

Data Sources Used in Calculation of Mass Fractions

- 1) Auto/Oil Air Quality Improvement Research Program.
(Speciation data from this program obtained on disk.)

Technical Bulletin No. 1: Initial Mass Exhaust Emissions Results from Reformulated Gasolines. December, 1990.

Technical Bulletin No. 4: Mass Exhaust Emissions Results From Reformulated Gasolines in Older Vehicles. May, 1991.

Technical Bulletin No. 5: Exhaust Emissions of Toxic Air Pollutants Using Reformulated Gasolines. June, 1991.

Technical Bulletin No. 6: Emissions Results of Oxygenated Gasolines and Changes in RVP. September, 1991.

Purpose of Study: These technical bulletins assess the exhaust and evaporative emissions and air quality effects of reformulated gasoline blends (15% MTBE and 0% MTBE) and 10% ethanol blends relative to industry average gasoline. We analyzed data for baseline gasoline, 8 15% MTBE blends and 4 10% ethanol blends.

Vehicle Information: Speciation data was available for 10 current model LDGVs and LDGTs (1989 model year) with three-way and three-way plus oxidation catalysts, PFI, TBI, and carburetor fuel systems, low mileage (10,000 to 29,000 miles). Speciation data was available for 7 older model LDGVs and LDGTs (1983 - 1985 model year) with three-way, oxidation, and three-way plus oxidation catalysts, TBI and carburetor fuel systems, high mileage (42,000 - 79,000 miles). Speciated emissions were measured on current and older vehicles for baseline fuel and MTBE blends, but for 10% ethanol blends only speciation from current vehicles was measured.

- 2) Boekhaus, Kenneth L., Linda K. Cohu, Larry A. Rapp and Jack S. Segal. 1991. Clean Fuels Report 91-02: Impact of EC-1 Reformulated Gasoline Emissions and Their Reactivity on Five 1989 Cars. Arco Products Co., Anaheim, California.

Purpose of Study: Comparison of exhaust and evaporative emissions and reactivity from vehicles running on unleaded regular gasoline and EC-1, an MTBE reformulated blend (5.5% MTBE).

Vehicle Information: This study analyzed data from 5 1989 model year LDGVs with three-way catalysts, PFI, low-mileage.

- 3) Boekhaus, K. L., J. M. DeJovine, D. A. Paulsen, L. A. Rapp, J.S. Segal and D. J. Townsend. 1991. Clean Fuels Report 91-03: Fleet Test Emissions Data -- EC-Premium Emission Control Gasoline. Arco Products Co., Anaheim, California.

Purpose of Study: Compare exhaust and evaporative emissions and reactivity from vehicles running on unleaded premium gasoline, pilot EC-Premium reformulated gasoline (9.0% MTBE), and production EC-Premium reformulated gasoline (12.5% MTBE).

Vehicle Information: 20 1980 to 1989 LDGVs and LDGTs with three-way, oxidation and three-way plus oxidation catalysts, PFI, TBI, and carburetor fuel systems, odometers ranging from 5,000 to 140,000 miles.

- 4) CARB memo from K. D. Drachand to Terry McGuire and Peter Venturini, "Butadiene Emission Factors," July 17, 1991.

Purpose of Study: Determine 1,3-butadiene emissions for various vehicle categories and emission technologies, for vehicles running on gasoline.

Vehicle Information: 78 LDGVs/LDGTs with three-way, oxidation, and no catalysts, PFI, TBI, and carburetor fuel systems, 2 LDDVs and 1 HDDV, mileage ranging from 10,000 to 200,000 miles.

- 5) Colorado Department of Health. 1987. Unpublished data from a motor vehicle emissions toxics study of regulated and non-regulated pollutants. Aurora Emission Technical Center.

Purpose of Study: Measurement of exhaust TOG, total aldehydes, formaldehyde, acetaldehyde and benzene from vehicles running on unleaded gasoline, 10% ethanol and 11% MTBE. 1,3-butadiene measurements were not taken.

Vehicle Information: Emissions were measured for 19 LDGVs. We analyzed data for 17 LDGVs running on gasoline and 10% ethanol. Of these, 6 vehicles had three-way catalysts, one had a three-way plus oxidation catalyst, one had an oxidation catalyst and 4 had no catalyst. 2 had PFI, 4 had TBI and the other 11 were carbureted. Odometer readings for these vehicles were unavailable.

- 6) DeJovine, J. M., K. J. McHugh, D. A. Paulsen, L. A. Rapp, J. S. Segal, B. K. Sullivan, D. J. Townsend. 1991. Clean Fuels Report 91-06: EC-X Reformulated Gasoline Test Program Emissions Data. Arco Products Co., Anaheim, California.

Purpose of Study: Compare exhaust and evaporative emissions and reactivity from vehicles running on industry average base fuels and four reformulated gasoline test blends (15% MTBE). We analyzed data for test blends 1 and 2, which Arco stated were the most commercially feasible.

Vehicle Information: 10 1990 LDGVs and LDGTs with three-way and three-way plus oxidation catalysts, PFI and TBI, low-mileage.

- 6) Sigsby, John E., Silvestre Tejeda, William Ray, John M. Lang, and John W. Duncan. 1987. Volatile Organic Compound Emissions from 46 In-Use Passenger Cars. *Environ. Sci. Technol.* 21: 466-475.

Purpose of Study: Determine mass, detailed hydrocarbon, and aldehyde emissions from in-use vehicles running on gasoline. No 1,3-butadiene measurements were taken in this study.

Vehicle Information: 46 LDGVs with three-way, oxidation, three-way plus oxidation and no catalysts, PFI, TBI and carburetor fuel systems.

- 7) Smith, Lawrence R. 1981. Characterization of Exhaust Emissions from High Mileage Catalyst-Equipped Automobiles. U.S. Environmental Protection Agency, Ann Arbor, Michigan. (EPA-460/3-81-024)

Purpose of Study: Regulated and unregulated exhaust emissions, particularly aldehydes, were evaluated for high mileage LDGVs. Benzene, formaldehyde, and acetaldehyde were measured, but not 1,3-butadiene.

Vehicle Information: 10 LDGVs, with odometer readings ranging from 37,000 to 68,000 miles, were included in this study. 3 had three-way catalysts, while the rest had oxidation catalysts. We analyzed only the vehicles with oxidation catalysts. All were carbureted.

- 8) Springer, Karl J. 1979. Characterization of Sulfates, Odor, Smoke, POM and Particulates from Light and Heavy-Duty Engines -- Part IX. U.S. Environmental Protection Agency, Ann Arbor, Michigan. (EPA-460/3-79-007)

Purpose of Study: Regulated and unregulated exhaust emissions were compared for LDGVs, HDGVs, LDDVs and HDDVs, running on unleaded gasoline and no. 2 diesel fuel. Benzene, formaldehyde, and acetaldehyde were measured, but not 1,3-butadiene.

Vehicle Information: This study contained regulated and unregulated exhaust emissions data for 2 LDGVs with oxidation catalysts, one with fuel injection and one carbureted, 2LDDVs, 2 HDDVs, and 1 HDGV with no catalyst. Odometer readings for these vehicles were not available. We used data collected from all these vehicles in our analyses.

- 9) Springer, Karl J. 1977. Investigation of Diesel-Powered Vehicle Emissions VII. U.S. Environmental Agency, Ann Arbor, Michigan. (EPA-460/3-76-034)

Purpose of Study: Regulated exhaust emissions were measured for five diesel engine configurations, and both regulated and unregulated exhaust emissions were measured for 5 LDDVs. Benzene, formaldehyde, and acetaldehyde were measured for the LDDVs, but not 1,3-butadiene.

Vehicle Information: We analyzed data from the 5 LDDVs. All were low mileage vehicles, with odometer readings ranging from about 2000 to 10,000 miles.

- 10) Stump, Fred D., Kenneth T. Knapp and William D. Ray. 1990. Seasonal impact of blending oxygenated organics with gasoline on motor vehicle tailpipe and evaporative emissions. *J. Air Waste Manage. Assoc.* 40: 872-880.

Stump, Fred D., Kenneth T. Knapp, William D. Ray, Charles Burton and Richard Snow. 1990. The Seasonal Impact of Blending Oxygenated Organics with Gasoline on Motor Vehicle Tailpipe and Evaporative Emissions -- Part II. SAE 902129.

Purpose of Study: Speciated exhaust and evaporative emission rates were measured for vehicles running on MTBE (16.2% and 5.5%) and ethanol (8.1%) oxygenated fuel blends at several ambient temperatures.

Vehicle Information: Emissions were measured for two LDGVs with TBI and three-way catalysts. Mileage on both vehicles was about 30,000 miles. We only analyzed data for emissions using 8.1% EtOH.

- 11) Stump, Fred, Silvestre Tejada, William Ray, David Dropkin, Frank Black, Richard Snow, William Crews, Paula Siudak, C. O. Davis and Phillip Carter. 1990. The Influence of Ambient Temperature on Tailpipe Emissions from 1985-1987 Model Year Light-Duty Gasoline Vehicles -- II. *Atmospheric Environment* 24A: 2105-2112.

Stump, Fred, Silvestre Tejada, William Ray, David Dropkin, Frank Black, Richard Snow, William Crews, Paula Siudak, C. O. Davis, Linnie Baker and Ned Perry. 1989. The Influence of Ambient Temperature on Tailpipe Emissions from 1984 to 1987 Model Year Light-Duty Gasoline Vehicles. *Atmospheric Environment* 23: 307-320.

Purpose of Study: Speciated exhaust emissions data for vehicles running on summer and winter grade gasoline were measured at ambient temperatures ranging from about 70°C to 20°C.

Vehicle Information: 20 LDGVs were tested. 13 had three-way catalysts, 6 had three-way plus oxidation catalysts, and one had an oxidation catalyst. 8 had PFI, 4 had TBI, and 8 were carbureted. Mileage ranged from about 5,000 to 100,000. We only included 6 vehicles with three-way plus oxidation catalysts and one with an oxidation catalyst in our analysis.

- 12) Stump, Fred D., Kenneth T. Knapp, William D. Ray, Richard Snow and Charles Burton. The composition of Motor Vehicle Organic Emissions Under Elevated Temperature Summer Driving Conditions (75 to 105°F). Unpublished.

Purpose of Study: Speciated exhaust and evaporative emissions data for vehicles running on summer grade gasoline were measured at ambient temperatures of 75°F and 105°F.

Vehicle Information: The database used for this study consisted of 15 vehicles. 14 had three-way catalysts and one had a three-way plus oxidation catalyst. We only used data from the vehicle with a three-way plus oxidation catalyst, which was carbureted and had 39970 miles on the odometer.

- 13) Warner-Selph, Mary Ann, and Craig A. Harvey. 1990. Assessment of Unregulated Emissions from Gasoline Oxygenated Blends. SAE 902131.

Purpose of Study: Compare exhaust and evaporative emission data from tests using baseline gasoline, 10% ethanol, 16.4% MTBE and 19.1% ETBE to determine what statistically significant differences existed for a number of unregulated emissions.

Vehicle Information: 5 LDGVs were tested. 3 vehicles had three-way catalysts, one an oxidation catalyst, and one no catalyst. One had PFI, one TBI, and three were carbureted. Mileage ranged from about 5,000 to 80,000 miles.

- 14) Warner-Selph, Mary Ann, and Joseph DeVita. 1989. Measurements of Toxic Exhaust Emissions from Gasoline-Powered Light Duty Vehicles. SAE 892075.

Purpose of Study: Exhaust emission rates of toxics under California's air toxics program were measured for vehicles running on gasoline.

Vehicle Information: Toxics emissions were measured for two LDGVs, both with fuel injection. One had a three-way plus oxidation catalyst, while the other had a three-way catalyst. Mileage for both vehicles was between 20,000 and 30,000 miles.

- 15) Urban, Charles. 1980. Regulated and Unregulated Exhaust Emissions from Malfunctioning Non-Catalyst and Oxidation Catalyst Gasoline Automobiles. U.S. Environmental Protection Agency, Ann Arbor, Michigan. (EPA-460/3-80-003)

Urban, Charles. 1980. Regulated and Unregulated Exhaust Emissions from Malfunctioning Three-Way Catalyst Gasoline Automobiles. U.S. Environmental Protection Agency, Ann Arbor, Michigan. (EPA-460/3-80-004)

Urban, Charles. 1980. Regulated and Unregulated Exhaust Emissions from a Malfunctioning Three-Way Catalyst Gasoline Automobile. U.S. Environmental Protection Agency, Ann Arbor, Michigan. (EPA-460/3-8-005)

Urban, Charles. 1981. Unregulated Exhaust Emissions from Non-Catalyst Baseline Cars Under Malfunction Conditions. U.S. Environmental Protection Agency, Ann Arbor, Michigan. (EPA-460/3-81-020)

Purpose of Study: Regulated and unregulated exhaust emissions from LDGVs with various catalyst types running on unleaded gasoline were measured under properly functioning and malfunctioning conditions. Benzene, formaldehyde, and acetaldehyde were measured, but not 1,3-butadiene.

Vehicle Information: Emissions from 13 LDGVs running on unleaded gasoline were analyzed in these reports. 2 had three-way catalysts, 2 had three-way plus oxidation catalysts, 4 had oxidation catalysts and five had no catalysts. The remaining vehicle had a 1978 California emission control package. All these vehicles except one were carbureted. We analyzed data from the 2 three-way plus ox-cat, 4 ox-cat and 5 non-cat vehicles. Odometer readings for the vehicles were not given in the reports.

LDGV (3-WAY+OX-CAT -- FTP Data)

	Exhaust mg/mile						TOG, g/mile	Fraction of TOG					
	Methane	Ethane	Formaldehyde	Acetaldehyde	1,3-Butadiene	Benzene		Methane	Ethane	Formaldehyde	Acetaldehyde	1,3-Butadiene	Benzene
0% MTBE													
Urban, 1980b, 1980c (EPA-460/3-80-004, 005)													
41 1978 Pinto CARB	47.400	3.200	1.270	0.000	N.A.	3.060	0.11	0.4235	0.0286	0.0113	0.0000	N.A.	0.0273
1979 Marquis CARB	73.310	7.450	3.880	0.180	N.A.	7.440	0.21	0.3431	0.0349	0.0182	0.0008	N.A.	0.0348
Average	60.355	5.325	2.575	0.090		5.250	0.16	0.3833	0.0317	0.0148	0.0004		0.0311
Sigsby et al., 1987 (46 car study)													
3 1981 Chev Citation (Carb)	93.430	9.400	1.750	0.100	N.A.	11.230	0.30	0.3166	0.0319	0.0059	0.0003	N.A.	0.0381
8 1982 Mazda RX-7 (Carb)	242.490	35.280	18.100	6.520	N.A.	7.375	0.85	0.2837	0.0413	0.0212	0.0076	N.A.	0.0086
21 1982 Olds Delta 88 (Carb)	127.190	25.130	5.750	2.170	N.A.	11.224	0.52	0.2451	0.0484	0.0111	0.0042	N.A.	0.0216
28 1981 Merc Lynx (Carb)	160.480	22.400	6.570	2.880	N.A.	6.880	0.65	0.2464	0.0344	0.0101	0.0044	N.A.	0.0106
29 1981 VW Jetta (FI)	95.470	13.320	7.680	3.020	N.A.	10.080	0.54	0.1770	0.0247	0.0142	0.0056	N.A.	0.0187
30 1982 Chev Chevette (Carb)	98.140	6.790	6.570	2.430	N.A.	3.903	0.23	0.4194	0.0290	0.0281	0.0104	N.A.	0.0167
36 1981 Chev Citation (Carb)	102.340	20.800	9.750	3.100	N.A.	8.996	0.38	0.2718	0.0552	0.0259	0.0082	N.A.	0.0239
41 1981 Chev Citation (Carb)	85.290	15.460	1.350	0.860	N.A.	3.480	0.19	0.4412	0.0800	0.0070	0.0044	N.A.	0.0180
Average	125.604	18.573	7.190	2.635		7.896	0.46	0.3002	0.0431	0.0154	0.0057		0.0195
Stump et al., 1989, 1990 (MSERB Low Temp. Study All Carb)													
1986 Ford Mustang	126.900	29.000	24.900	7.030	0.200	21.800	1.13	0.1124	0.0257	0.0220	0.0062	0.0002	0.0193
1987 Nissan Sentra	46.310	2.570	6.250	0.450	0.050	4.810	0.16	0.2845	0.0158	0.0384	0.0028	0.0003	0.0295
1986 Dodge Omni	165.300	25.100	9.380	*	0.190	14.240	1.14	0.1451	0.0220	0.0082	N.A.	0.0002	0.0125
1987 Toyota Corolla	64.400	8.000	1.210	0.840	0.100	14.400	0.30	0.2182	0.0271	0.0041	0.0028	0.0003	0.0488
1986 Olds Cutlass Sup	158.100	31.900	1.500	0.830	0.200	4.400	0.36	0.4439	0.0896	0.0042	0.0023	0.0006	0.0124
1987 Chev Monte Carlo	132.200	38.700	5.800	2.300	0.500	20.800	0.55	0.2406	0.0704	0.0106	0.0042	0.0009	0.0379
Average	115.535	22.545	8.173	1.908	0.207	13.408	0.61	0.2408	0.0418	0.0146	0.0031	0.0004	0.0267
Stump et al., unpublished (MSERB High Temp. Study)													
1986 Chev Caprice (Carb)	103.880	27.430	23.520	15.280	4.280	22.530	1.36	0.0762	0.0201	0.0173	0.0112	0.0031	0.0165
Warner-Selph and DeVita, 1989 (CARB Toxics Study)													
1987 Ford Taurus (PFI)	N.A.	N.A.	2.100	1.080	0.770	15.000	0.32	N.A.	N.A.	0.0067	0.0034	0.0024	0.0476
Arco 91-03 (Unleaded Premium)													
1985 Ford Bronco (PFI)	157.200	30.100	8.800	5.000	0.700	27.800	0.66	0.2395	0.0459	0.0134	0.0076	0.0011	0.0424
1983 Ford Thunderbird (TBI)	397.200	54.460	26.970	9.250	8.040	105.180	2.68	0.1481	0.0203	0.0101	0.0035	0.0030	0.0392
1985 Chevrolet Camaro (Carb)	111.160	29.480	4.370	1.760	0.550	12.400	0.37	0.2993	0.0794	0.0118	0.0047	0.0015	0.0334
Average	221.853	38.013	13.380	5.337	3.097	48.460	1.24	0.2290	0.0485	0.0117	0.0053	0.0018	0.0383
Auto/Oil Study													
1989 Ford Mustang (SFI)	61.593	14.301	2.625	0.903	0.609	5.985	0.23	0.2632	0.0611	0.0112	0.0039	0.0026	0.0256
1985 Chevrolet Impala (Carb)	69.502	17.174	4.743	0.899	0.992	11.873	0.32	0.2203	0.0544	0.0150	0.0029	0.0031	0.0376
1984 Pontiac Grand Prix (Carb)	111.499	27.047	2.537	0.946	0.599	12.642	0.46	0.2435	0.0591	0.0055	0.0021	0.0013	0.0276
1985 Ford Tempo (TBI)	60.078	20.064	4.408	2.014	1.368	18.582	0.43	0.1406	0.0469	0.0103	0.0047	0.0032	0.0435
Average	75.668	19.647	3.578	1.191	0.892	12.271	0.36	0.2169	0.0554	0.0105	0.0034	0.0026	0.0336
AVERAGE**	115.634	20.582	7.671	2.794	0.766	15.444	0.58	0.2497	0.0418	0.0137	0.0043	0.0010	0.0277
9.0% MTBE													
Arco 91-03													
1985 Ford Bronco (PFI)	122.200	31.400	10.800	4.900	1.700	14.200	0.62	0.1977	0.0508	0.0175	0.0079	0.0027	0.0230
1983 Ford Thunderbird (TBI)	328.180	57.930	20.720	6.330	7.560	49.180	1.66	0.1982	0.0350	0.0125	0.0038	0.0046	0.0297
1985 Chevrolet Camaro (Carb)	115.350	32.530	7.120	2.770	0.750	12.570	0.45	0.2574	0.0726	0.0159	0.0062	0.0017	0.0280
1985 Chevrolet Camaro (Carb)	103.590	36.150	5.170	1.420	0.830	11.110	0.41	0.2514	0.0877	0.0125	0.0034	0.0020	0.0270
AVERAGE**	167.330	39.503	10.953	3.855	2.710	21.765	0.78	0.2262	0.0615	0.0146	0.0053	0.0028	0.0269
12.5% MTBE													
Arco 91-03													
1985 Chevrolet Camaro (Carb)	111.070	38.580	4.200	1.160	0.620	7.630	0.40	0.2789	0.0969	0.0105	0.0029	0.0016	0.0192

