CARB Fuels Workshop

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WSPA
January 26, 2007

Outline

- Introduction
- Statement of principles
- Review Predictive Model responses
  - Sulfur
  - T50
  - T90
- Oxygen flat spot
- Random Balance Method
- Next steps to finalize model

Introduction

- Workshop and Expert Group process has worked well and led to considerable progress in modeling
  - Ethanol permeation
  - Updated emissions inventory
  - Reactivity of exhaust and evaporative emissions
  - CO impacts
  - Incorporation of new vehicle data
- WSPA providing comments on draft of Predictive Model issued December 2006
  - Only a few remaining issues to be addressed

Principles for Evaluation

- Sound science should be basis for evaluating Predictive Model
- Responses in the Predictive Model should be consistent with results from designed studies
- If not, need to understand
  - What data are driving the responses?
  - Does statistical approach need to be modified?
- Check for terms in the model that cause kinks in the response surfaces

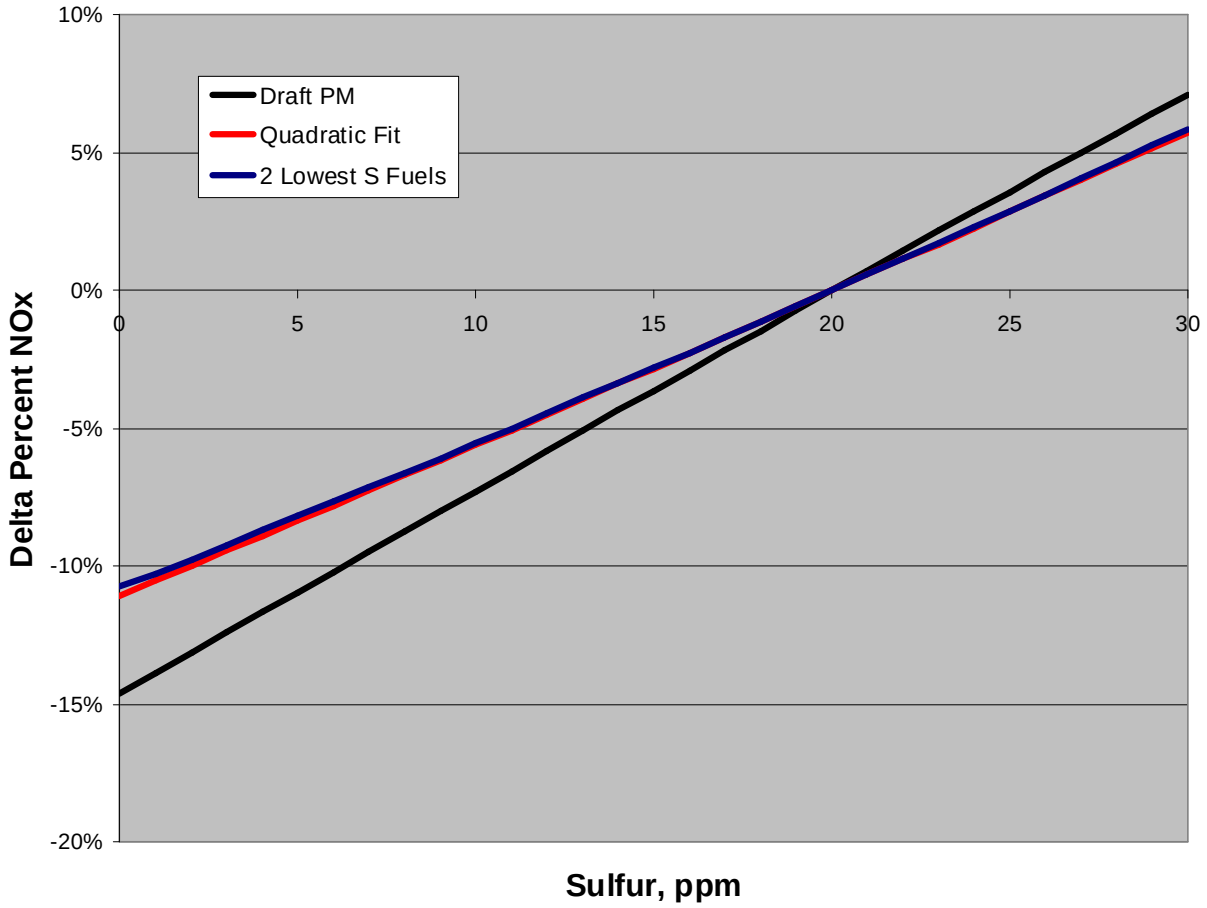
Tech 5 Sulfur-NOx Response

- Four studies evaluated sulfur response in Tech 5 vehicles
  - AAM
    + 3 sulfur levels, 3 oxygen levels (no interaction)
  - AAMA
    + 5 sulfur levels (non-oxy)
  - CRC LEV program
    + As-received and aged catalysts
    + 5 sulfur levels (non-oxy), 2 sulfur levels (oxygenated)
  - CRC E-60
    + As-received and aged catalysts
