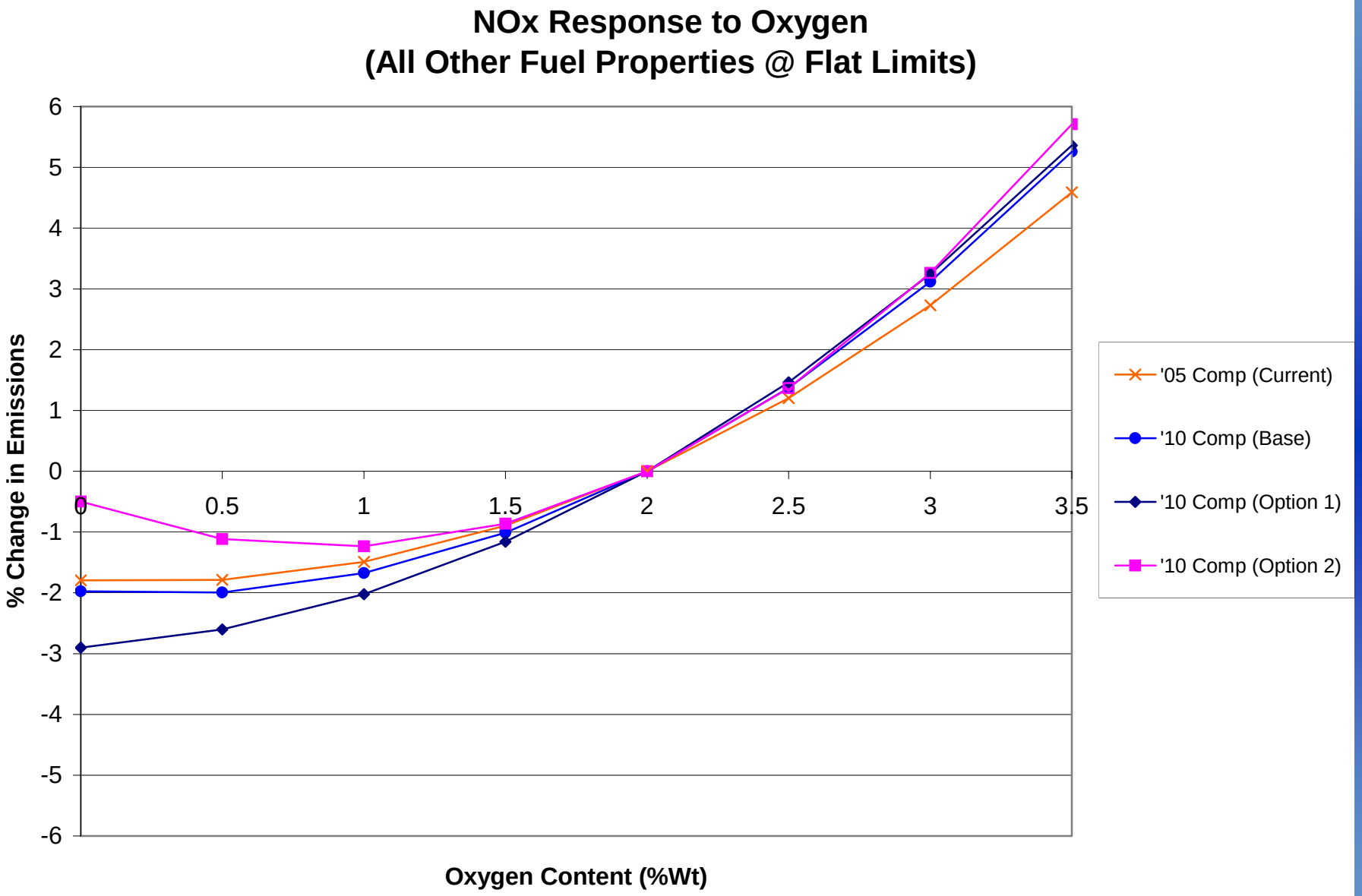


THC Response to Oxygen
(All Other Fuel Properties @ Flat Limits)