15.0% MTBE

Auto/Oil Study

1989 Ford Mustang (SFI)	59.641	12.996	3.629	1.064	0.513	6.023	0.21	0.2874	0.0626	0.0175	0.0051	0.0025	0.0290
1985 Chevrolet Impala (Carb)	68.520	16.950	3.330	0.750	1.020	12.390	0.31	0.2201	0.0545	0.0107	0.0024	0.0033	0.0398
1984 Pontiac Grand Prix (Carb)	108.224	25.042	3.686	1.064	0.494	12.274	0.42	0.2608	0.0603	0.0089	0.0026	0.0012	0.0296
1985 Ford Tempo (TBI)	57.645	18.305	4.900	1.295	1.295	17.290	0.40	0.1425	0.0452	0.0121	0.0032	0.0032	0.0427
AVERAGE**	73.508	18.323	3.886	1.043	0.831	11.994	0.33	0.2277	0.0557	0.0123	0.0033	0.0025	0.0353

* Acetaldehyde level (129.68 mg/mile) suspicious and not included.

**Data used in subsequent emission fractions calculations

01/28/1988

LDGV (3-WAY -- FTP Data)

	Exhaust mg/mile						TOG, g/mile	Fraction of TOG					
	Methane	Ethane	Formaldehyde	Acetaldehyde	1,3-Butadiene	Benzene		Methane	Ethane	Formaldehyde	Acetaldehyde	1,3-Butadiene	Benzene
0% MTBE													
Arco 91-02 (Unleaded Reg) All FI													
21 1989 Toyota Camry	26.320	4.780	3.520	1.060	1.220	12.240	0.20	0.1333	0.0242	0.0178	0.0054	0.0062	0.0620
22 1989 Pont. Grand Prix	44.120	8.460	7.400	3.420	1.570	17.550	0.26	0.1709	0.0328	0.0287	0.0132	0.0061	0.0680
23 1989 Ford Taurus	39.880	4.200	5.230	2.080	1.360	13.080	0.28	0.1432	0.0151	0.0188	0.0075	0.0049	0.0470
24 1989 Dodge Dynasty	50.560	9.670	5.960	3.240	3.640	22.810	0.53	0.0951	0.0182	0.0112	0.0061	0.0068	0.0429
25 1989 Nissan Maxima	27.380	5.110	3.870	1.500	2.210	11.340	0.27	0.1020	0.0190	0.0144	0.0056	0.0082	0.0423
Average	37.652	6.444	5.196	2.260	2.000	15.404	0.31	0.1289	0.0219	0.0182	0.0076	0.0064	0.0524
Arco 91-03 (Unleaded Premium)													
35 1988 Pontiac Grand Am (PFI)	8.100	2.600	3.200	2.500	0.400	8.900	0.15	0.0526	0.0169	0.0208	0.0162	0.0026	0.0578
37 1981 Oldsmobile Delta 88 (Carb)	251.630	29.280	22.730	9.980	11.540	84.710	1.71	0.1473	0.0171	0.0133	0.0058	0.0068	0.0496
39 1984 Honda Accord (Carb)	103.350	8.310	12.741	4.503	1.840	35.570	0.88	0.1173	0.0094	0.0145	0.0051	0.0021	0.0404
40 1987 Nissan 300ZX (PFI)	62.730	14.000	8.290	1.900	2.400	18.160	0.48	0.1318	0.0294	0.0174	0.0040	0.0050	0.0382
41 1988 Toyota 4WD Pickup (PFI)	61.270	7.130	2.850	0.730	1.050	24.310	0.48	0.1269	0.0148	0.0059	0.0015	0.0022	0.0503
42 1988 Toyota Celica (PFI)	40.250	5.680	1.200	0.800	0.600	12.800	0.32	0.1254	0.0177	0.0037	0.0025	0.0019	0.0399
44 1986 Mercedes 190E (PFI)	101.220	25.990	4.040	1.700	3.130	58.230	0.98	0.1036	0.0266	0.0041	0.0017	0.0032	0.0596
45 1989 Lincoln Continental (PFI)	67.700	11.570	3.480	0.900	1.120	32.250	0.55	0.1231	0.0210	0.0063	0.0016	0.0020	0.0587
46 1990 Plymouth Acclaim (PFI)	62.880	13.220	1.920	1.240	2.510	37.210	0.75	0.0839	0.0176	0.0026	0.0017	0.0034	0.0497
47 1984 Toyota Celica (PFI)	89.600	10.500	4.700	1.300	1.800	64.600	0.98	0.0912	0.0107	0.0048	0.0013	0.0018	0.0658
48 1985 Ford Mustang (Carb)	99.500	22.250	11.150	4.300	2.150	28.950	0.75	0.1328	0.0297	0.0149	0.0057	0.0029	0.0386
49 1987 Oldsmobile Regency (PFI)	76.800	15.300	1.100	1.500	1.400	56.000	0.86	0.0892	0.0178	0.0013	0.0017	0.0016	0.0651
56 1982 Nissan Maxima (PFI)	132.900	28.500	6.300	3.900	3.500	83.300	1.17	0.1136	0.0244	0.0054	0.0033	0.0030	0.0712
57 1986 Buick Park Avenue (PFI)	44.000	4.400	4.200	1.400	1.100	13.500	0.29	0.1525	0.0152	0.0146	0.0049	0.0038	0.0468
58 1989 Toyota Tercel (Carb)	29.700	3.200	1.000	0.700	0.600	12.100	0.22	0.1333	0.0144	0.0045	0.0031	0.0027	0.0543
59 1982 Buick Regal (Carb)	87.300	16.900	8.400	3.900	2.000	79.200	0.98	0.0893	0.0173	0.0086	0.0040	0.0020	0.0811
Average	82.433	13.677	6.081	2.578	2.321	40.612	0.72	0.1134	0.0188	0.0089	0.0040	0.0029	0.0542
Arco 91-06 (Ind. Avg. Baseline)													
350 1990 Ford Taurus (PFI)	55.520	6.740	1.100	1.030	2.510	24.200	0.43	0.1306	0.0158	0.0026	0.0024	0.0059	0.0569
351 1990 Toyota Camry (PFI)	24.190	4.330	0.510	0.470	1.750	9.270	0.21	0.1138	0.0204	0.0024	0.0022	0.0082	0.0436
352 1990 Plymouth Sundance (TBI)	31.790	4.920	0.540	0.350	1.340	17.130	0.21	0.1495	0.0231	0.0025	0.0016	0.0063	0.0806
353 1990 Honda Accord (PFI)	46.220	6.250	0.870	0.890	2.640	15.290	0.27	0.1691	0.0229	0.0032	0.0033	0.0097	0.0559
354 1990 Nissan Stanza (PFI)	48.370	9.690	1.320	0.840	3.330	26.790	0.36	0.1327	0.0266	0.0036	0.0023	0.0091	0.0735
355 1990 Pontiac Grand Am (PFI)	39.190	8.190	1.610	0.860	3.350	19.480	0.33	0.1173	0.0245	0.0048	0.0026	0.0100	0.0583
356 1990 Ford Crown Victoria (PFI)	54.220	7.950	1.260	0.700	0.920	13.550	0.35	0.1530	0.0224	0.0036	0.0020	0.0026	0.0382
357 1990 Plymouth Voyager (PFI)	61.500	10.830	3.280	1.880	3.320	39.030	0.62	0.0996	0.0175	0.0053	0.0030	0.0054	0.0632
358 1990 Nissan Pickup (PFI)	27.100	6.350	2.280	1.360	3.170	19.200	0.35	0.0765	0.0179	0.0064	0.0038	0.0089	0.0542
359 1990 Buick LeSabre (PFI)	40.260	6.510	1.010	0.570	1.460	15.590	0.28	0.1420	0.0230	0.0036	0.0020	0.0051	0.0550
Average	42.836	7.176	1.378	0.895	2.379	19.953	0.34	0.1284	0.0214	0.0038	0.0025	0.0071	0.0579
Auto/Oil Study*													
1989 Plymouth Sundance (TBI)	24.692	4.294	1.697	1.365	0.461	9.040	0.12	0.2074	0.0361	0.0143	0.0115	0.0039	0.0759
1989 Dodge Shadow (PFI)	26.489	2.853	1.810	1.390	0.639	7.359	0.13	0.2009	0.0216	0.0137	0.0105	0.0048	0.0558
1989 Ford Taurus (PFI)	28.179	2.931	1.033	0.528	0.602	9.189	0.17	0.1705	0.0177	0.0063	0.0032	0.0036	0.0556
1989 Ford Aerostar (PFI)	60.646	9.694	0.605	0.720	0.656	18.875	0.30	0.1989	0.0318	0.0020	0.0024	0.0022	0.0619
1989 Toyota Camry (PFI)	17.102	3.176	0.778	0.829	0.696	7.974	0.15	0.1153	0.0214	0.0052	0.0056	0.0047	0.0538
1989 Honda Accord (Carb)	39.561	2.854	0.912	1.249	1.214	6.693	0.18	0.2214	0.0160	0.0051	0.0070	0.0068	0.0375
1989 Chevrolet Suburban (TBI)	51.843	12.142	4.240	2.462	1.913	29.348	0.46	0.1136	0.0266	0.0093	0.0054	0.0042	0.0643
1989 Pontiac Grand Am (PFI)	22.918	3.437	1.962	1.133	1.268	6.963	0.17	0.1377	0.0207	0.0118	0.0068	0.0076	0.0418
1989 Oldsmobile Delta 88 (SFI)	22.169	1.651	1.146	0.762	0.528	7.965	0.12	0.1879	0.0140	0.0097	0.0065	0.0045	0.0675
Average	32.622	4.781	1.576	1.160	0.886	11.490	0.20	0.1726	0.0229	0.0086	0.0065	0.0047	0.0571
AVERAGE (All 38 vehicles)**	55.729	9.146	3.781	1.799	1.973	25.744	0.46	0.1324	0.0207	0.0087	0.0047	0.0048	0.0556
CARB Butadiene Study (55 vehicles)												0.0060	
Average												0.0055	

5.5% MTBE (EC-1)

Arco 91-02 All FI

21 1989 Toyota Camry	26.550	5.830	1.520	1.000	0.960	5.880	0.20	0.1335	0.0293	0.0076	0.0050	0.0048	0.0296
22 1989 Pont. Grand Prix	57.820	14.050	7.880	3.400	1.550	10.470	0.26	0.2223	0.0540	0.0303	0.0131	0.0060	0.0403
23 1989 Ford Taurus	43.780	5.360	3.780	1.950	1.380	9.880	0.28	0.1561	0.0191	0.0135	0.0070	0.0049	0.0352
24 1989 Dodge Dynasty	60.730	13.240	6.290	2.960	3.530	12.380	0.54	0.1134	0.0247	0.0117	0.0055	0.0066	0.0231
25 1989 Nissan Maxima	32.210	6.440	6.230	2.930	2.250	4.790	0.27	0.1192	0.0238	0.0231	0.0108	0.0083	0.0177
AVERAGE**	44.218	8.984	5.140	2.448	1.934	8.680	0.31	0.1489	0.0302	0.0172	0.0083	0.0061	0.0292

9.0% MTBE

Arco 91-03

35 1988 Pontiac Grand Am (PFI)	26.600	4.100	1.500	1.400	0.900	6.500	0.14	0.1855	0.0286	0.0105	0.0098	0.0063	0.0453
35 1988 Pontiac Grand Am (PFI)	21.850	5.750	4.550	1.800	1.250	6.950	0.15	0.1471	0.0387	0.0306	0.0121	0.0084	0.0468
37 1981 Oldsmobile Delta 88 (Carb)	216.750	31.700	24.210	9.280	11.840	44.220	1.34	0.1613	0.0236	0.0180	0.0069	0.0088	0.0329
37 1981 Oldsmobile Delta 88 (Carb)	303.870	37.070	32.860	10.850	17.680	64.290	1.98	0.1533	0.0187	0.0166	0.0055	0.0089	0.0324
39 1984 Honda Accord (Carb)	90.720	9.190	1.410	1.080	2.010	14.010	0.49	0.1845	0.0187	0.0029	0.0022	0.0041	0.0285
39 1984 Honda Accord (Carb)	83.530	9.410	2.190	1.130	2.260	13.490	0.49	0.1717	0.0193	0.0045	0.0023	0.0046	0.0277
40 1987 Nissan 300ZX (PFI)	66.450	17.240	8.500	2.190	3.100	13.790	0.40	0.1642	0.0426	0.0210	0.0054	0.0077	0.0341
40 1987 Nissan 300ZX (PFI)	67.560	12.920	3.160	1.030	4.030	13.640	0.42	0.1608	0.0308	0.0075	0.0025	0.0096	0.0325
41 1988 Toyota 4WD Pickup (PFI)	68.590	8.570	1.530	0.890	1.960	20.420	0.47	0.1471	0.0184	0.0033	0.0019	0.0042	0.0438
41 1988 Toyota 4WD Pickup (PFI)	52.070	8.070	2.380	0.640	1.710	12.060	0.35	0.1473	0.0228	0.0067	0.0018	0.0048	0.0341
42 1988 Toyota Celica (PFI)	45.720	7.410	2.600	0.620	1.130	10.470	0.29	0.1566	0.0254	0.0089	0.0021	0.0039	0.0359
42 1988 Toyota Celica (PFI)	46.660	7.690	1.070	0.580	1.060	9.620	0.31	0.1503	0.0248	0.0034	0.0019	0.0034	0.0310
44 1986 Mercedes 190E (PFI)	95.980	25.360	3.340	2.070	4.710	38.170	0.87	0.1102	0.0291	0.0038	0.0024	0.0054	0.0438
44 1986 Mercedes 190E (PFI)	86.390	24.460	2.920	1.440	4.340	31.570	0.79	0.1095	0.0310	0.0037	0.0018	0.0055	0.0400
45 1989 Lincoln Continental (PFI)	72.610	13.520	1.670	0.970	1.780	22.060	0.50	0.1461	0.0272	0.0034	0.0020	0.0036	0.0444
45 1989 Lincoln Continental (PFI)	57.060	11.090	0.860	0.610	1.660	15.330	0.35	0.1614	0.0314	0.0024	0.0017	0.0047	0.0434
46 1990 Plymouth Acclaim (PFI)	64.470	13.820	2.450	1.370	3.860	25.280	0.67	0.0961	0.0206	0.0037	0.0020	0.0058	0.0377
46 1990 Plymouth Acclaim (PFI)	53.880	12.990	2.670	1.010	3.570	18.440	0.49	0.1107	0.0267	0.0055	0.0021	0.0073	0.0379
47 1984 Toyota Celica (PFI)	103.800	13.000	4.000	2.200	2.100	51.600	0.81	0.1275	0.0160	0.0049	0.0027	0.0026	0.0634
47 1984 Toyota Celica (PFI)	108.650	15.150	3.800	2.050	1.600	42.600	0.80	0.1351	0.0188	0.0047	0.0025	0.0020	0.0530
48 1985 Ford Mustang (Carb)	96.350	24.500	17.450	6.700	2.700	17.000	0.65	0.1479	0.0376	0.0268	0.0103	0.0041	0.0261
48 1985 Ford Mustang (Carb)	74.300	25.250	13.950	5.200	1.950	24.750	0.72	0.1036	0.0352	0.0195	0.0073	0.0027	0.0345
49 1987 Oldsmobile Regency (PFI)	63.800	11.250	1.850	1.250	1.750	34.700	0.62	0.1024	0.0181	0.0030	0.0020	0.0028	0.0557
56 1982 Nissan Maxima (PFI)	55.000	7.000	9.200	4.100	1.800	60.200	1.01	0.0545	0.0069	0.0091	0.0041	0.0018	0.0597
57 1986 Buick Park Avenue (PFI)	32.900	2.900	2.600	0.900	1.000	8.600	0.26	0.1259	0.0111	0.0100	0.0034	0.0038	0.0329
57 1986 Buick Park Avenue (PFI)	46.550	6.850	4.400	1.450	1.200	8.750	0.25	0.1855	0.0273	0.0175	0.0058	0.0048	0.0349
58 1989 Toyota Tercel (Carb)	32.900	2.900	2.600	0.900	1.000	8.600	0.20	0.1647	0.0145	0.0130	0.0045	0.0050	0.0431
58 1989 Toyota Tercel (Carb)	32.550	3.950	1.100	0.800	0.850	9.650	0.18	0.1816	0.0220	0.0061	0.0045	0.0047	0.0538
59 1982 Buick Regal (Carb)	89.900	20.600	10.900	2.900	3.100	63.600	0.82	0.1097	0.0251	0.0133	0.0035	0.0038	0.0776
AVERAGE**	77.843	13.576	5.921	2.324	3.031	24.495	0.58	0.1415	0.0245	0.0098	0.0040	0.0050	0.0416