    + 3 sulfur levels (non-oxy)

Tech 5 Sulfur-NOx Response (Cont'd)

- Conducted regression for each study and compared to the Draft PM Tech 5 response. Used 2 approaches
  - All fuels, allowing quadratic term
  - Only two lowest sulfur fuels
- In each case, Draft PM response was larger than the program results
  - If PM is correct, would have expected individual study results to be both above and below PM value
- Compared overall average response to Draft PM for 10 ppm sulfur

AAM Study


10%
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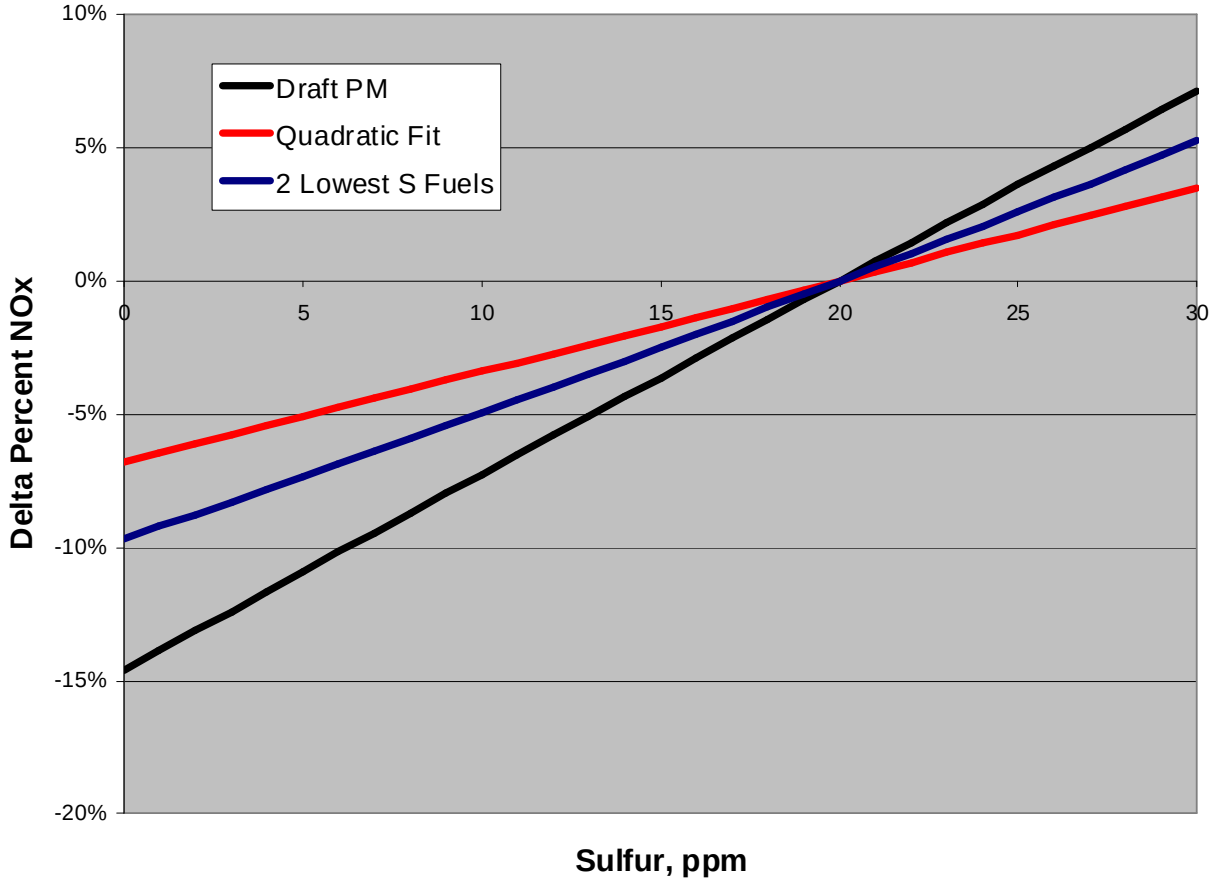
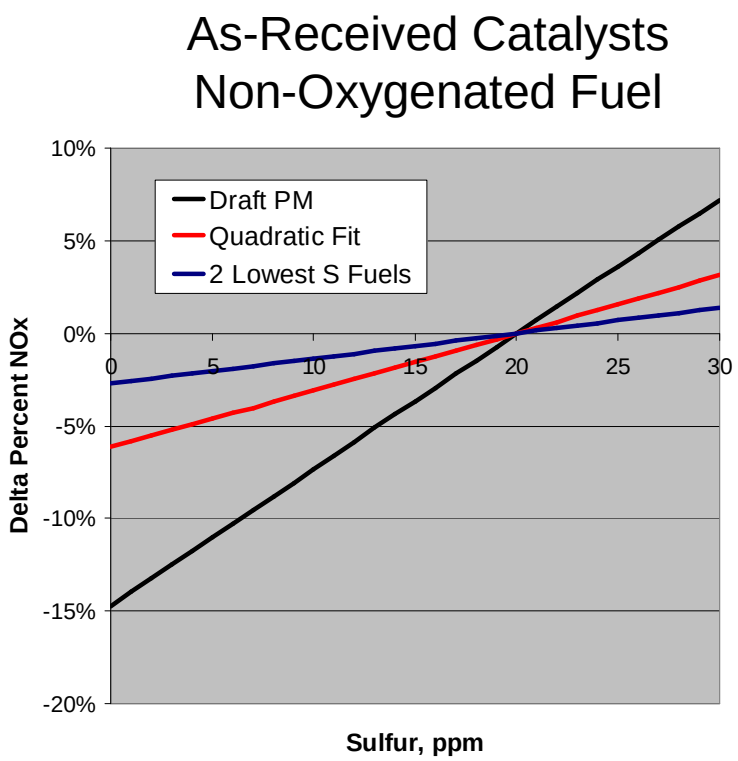
Draft PM
Quadratic Fit
2 Lowest S Fuels
Delta Percent NOx
Sulfur, ppm