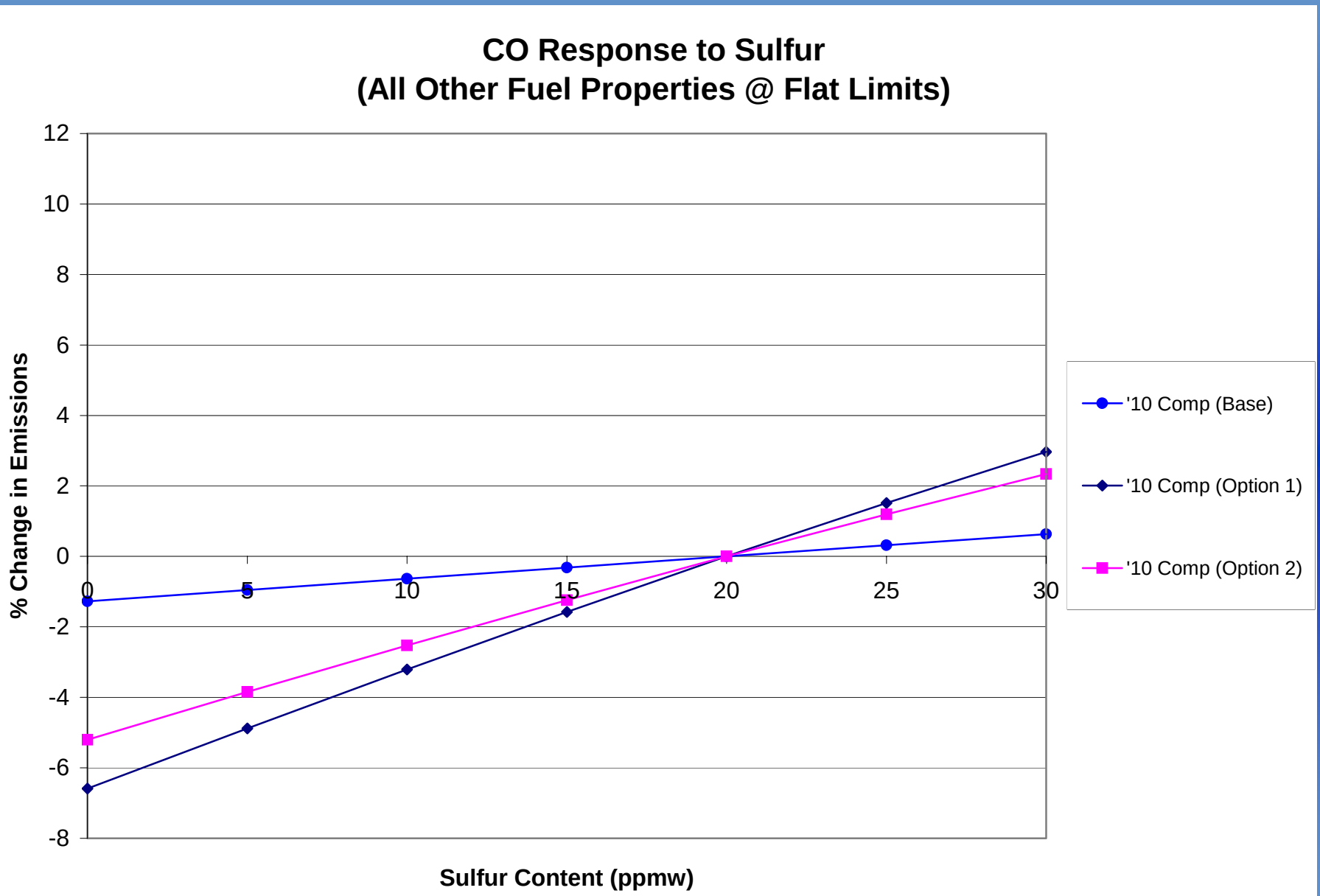


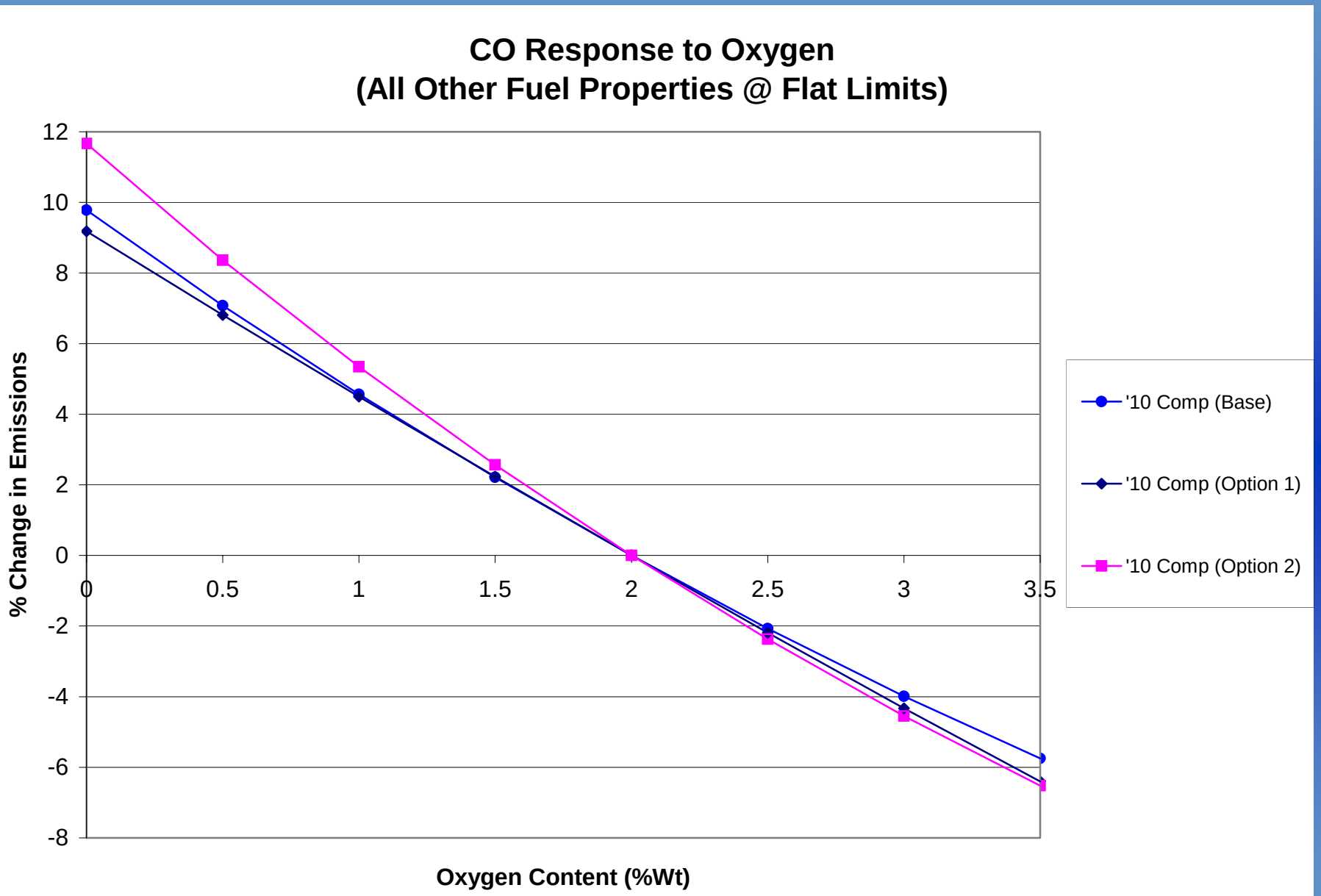
NOx Response to Fuel Properties


NOx Response to Sulfur
(All Other Fuel Properties @ Flat Limits)
% Change in Emissions
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
0
5
10
15
20
25
30
Sulfur Content (ppmw)
'05 Comp (Current)
'10 Comp (Base)
'10 Comp (Option 1)
'10 Comp (Option 2)


NOx Response to Oxygen
(All Other Fuel Properties @ Flat Limits)
% Change in Emissions
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
0
0.5
1
1.5
2
2.5
3
3.5
Oxygen Content (%Wt)
'05 Comp (Current)
'10 Comp (Base)
'10 Comp (Option 1)
'10 Comp (Option 2)

CO Response to Fuel Properties


CO Response to Sulfur
(All Other Fuel Properties @ Flat Limits)
% Change in Emissions
12
10
8
6
4
2
0
-2
-4
-6
-8
0
5
10
15
20
25
30
Sulfur Content (ppmw)
'10 Comp (Base)
'10 Comp (Option 1)
'10 Comp (Option 2)


CO Response to Oxygen
(All Other Fuel Properties @ Flat Limits)
% Change in Emissions
12
10
8
6
4
2
0
-2
-4
-6
-8
0
0.5
1
1.5
2
2.5
3
3.5
Oxygen Content (%Wt)
'10 Comp (Base)
'10 Comp (Option 1)
'10 Comp (Option 2)

Emissions Inventory

Presentations by Others

Open Discussions

Closing Remarks