12.5% MTBE

Arco 91-03

35 1988 Pontiac Grand Am (PFI)	38.350	5.800	4.750	1.850	1.100	7.150	0.15	0.2570	0.0389	0.0318	0.0124	0.0074	0.0479
37 1981 Oldsmobile Delta 88 (Carb)	314.750	38.790	27.280	8.660	14.980	53.670	2.01	0.1568	0.0193	0.0136	0.0043	0.0075	0.0267
39 1984 Honda Accord (Carb)	89.680	10.710	3.410	1.280	2.140	11.290	0.48	0.1874	0.0224	0.0071	0.0027	0.0045	0.0236
40 1987 Nissan 300ZX (PFI)	68.710	12.900	3.520	1.020	3.960	9.680	0.38	0.1829	0.0343	0.0094	0.0027	0.0105	0.0258
41 1988 Toyota 4WD Pickup (PFI)	56.350	8.210	1.580	0.680	1.850	8.980	0.33	0.1685	0.0245	0.0047	0.0020	0.0055	0.0268
42 1988 Toyota Celica (PFI)	42.830	7.260	1.810	0.620	1.010	8.430	0.30	0.1435	0.0243	0.0061	0.0021	0.0034	0.0282
44 1986 Mercedes 190E (PFI)	91.630	25.590	3.480	1.450	3.710	23.390	0.71	0.1296	0.0362	0.0049	0.0021	0.0052	0.0331
45 1989 Lincoln Continental (PFI)	68.120	10.770	1.070	0.670	1.570	12.230	0.38	0.1789	0.0283	0.0028	0.0018	0.0041	0.0321
46 1990 Plymouth Acclaim (PFI)	48.100	13.030	2.270	1.030	3.300	13.310	0.43	0.1113	0.0301	0.0053	0.0024	0.0076	0.0308
47 1984 Toyota Celica (PFI)	94.600	12.950	3.200	1.850	2.900	24.600	0.64	0.1483	0.0203	0.0050	0.0029	0.0045	0.0386
48 1985 Ford Mustang (Carb)	77.200	27.750	14.600	5.550	2.050	14.950	0.68	0.1137	0.0409	0.0215	0.0082	0.0030	0.0220
57 1986 Buick Park Avenue (PFI)	59.550	6.000	4.150	1.500	1.400	8.350	0.23	0.2572	0.0259	0.0179	0.0065	0.0060	0.0361
58 1989 Toyota Tercel (Carb)	30.350	3.300	1.450	0.850	0.900	6.200	0.15	0.1966	0.0214	0.0094	0.0055	0.0058	0.0402

AVERAGE**	83.094	14.082	5.582	2.078	3.144	15.556	0.53	0.1717	0.0282	0.0107	0.0043	0.0058	0.0317
15.0% MTBE													
Arco 91-06 (Test Blend 1)													
350 1990 Ford Taurus (PFI)	59.730	6.930	1.550	0.840	1.810	10.820	0.31	0.1928	0.0224	0.0050	0.0027	0.0058	0.0349
351 1990 Toyota Camry (PFI)	23.290	2.950	0.510	0.380	1.240	5.510	0.17	0.1410	0.0179	0.0031	0.0023	0.0075	0.0334
352 1990 Plymouth Sundance (TBI)	26.090	3.240	1.040	0.160	0.520	4.840	0.13	0.1944	0.0241	0.0077	0.0012	0.0039	0.0361
353 1990 Honda Accord (PFI)	49.430	6.330	1.660	0.490	1.900	7.300	0.20	0.2520	0.0323	0.0085	0.0025	0.0097	0.0372
354 1990 Nissan Stanza (PFI)	52.280	5.930	1.440	0.620	1.870	10.640	0.25	0.2110	0.0239	0.0058	0.0025	0.0075	0.0429
355 1990 Pontiac Grand Am (PFI)	36.120	6.250	1.720	0.770	2.420	8.670	0.24	0.1521	0.0263	0.0072	0.0032	0.0102	0.0365
356 1990 Ford Crown Victoria (PFI)	54.030	7.740	1.120	0.590	0.770	9.040	0.23	0.2379	0.0341	0.0049	0.0026	0.0034	0.0398
357 1990 Plymouth Voyager (PFI)	51.000	7.170	1.740	2.410	2.040	8.330	0.35	0.1453	0.0204	0.0050	0.0069	0.0058	0.0237
358 1990 Nissan Pickup (PFI)	24.770	3.720	3.330	1.080	2.150	10.640	0.28	0.0889	0.0133	0.0119	0.0039	0.0077	0.0382
359 1990 Buick LeSabre (PFI)	28.660	3.240	1.390	0.460	1.130	8.740	0.19	0.1542	0.0174	0.0075	0.0025	0.0061	0.0470
Average	40.540	5.350	1.550	0.780	1.585	8.453	0.23	0.1770	0.0232	0.0067	0.0030	0.0068	0.0370
Arco 91-06 (Test Blend 2)													
350 1990 Ford Taurus (PFI)	54.010	4.420	1.660	0.800	1.780	11.970	0.30	0.1804	0.0148	0.0055	0.0027	0.0059	0.0400
351 1990 Toyota Camry (PFI)	24.910	2.910	0.630	0.440	1.020	10.170	0.18	0.1419	0.0166	0.0036	0.0025	0.0058	0.0579
352 1990 Plymouth Sundance (TBI)	30.850	3.570	0.900	0.370	0.580	5.970	0.13	0.2298	0.0266	0.0067	0.0028	0.0043	0.0445
353 1990 Honda Accord (PFI)	52.300	5.020	1.400	0.470	1.450	7.800	0.20	0.2666	0.0256	0.0071	0.0024	0.0074	0.0398
354 1990 Nissan Stanza (PFI)	59.300	8.360	1.450	1.450	2.170	11.030	0.30	0.1981	0.0279	0.0048	0.0048	0.0072	0.0368
355 1990 Pontiac Grand Am (PFI)	39.740	6.230	1.690	0.530	2.510	9.850	0.25	0.1604	0.0251	0.0068	0.0021	0.0101	0.0398
356 1990 Ford Crown Victoria (PFI)	67.940	5.930	0.980	0.310	0.780	7.280	0.25	0.2742	0.0239	0.0040	0.0013	0.0031	0.0294
357 1990 Plymouth Voyager (PFI)	52.900	8.410	2.670	1.030	2.390	14.020	0.38	0.1385	0.0220	0.0070	0.0027	0.0063	0.0367
358 1990 Nissan Pickup (PFI)	25.120	3.780	3.050	1.020	2.460	11.650	0.27	0.0936	0.0141	0.0114	0.0038	0.0092	0.0434
359 1990 Buick LeSabre (PFI)	24.820	3.710	1.170	0.490	0.800	12.400	0.15	0.1603	0.0240	0.0076	0.0032	0.0052	0.0801
Average	43.189	5.234	1.560	0.691	1.594	10.214	0.24	0.1844	0.0221	0.0065	0.0028	0.0065	0.0448
Auto/Oil Study													
1989 Plymouth Sundance (TBI)	20.860	2.870	0.800	0.440	0.450	7.880	0.12	0.1684	0.0232	0.0065	0.0036	0.0036	0.0636
1989 Dodge Shadow (PFI)	25.900	2.618	0.924	0.630	0.980	8.918	0.18	0.1476	0.0149	0.0053	0.0036	0.0056	0.0508
1989 Ford Taurus (PFI)	28.713	3.468	1.190	0.731	0.782	10.438	0.21	0.1391	0.0168	0.0058	0.0035	0.0038	0.0505
1989 Ford Aerostar (PFI)	55.356	8.456	1.344	0.980	1.204	19.040	0.33	0.1676	0.0256	0.0041	0.0030	0.0036	0.0576
1989 Toyota Camry (PFI)	17.199	3.159	1.677	0.455	0.637	7.930	0.18	0.0980	0.0180	0.0096	0.0026	0.0036	0.0452
1989 Honda Accord (Carb)	39.480	2.296	1.610	0.798	0.840	5.292	0.17	0.2390	0.0139	0.0097	0.0048	0.0051	0.0320
1989 Chevrolet Suburban (TBI)	56.870	11.891	5.687	2.820	1.833	34.357	0.52	0.1102	0.0230	0.0110	0.0055	0.0036	0.0666
1989 Pontiac Grand Am (PFI)	21.045	3.045	1.995	1.080	1.425	7.620	0.18	0.1199	0.0173	0.0114	0.0062	0.0081	0.0434
1989 Oldsmobile Delta 88 (SFI)	21.024	2.496	1.908	0.660	0.792	8.052	0.14	0.1455	0.0173	0.0132	0.0046	0.0055	0.0557
Average	31.827	4.478	1.904	0.955	0.994	12.170	0.22	0.1483	0.0189	0.0085	0.0041	0.0047	0.0517
AVERAGE (All vehicles)**	38.750	5.039	1.663	0.804	1.405	10.214	0.23	0.1706	0.0215	0.0072	0.0033	0.0060	0.0443

*Only data for fuel A considered.

**Data used in subsequent emission fractions calculations

09/15/1987

LDGV (Carb -- FTP Data)

	Diurnal Evap (mg/test)			Fraction of THC		Hot Soak Evap (mg/test)			Fraction of THC	
	MTBE*	Benzene	THC (g/test)	MTBE	Benzene	MTBE*	Benzene	THC (g/test)	MTBE	Benzene
0% MTBE										
Arco 91-03 (Unleaded Premium)										
37 1981 Olsmobile Delta 88 (TWC)	25.070	94.370	12.427	0.0020	0.0076	0.000	167.210	5.970	0.0000	0.0280
39 1984 Honda Accord (TWC)	23.450	19.580	0.516	0.0455	0.0380	20.680	48.910	0.817	0.0253	0.0599
48 1985 Ford Mustang (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
58 1989 Toyota Tercel (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
59 1982 Buick Regal (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
43 1985 Chevrolet Camaro (TWC + OX)	201.750	47.710	3.133	0.0644	0.0152	436.560	121.150	10.321	0.0423	0.0117
Average	41.712	26.943	2.679	0.0186	0.0101	76.207	56.212	2.851	0.0113	0.0166
Auto/Oil Study										
1989 Honda Accord (Carb)**	0.000	13.320	1.470	0.0000	0.0091	0.000	34.850	1.560	0.0000	0.0223
1985 Plymouth Reliant (TWC)	1.232	10.010	0.770	0.0016	0.0130	7.224	33.927	1.290	0.0056	0.0263
1985 Honda Accord (TWC)	1.188	8.856	0.270	0.0044	0.0328	1.975	22.436	0.790	0.0025	0.0284
1985 Chevrolet Impala (TWC + OX)	1.610	11.109	1.610	0.0010	0.0069	4.263	25.491	0.870	0.0049	0.0293
1984 Pontiac Grand Prix (TWC + OX)	6.540	8.938	1.090	0.0060	0.0082	5.688	42.660	1.580	0.0036	0.0270
1984 Chevrolet Suburban (OX)	1.440	14.220	1.800	0.0008	0.0079	5.922	25.756	0.940	0.0063	0.0274
1983 Ford F-150 (OX)	4.275	21.150	0.750	0.0057	0.0282	10.416	39.556	1.240	0.0084	0.0319
Average	2.326	12.515	1.109	0.0028	0.0152	5.070	32.097	1.181	0.0045	0.0275
Stump et al., unpublished (MSERB High Temp. Study)										
1986 Chev Caprice (TWC + OX)	0.000	5.700	0.756	0.0000	0.0075	0.000	19.100	1.772	0.0000	0.0108
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)										
1977 Mercury Marquis (OX)	41.000	27.670	5.300	0.0077	0.0052	27.170	87.670	14.000	0.0019	0.0063
1974 Chevy Impala (Non-cat)	0.330	31.330	3.330	0.0001	0.0094	3.000	47.000	2.620	0.0011	0.0179
Average	20.665	29.500	4.315	0.0039	0.0073	15.085	67.335	8.310	0.0015	0.0121
AVERAGE (All vehicles)***	20.526	20.043	2.117	0.0093	0.0120	34.860	45.391	2.814	0.0068	0.0203
9.0% MTBE										
Arco 91-03										
37 1981 Olsmobile Delta 88 (TWC)	529.930	50.480	7.109	0.0745	0.0071	577.410	59.490	3.358	0.1720	0.0177
37 1981 Olsmobile Delta 88 (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
39 1984 Honda Accord (TWC)	48.190	13.190	0.450	0.1072	0.0293	79.920	27.880	0.749	0.1068	0.0372
39 1984 Honda Accord (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
48 1985 Ford Mustang (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
48 1985 Ford Mustang (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
58 1989 Toyota Tercel (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
58 1989 Toyota Tercel (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
59 1982 Buick Regal (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
43 1985 Chevrolet Camaro (TWC + OX)	226.500	44.950	1.987	0.1140	0.0226	573.120	112.450	6.779	0.0845	0.0166
Average***	80.462	10.862	0.955	0.0296	0.0059	123.045	19.982	1.089	0.0363	0.0072

15.0% MTBE

Auto/Oil Study

1989 Honda Accord (TWC)	122.130	13.570	1.150	0.1062	0.0118	288.288	32.592	1.680	0.1716	0.0194
1985 Plymouth Reliant (TWC)	115.368	11.088	0.880	0.1311	0.0126	408.360	56.334	2.460	0.1660	0.0229
1985 Honda Accord (TWC)	30.591	8.910	0.330	0.0927	0.0270	169.983	24.442	1.010	0.1683	0.0242
1985 Chevrolet Impala (TWC + OX)	120.897	9.918	1.710	0.0707	0.0058	143.152	26.588	0.920	0.1556	0.0289
1984 Pontiac Grand Prix (TWC + OX)	116.035	11.155	1.150	0.1009	0.0097	132.388	25.208	0.920	0.1439	0.0274
1984 Chevrolet Suburban (OX)	242.109	15.876	1.890	0.1281	0.0084	116.964	28.188	1.080	0.1083	0.0261
1983 Ford F-150 (OX)	106.400	19.040	0.800	0.1330	0.0238	178.976	37.128	1.360	0.1316	0.0273
Average***	121.933	12.794	1.130	0.1090	0.0142	205.444	32.926	1.347	0.1493	0.0252

16.4% MTBE

Warner-Selph and Smith, 1991 (EPA-460/3-91-02)

1977 Mercury Marquis (OX)	228.000	18.000	3.600	0.0633	0.0050	1762.670	136.330	15.800	0.1116	0.0086
1974 Chevy Impala (Non-cat)	240.000	22.330	2.400	0.1000	0.0093	537.330	49.000	3.770	0.1425	0.0130
Average***	234.000	20.165	3.000	0.0817	0.0072	1150.000	92.665	9.785	0.1270	0.0108

*Evaporative MTBE emissions in fuels with 0% MTBE is likely due to carryover from tests done on MTBE blends.

**Only data for fuel A considered.

***Data used in subsequent emission fractions calculations.

01/28/1988

	DIURNAL					HOT SOAK				
	Evap (mg/test)		THC (g/test)	Fraction of THC		Evap (mg/test)		THC (g/test)	Fraction of THC	
	Ethanol	Benzene		Ethanol	Benzene	Ethanol	Benzene		Ethanol	Benzene
LDGV -- CARB										
E0										
Auto/Oil (Fuel A/Industry Avg.)										
1989 Accord Sedan (TWC)	N.A.	9.31	0.95		0.0098	0.00	25.66	0.91	0.0000	0.0282
E10										
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)										
1983 Buick Regal (TWC)	65.00	12.00	1.29	0.0504	0.0093	234.67	39.67	1.55	0.1514	0.0256
1977 Mercury Marquis (Oxy)	246.67	37.33	5.80	0.0425	0.0064	1230.00	86.33	20.70	0.0594	0.0042
1974 Chevy Impala (Noncat)	106.00	29.00	2.44	0.0434	0.0119	173.67	44.00	3.61	0.0481	0.0122
Average	139.22	26.11	3.18	0.0455	0.0092	546.11	56.67	8.62	0.0863	0.0140
Auto/Oil (Fuel X/Industry Avg. + 10% EtOH, 10 RVP)										
1989 Accord Sedan (TWC)	143.22	11.11	1.10	0.1302	0.0101	303.03	40.53	2.10	0.1443	0.0193
Auto/Oil (Fuel W/Industry Avg. + 10% EtOH, 9 RVP)										
1989 Accord Sedan (TWC)	150.18	12.58	1.04	0.1444	0.0121	281.39	39.95	1.93	0.1458	0.0207
Auto/Oil (Fuel U/low ole., low T90, low arom., 10% EtOH, 10 RVP)										
1989 Accord Sedan (TWC)	24.10	11.64	1.03	0.0234	0.0113	294.12	38.02	1.97	0.1493	0.0193
Auto/Oil (Fuel T/low ole., low T90, low arom., 10% EtOH, 9 RVP)										
1989 Accord Sedan (TWC)	0.00	11.40	0.82	0.0000	0.0139	108.16	40.80	1.60	0.0676	0.0255
Average*	105.02	17.87	1.93	0.0621	0.0107	375.01	47.04	4.78	0.1094	0.0181
LDGV -- TBI										
E0										
Auto/Oil (Fuel A/Industry Avg.)										
1989 Plymouth Sundance (TWC)	N.A.	5.68	0.66		0.0086	N.A.	5.72	0.10		0.0572
1989 Dodge Shadow (TWC)	N.A.	7.52	0.66		0.0114	N.A.	7.75	0.17		0.0456
1989 Chevy Suburban (TWC)	N.A.	9.88	0.40		0.0247	N.A.	16.34	0.36		0.0454
Average*		7.69	0.57		0.0149		9.94	0.21		0.0494
8.1% EtOH										
Stump et al., 1990 (MSERB Oxyfuels Study)										
CO665 1988 Chevy Corsica (TWC)	2.70	3.40	0.50	0.0054	0.0068	0.00	6.70	0.21	0.0000	0.0319
CO322 1987 Chevy Corsica (TWC)	10.30	4.70	0.46	0.0224	0.0102	12.40	4.70	0.17	0.0729	0.0276
Average*	6.50	4.05	0.48	0.0139	0.0085	6.20	5.70	0.19	0.0365	0.0298