AAMA Low Sulfur Study



CRC LEV


As-Received Catalysts
Non-Oxygenated Fuel
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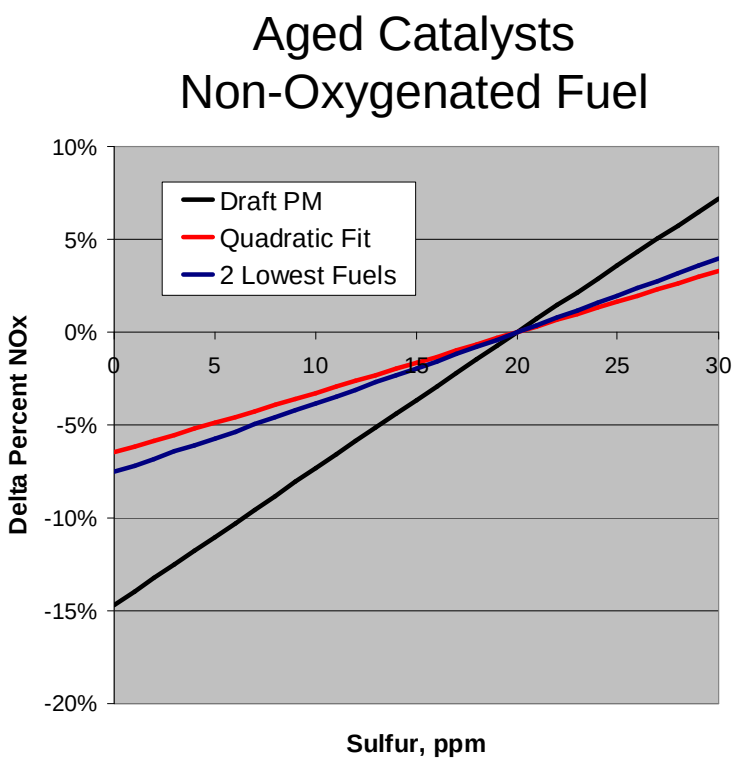
Draft PM
Quadratic Fit
2 Lowest S Fuels
Delta Percent NOx
Sulfur, ppm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Draft PM
Quadratic Fit
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Delta Percent NOx
