

# **Assessing the Effect of Five Gasoline Properties on Exhaust Emissions from Light-Duty Vehicles certified to Tier-2 Standards**

## **Analysis of Data from EPA Phase 3**

**(EPAct/V2/E-89)**

### **Appendix P.3**

#### **Model Fitting Information for**

#### **1,3-Butadiene (Bag 1)**

This appendix summarizes model fitting for Bag-1 1,3-Butadiene. Model-fitting techniques and approaches summarized in Section 8.7. Features of the data and modeling for this compound are listed below.

Fuel-parameter matrix: REDUCED

Media contamination: NO

No. measurements: 62

No. censored values: 0

Modeling approach: MIXED MODEL

Estimated Dependent Variable model: NO

### Models fit for 1,3-Butadiene (Bag 1)

Model term	Notation	Model				
		Full Model (Linear Effects)	FM1 <sup>1</sup>	FM2	FM3	Null Model <sup>2</sup>
etOH	$Z_e$	•	•	•	•	×
Arom	$Z_a$	•	•	×		
T50	$Z_5$	•	•	•	×	
T90	$Z_9$	•	×			

<sup>1</sup> Denotes “Full minus 1,” etc.  
<sup>2</sup> Model fit with intercept only.

### Fitting history for 1,3-Butadiene (Bag 1) – with “FM3” selected as best fit model.

Fit Parameters				Test with respect to Benchmark			Test with respect to Previous Model		
Model	$p$	-2lnL	BIC <sup>1</sup>	Dev. <sup>1</sup>	$d$	Pr> $\chi^2$	Dev.	$d$	Pr> $\chi^2$
Linear Effects	5	21.82	33.08						
FM1	4	22.07	31.73	0.2556	1	0.61			
FM2	3	22.61	30.66	0.7939	1	0.37	0.5383	1	0.46
FM3	2	23.66	30.10	1.8468	1	0.17	1.0529	1	0.30
Null Model	1	39.80	44.63	17.98	1	0.00002	16.1328	1	0.0001

<sup>1</sup> A lower value indicates a better fit.

<sup>1</sup> The deviation is the difference in the -2loglik statistics for the nested and reference models, respectively, per Equation 14.

### Coefficients and Type-III Tests of Effect for the Full and Best-Fit Models – 1,3-Butadiene (Bag 1).

Effect	Full Model					Best-Fit Model (FM3)				
	Estimate	Std.Err.	d.f.	$t$ -value	Pr> $t$	Estimate	Std.Err.	d.f.	$t$ -value	Pr> $t$
Intercept	-5.9175	0.1131	5.02	-50.97	0.00000005	-5.9175	0.1159	5.02	-51.04	0.00000005
$Z_e$	-0.1210	0.03986	57.04	-3.04	0.0036	-0.1273	0.03851	57.05	-3.30	0.0017
$Z_a$	-0.02730	0.03496	57.06	-0.78	0.44					
$Z_5$	0.0441	0.03887	57.04	1.14	0.26	0.03968	0.03851	57.04	1.03	0.31
$Z_9$	-0.01715	0.03389	57.10	-0.51	0.61					
$\sigma_{veh}^2$	0.06188					0.06161				
$\sigma_{\varepsilon}^2$	0.06801					0.06898				