	Evap (mg/test)			Fraction of THC		Evap (mg/test)			Fraction of THC	
	Ethanol	Benzene	THC (g/test)	Ethanol	Benzene	Ethanol	Benzene	THC (g/test)	Ethanol	Benzene
E10										
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)										
1990 Chevy Lumina (TWC)	20.00	3.67	0.38	0.0526	0.0097	20.33	10.67	0.29	0.0701	0.0368
Auto/Oil (Fuel X/Industry Avg. + 10% EtOH, 10 RVP)										
1989 Plymouth Sundance (TWC)	70.53	10.86	0.77	0.0916	0.0141	70.62	11.46	0.30	0.2354	0.0382
1989 Dodge Shadow (TWC)	13.44	2.10	0.35	0.0384	0.0060	38.26	5.48	0.20	0.1913	0.0274
1989 Chevy Suburban (TWC)	59.89	15.28	0.59	0.1015	0.0259	68.81	16.02	0.45	0.1529	0.0356
Average	47.95	9.41	0.57	0.0772	0.0153	59.23	10.99	0.32	0.1932	0.0337
Auto/Oil (Fuel W/Industry Avg. + 10% EtOH, 9 RVP)										
1989 Plymouth Sundance (TWC)	49.08	10.99	0.41	0.1197	0.0268	75.42	11.33	0.32	0.2357	0.0354
1989 Dodge Shadow (TWC)	7.38	2.65	0.18	0.0410	0.0147	9.41	5.52	0.14	0.0672	0.0394
1989 Chevy Suburban (TWC)	44.62	16.68	0.67	0.0666	0.0249	60.14	15.55	0.48	0.1253	0.0324
Average	33.69	10.11	0.42	0.0758	0.0221	48.33	10.80	0.31	0.1427	0.0357
Auto/Oil (Fuel U/low ole., low T90, low arom., 10% EtOH, 10 RVP)										
1989 Plymouth Sundance (TWC)	37.03	5.30	0.22	0.1683	0.0241	44.77	9.26	0.26	0.1722	0.0356
1989 Dodge Shadow (TWC)	8.88	1.63	0.25	0.0355	0.0065	45.25	6.93	0.18	0.2514	0.0385
1989 Chevy Suburban (TWC)	31.35	10.78	0.55	0.0570	0.0196	72.48	22.75	0.62	0.1169	0.0367
Average	25.75	5.90	0.34	0.0869	0.0167	54.17	12.98	0.35	0.1802	0.0369
Auto/Oil (Fuel T/low ole., low T90, low arom., 10% EtOH, 9 RVP)										
1989 Plymouth Sundance (TWC)	24.89	8.57	0.51	0.0488	0.0168	37.70	10.58	0.24	0.1571	0.0441
1989 Dodge Shadow (TWC)	10.04	1.65	0.15	0.0669	0.0110	25.09	5.40	0.13	0.1930	0.0415
1989 Chevy Suburban (TWC)	23.30	8.47	0.24	0.0971	0.0353	32.19	17.92	0.41	0.0785	0.0437
Average	19.41	6.23	0.30	0.0709	0.0210	31.66	11.30	0.26	0.1429	0.0431
Average (All E10)*	30.80	7.59	0.41	0.0758	0.0181	46.19	11.45	0.31	0.1575	0.0373

LDGV -- PFI

E0

Auto/Oil (Fuel A/Industry Avg.)										
1989 Ford Mustang (TWC)	N.A.	3.92	0.53		0.0074	N.A.	3.46	0.05		0.0692
1989 Ford Taurus (TWC)	N.A.	5.93	0.15		0.0395	N.A.	10.01	0.19		0.0527
1989 Ford Aerostar (TWC)	N.A.	14.04	0.35		0.0401	N.A.	26.11	0.68		0.0384
1989 Camry Sedan (TWC)	N.A.	3.12	0.24		0.0130	N.A.	12.83	0.27		0.0475
1989 Pontiac Grand Am (TWC)	N.A.	7.28	0.28		0.0260	N.A.	17.36	0.33		0.0526
1989 Oldsmobile Delta 88 (TWC)	N.A.	8.82	0.45		0.0196	N.A.	11.48	0.28		0.0410
Average*		7.18	0.33		0.0243		13.54	0.30		0.0502

	Evap (mg/test)			Fraction of THC		Evap (mg/test)			Fraction of THC	
	Ethanol	Benzene	THC (g/test)	Ethanol	Benzene	Ethanol	Benzene	THC (g/test)	Ethanol	Benzene

E10

Warner-Selph and Smith, 1991 (EPA-460/3-91-02)

1990 Ford Probe (TWC)	19.50	5.50	0.12	0.1625	0.0458	92.50	12.50	0.30	0.3083	0.0417
Auto/Oil (Fuel X/Industry Avg. + 10% EtOH, 10 RVP)										
1989 Ford Mustang (TWC)	13.71	3.90	0.30	0.0457	0.0130	19.02	5.40	0.11	0.1729	0.0491
1989 Ford Taurus (TWC)	59.55	6.34	0.16	0.3722	0.0396	211.15	17.38	0.55	0.3839	0.0316
1989 Ford Aerostar (TWC)	60.53	20.24	0.57	0.1062	0.0355	171.91	37.51	1.14	0.1508	0.0329
1989 Camry Sedan (TWC)	37.03	3.80	0.25	0.1481	0.0152	57.39	10.47	0.29	0.1979	0.0361
1989 Pontiac Grand Am (TWC)	41.18	9.14	0.36	0.1144	0.0254	68.17	16.81	0.39	0.1748	0.0431
1989 Oldsmobile Delta 88 (TWC)	18.76	6.56	0.29	0.0647	0.0226	22.30	9.89	0.32	0.0697	0.0309
Average	38.46	8.33	0.32	0.1419	0.0252	91.66	16.24	0.47	0.1917	0.0373

Auto/Oil (Fuel W/Industry Avg. + 10% EtOH, 9 RVP)

1989 Ford Mustang (TWC)	0.00	2.63	0.09	0.0000	0.0292	43.18	7.51	0.17	0.2540	0.0442
1989 Ford Taurus (TWC)	15.56	5.41	0.13	0.1197	0.0416	179.82	15.70	0.47	0.3826	0.0334
1989 Ford Aerostar (TWC)	45.50	17.91	0.45	0.1011	0.0398	129.64	41.82	1.02	0.1271	0.0410
1989 Camry Sedan (TWC)	17.45	4.64	0.13	0.1342	0.0357	54.50	0.00	0.35	0.1557	0.0000
1989 Pontiac Grand Am (TWC)	17.54	7.71	0.21	0.0835	0.0367	38.01	16.28	0.31	0.1226	0.0525
1989 Oldsmobile Delta 88 (TWC)	7.99	6.42	0.22	0.0363	0.0292	27.16	11.15	0.27	0.1006	0.0413
Average	17.34	7.45	0.21	0.0791	0.0354	78.72	15.41	0.43	0.1904	0.0354

Auto/Oil (Fuel U/low ole., low T90, low arom., 10% EtOH, 10 RVP)

1989 Ford Mustang (TWC)	16.64	3.58	0.20	0.0832	0.0179	42.91	6.52	0.14	0.3065	0.0466
1989 Ford Taurus (TWC)	66.28	7.29	0.21	0.3156	0.0347	199.75	18.59	0.56	0.3567	0.0332
1989 Ford Aerostar (TWC)	54.00	17.49	0.49	0.1102	0.0357	57.92	17.74	0.96	0.0603	0.0185
1989 Camry Sedan (TWC)	33.46	6.70	0.24	0.1394	0.0279	62.55	13.20	0.29	0.2157	0.0455
1989 Pontiac Grand Am (TWC)	32.58	15.37	0.32	0.1018	0.0480	62.37	20.35	0.47	0.1327	0.0433
1989 Oldsmobile Delta 88 (TWC)	18.49	6.89	0.26	0.0711	0.0265	40.90	13.79	0.32	0.1278	0.0431
Average	36.91	9.55	0.29	0.1369	0.0318	77.73	15.03	0.46	0.2000	0.0384

Auto/Oil (Fuel T/low ole., low T90, low arom., 10% EtOH, 9 RVP)

1989 Ford Mustang (TWC)	8.99	2.16	0.17	0.0529	0.0127	20.64	5.15	0.12	0.1720	0.0429
1989 Ford Taurus (TWC)	41.02	6.55	0.18	0.2279	0.0364	148.56	18.56	0.51	0.2913	0.0364
1989 Ford Aerostar (TWC)	49.06	14.13	0.37	0.1326	0.0382	141.70	39.85	1.08	0.1312	0.0369
1989 Camry Sedan (TWC)	13.82	4.40	0.15	0.0921	0.0293	41.30	9.44	0.28	0.1475	0.0337
1989 Pontiac Grand Am (TWC)	34.48	11.41	0.35	0.0985	0.0326	58.96	20.99	0.41	0.1438	0.0512
1989 Oldsmobile Delta 88 (TWC)	18.65	5.89	0.18	0.1036	0.0327	22.53	12.50	0.29	0.0777	0.0431
Average	27.67	7.42	0.23	0.1179	0.0303	72.28	17.75	0.45	0.1606	0.0407
Average (All E10)*	29.67	8.08	0.26	0.1207	0.0313	80.59	15.96	0.44	0.1906	0.0381

MTBE Blends -- Auto/Oil

Evap (mg/test)			THC (g/test)	Fraction of THC		Evap (mg/test)			THC (g/test)	Fraction of THC	
MTBE	Benzene			MTBE	Benzene	MTBE	Benzene			MTBE	Benzene

LDGV -- CARB

Auto/Oil (Fuel N2/low ole., low T90, low arom., 15% MTBE, 9 RVP)

1989 Accord Sedan (TWC)	62.43	7.70	0.55	0.1135	0.0140	299.92	26.90	1.63	0.1840	0.0165
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Auto/Oil (Fuel MM/low ole., low T90, low arom., 15% MTBE, 8 RVP)										
1989 Accord Sedan (TWC)	99.85	7.40	0.86	0.1161	0.0086	277.38	30.98	1.75	0.1585	0.0177
Average (All 15% MTBE)*	81.14	7.55	0.71	0.1151	0.0107	288.65	28.94	1.69	0.1708	0.0171

LDGV -- TBI

Auto/Oil (Fuel N2/low ole., low T90, low arom., 15% MTBE, 9 RVP)										
1989 Plymouth Sundance (TWC)	0.00	3.20	0.25	0.0000	0.0128	0.00	6.66	0.18	0.0000	0.0370
1989 Dodge Shadow (TWC)	0.00	1.32	0.14	0.0000	0.0094	0.00	3.95	0.07	0.0000	0.0564
1989 Chevy Suburban (TWC)	0.00	12.65	0.55	0.0000	0.0230	46.54	14.68	0.41	0.1135	0.0358
Average	0.00	5.72	0.31	0.0000	0.0151	15.51	8.43	0.22	0.0378	0.0431

Auto/Oil (Fuel MM/low ole., low T90, low arom., 15% MTBE, 8 RVP)										
1989 Plymouth Sundance (TWC)	5.12	5.18	0.33	0.0155	0.0157	22.84	8.07	0.23	0.0993	0.0351
1989 Dodge Shadow (TWC)	0.00	1.33	0.13	0.0000	0.0102	0.00	5.76	0.12	0.0000	0.0480
1989 Chevy Suburban (TWC)	12.65	8.81	0.37	0.0342	0.0238	59.51	18.18	0.57	0.1044	0.0319
Average	5.92	5.10	0.28	0.0166	0.0166	27.45	10.67	0.31	0.0679	0.0383
Average (All 15% MTBE)*	2.96	5.41	0.30	0.0083	0.0158	21.48	9.55	0.26	0.0529	0.0407

LDGV -- PFI

Auto/Oil (Fuel N2/low ole., low T90, low arom., 15% MTBE, 9 RVP)										
1989 Ford Mustang (TWC)	0.00	0.75	0.08	0.0000	0.0094	2.72	2.67	0.07	0.0388	0.0382
1989 Ford Taurus (TWC)	0.00	1.96	0.06	0.0000	0.0327	6.89	5.57	0.15	0.0459	0.0371
1989 Ford Aerostar (TWC)	0.00	14.58	0.45	0.0000	0.0324	48.36	31.25	0.93	0.0520	0.0336
1989 Camry Sedan (TWC)	0.00	4.31	0.11	0.0000	0.0392	20.77	6.65	0.19	0.1093	0.0350
1989 Pontiac Grand Am (TWC)	34.08	6.18	0.22	0.1549	0.0281	62.66	13.64	0.38	0.1649	0.0359
1989 Oldsmobile Delta 88 (TWC)	10.73	4.56	0.13	0.0825	0.0351	21.23	5.95	0.17	0.1249	0.0350
Average	7.47	5.39	0.18	0.0396	0.0295	27.10	10.95	0.32	0.0893	0.0358

Auto/Oil (Fuel MM/low ole., low T90, low arom., 15% MTBE, 8 RVP)										
1989 Ford Mustang (TWC)	31.23	2.40	0.16	0.1952	0.0150	0.00	4.70	0.07	0.0000	0.0672
1989 Ford Taurus (TWC)	8.10	3.60	0.10	0.0810	0.0360	18.60	6.43	0.17	0.1094	0.0378
1989 Ford Aerostar (TWC)	14.52	13.24	0.40	0.0363	0.0331	34.58	28.12	0.91	0.0380	0.0309
1989 Camry Sedan (TWC)	0.00	6.16	0.19	0.0000	0.0324	0.00	11.17	0.29	0.0000	0.0385
1989 Pontiac Grand Am (TWC)	9.70	4.79	0.14	0.0693	0.0342	0.00	11.09	0.22	0.0000	0.0504
1989 Oldsmobile Delta 88 (TWC)	0.00	5.80	0.23	0.0000	0.0252	31.69	15.23	0.46	0.0689	0.0331
Average	10.59	6.00	0.20	0.0636	0.0293	14.15	12.79	0.35	0.0361	0.0430
Average (All 15% MTBE)*	9.03	5.69	0.19	0.0516	0.0294	20.62	11.87	0.33	0.0627	0.0394

*Data used in subsequent emission fractions calculations

01/28/1987

LDGV (FTP Data) EtOH/Misc Blends

	Exhaust (mg/mi)										TOG, g/mile
	Methane	Ethane	Formaldehyde	Acetaldehyde	1,3-Butadiene	Benzene	Methanol	Ethanol	MTBE	ETBE	
TWC											
M85											
AB234 Study											
1987 Ford Crown Victoria (FI)	44.000	1.169	22.366	1.395	N.A.	2.118	156.217	0.000	N.A.	N.A.	
MSERB FFV Study											
1988 Chevrolet Corsica (TBI)	19.760	0.610	27.470	0.470	0.330	2.640	290.000	0.000	N.A.	N.A.	
AVERAGE	31.880	0.890	24.918	0.933	0.165	2.379	223.109	0.000			
M100											
AB234 Study											
1987 Ford Crown Victoria (FI)	21.000	0.105	34.987	0.434	N.A.	0.520	504.287	0.000	N.A.	N.A.	
MSERB FFV Study											
1988 Chevrolet Corsica (TBI)	9.170	0.000	636.150	4.290	0.000	0.210	820.000	0.000	N.A.	N.A.	
AVERAGE	15.085	0.053	335.569	2.362	0.000	0.365	662.144	0.000			
E95											
AB234 Study											
1987 Ford Crown Victoria (FI)	195.000	8.222	12.264	60.971	N.A.	3.097	0.000	742.710	N.A.	N.A.	
E85											
AB234 Study											
1987 Ford Crown Victoria (TBI)	167.000	10.742	10.638	52.514	N.A.	3.424	0.000	783.371	N.A.	N.A.	
E0											
Auto/Oil (Fuel A/Industry Avg.)											
1989 Plymouth Sundance (TBI)	21.912	3.590	0.443	0.492	0.646	6.571	N.A.	N.A.	0.000	0.239	0.14
1989 Dodge Shadow (TBI)	26.424	3.262	0.927	0.366	1.024	8.911	N.A.	N.A.	0.000	0.179	0.17
1989 Ford Mustang (PFI)	66.792	13.003	1.244	0.942	0.690	7.414	N.A.	N.A.	1.564	0.289	0.33
1989 Ford Taurus (PFI)	25.379	3.203	0.577	1.322	0.912	8.900	N.A.	N.A.	0.000	0.354	0.19
1989 Ford Aerostar (PFI)	52.372	8.280	0.688	0.172	1.404	14.841	N.A.	N.A.	2.550	0.372	0.31
1989 Camry Sedan (PFI)	16.024	3.374	0.564	2.612	0.448	5.708	N.A.	N.A.	0.000	0.215	0.15
1989 Accord Sedan (Carb)	35.396	2.672	2.557	2.502	0.822	4.917	N.A.	N.A.	0.000	0.152	0.14
1989 Chevy Suburban (TBI)	59.359	13.842	3.661	3.087	2.194	32.781	N.A.	N.A.	0.310	1.038	0.52
1989 Pontiac Grand Am (PFI)	16.154	2.706	1.060	3.013	1.353	6.501	N.A.	N.A.	0.000	0.251	0.16
1989 Oldsmobile Delta 88 (PFI)	18.131	2.549	0.763	0.540	1.025	5.647	N.A.	N.A.	0.000	0.188	0.14
Average*	33.794	5.648	1.248	1.505	1.052	10.219			0.442	0.328	0.23
E10											
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)											
1990 Ford Probe (PFI)	N.A.	N.A.	3.800	2.200	0.800	8.000	N.A.	8.500	N.A.	N.A.	0.21
1990 Chevy Lumina (TBI)	N.A.	N.A.	4.100	2.600	0.800	6.100	N.A.	0.000	N.A.	N.A.	0.15
1983 Buick Regal (Carb)	N.A.	N.A.	5.900	7.000	1.100	21.200	N.A.	18.100	N.A.	N.A.	0.81
Average			4.600	3.933	0.900	11.767		8.867			0.39
Auto/Oil (Fuel X/Industry Avg. +10% EtOH, 10 RVP)											
1989 Plymouth Sundance (TBI)	23.904	3.921	0.832	1.352	0.586	6.330	N.A.	3.217	0.000	0.239	0.13
1989 Dodge Shadow (TBI)	26.078	2.853	9.163	1.718	1.000	7.320	N.A.	3.135	0.000	0.167	0.17