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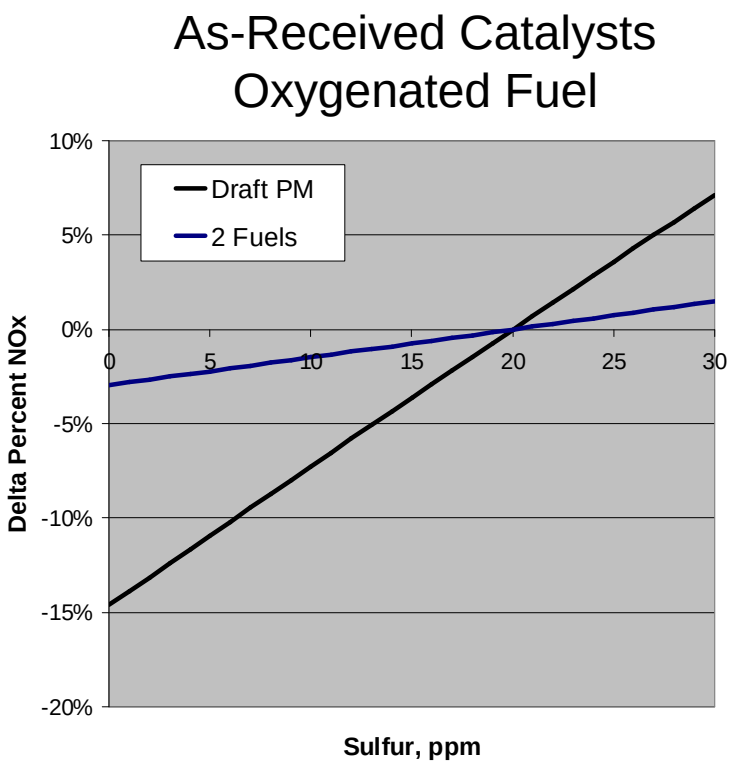
CRC LEV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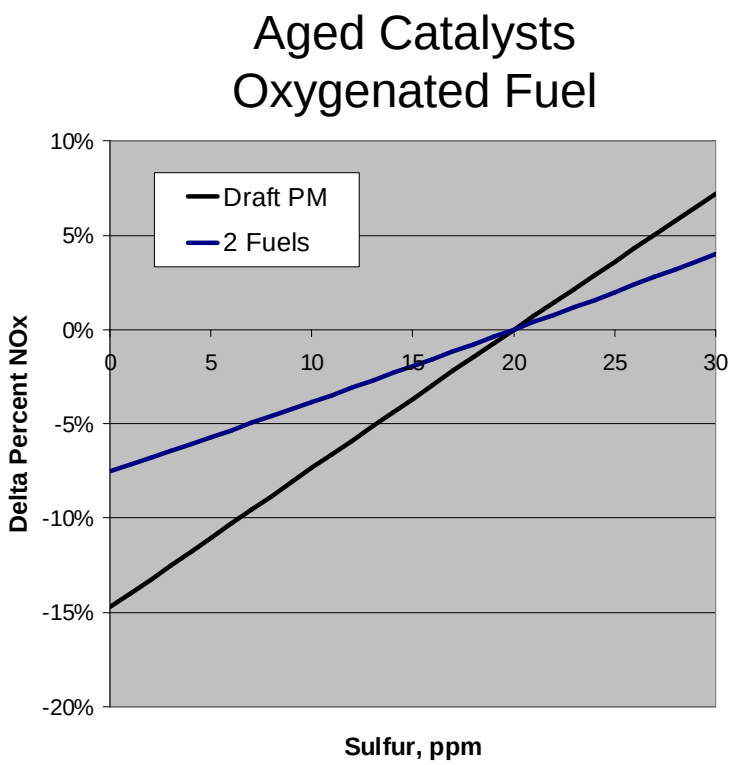
Draft PM
2 Fuels
Delta Percent NOx
Sulfur, ppm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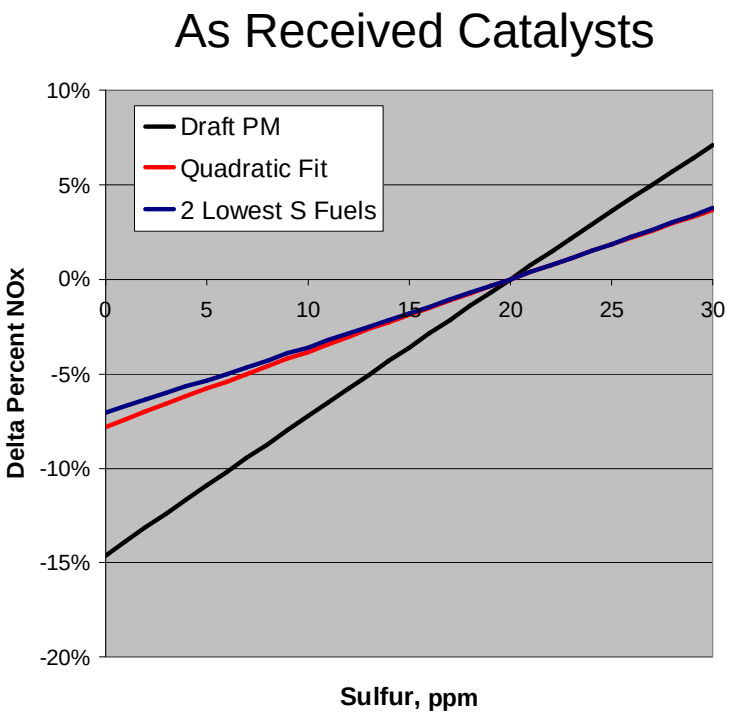
Draft PM
2 Fuels
Delta Percent NOx
Sulfur, ppm

