

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 K.3

Model Fitting Information for

Acetaldehyde (Bag 2)

This appendix summarizes model fitting for Bag-2 acetaldehyde. Model-fitting techniques and approaches are summarized in Section 8.7. Features of the data and modeling for this compound are listed below.

Media contamination: YES

No. measurements: 63

No. censored values: 1

Modeling approach: MIXED MODEL

Estimated Dependent Variable model: YES

Models fit for Bag-2 Acetaldehyde

| Model term | Notation | Model | | | | |
|------------|----------|-------|------------------|-----|-----|-------------------------|
| | | Full | FM1 ¹ | FM2 | FM3 | Null model ² |
| etOH | Z_e | • | • | • | • | × |
| Arom | Z_a | • | • | × | | |
| T50 | Z_5 | • | × | | | |
| T90 | Z_9 | • | • | • | × | |

¹ Indicates “Full minus 1,” etc.

² Indicates model with no terms except an intercept.

Fitting history for Bag-2 Acetaldehyde – with “FM3” selected as best fit model.

| Fit Parameters | | | | Test with respect to Full | | | Test with respect to Previous Model | | |
|--|-----|-------|------------------|--|-----|--------------|-------------------------------------|-----|--------------|
| Model | p | -2lnL | BIC ¹ | Dev. ¹ | d | Pr> χ^2 | Dev. | d | Pr> χ^2 |
| Full | 5 | 71.62 | 82.89 | | | | | | |
| FM1 | 4 | 71.87 | 81.53 | 1.66 | 2 | 0.43 | 0.25 | 1 | 0.62 |
| FM2 | 3 | 73.92 | 81.96 | 3.71 | 3 | 0.29 | 2.04 | 1 | 0.15 |
| FM3 | 2 | 76.44 | 82.87 | 6.23 | 4 | 0.18 | 2.52 | 1 | 0.11 |
| Null model | 1 | 88.03 | 92.86 | 17.82 | 5 | 0.0032 | 11.59 | 1 | 0.00066 |
| ¹ A lower value indicates a better fit. | | | | ¹ The deviation is the difference in the -2lnL statistics for the nested and reference models, respectively, per Equation 14. | | | | | |

Acetaldehyde (Bag 2): Coefficients and Type-III Tests of Effect for Full and Best-Fit Models.

| Effect | Full Model | | | | | Best-Fit Model (MM3) | | | | |
|--------------------------|------------|----------|------|------------|----------|----------------------|----------|-------|------------|----------|
| | Estimate | Std.Err. | d.f. | t -value | Pr> t | Estimate | Std.Err. | d.f. | t -value | Pr> t |
| Intercept | -9.4189 | 0.1177 | 5 | -80.1 | 0.000000 | -9.4192 | 0.1162 | 5.007 | -81.1 | 0.000000 |
| Z_e | 0.1520 | 0.06080 | 58 | 2.50 | 0.0152 | 0.1910 | 0.05306 | 58.13 | 3.60 | 0.00066 |
| Z_a | 0.07991 | 0.05279 | 58 | 1.51 | 0.136 | | | | | |
| Z_5 | -0.02997 | 0.05957 | 58 | -0.503 | 0.617 | | | | | |
| Z_9 | -0.07836 | 0.05153 | 58 | -1.52 | 0.134 | | | | | |
| σ_{veh}^2 | 0.05654 | | | | | 0.05372 | | | | |
| σ_{ε}^2 | 0.3814 | | | | | 0.4153 | | | | |