1989 Ford Mustang (PFI)	64.576	12.983	1.782	1.879	0.444	4.204	N.A.	3.240	0.000	0.000	0.28
1989 Ford Taurus (PFI)	27.260	3.451	0.901	1.916	0.761	7.627	N.A.	4.734	0.000	0.308	0.20
1989 Ford Aerostar (PFI)	53.185	7.810	0.845	2.583	1.355	13.589	N.A.	7.371	0.000	0.368	0.26
1989 Camry Sedan (PFI)	16.767	4.080	0.202	0.941	0.523	5.978	N.A.	2.507	0.000	0.248	0.16
1989 Accord Sedan (Carb)	38.525	4.107	2.979	1.688	0.713	3.720	N.A.	2.327	0.000	0.190	0.14
1989 Chevy Suburban (TBI)	63.135	14.147	4.889	8.614	3.282	28.014	N.A.	18.459	0.000	0.871	0.50
1989 Pontiac Grand Am (PFI)	17.943	2.792	2.028	2.303	1.071	5.428	N.A.	5.555	0.000	0.105	0.19
1989 Oldsmobile Delta 88 (PFI)	22.547	3.144	1.206	1.279	0.733	5.973	N.A.	3.369	0.000	0.195	0.13
Average	35.392	5.929	2.483	2.427	1.047	8.818		5.391	0.000	0.269	0.22

Auto/Oil (Fuel W/Industry Avg. +10% EtOH, 9 RVP)

1989 Plymouth Sundance (TBI)	26.382	4.649	0.762	1.517	0.511	8.771	N.A.	3.414	0.000	0.242	0.14
1989 Dodge Shadow (TBI)	23.528	3.751	1.273	0.692	0.886	6.948	N.A.	3.377	0.000	0.166	0.15
1989 Ford Mustang (PFI)	65.124	12.429	2.389	4.384	0.636	5.436	N.A.	3.200	0.000	0.263	0.25
1989 Ford Taurus (PFI)	24.782	2.956	1.052	1.792	0.769	6.631	N.A.	3.902	0.000	0.266	0.19
1989 Ford Aerostar (PFI)	51.101	7.850	6.568	3.195	1.465	12.326	N.A.	7.237	0.000	0.347	0.25
1989 Camry Sedan (PFI)	15.547	3.400	0.708	0.657	0.531	5.498	N.A.	2.275	0.000	0.215	0.15
1989 Accord Sedan (Carb)	38.152	2.397	0.877	1.658	0.753	4.283	N.A.	2.337	0.000	0.247	0.14
1989 Chevy Suburban (TBI)	61.457	12.229	5.008	7.226	2.062	25.370	N.A.	19.274	0.052	0.921	0.49
1989 Pontiac Grand Am (PFI)	18.358	3.425	1.783	2.341	1.230	6.306	N.A.	5.966	0.000	0.290	0.19
1989 Oldsmobile Delta 88 (PFI)	14.572	2.002	1.057	2.225	0.714	4.097	N.A.	3.170	0.000	0.000	0.09
Average	33.900	5.509	2.148	2.569	0.956	8.567		5.415	0.005	0.296	0.20

Auto/Oil (Fuel U/Low ole., low T90, low arom., 10% EtOH, 10 RVP)

1989 Plymouth Sundance (TBI)	34.250	6.285	0.896	1.862	0.440	7.259	N.A.	5.030	0.000	0.000	0.15
1989 Dodge Shadow (TBI)	31.175	3.235	1.384	1.125	0.779	6.591	N.A.	5.432	0.000	0.156	0.18
1989 Ford Mustang (PFI)	73.645	15.817	2.162	1.322	0.381	4.171	N.A.	3.509	0.000	0.000	0.27
1989 Ford Taurus (PFI)	29.994	3.051	0.871	1.272	0.531	4.683	N.A.	4.113	0.000	0.000	0.18
1989 Ford Aerostar (PFI)	77.244	10.113	0.934	2.514	0.755	14.822	N.A.	8.639	0.000	0.258	0.28
1989 Camry Sedan (PFI)	17.356	3.191	0.086	0.649	0.374	3.958	N.A.	3.788	0.000	0.000	0.13
1989 Accord Sedan (Carb)	45.912	3.348	1.359	0.946	0.522	3.033	N.A.	2.632	0.000	0.000	0.15
1989 Chevy Suburban (TBI)	70.974	14.711	0.168	1.628	0.505	24.032	N.A.	18.642	0.000	0.000	0.55
1989 Pontiac Grand Am (PFI)	18.595	2.756	1.965	2.013	0.978	4.084	N.A.	4.867	0.000	1.965	0.13
1989 Oldsmobile Delta 88 (PFI)	20.169	2.771	1.463	3.079	0.988	5.671	N.A.	4.388	0.000	0.000	0.13
Average	41.931	6.528	1.129	1.641	0.625	7.830		6.104	0.000	0.238	0.21

Auto/Oil (Fuel T/Low ole., low T90, low arom., 10% EtOH, 9 RVP)

1989 Plymouth Sundance (TBI)	36.568	6.460	0.790	1.565	0.600	9.924	N.A.	4.639	0.000	0.000	0.15
1989 Dodge Shadow (TBI)	27.838	2.735	0.492	1.378	0.767	5.983	N.A.	4.173	0.000	0.000	0.17
1989 Ford Mustang (PFI)	72.887	14.916	1.475	2.392	0.453	3.967	N.A.	3.790	0.000	0.000	0.28
1989 Ford Taurus (PFI)	33.009	4.228	1.368	1.962	0.607	6.665	N.A.	4.306	0.000	0.000	0.17
1989 Ford Aerostar (PFI)	66.609	9.812	1.025	2.048	0.751	11.219	N.A.	6.920	0.000	0.329	0.25
1989 Camry Sedan (PFI)	16.995	2.105	0.288	0.649	0.278	4.092	N.A.	3.445	0.000	0.195	0.13
1989 Accord Sedan (Carb)	41.088	3.795	1.006	1.071	0.635	4.040	N.A.	2.458	0.000	0.000	0.15
1989 Chevy Suburban (TBI)	69.105	13.865	7.208	2.531	2.256	24.099	N.A.	18.982	0.000	0.000	0.54
1989 Pontiac Grand Am (PFI)	17.515	2.823	2.141	1.907	0.991	4.043	N.A.	6.939	0.000	0.163	0.14
1989 Oldsmobile Delta 88 (PFI)	19.332	2.450	0.983	0.966	0.610	3.839	N.A.	3.749	0.000	0.000	0.11
Average	40.095	6.319	1.678	1.647	0.795	7.787		5.940	0.000	0.069	0.21
AVERAGE*	35.190	5.648	2.050	2.201	0.859	8.496		5.933	0.001	0.203	0.22

8.1% EtOH

Stump et al., 1990 (MSERB Oxyfuels Study)

CO665 1988 Chevy Corsica TBI	45.200	11.630	2.870	2.910	0.570	15.320	0.000	17.070	N.A.	N.A.	0.34
CO322 1987 Chevy Corsica TBI	36.160	14.830	4.530	3.500	0.600	13.980	0.000	24.850	N.A.	N.A.	0.36
AVERAGE*	40.680	13.230	3.700	3.205	0.585	14.650	0.000	20.960			0.35

19.1% ETBE

1990 SwRI Report Data											
1990 Ford Probe (PFI)	N.A.	N.A.	3.400	1.800	0.700	9.500	N.A.	0.000			
1990 Chevy Lumina (TBI)	N.A.	N.A.	4.300	2.600	0.800	8.200	N.A.	0.000			
1983 Buick Regal (Carb)	N.A.	N.A.	5.300	5.100	0.800	17.500	N.A.	0.000			
AVERAGE			4.333	3.167	0.767	11.733		0.000			

OXY
E10

Warner-Selph and Smith, 1991 (EPA-460/3-91-02)											
1977 Mercury Marquis (Carb)	N.A.	N.A.	44.400	22.400	1.700	13.200	N.A.	3.000	N.A.	N.A.	1.11

NOCAT
E10

Warner-Selph and Smith, 1991 (EPA-460/3-91-02)											
1974 Chevy Impala (Carb)	N.A.	N.A.	80.300	26.600	68.000	332.000	N.A.	44.800	N.A.	N.A.	8.31

TWC

MTBE Blends

Auto/Oil (Fuel N2/low ole., low T90, low arom., 15% MTBE, 9 RVP)											
1989 Plymouth Sundance (TBI)	24.888	3.755	0.511	0.350	0.579	5.721	N.A.	N.A.	4.953	0.000	0.14
1989 Dodge Shadow (TBI)	58.939	2.746	0.387	0.276	0.682	6.045	N.A.	N.A.	6.838	0.147	0.18
1989 Ford Mustang (PFI)	68.630	13.240	0.613	1.612	0.477	4.769	N.A.	N.A.	2.544	0.000	0.25
1989 Ford Taurus (PFI)	24.485	2.542	0.428	2.181	0.589	6.048	N.A.	N.A.	4.322	0.000	0.14
1989 Ford Aerostar (PFI)	63.054	9.012	0.599	0.928	0.838	14.072	N.A.	N.A.	5.928	0.269	0.35
1989 Camry Sedan (PFI)	16.332	2.540	0.146	0.292	0.315	4.159	N.A.	N.A.	4.620	0.146	0.12
1989 Accord Sedan (Carb)	39.613	3.038	0.538	0.863	0.713	3.700	N.A.	N.A.	0.000	0.000	0.14
1989 Chevy Suburban (TBI)	63.693	13.846	2.822	2.978	2.142	24.453	N.A.	N.A.	31.873	0.470	0.54
1989 Pontiac Grand Am (PFI)	17.628	2.464	0.775	1.638	1.105	4.394	N.A.	N.A.	5.321	0.000	0.13
1989 Oldsmobile Delta 88 (PFI)	20.773	2.854	0.408	1.223	0.540	4.827	N.A.	N.A.	2.843	0.000	0.13
Average*	39.803	5.604	0.723	1.234	0.798	7.819			6.924	0.103	0.21

Auto/Oil (Fuel MM/low ole., low T90, low arom., 15% MTBE, 8 RVP)											
1989 Plymouth Sundance (TBI)	24.812	4.942	0.354	1.479	0.455	5.953	N.A.	N.A.	4.222	0.000	0.14
1989 Dodge Shadow (TBI)	31.411	4.618	0.000	0.000	0.731	5.909	N.A.	N.A.	3.903	0.171	0.17
1989 Ford Mustang (PFI)	66.130	12.544	0.612	3.734	0.435	3.378	N.A.	N.A.	0.000	0.000	0.22
1989 Ford Taurus (PFI)	25.365	2.963	1.723	1.125	0.627	5.465	N.A.	N.A.	6.121	0.154	0.15
1989 Ford Aerostar (PFI)	60.077	7.848	0.642	0.782	0.894	12.289	N.A.	N.A.	5.558	0.279	0.33
1989 Camry Sedan (PFI)	16.843	2.778	0.096	0.299	0.310	4.035	N.A.	N.A.	8.171	0.085	0.13
1989 Accord Sedan (Carb)	42.966	3.291	0.633	1.159	0.726	4.295	N.A.	N.A.	2.905	0.000	0.17
1989 Chevy Suburban (TBI)	58.530	12.093	3.073	5.501	2.379	21.955	N.A.	N.A.	23.392	0.545	0.52
1989 Pontiac Grand Am (PFI)	15.590	2.501	0.750	1.322	1.072	4.169	N.A.	N.A.	4.562	0.167	0.12
1989 Oldsmobile Delta 88 (PFI)	19.671	2.748	0.371	0.796	0.573	4.435	N.A.	N.A.	4.361	0.000	0.12
Average*	36.140	5.633	0.826	1.620	0.820	7.188			6.319	0.140	0.21

*Data used in subsequent emission fractions calculations

Methane	Ethane	Fraction of TOG Formaldehyde	Acetaldehyde	1,3-Butadiene	Benzene	Methanol	Ethanol	MTBE	ETBE	
										TWC M85
										AB234 Study 1987 Ford Crown Victoria (FI)
										MSERB FFV Study 1988 Chevrolet Corsica (TBI) AVERAGE
										M100
										AB234 Study 1987 Ford Crown Victoria (FI)
										MSERB FFV Study 1988 Chevrolet Corsica (TBI) AVERAGE
										E95
										AB234 Study 1987 Ford Crown Victoria (FI)
										E85
										AB234 Study 1987 Ford Crown Victoria (TBI)
										E0
										Auto/Oil (Fuel A/Industry Avg.) 1989 Plymouth Sundance (TBI)
0.1528	0.0250	0.0031	0.0034	0.0045	0.0458	N.A.	N.A.	0.0000	0.0017	1989 Dodge Shadow (TBI)
0.1525	0.0188	0.0054	0.0021	0.0059	0.0514	N.A.	N.A.	0.0000	0.0010	1989 Ford Mustang (PFI)
0.2031	0.0395	0.0038	0.0029	0.0021	0.0225	N.A.	N.A.	0.0048	0.0009	1989 Ford Taurus (PFI)
0.1319	0.0166	0.0030	0.0069	0.0047	0.0463	N.A.	N.A.	0.0000	0.0018	1989 Ford Aerostar (PFI)
0.1669	0.0264	0.0022	0.0005	0.0045	0.0473	N.A.	N.A.	0.0081	0.0012	1989 Camry Sedan (PFI)
0.1060	0.0223	0.0037	0.0173	0.0030	0.0378	N.A.	N.A.	0.0000	0.0014	1989 Accord Sedan (Carb)
0.2599	0.0196	0.0188	0.0184	0.0060	0.0361	N.A.	N.A.	0.0000	0.0011	1989 Chevy Suburban (TBI)
0.1145	0.0267	0.0071	0.0060	0.0042	0.0633	N.A.	N.A.	0.0006	0.0020	1989 Pontiac Grand Am (PFI)
0.0997	0.0167	0.0065	0.0186	0.0084	0.0401	N.A.	N.A.	0.0000	0.0016	1989 Oldsmobile Delta 88 (PFI)
0.1271	0.0179	0.0053	0.0038	0.0072	0.0396	N.A.	N.A.	0.0000	0.0013	Average*
0.1515	0.0230	0.0059	0.0080	0.0050	0.0430			0.0013	0.0014	
										E10
										Warner-Selph and Smith, 1991 (EPA-460/3-91-02)
N.A.	N.A.	0.0183	0.0106	0.0039	0.0386	N.A.	0.0410	N.A.	N.A.	1990 Ford Probe (PFI)
N.A.	N.A.	0.0283	0.0179	0.0055	0.0421	N.A.	0.0000	N.A.	N.A.	1990 Chevy Lumina (TBI)
N.A.	N.A.	0.0073	0.0087	0.0014	0.0262	N.A.	0.0224	N.A.	N.A.	1983 Buick Regal (Carb)
		0.0180	0.0124	0.0036	0.0356		0.0211			Average
										Auto/Oil (Fuel X/Industry Avg. +10% EtOH, 10 RVP)
0.1828	0.0300	0.0064	0.0103	0.0045	0.0484	N.A.	0.0246	0.0000	0.0018	1989 Plymouth Sundance (TBI)
0.1511	0.0165	0.0531	0.0100	0.0058	0.0424	N.A.	0.0182	0.0000	0.0010	1989 Dodge Shadow (TBI)

0.2267	0.0456	0.0063	0.0066	0.0016	0.0148	N.A.	0.0114	0.0000	0.0000	1989 Ford Mustang (PFI)
0.1372	0.0174	0.0045	0.0096	0.0038	0.0384	N.A.	0.0238	0.0000	0.0016	1989 Ford Taurus (PFI)
0.2066	0.0303	0.0033	0.0100	0.0053	0.0528	N.A.	0.0286	0.0000	0.0014	1989 Ford Aerostar (PFI)
0.1050	0.0256	0.0013	0.0059	0.0033	0.0374	N.A.	0.0157	0.0000	0.0016	1989 Camry Sedan (PFI)
0.2790	0.0297	0.0216	0.0122	0.0052	0.0269	N.A.	0.0169	0.0000	0.0014	1989 Accord Sedan (Carb)
0.1256	0.0281	0.0097	0.0171	0.0065	0.0557	N.A.	0.0367	0.0000	0.0017	1989 Chevy Suburban (TBI)
0.0943	0.0147	0.0107	0.0121	0.0056	0.0285	N.A.	0.0292	0.0000	0.0006	1989 Pontiac Grand Am (PFI)
0.1706	0.0238	0.0091	0.0097	0.0055	0.0452	N.A.	0.0255	0.0000	0.0015	1989 Oldsmobile Delta 88 (PFI)
0.1679	0.0262	0.0126	0.0104	0.0047	0.0391		0.0231	0.0000	0.0012	Average

Auto/Oil (Fuel W/Industry Avg. +10% EtOH, 9 RVP)

0.1867	0.0329	0.0054	0.0107	0.0036	0.0621	N.A.	0.0242	0.0000	0.0017	1989 Plymouth Sundance (TBI)
0.1622	0.0259	0.0088	0.0048	0.0061	0.0479	N.A.	0.0233	0.0000	0.0011	1989 Dodge Shadow (TBI)
0.2619	0.0500	0.0096	0.0176	0.0026	0.0219	N.A.	0.0129	0.0000	0.0011	1989 Ford Mustang (PFI)
0.1313	0.0157	0.0056	0.0095	0.0041	0.0351	N.A.	0.0207	0.0000	0.0014	1989 Ford Taurus (PFI)
0.2065	0.0317	0.0265	0.0129	0.0059	0.0498	N.A.	0.0292	0.0000	0.0014	1989 Ford Aerostar (PFI)
0.1072	0.0234	0.0049	0.0045	0.0037	0.0379	N.A.	0.0157	0.0000	0.0015	1989 Camry Sedan (PFI)
0.2732	0.0172	0.0063	0.0119	0.0054	0.0307	N.A.	0.0167	0.0000	0.0018	1989 Accord Sedan (Carb)
0.1249	0.0249	0.0102	0.0147	0.0042	0.0516	N.A.	0.0392	0.0001	0.0019	1989 Chevy Suburban (TBI)
0.0965	0.0180	0.0094	0.0123	0.0065	0.0331	N.A.	0.0314	0.0000	0.0015	1989 Pontiac Grand Am (PFI)
0.1563	0.0215	0.0113	0.0239	0.0077	0.0439	N.A.	0.0340	0.0000	0.0000	1989 Oldsmobile Delta 88 (PFI)
0.1707	0.0261	0.0098	0.0123	0.0050	0.0414		0.0247	0.0000	0.0013	Average

Auto/Oil (Fuel U/Low ole., low T90, low arom., 10% EtOH, 10 RVP)