CRC E-60


As Received Catalysts
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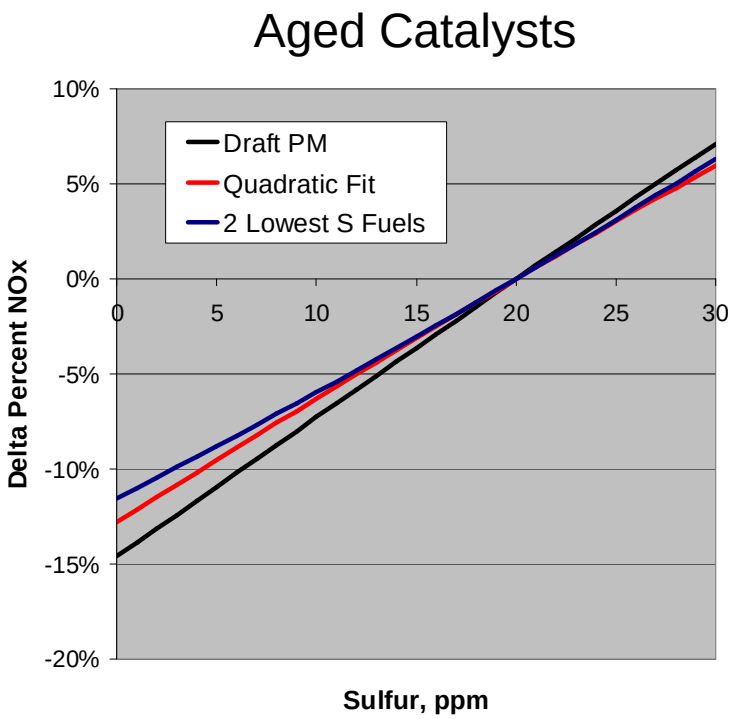
Draft PM
Quadratic Fit
2 Lowest S Fuels
Delta Percent NOx