0.2317	0.0425	0.0061	0.0126	0.0030	0.0491	N.A.	0.0340	0.0000	0.0000	1989 Plymouth Sundance (TBI)
0.1770	0.0184	0.0079	0.0064	0.0044	0.0374	N.A.	0.0308	0.0000	0.0009	1989 Dodge Shadow (TBI)
0.2734	0.0587	0.0080	0.0049	0.0014	0.0155	N.A.	0.0130	0.0000	0.0000	1989 Ford Mustang (PFI)
0.1661	0.0169	0.0048	0.0070	0.0029	0.0259	N.A.	0.0228	0.0000	0.0000	1989 Ford Taurus (PFI)
0.2758	0.0361	0.0033	0.0090	0.0027	0.0529	N.A.	0.0309	0.0000	0.0009	1989 Ford Aerostar (PFI)
0.1323	0.0243	0.0007	0.0049	0.0028	0.0302	N.A.	0.0289	0.0000	0.0000	1989 Camry Sedan (PFI)
0.3166	0.0231	0.0094	0.0065	0.0036	0.0209	N.A.	0.0181	0.0000	0.0000	1989 Accord Sedan (Carb)
0.1293	0.0268	0.0003	0.0030	0.0009	0.0438	N.A.	0.0340	0.0000	0.0000	1989 Chevy Suburban (TBI)
0.1452	0.0215	0.0153	0.0157	0.0076	0.0319	N.A.	0.0380	0.0000	0.0153	1989 Pontiac Grand Am (PFI)
0.1498	0.0206	0.0109	0.0229	0.0073	0.0421	N.A.	0.0326	0.0000	0.0000	1989 Oldsmobile Delta 88 (PFI)
0.1997	0.0289	0.0067	0.0093	0.0037	0.0350		0.0283	0.0000	0.0017	Average

Auto/Oil (Fuel T/Low ole., low T90, low arom., 10% EtOH, 9 RVP)

0.2424	0.0428	0.0052	0.0104	0.0040	0.0658	N.A.	0.0308	0.0000	0.0000	1989 Plymouth Sundance (TBI)
0.1603	0.0158	0.0028	0.0079	0.0044	0.0345	N.A.	0.0240	0.0000	0.0000	1989 Dodge Shadow (TBI)
0.2573	0.0527	0.0052	0.0084	0.0016	0.0140	N.A.	0.0134	0.0000	0.0000	1989 Ford Mustang (PFI)
0.1968	0.0252	0.0082	0.0117	0.0036	0.0397	N.A.	0.0257	0.0000	0.0000	1989 Ford Taurus (PFI)
0.2615	0.0385	0.0040	0.0080	0.0029	0.0440	N.A.	0.0272	0.0000	0.0013	1989 Ford Aerostar (PFI)
0.1278	0.0158	0.0022	0.0049	0.0021	0.0308	N.A.	0.0259	0.0000	0.0015	1989 Camry Sedan (PFI)
0.2787	0.0257	0.0068	0.0073	0.0043	0.0274	N.A.	0.0167	0.0000	0.0000	1989 Accord Sedan (Carb)
0.1283	0.0257	0.0134	0.0047	0.0042	0.0447	N.A.	0.0352	0.0000	0.0000	1989 Chevy Suburban (TBI)
0.1215	0.0196	0.0148	0.0132	0.0069	0.0280	N.A.	0.0481	0.0000	0.0011	1989 Pontiac Grand Am (PFI)
0.1764	0.0224	0.0090	0.0088	0.0056	0.0350	N.A.	0.0342	0.0000	0.0000	1989 Oldsmobile Delta 88 (PFI)
0.1951	0.0284	0.0072	0.0085	0.0040	0.0364		0.0281	0.0000	0.0004	Average
0.1705	0.0255	0.0097	0.0103	0.0043	0.0378		0.0257	0.0000	0.0011	AVERAGE*

8.1% EtOH

Stump et al., 1990 (MSERB Oxyfuels Study)

0.1322	0.0340	0.0084	0.0085	0.0017	0.0448	0.0000	0.0499	N.A.	N.A.	CO665 1988 Chevy Corsica TBI
0.0997	0.0409	0.0125	0.0097	0.0017	0.0386	0.0000	0.0685	N.A.	N.A.	CO322 1987 Chevy Corsica TBI
0.1160	0.0375	0.0104	0.0091	0.0017	0.0417	0.0000	0.0592			AVERAGE*

19.1% ETBE

1990 SwRI Report Data
 1990 Ford Probe (PFI)
 1990 Chevy Lumina (TBI)
 1983 Buick Regal (Carb)
 AVERAGE

OXY
 E10

N.A.	N.A.	0.0399	0.0201	0.0015	0.0119	N.A.	0.0027	N.A.	N.A.	Warner-Selph and Smith, 1991 (EPA-460/3-91-02) 1977 Mercury Marquis (Carb)
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NOCAT
 E10

N.A.	N.A.	0.0097	0.0032	0.0082	0.0400	N.A.	0.0054	N.A.	N.A.	Warner-Selph and Smith, 1991 (EPA-460/3-91-02) 1974 Chevy Impala (Carb)
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TWC

MTBE Blends

Auto/Oil (Fuel N2/low ole., low T90, low arom., 15% MTBE, 9 RVP)										
0.1722	0.0260	0.0035	0.0024	0.0040	0.0396	N.A.	N.A.	0.0343	0.0000	1989 Plymouth Sundance (TBI)
0.3358	0.0156	0.0022	0.0016	0.0039	0.0344	N.A.	N.A.	0.0390	0.0008	1989 Dodge Shadow (TBI)
0.2770	0.0534	0.0025	0.0065	0.0019	0.0192	N.A.	N.A.	0.0103	0.0000	1989 Ford Mustang (PFI)
0.1694	0.0176	0.0030	0.0151	0.0041	0.0418	N.A.	N.A.	0.0299	0.0000	1989 Ford Taurus (PFI)
0.1796	0.0257	0.0017	0.0026	0.0024	0.0401	N.A.	N.A.	0.0169	0.0008	1989 Ford Aerostar (PFI)
0.1318	0.0205	0.0012	0.0024	0.0025	0.0336	N.A.	N.A.	0.0373	0.0012	1989 Camry Sedan (PFI)
0.2741	0.0210	0.0037	0.0060	0.0049	0.0256	N.A.	N.A.	0.0000	0.0000	1989 Accord Sedan (Carb)
0.1186	0.0258	0.0053	0.0055	0.0040	0.0455	N.A.	N.A.	0.0594	0.0009	1989 Chevy Suburban (TBI)
0.1313	0.0184	0.0058	0.0122	0.0082	0.0327	N.A.	N.A.	0.0396	0.0000	1989 Pontiac Grand Am (PFI)
0.1548	0.0213	0.0030	0.0091	0.0040	0.0360	N.A.	N.A.	0.0212	0.0000	1989 Oldsmobile Delta 88 (PFI)
0.1945	0.0245	0.0032	0.0063	0.0040	0.0349			0.0288	0.0004	Average*

Auto/Oil (Fuel MM/low ole., low T90, low arom., 15% MTBE, 8 RVP)										
0.1717	0.0342	0.0024	0.0102	0.0031	0.0412	N.A.	N.A.	0.0292	0.0000	1989 Plymouth Sundance (TBI)
0.1901	0.0280	0.0000	0.0000	0.0044	0.0358	N.A.	N.A.	0.0236	0.0010	1989 Dodge Shadow (TBI)
0.3050	0.0579	0.0028	0.0172	0.0020	0.0156	N.A.	N.A.	0.0000	0.0000	1989 Ford Mustang (PFI)
0.1638	0.0191	0.0111	0.0073	0.0041	0.0353	N.A.	N.A.	0.0395	0.0010	1989 Ford Taurus (PFI)
0.1818	0.0238	0.0019	0.0024	0.0027	0.0372	N.A.	N.A.	0.0168	0.0008	1989 Ford Aerostar (PFI)
0.1305	0.0215	0.0007	0.0023	0.0024	0.0313	N.A.	N.A.	0.0633	0.0007	1989 Camry Sedan (PFI)
0.2601	0.0199	0.0038	0.0070	0.0044	0.0260	N.A.	N.A.	0.0176	0.0000	1989 Accord Sedan (Carb)
0.1134	0.0234	0.0060	0.0107	0.0046	0.0425	N.A.	N.A.	0.0453	0.0011	1989 Chevy Suburban (TBI)
0.1258	0.0202	0.0061	0.0107	0.0087	0.0336	N.A.	N.A.	0.0368	0.0013	1989 Pontiac Grand Am (PFI)
0.1588	0.0222	0.0030	0.0064	0.0046	0.0358	N.A.	N.A.	0.0352	0.0000	1989 Oldsmobile Delta 88 (PFI)
0.1801	0.0270	0.0038	0.0074	0.0041	0.0334			0.0307	0.0006	Average*

LDDV, HDDV, HDGV (FTP and 13 Mode Data)

LDDV

	Exhaust mg/mile					TOG, g/mile	Fraction of TOG						
	Methane	Ethane	Formaldehyde	Acetaldehyde	1,3-Butadiene		Benzene	Methane	Ethane	Formaldehyde	Acetaldehyde	1,3-Butadiene	Benzene
Springer, 1977 (EPA-460/3-76-034)													
1975 Mercedes 220D	31.620	0.000	4.050	1.610	N.A.	9.767	0.19	0.1675	0.0000	0.0214	0.0085		0.0517
1975 Mercedes 240D	8.960	0.000	6.370	1.820	N.A.	0.000	0.30	0.0295	0.0000	0.0209	0.0060		0.0000
1975 Mercedes 300D	6.340	0.000	6.110	1.790	N.A.	4.039	0.17	0.0378	0.0000	0.0364	0.0107		0.0241
1974 Peugeot 204D	14.960	0.000	18.100	6.890	N.A.	0.000	1.16	0.0128	0.0000	0.0155	0.0059		0.0000
1974 Perkins 6-247	39.390	0.000	61.420	16.890	N.A.	15.382	0.76	0.0522	0.0000	0.0813	0.0224		0.0204
Average	20.254	0.000	19.210	5.800		5.837	0.52	0.0599	0.0000	0.0351	0.0107		0.0192

Springer, 1979 (EPA-460/3-79-007)													
1976 Cutlass	20.430	6.760	25.420	10.460	N.A.	18.664	0.80	0.0256	0.0085	0.0319	0.0131		0.0234
1977 Rabbit	10.780	1.450	25.740	8.050	N.A.	8.206	0.39	0.0278	0.0037	0.0663	0.0207		0.0211
Average	15.605	4.105	25.580	9.255		13.435	0.59	0.0267	0.0061	0.0491	0.0169		0.0223
AVERAGE*	19.092	1.026	20.803	6.664		7.737	0.43	0.0516	0.0015	0.0386	0.0123		0.0200
CARB Butadiene Study (2 vehicles)												0.0090	

HDDV (mg/kw-hr)

Springer, 1979 (EPA-460/3-79-007)													
Mack ETAY(B)673A	6.900	0.680	16.590	0.940	N.A.	4.480	0.66	0.0105	0.0010	0.0251	0.0014		0.0068
Cat 3208/EGR	40.350	3.500	49.900	21.850	N.A.	21.930	1.61	0.0250	0.0022	0.0309	0.0136		0.0136
AVERAGE*	23.625	2.090	33.245	11.395		13.205	1.14	0.0177	0.0016	0.0280	0.0075		0.0102
CARB Butadiene Study (1 vehicle)												0.0136	

HDGV (mg/kw-hr)

Springer, 1979 (EPA-460/3-79-007)													
Chev. 366 (23 mode)	836.600	41.810	105.360	21.270	N.A.	348.780	3.40	0.2461	0.0123	0.0310	0.0063		0.1026

*Data used in subsequent emission fractions calculations

01/28/1988

LDGV (NON-CAT -- FTP Data)

	Exhaust mg/mile						TOG, g/mile	Fraction of TOG					
	Methane	Ethane	Formaldehyde	Acetaldehyde	1,3-Butadiene	Benzene		Methane	Ethane	Formaldehyde	Acetaldehyde	1,3-Butadiene	Benzene
0% MTBE													
Urban, 1980a, 1981 (EPA-460/3-80-003, 81-020, All Carb)													
71 1970 Olds Delta 88 (Carb)	133.580	22.850	51.280	7.180	N.A.	82.192	2.38	0.0562	0.0096	0.0216	0.0030	N.A.	0.0346
72 1970 Dodge Challenger (Carb)	158.840	24.330	14.980	5.550	N.A.	86.544	2.84	0.0559	0.0086	0.0053	0.0020	N.A.	0.0305
73 1970 Chev Monte Carlo (Carb)	135.930	29.380	107.430	10.840	N.A.	91.104	3.41	0.0399	0.0086	0.0315	0.0032	N.A.	0.0267
74 1970 Ford Fairlane (Carb)	123.670	37.480	34.260	2.280	N.A.	85.456	3.90	0.0317	0.0096	0.0088	0.0006	N.A.	0.0219
11 1977 AMC Pacer (Carb)	77.230	11.260	15.620	3.780	N.A.	64.000	1.21	0.0639	0.0093	0.0129	0.0031	N.A.	0.0530
Average	125.850	25.060	44.714	5.926		81.859	2.75	0.0495	0.0091	0.0160	0.0024		0.0333
Sigsby et al., 1987 (46 car study)													
6 1976 Toyota Celica	44.160	9.890	77.640	19.680	N.A.	26.163	0.88	0.0503	0.0113	0.0884	0.0224	N.A.	0.0298
11 1977 AMC Hornet	1066.670	60.810	121.840	20.630	N.A.	112.889	6.31	0.1690	0.0096	0.0193	0.0033	N.A.	0.0179
24 1977 Datsun F-10	71.300	13.280	84.800	20.690	N.A.	21.436	1.98	0.0359	0.0067	0.0428	0.0104	N.A.	0.0108
31 1979 Mazda RX-7	43.840	11.540	65.680	14.760	N.A.	20.826	1.29	0.0340	0.0089	0.0509	0.0114	N.A.	0.0161
35 1980 Olds Cutlass	201.170	40.130	9.740	12.750	N.A.	42.768	2.07	0.0974	0.0194	0.0047	0.0062	N.A.	0.0207
Average	285.428	27.130	71.940	17.702		44.816	2.51	0.0773	0.0112	0.0412	0.0107		0.0191
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)													
1974 Chevy Impala (Carb)	N.A.	N.A.	84.100	19.500	60.400	421.000	8.31	N.A.	N.A.	0.0101	0.0023	0.0073	0.0507
AVERAGE (1 vehicle)*	186.945	23.723	60.670	12.513	5.491	95.852	3.14	0.0577	0.0092	0.0269	0.0062	0.0007	0.0284
CARB Butadiene Study (16 vehicles)												0.0097	
										Average		0.0096	
16.4% MTBE													
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)													
1974 Chevy Impala (Carb)	N.A.	N.A.	100.000	21.600	58.200	240.000	6.30	N.A.	N.A.	0.0159	0.0034	0.0092	0.0381

*Data used in subsequent emission fractions calculations
01/28/1988

LDGV (OX-CAT -- FTP Data)

	Exhaust (mg/mi)						TOG, g/mile	Fraction of TOG					
	Methane	Ethane	Formaldehyde	Acetaldehyde	1,3-Butadiene	Benzene		Methane	Ethane	Formaldehyde	Acetaldehyde	1,3-Butadiene	Benzene
0% MTBE													
Urban, 1980a (EPA-460/3-80-003, All Carb)													
12 1978 Chev. Malibu	69.830	16.570	1.770	0.500	N.A.	26.560	0.51	0.1373	0.0326	0.0035	0.0010	N.A.	0.0522
14 1978 Ford Granada	59.530	22.530	4.650	0.230	N.A.	12.800	0.44	0.1361	0.0515	0.0106	0.0005	N.A.	0.0293
15 1978 Ford Mustang II	72.410	12.870	2.540	1.010	N.A.	22.400	0.52	0.1396	0.0248	0.0049	0.0019	N.A.	0.0432
Average	67.257	17.323	2.987	0.580		20.587	0.49	0.1377	0.0363	0.0063	0.0012		0.0416
Springer, 1979 (EPA-460/3-79-007)													
1977 Oldsmobile Cutlass (Carb)	47.466	23.680	4.183	0.644	N.A.	9.010	0.34	0.1381	0.0689	0.0122	0.0019	N.A.	0.0262
1977 Volkswagen Rabbit (FI)	53.097	10.298	0.644	0.000	N.A.	14.642	0.23	0.2318	0.0450	0.0028	0.0000	N.A.	0.0639
Average	50.281	16.989	2.414	0.322		11.826	0.29	0.1850	0.0569	0.0075	0.0009		0.0451
Sigsby et al., 1987 (46 car study)													
1 1979 Chev. Chevette (Carb)	138.320	22.800	7.550	2.450	N.A.	53.960	1.25	0.1106	0.0182	0.0060	0.0020	N.A.	0.0431
2 1978 Ford LTD Wagon (Carb)	129.930	27.800	18.470	7.630	N.A.	17.767	0.74	0.1750	0.0374	0.0249	0.0103	N.A.	0.0239
4 1979 Ply Volare (Carb)	222.500	40.000	12.740	6.170	N.A.	80.250	2.12	0.1052	0.0189	0.0060	0.0029	N.A.	0.0379
5 1978 Ford Mustang (FI)	468.940	72.810	68.100	18.910	N.A.	144.622	4.78	0.0981	0.0152	0.0142	0.0040	N.A.	0.0303
7 1980 VW Scirocco (FI)	71.810	11.220	4.010	2.940	N.A.	8.825	0.45	0.1605	0.0251	0.0090	0.0066	N.A.	0.0197
12 1976 Olds Starfire (Carb)	239.730	66.690	18.990	12.080	N.A.	6.511	2.86	0.0839	0.0233	0.0066	0.0042	N.A.	0.0023
13 1976 Olds Regency (Carb)	295.370	43.290	17.040	8.130	N.A.	58.499	2.22	0.1332	0.0195	0.0077	0.0037	N.A.	0.0264
14 1977 Buick Skyhawk (Carb)	180.970	29.300	16.300	7.240	N.A.	29.700	1.51	0.1202	0.0195	0.0108	0.0048	N.A.	0.0197
15 1975 Ply Valiant (Carb)	134.640	25.610	35.760	10.660	N.A.	30.652	1.55	0.0871	0.0166	0.0231	0.0069	N.A.	0.0198
17 1978 Pont Phoenix (Carb)	209.980	35.790	17.020	11.210	N.A.	46.452	1.95	0.1075	0.0183	0.0087	0.0057	N.A.	0.0238
18 1979 Toyota Corolla (Carb)	114.970	31.560	27.360	9.730	N.A.	29.447	1.61	0.0715	0.0196	0.0170	0.0061	N.A.	0.0183
19 1980 Buick Electra (Carb)	155.750	28.480	16.360	7.660	N.A.	12.060	0.78	0.1989	0.0364	0.0209	0.0098	N.A.	0.0154
20 1977 Chev Chevette (Carb)	162.260	27.850	9.330	5.510	N.A.	24.898	1.70	0.0955	0.0164	0.0055	0.0032	N.A.	0.0147
22 1978 Ply Volare (Carb)	204.770	35.210	18.570	5.570	N.A.	34.020	1.86	0.1100	0.0189	0.0100	0.0030	N.A.	0.0183
23 1978 Datsun 200SX (Carb)	83.300	23.500	129.950	25.980	N.A.	18.512	1.55	0.0539	0.0152	0.0841	0.0168	N.A.	0.0120
25 1979 Ford Fairmont (Carb)	268.200	33.190	19.540	8.630	N.A.	25.565	2.26	0.1188	0.0147	0.0087	0.0038	N.A.	0.0113
26 1980 Mazda GLC (Carb)	178.230	21.170	48.750	14.290	N.A.	23.562	1.92	0.0927	0.0110	0.0254	0.0074	N.A.	0.0123
27 1981 Chev Chevette (Carb)	138.170	22.120	3.890	2.930	N.A.	20.121	0.83	0.1657	0.0265	0.0047	0.0035	N.A.	0.0241
32 1975 Olds Cutlass (Carb)	722.230	71.640	92.820	22.730	N.A.	87.355	5.36	0.1348	0.0134	0.0173	0.0042	N.A.	0.0163
37 1980 Chev Citation (Carb)	88.140	13.620	5.840	2.460	N.A.	6.705	0.37	0.2407	0.0372	0.0160	0.0067	N.A.	0.0183
39 1980 Ford Fairmont (Carb)	124.570	38.010	78.460	19.200	N.A.	39.104	1.78	0.0700	0.0214	0.0441	0.0108	N.A.	0.0220
43 1981 Crys Lebaron (Carb)	124.660	16.640	6.330	3.670	N.A.	10.363	0.41	0.3064	0.0409	0.0156	0.0090	N.A.	0.0255
44 1981 AMC Concord (Carb)	96.860	28.890	8.680	6.790	N.A.	27.305	1.38	0.0700	0.0209	0.0063	0.0049	N.A.	0.0197
46 1980 Crys Lebaron (Carb)	101.770	8.820	6.600	2.820	N.A.	10.363	0.38	0.2705	0.0234	0.0175	0.0075	N.A.	0.0275
Average	194.003	32.334	28.686	9.391		35.276	1.73	0.1325	0.0220	0.0171	0.0062		0.0209
Smith, 1981 (EPA-460/3-81-024, All Carb)													
1 1978 Buick Regal B	109.910	26.760	14.210	2.610	N.A.	86.528	1.74	0.0632	0.0154	0.0082	0.0015	N.A.	0.0498
4 1978 Ford Granada B	215.120	68.800	8.660	1.830	N.A.	59.664	1.77	0.1216	0.0389	0.0049	0.0010	N.A.	0.0337
A	195.700	68.060	11.860	2.700	N.A.	53.344	1.83	0.1069	0.0372	0.0065	0.0015	N.A.	0.0291
6 1978 Olds Cutlass B	87.220	15.590	1.820	3.440	N.A.	51.264	0.88	0.0986	0.0176	0.0021	0.0039	N.A.	0.0579
A	89.640	19.400	1.960	1.950	N.A.	43.712	0.78	0.1145	0.0248	0.0025	0.0025	N.A.	0.0558
7 1978 Chev Malibu B	143.640	19.550	10.230	2.140	N.A.	33.872	0.65	0.2207	0.0300	0.0157	0.0033	N.A.	0.0520
A	113.160	16.780	12.360	1.350	N.A.	33.520	0.67	0.1686	0.0250	0.0184	0.0020	N.A.	0.0499
8 1978 Chev Monte C B	34.350	10.510	8.540	0.000	N.A.	17.936	0.46	0.0751	0.0230	0.0187	0.0000	N.A.	0.0392
A	83.060	21.380	2.040	0.480	N.A.	48.464	0.85	0.0972	0.0250	0.0024	0.0006	N.A.	0.0567
9 1978 Ford Fiesta B	39.520	15.770	2.740	0.000	N.A.	12.512	0.65	0.0607	0.0242	0.0042	0.0000	N.A.	0.0192
A	52.940	16.520	2.160	0.000	N.A.	9.808	0.56	0.0946	0.0295	0.0039	0.0000	N.A.	0.0175
10 1978 Chy N YorkerB	472.180	54.580	27.370	4.540	N.A.	209.408	4.65	0.1016	0.0117	0.0059	0.0010	N.A.	0.0451
A	137.940	31.790	9.350	0.290	N.A.	67.248	1.36	0.1012	0.0233	0.0069	0.0002	N.A.	0.0493
Average	136.491	29.653	8.715	1.641		55.945	1.30	0.1096	0.0251	0.0077	0.0013		0.0427
Stump et al., 1989, 1990 (MSERB Low Temp. Study All Carb)													
1987 Chy Caravelle (FI)	82.500	7.600	2.460	1.320	0.800	16.080	0.41	0.2028	0.0187	0.0060	0.0032	0.0020	0.0395

Auto/Oil Study													
1984 Chevrolet Suburban (Carb)	73.514	16.815	22.656	9.086	1.888	20.355	0.58	0.1268	0.0290	0.0391	0.0157	0.0033	0.0351
1983 Ford F-150 (Carb)	124.092	33.156	25.164	7.668	4.644	32.616	1.09	0.1140	0.0305	0.0231	0.0070	0.0043	0.0300
Average	98.803	24.986	23.910	8.377	3.266	26.486	0.83	0.1204	0.0297	0.0311	0.0114	0.0038	0.0325
Arco 91-03													
1980 Chevrolet Monza (Carb)	130.800	14.200	8.900	0.600	4.300	42.100	1.42	0.0919	0.0100	0.0063	0.0004	0.0030	0.0296
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)													
1977 Mercury Marquis (Carb)	N.A.	N.A.	31.700	10.900	1.500	17.300	0.92	N.A.	N.A.	0.0346	0.0119	0.0016	0.0189
AVERAGE (5 vehicles)*	151.993	28.068	19.286	5.929	0.279	38.037	1.38	0.1260	0.0248	0.0139	0.0044	0.0003	0.0303
CARB Butadiene Study (7 vehicles)											Average	0.0054	0.0043
9.0% MTBE													
Arco 91-03													
1980 Chevrolet Monza (Carb)	130.800	14.200	8.900	0.600	1.100	42.100	1.44	0.0908	0.0099	0.0062	0.0004	0.0008	0.0292
15.0% MTBE													
Auto/Oil Study													
1984 Chevrolet Suburban (Carb)	56.699	15.281	33.748	10.620	1.829	18.526	0.58	0.0976	0.0263	0.0581	0.0183	0.0031	0.0319
1983 Ford F-150 (Carb)	91.560	29.400	60.795	9.030	6.300	32.130	1.03	0.0892	0.0286	0.0592	0.0088	0.0061	0.0313
AVERAGE*	74.130	22.341	47.272	9.825	4.065	25.328	0.80	0.0934	0.0275	0.0587	0.0135	0.0046	0.0316
16.4% MTBE													
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)													
1977 Mercury Marquis (Carb)	N.A.	N.A.	100.000	21.600	1.700	12.600	1.11	N.A.	N.A.	0.0900	0.0194	0.0015	0.0113

*Data used in subsequent emission fractions calculations
01/28/1988

LDGV (PFI -- FTP Data)

	Diurnal Evap (mg/test)			Fraction of THC		Hot Soak Evap (mg/test)			Fraction of THC	
	MTBE*	Benzene	THC (g/test)	MTBE	Benzene	MTBE*	Benzene	THC (g/test)	MTBE	Benzene
0% MTBE										
Arco 91-02 (Unleaded Reg)**										
21 1989 Toyota Camry (TWC)	0.000	7.330	0.256	0.0000	0.0286	0.000	9.190	0.157	0.0000	0.0585
22 1989 Pont. Grand Prix (TWC)	0.000	1.200	0.578	0.0000	0.0021	0.000	9.680	0.359	0.0000	0.0270
23 1989 Ford Taurus (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
24 1989 Dodge Dynasty (TWC)	0.000	2.250	0.219	0.0000	0.0103	0.000	2.180	0.213	0.0000	0.0102
25 1989 Nissan Maxima (TWC)	0.000	9.720	0.469	0.0000	0.0207	0.000	41.130	1.203	0.0000	0.0342
Average	0.000	4.100	0.304	0.0000	0.0123	0.000	12.436	0.386	0.0000	0.0260
Arco 91-03 (Unleaded Premium)										
35 1988 Pontiac Grand Am (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
40 1987 Nissan 300ZX (TWC)	5.450	14.700	0.430	0.0127	0.0342	6.240	24.820	0.384	0.0163	0.0647
41 1988 Toyota 4WD Pickup (TWC)	4.210	5.050	0.146	0.0289	0.0346	2.180	9.040	0.129	0.0170	0.0703
42 1988 Toyota Celica (TWC)	1.160	6.600	0.264	0.0044	0.0250	0.860	8.140	0.109	0.0079	0.0746
44 1986 Mercedes 190E (TWC)	0.000	3.790	0.088	0.0000	0.0428	0.000	8.300	0.174	0.0000	0.0478
45 1989 Lincoln Continental (TWC)	0.000	4.840	0.157	0.0000	0.0309	0.000	5.840	0.137	0.0000	0.0426
46 1990 Plymouth Acclaim (TWC)	0.450	8.180	0.280	0.0016	0.0292	10.230	8.340	0.278	0.0368	0.0300
47 1984 Toyota Celica (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
49 1987 Oldsmobile Regency (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
56 1982 Nissan Maxima (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
57 1986 Buick Park Avenue (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
34 1985 Ford Bronco (TWC + OX)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Average	0.939	3.597	0.114	0.0040	0.0164	1.626	5.373	0.101	0.0065	0.0275
Arco 91-06 (Ind. Avg. Baseline)**										
350 1990 Ford Taurus (TWC)	0.000	5.860	0.262	0.0000	0.0224	0.000	3.320	0.150	0.0000	0.0221
351 1990 Toyota Camry (TWC)	0.000	12.030	0.643	0.0000	0.0187	0.000	10.440	0.585	0.0000	0.0178
353 1990 Honda Accord (TWC)	0.000	1.220	0.120	0.0000	0.0102	4.270	3.030	0.193	0.0221	0.0157
354 1990 Nissan Stanza (TWC)	0.000	20.930	0.805	0.0000	0.0260	0.000	32.090	1.190	0.0000	0.0270
355 1990 Pontiac Grand Am (TWC)	0.000	3.650	0.150	0.0000	0.0243	0.000	11.230	0.285	0.0000	0.0394
356 1990 Ford Crown Victoria (TWC)	0.000	6.320	0.355	0.0000	0.0178	0.000	3.460	0.130	0.0000	0.0266
357 1990 Plymouth Voyager (TWC)	0.000	3.900	0.485	0.0000	0.0080	0.000	5.050	0.133	0.0000	0.0380
358 1990 Nissan Pickup (TWC)	0.000	9.150	0.358	0.0000	0.0256	0.000	10.040	0.293	0.0000	0.0343
359 1990 Buick LeSabre (TWC)	0.000	1.430	0.123	0.0000	0.0116	0.000	6.350	0.128	0.0000	0.0496
Average	0.000	7.166	0.367	0.0000	0.0183	0.474	9.446	0.343	0.0025	0.0301
Auto/Oil Study***										
1989 Dodge Shadow (TWC)	0.000	4.550	0.480	0.0000	0.0095	0.000	6.730	0.080	0.0000	0.0841
1989 Ford Taurus (TWC)	0.000	7.600	0.150	0.0000	0.0507	0.864	12.710	0.210	0.0041	0.0605
1989 Ford Aerostar (TWC)	3.370	19.280	0.460	0.0073	0.0419	16.180	42.700	1.090	0.0148	0.0392
1989 Toyota Camry (TWC)	0.000	10.380	0.660	0.0000	0.0157	0.000	11.050	0.290	0.0000	0.0381
1989 Pontiac Grand Am (TWC)	0.000	8.800	0.170	0.0000	0.0518	4.050	17.010	0.290	0.0140	0.0587
1989 Oldsmobile Delta 88 (TWC)	4.710	8.910	0.320	0.0147	0.0278	4.610	15.080	0.300	0.0154	0.0503
1989 Ford Mustang (TWC + OX)	1.975	4.750	0.250	0.0079	0.0190	0.000	6.251	0.070	0.0000	0.0893
Average	1.436	9.181	0.356	0.0043	0.0309	3.672	15.933	0.333	0.0069	0.0600
AVERAGE (All vehicles)****	0.646	5.831	0.263	0.0023	0.0194	1.500	9.794	0.259	0.0045	0.0349

5.5% MTBE (EC-1)

Arco 91-02 (Unleaded Reg)**

21 1989 Toyota Camry (TWC)	14.740	3.090	0.149	0.0989	0.0207	8.250	6.790	0.220	0.0375	0.0309
22 1989 Pont. Grand Prix (TWC)	0.000	6.090	0.470	0.0000	0.0130	2.740	4.530	0.277	0.0099	0.0164
23 1989 Ford Taurus (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
24 1989 Dodge Dynasty (TWC)	0.000	0.380	0.188	0.0000	0.0020	0.000	2.310	0.163	0.0000	0.0142
25 1989 Nissan Maxima (TWC)	23.090	10.420	0.597	0.0387	0.0175	6.640	28.210	1.276	0.0052	0.0221
Average****	7.566	3.996	0.281	0.0275	0.0106	3.526	8.368	0.387	0.0105	0.0167

9.0% MTBE

Arco 91-03

35 1988 Pontiac Grand Am (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
35 1988 Pontiac Grand Am (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
40 1987 Nissan 300ZX (TWC)	43.540	13.840	0.430	0.1012	0.0322	24.680	20.180	0.404	0.0611	0.0500
40 1987 Nissan 300ZX (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
41 1988 Toyota 4WD Pickup (TWC)	11.070	5.470	0.144	0.0768	0.0380	7.260	8.530	0.117	0.0621	0.0730
41 1988 Toyota 4WD Pickup (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
42 1988 Toyota Celica (TWC)	9.070	4.530	0.134	0.0676	0.0338	8.120	7.520	0.131	0.0620	0.0574
42 1988 Toyota Celica (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
44 1986 Mercedes 190E (TWC)	26.490	7.710	0.265	0.0999	0.0291	14.280	8.020	0.211	0.0676	0.0380
44 1986 Mercedes 190E (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
45 1989 Lincoln Continental (TWC)	19.870	5.070	0.211	0.0944	0.0241	4.260	5.780	0.134	0.0317	0.0430
45 1989 Lincoln Continental (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
46 1990 Plymouth Acclaim (TWC)	19.980	9.410	0.325	0.0615	0.0290	18.690	8.760	0.230	0.0814	0.0382
46 1990 Plymouth Acclaim (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
47 1984 Toyota Celica (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
47 1984 Toyota Celica (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
49 1987 Oldsmobile Regency (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
56 1982 Nissan Maxima (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
57 1986 Buick Park Avenue (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
57 1986 Buick Park Avenue (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Average****	6.501	2.302	0.075	0.0251	0.0093	3.865	2.940	0.061	0.0183	0.0150

15.0% MTBE

Arco 91-06 (Test Blend 1)**

350 1990 Ford Taurus (TWC)	0.000	0.000	0.063	0.0000	0.0000	0.000	0.000	0.118	0.0000	0.0000
351 1990 Toyota Camry (TWC)	0.000	0.000	0.375	0.0000	0.0000	0.000	4.920	0.535	0.0000	0.0092
353 1990 Honda Accord (TWC)	51.450	6.270	0.470	0.1095	0.0133	42.940	6.620	0.615	0.0698	0.0108
354 1990 Nissan Stanza (TWC)	46.220	15.360	0.680	0.0680	0.0226	70.690	24.940	1.458	0.0485	0.0171
355 1990 Pontiac Grand Am (TWC)	4.100	2.790	0.105	0.0390	0.0266	10.410	11.330	0.260	0.0400	0.0436
356 1990 Ford Crown Victoria (TWC)	1.180	0.130	0.130	0.0091	0.0010	4.390	3.550	0.125	0.0351	0.0284
357 1990 Plymouth Voyager (TWC)	4.210	0.000	0.085	0.0495	0.0000	5.790	2.350	0.140	0.0414	0.0168
358 1990 Nissan Pickup (TWC)	7.810	5.650	0.190	0.0411	0.0297	13.380	9.940	0.320	0.0418	0.0311
359 1990 Buick LeSabre (TWC)	2.480	2.350	0.075	0.0331	0.0313	N.A.	N.A.	N.A.	N.A.	N.A.
Average	13.050	3.617	0.241	0.0388	0.0138	16.400	7.072	0.397	0.0307	0.0174

Arco 91-06 (Test Blend 2)**

350 1990 Ford Taurus (TWC)	0.000	0.680	0.090	0.0000	0.0076	0.000	4.040	0.135	0.0000	0.0299
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351 1990 Toyota Camry (TWC)	0.000	7.290	0.325	0.0000	0.0224	0.000	11.860	0.575	0.0000	0.0206
353 1990 Honda Accord (TWC)	6.000	3.750	0.080	0.0750	0.0469	6.840	4.640	0.140	0.0489	0.0331
354 1990 Nissan Stanza (TWC)	11.450	8.720	0.437	0.0262	0.0200	4.900	21.710	0.912	0.0054	0.0238
355 1990 Pontiac Grand Am (TWC)	4.990	1.040	0.095	0.0525	0.0109	7.500	8.090	0.205	0.0366	0.0395
356 1990 Ford Crown Victoria (TWC)	2.570	2.100	0.185	0.0139	0.0114	3.640	0.000	0.100	0.0364	0.0000
357 1990 Plymouth Voyager (TWC)	6.900	4.550	0.100	0.0690	0.0455	3.790	1.310	0.140	0.0271	0.0094
358 1990 Nissan Pickup (TWC)	8.280	2.240	0.185	0.0448	0.0121	13.120	7.100	0.290	0.0452	0.0245
359 1990 Buick LeSabre (TWC)	2.130	2.620	0.060	0.0355	0.0437	5.080	6.180	0.145	0.0350	0.0426
Average	4.702	3.666	0.173	0.0352	0.0245	4.986	7.214	0.294	0.0261	0.0248

Auto/Oil Study

1989 Dodge Shadow (TWC)	7.876	6.424	0.220	0.0358	0.0292	16.176	6.792	0.120	0.1348	0.0566
1989 Ford Taurus (TWC)	31.395	7.429	0.230	0.1365	0.0323	29.700	13.233	0.330	0.0900	0.0401
1989 Ford Aerostar (TWC)	30.996	16.031	0.410	0.0756	0.0391	5.151	3.596	1.010	0.0051	0.0036
1989 Toyota Camry (TWC)	40.428	6.516	0.360	0.1123	0.0181	39.970	12.775	0.350	0.1142	0.0365
1989 Pontiac Grand Am (TWC)	26.900	9.000	0.250	0.1076	0.0360	56.112	20.304	0.480	0.1169	0.0423
1989 Oldsmobile Delta 88 (TWC)	37.851	7.030	0.370	0.1023	0.0190	46.995	13.689	0.390	0.1205	0.0351
1989 Ford Mustang (TWC + OX)	28.593	7.128	0.270	0.1059	0.0264	8.001	5.895	0.090	0.0889	0.0655
Average	29.148	8.508	0.301	0.0966	0.0286	28.872	10.898	0.396	0.0958	0.0400
AVERAGE (All vehicles)****	14.552	5.004	0.234	0.0537	0.0218	15.783	8.195	0.359	0.0473	0.0264

*Evaporative MTBE emissions in fuels with 0% MTBE is likely due to carryover from tests done on MTBE blends.