Sulfur, ppm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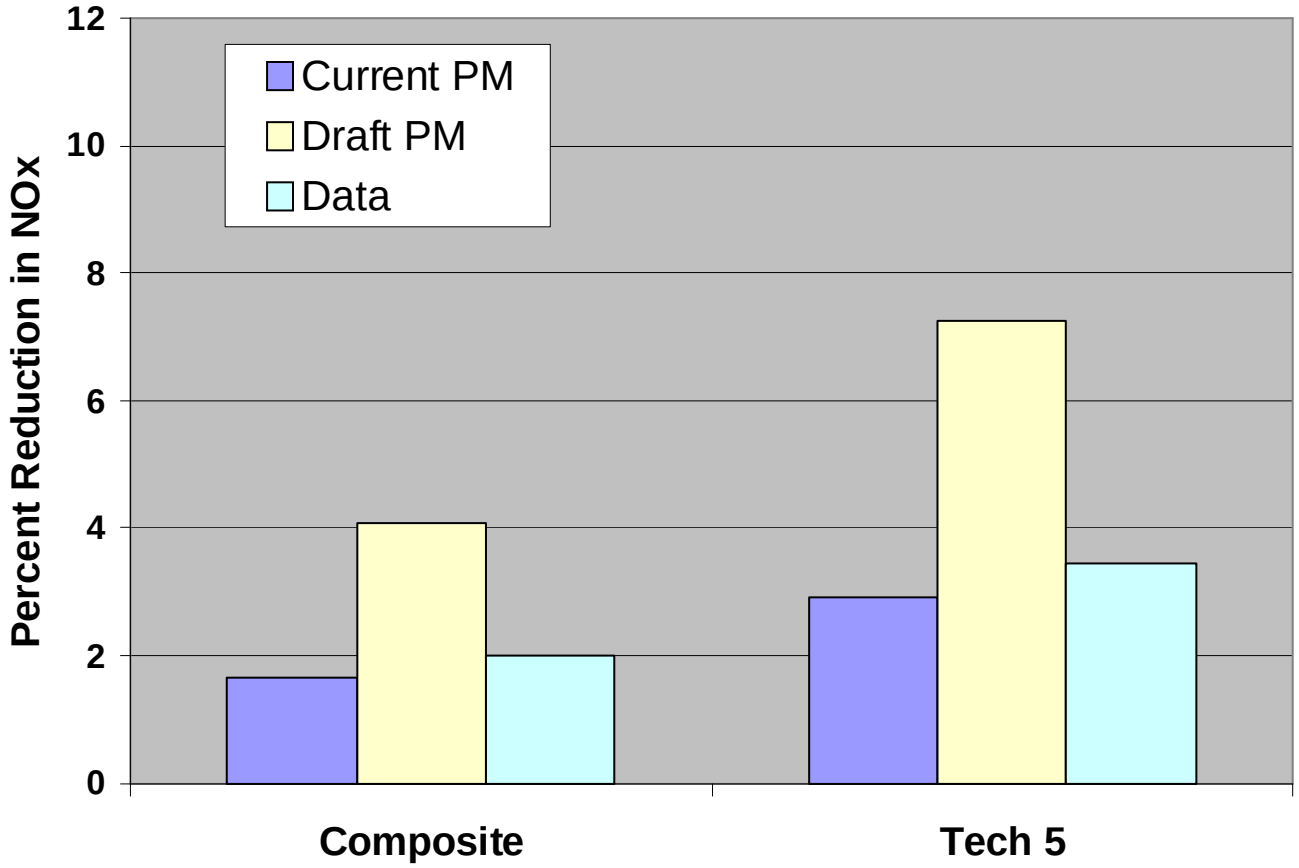
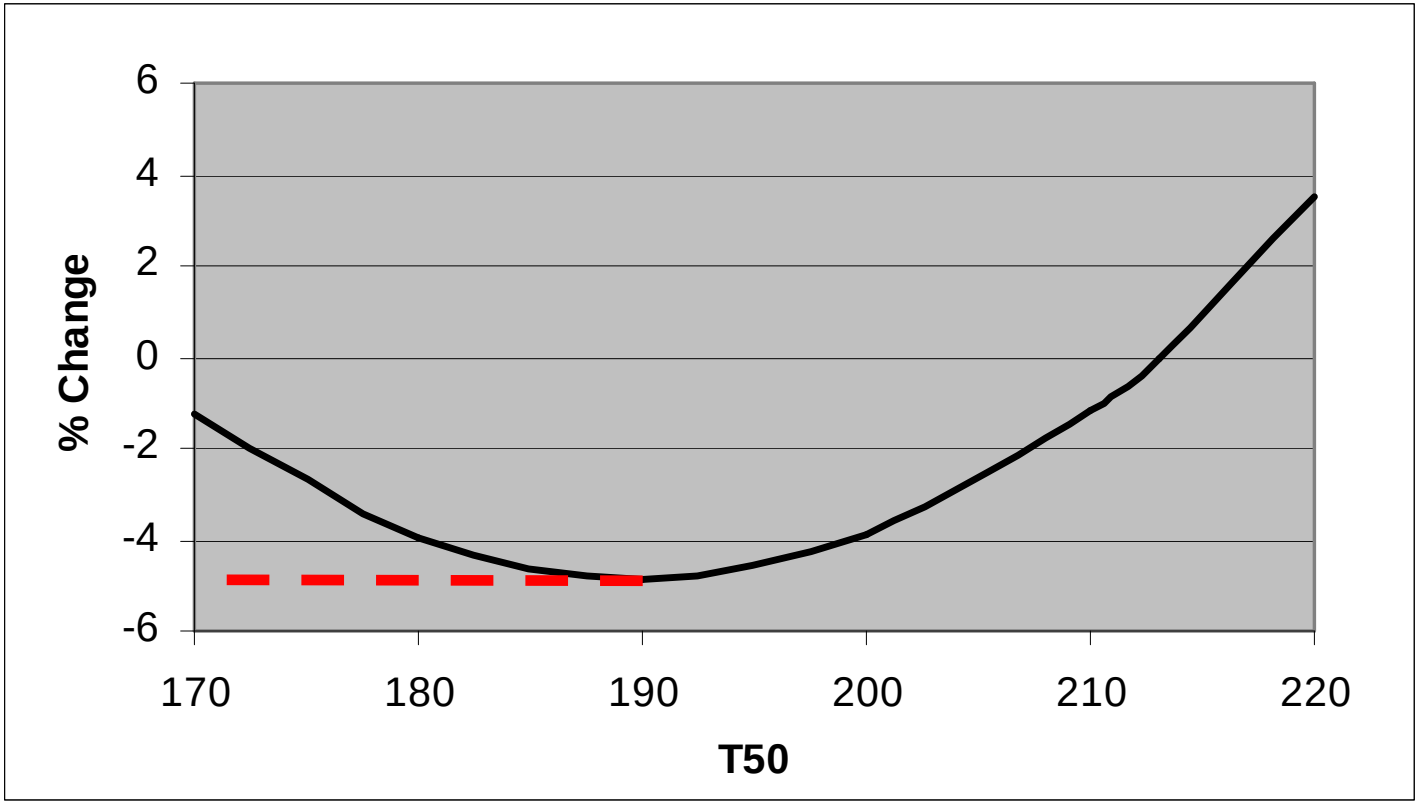
Comparison of Models with Data

NOx Reduction: 20→10 ppm Sulfur

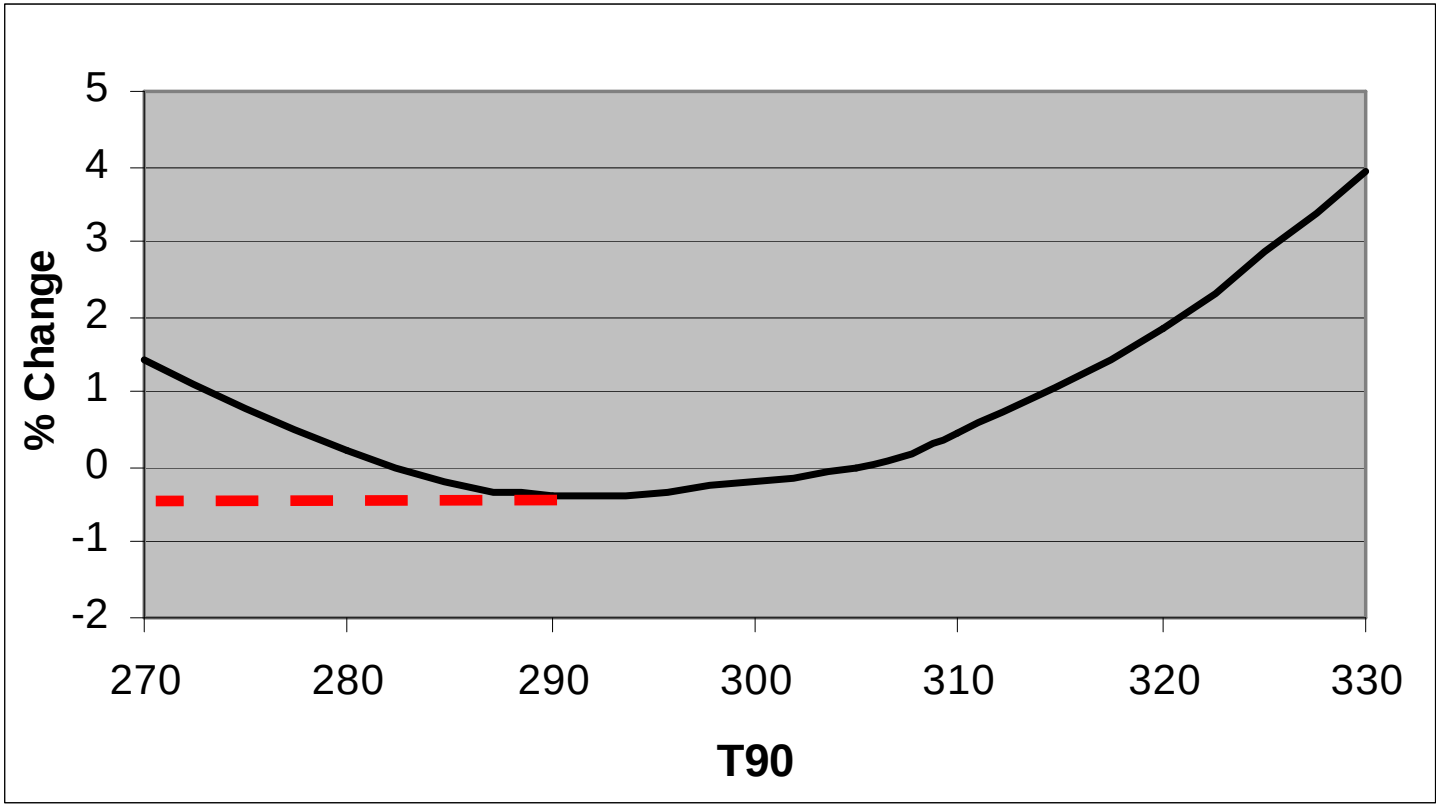


Tech 5 T50-Exhaust TOG



- Response should be flat below 190 ^{0}F

Tech 5 T90-Exhaust TOG



- Response should be flat below 290 ^{0}F

Oxygen Flat Spot

- Model has flat spot in Oxygen-NOx response
  - 1.8 – 2.2 wt.% oxygen
  - 2.5 – 2.9 wt. % oxygen
- Flat spot should cover all oxygen levels and should be as wide as possible considering
  - Emissions
  - Product quality (octane, volatility)
  - Ease of enforcement
  - Advantages of system fungibility
- Flat spot should include CO response as well as TOG response

Random Balance Technique

- Random Balance technique should be applied to regression equations
- Simplifies equations
- Avoids kinks in response surfaces
- Helps ensure optimum refinery blends

Next Steps to Finalize Model

- Predictive Model should be based on sound science
  - Best estimate of fuel-emissions relationship based on and consistent with all existing data for Sulfur-NOx response
  - Examine the statistical methodology
- Other model issues easier to address

Next Steps on Reg Package

- WSPA has many questions relative to the proposed Alternative Compliance Plan concept released today.
- WSPA commits to work with ARB to develop a comprehensive plan that addresses state renewable fuels initiatives and their emissions impacts.