**Evaporative emissions given in mass per mile. ARCO 91-02 and 91-06 converted mass per test data to mass per mile data using the MOBILE3 conversion.

***Only data for fuel A considered.

****Data used in subsequent emission fractions calculations.

09/09/1987

LDGV (TBI -- FTP Data)

	Diurnal Evap (mg/test)		THC (g/test)	Fraction of THC		Hot Soak Evap (mg/test)		THC (g/test)	Fraction of THC	
	MTBE*	Benzene		MTBE	Benzene	MTBE*	Benzene		MTBE	Benzene
0% MTBE										
Arco 91-03 (Unleaded Premium)										
1983 Ford Thunderbird (TWC + OX)	25.070	13.170	8.063	0.0031	0.0016	0.000	7.620	0.185	0.0000	0.0413
Arco 91-06 (Ind. Avg. Baseline)**										
352 1990 Plymouth Sundance (TWC)	0.000	3.840	0.583	0.0000	0.0066	0.000	4.760	0.382	0.0000	0.0125
Auto/Oil Study										
1989 Plymouth Sundance (TWC)***	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
1989 Chevrolet Suburban (TWC)***	7.030	6.790	0.230	0.0306	0.0295	10.080	12.710	0.300	0.0336	0.0424
1985 Ford Tempo (TWC + OX)	13.728	28.171	1.430	0.0096	0.0197	15.088	24.932	0.920	0.0164	0.0271
Average	6.919	11.654	0.553	0.0134	0.0164	8.389	12.547	0.407	0.0167	0.0232
AVERAGE (All vehicles)****	9.166	10.394	2.061	0.0087	0.0115	5.034	10.004	0.357	0.0100	0.0246
9.0% MTBE										
Arco 91-03										
1983 Ford Thunderbird (TWC + OX)****	82.090	8.760	2.972	0.0276	0.0029	25.570	4.760	0.205	0.1248	0.0232
15.0% MTBE										
Arco 91-06 (Test Blend 1)**										
352 1990 Plymouth Sundance (TWC)	12.870	0.000	0.205	0.0628	0.0000	12.490	2.240	0.190	0.0657	0.0118
Arco 91-06 (Test Blend 2)**										
352 1990 Plymouth Sundance (TWC)	1.110	8.110	0.245	0.0045	0.0331	10.880	6.650	0.205	0.0531	0.0324
Auto/Oil Study										
1989 Plymouth Sundance (TWC)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
1989 Chevrolet Suburban (TWC)	33.205	6.467	0.290	0.1145	0.0223	40.672	11.315	0.310	0.1312	0.0365
1985 Ford Tempo (TWC + OX)	134.332	68.460	1.420	0.0946	0.0482	68.460	21.070	0.700	0.0978	0.0301
Average	55.846	24.976	0.570	0.0697	0.0235	36.377	10.795	0.337	0.0763	0.0222
AVERAGE (All vehicles)****	36.303	16.607	0.432	0.0553	0.0207	26.500	8.255	0.281	0.0696	0.0222

*Evaporative MTBE emissions in fuels with 0% MTBE is likely due to carryover from tests done on MTBE blends.

**Evaporative emissions given in mass per mile. ARCO 91-06 converted mass per test data to mass per mile data using the MOBILE3 conversion.

***Only data for fuel A considered.

****Data used in subsequent emission fractions calculations.

09/04/1987

EXHAUST Catalyst	Fuel	# of Studies	# of Vehicles	Percent TOG				Weighted 1,3-Butadiene			
				Formaldehyde	Acetaldehyde	Benzene	1,3-Butadiene	CARB Butadiene	CARB THC/TOG***	EPA THC/TOG****	
3-WAY	Gasoline	4	38	0.87	0.47	5.56	0.48	0.60	0.55	0.57	
3-WAY	5.5% MTBE	1	5	1.72	0.83	2.92	0.61				
3-WAY	9.0% MTBE	1	16*	0.98	0.40	4.16	0.50				
3-WAY	12.5% MTBE	1	11	1.07	0.43	3.17	0.58				
3-WAY	15% MTBE	2	19**	0.72	0.33	4.43	0.60				
3-WAY + OX	Gasoline	7	25	1.37	0.45	2.77	0.16				
3-WAY + OX	9.0% MTBE	1	4	1.46	0.53	2.69	0.28				
3-WAY + OX	12.5% MTBE	1	1	1.05	0.29	1.92	0.16				
3-WAY + OX	15.0% MTBE	1	4	1.23	0.33	3.53	0.25				
OX	Gasoline	8	41	1.39	0.44	3.03	0.28	0.54	0.43	0.44	
OX	9.0% MTBE	1	1	0.62	0.04	2.92	0.08				
OX	15% MTBE	1	2	5.87	1.35	3.16	0.46				
OX	16.4% MTBE	1	1	9.00	1.94	1.13	0.15				
NONCAT	Gasoline	3	11	2.69	0.62	2.84	0.73	0.97	0.96	0.98	
NONCAT	16.4% MTBE	1	1	1.59	0.34	3.81	0.92				
LDDV	Diesel	2	7	3.91	1.25	2.01	N.A.	0.90	0.90	1.03	
HDDV	Diesel	1	2	2.80	0.75	1.02	N.A.	1.36	1.36	1.58	
HDGV	Gasoline	1	1	3.10	0.63	10.26	N.A.				

*13 of these vehicles were tested twice in two separate experiments.

**10 vehicles were tested twice, using different 15% MTBE blends.

***CARB THC/TOG correction factors are described in CARB memo "Butadiene emission factors" from K. D. Drachand to Terry McGuire and Peter Venturini, July 17, 1991.

****EPA THC/TOG correction factors are described in EPA memo "Correction factors to convert THC to TOG" from Greg Janssen to Phil Lorang, September 3, 1991.

02/06/1988

Fuel System	Fuel	# of Studies	# of Vehicles	Diurnal		Hot Soak	
				MTBE*	Benzene	MTBE*	Benzene
Carb.	Gasoline	4	13	1.16	1.50	0.85	2.54
Carb.	9.0% MTBE	1	3	9.86	1.97	12.11	2.38
Carb.	15.0% MTBE	1	7	10.90	1.42	14.93	2.52
Carb.	16.4% MTBE	1	2	8.17	0.72	12.70	1.08
TBI	Gasoline	3	5	1.08	1.44	1.25	3.08
TBI	9.0% MTBE	1	1	2.76	0.29	12.48	2.32
TBI	15.0% MTBE	3	4**	6.91	2.59	8.70	2.77
PFI	Gasoline	4	26	0.30	2.46	0.57	4.43
PFI	5.5% MTBE	1	4	3.44	1.33	1.31	2.09
PFI	9.0% MTBE	1	6	8.36	3.10	6.10	4.99
PFI	15.0% MTBE	3	16***	5.37	2.18	4.92	2.75

1987 Air Toxics Report (Carey, 1987)

Benzene 1.11 to 1.53% of evaporative emissions for carbureted LDGVs and 0.35-0.46% for fuel injected vehicles.

*Evaporative emissions in fuels with 0% MTBE is likely due to carryover from tests done on MTBE blends.

**1 of these vehicles was tested twice, using different 15% MTBE blends.

***9 of these vehicles were tested twice, using different 15% MTBE blends.

02/20/1988

LDGV (3-WAY -- FTP Data)

	Formaldehyde			Acetaldehyde			1,3-Butadiene			Benzene		
	0% MTBE TOG Fraction	15% MTBE TOG Fraction	Change	0% MTBE TOG Fraction	15% MTBE TOG Fraction	Change	0% MTBE TOG Fraction	15% MTBE TOG Fraction	Change	0% MTBE TOG Fraction	15% MTBE TOG Fraction	Change
Auto/Oil Study (pooled data)												
1989 Plymouth Sundance (TBI)	0.0048	0.0065	0.3542	0.0048	0.0036	-0.2500	0.0034	0.0036	0.0588	0.0637	0.0636	-0.0016
1989 Dodge Shadow (PFI)	0.0054	0.0053	-0.0185	0.0044	0.0036	-0.1818	0.0063	0.0056	-0.1111	0.0499	0.0508	0.0180
1989 Ford Taurus (PFI)	0.0047	0.0058	0.2340	0.0032	0.0035	0.0938	0.0039	0.0038	-0.0256	0.0482	0.0505	0.0477
1989 Ford Aerostar (PFI)	0.0038	0.0041	0.0789	0.0028	0.003	0.0714	0.0037	0.0036	-0.0270	0.0563	0.0576	0.0231
1989 Toyota Camry (PFI)	0.0026	0.0096	2.6923	0.0028	0.0026	-0.0714	0.0036	0.0036	0.0000	0.0477	0.0452	-0.0524
1989 Honda Accord (Carb)	0.0052	0.0097	0.8654	0.0045	0.0048	0.0667	0.0052	0.0051	-0.0192	0.0388	0.032	-0.1753
1989 Chevrolet Suburban (TBI)	0.0095	0.0110	0.1579	0.0054	0.0055	0.0185	0.0031	0.0036	0.1613	0.0653	0.0666	0.0199
1989 Pontiac Grand Am (PFI)	0.0105	0.0114	0.0857	0.0061	0.0062	0.0164	0.008	0.0081	0.0125	0.0419	0.0434	0.0358
1989 Oldsmobile Delta 88 (SFI)	0.0093	0.0132	0.4194	0.0047	0.0046	-0.0213	0.0056	0.0055	-0.0179	0.0513	0.0557	0.0858
1985 Plymouth Reliant (Carb)	0.0055			0.0020			0.0015			0.0258		
1985 Honda Accord (Carb)	0.0051			0.0028			0.005			0.0483		
AVERAGE			0.5410			-0.0286			0.0515			0.0001

	Formaldehyde					Acetaldehyde					1,3-Butadiene				
	0% MTBE TOG Fraction	15% MTBE B1* TOG Fraction	15% MTBE B2** TOG Fraction	Change B1	Change B2	0% MTBE TOG Fraction	15% MTBE B1* TOG Fraction	15% MTBE B2** TOG Fraction	Change B1	Change B2	0% MTBE TOG Fraction	15% MTBE B1* TOG Fraction	15% MTBE B2** TOG Fraction	Change B1	Change B2
Arco 91-06 (Ind. Avg. Baseline)															
350 1990 Ford Taurus (PFI)	0.0026	0.005	0.0055	0.9231	1.1154	0.0024	0.0027	0.0027	0.1250	0.1250	0.0059	0.0058	0.0059	-0.0169	0.0000
351 1990 Toyota Camry (PFI)	0.0024	0.0031	0.0036	0.2917	0.5000	0.0022	0.0023	0.0025	0.0455	0.1364	0.0082	0.0075	0.0058	-0.0854	-0.2927
352 1990 Plymouth Sundance (TBI)	0.0025	0.0077	0.0067	2.0800	1.6800	0.0016	0.0012	0.0028	-0.2500	0.7500	0.0063	0.0039	0.0043	-0.3810	-0.3175
353 1990 Honda Accord (PFI)	0.0032	0.0085	0.0071	1.6563	1.2188	0.0033	0.0025	0.0024	-0.2424	-0.2727	0.0097	0.0097	0.0074	0.0000	-0.2371
354 1990 Nissan Stanza (PFI)	0.0036	0.0058	0.0048	0.6111	0.3333	0.0023	0.0025	0.0048	0.0870	1.0870	0.0091	0.0075	0.0072	-0.1758	-0.2088
355 1990 Pontiac Grand Am (PFI)	0.0048	0.0072	0.0068	0.5000	0.4167	0.0026	0.0032	0.0021	0.2308	-0.1923	0.01	0.0102	0.0101	0.0200	0.0100
356 1990 Ford Crown Victoria (PFI)	0.0036	0.0049	0.004	0.3611	0.1111	0.002	0.0026	0.0013	0.3000	-0.3500	0.0026	0.0034	0.0031	0.3077	0.1923
357 1990 Plymouth Voyager (PFI)	0.0053	0.005	0.007	-0.0566	0.3208	0.003	0.0069	0.0027	1.3000	-0.1000	0.0054	0.0058	0.0063	0.0741	0.1667
358 1990 Nissan Pickup (PFI)	0.0064	0.0119	0.0114	0.8594	0.7813	0.0038	0.0039	0.0038	0.0263	0.0000	0.0089	0.0077	0.0092	-0.1348	0.0337
359 1990 Buick LeSabre (PFI)	0.0036	0.0075	0.0076	1.0833	1.1111	0.002	0.0025	0.0032	0.2500	0.6000	0.0051	0.0061	0.0052	0.1961	0.0196
AVERAGE	0.0038	0.0067	0.0065	0.8309	0.7588	0.0025	0.0030	0.0028	0.1872	0.1783	0.0071	0.0068	0.0065	-0.0196	-0.0634

	Benzene				
	0% MTBE TOG Fraction	15% MTBE B1* TOG Fraction	15% MTBE B2** TOG Fraction	Change B1	Change B2
Arco 91-06 (Ind. Avg. Baseline)					
350 1990 Ford Taurus (PFI)	0.0569	0.0349	0.04	-0.3866	-0.2970
351 1990 Toyota Camry (PFI)	0.0436	0.0334	0.0579	-0.2339	0.3280
352 1990 Plymouth Sundance (TBI)	0.0806	0.0361	0.0445	-0.5521	-0.4479
353 1990 Honda Accord (PFI)	0.0559	0.0372	0.0398	-0.3345	-0.2880
354 1990 Nissan Stanza (PFI)	0.0735	0.0429	0.0368	-0.4163	-0.4993
355 1990 Pontiac Grand Am (PFI)	0.0583	0.0365	0.0398	-0.3739	-0.3173
356 1990 Ford Crown Victoria (PFI)	0.0382	0.0398	0.0294	0.0419	-0.2304
357 1990 Plymouth Voyager (PFI)	0.0632	0.0237	0.0367	-0.6250	-0.4193
358 1990 Nissan Pickup (PFI)	0.0542	0.0382	0.0434	-0.2952	-0.1993
359 1990 Buick LeSabre (PFI)	0.055	0.047	0.0801	-0.1455	0.4564
AVERAGE	0.0579	0.0370	0.0448	-0.3321	-0.1914

*B1 = Arco reformulated gasoline EC-X, test blend no. 1
 **B2 = Arco reformulated gasoline EC-X, test blend no. 2

Change is defined by solving the equation:
 TOG frac @ 0%MTBE * (1 + (change/2.7) * Ox) = TOG frac @ 15% MTBE
 where Ox = 2.7

Overall averages (weighted average of the averages)	
FORMALDEHYDE	0.6746
ACETALDEHYDE	0.0826
1,3-BUTADIENE	0.0025
BENZENE	-0.1377

LDGV (3-WAY -- FTP Data)

	Formaldehyde			Acetaldehyde			1,3-Butadiene			Benzene		
	0% EtOH TOG Fraction	10% EtOH TOG Fraction	Change	0% EtOH TOG Fraction	10% EtOH TOG Fraction	Change	0% EtOH TOG Fraction	10% EtOH TOG Fraction	Change	0% EtOH TOG Fraction	10% EtOH TOG Fraction	Change
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)												
1990 Ford Probe (PFI)	0.0121	0.0183	0.5124	0.0029	0.0106	2.6552	0.0029	0.0039	0.3448	0.0512	0.0386	-0.2461
1990 Chevy Lumina (TBI)	0.0161	0.0283	0.7578	0.0073	0.0179	1.4521	0.0042	0.0055	0.3095	0.0556	0.0421	-0.2428
1983 Buick Regal (Carb)	0.0073	0.0073	0.0000	0.003	0.0087	1.9000	0.0017	0.0014	-0.1765	0.0346	0.0262	-0.2428
Average	0.0118	0.0180	0.4234	0.0044	0.0124	2.0024	0.0029	0.0036	0.1593	0.0471	0.0356	-0.2439
Auto/Oil (Fuel X/Industry Avg. +10% EtOH, 10 RVP)												
1989 Plymouth Sundance (TBI)	0.0031	0.0064	1.0645	0.0034	0.0103	2.0294	0.0045	0.0045	0.0000	0.0458	0.0484	0.0568
1989 Dodge Shadow (TBI)	0.0054	0.0531	8.8333	0.0021	0.01	3.7619	0.0059	0.0058	-0.0169	0.0514	0.0424	-0.1751
1989 Ford Mustang (PFI)	0.0038	0.0063	0.6579	0.0029	0.0066	1.2759	0.0021	0.0016	-0.2381	0.0225	0.0148	-0.3422
1989 Ford Taurus (PFI)	0.003	0.0045	0.5000	0.0069	0.0096	0.3913	0.0047	0.0038	-0.1915	0.0463	0.0384	-0.1706
1989 Ford Aerostar (PFI)	0.0022	0.0033	0.5000	0.0005	0.01	19.0000	0.0045	0.0053	0.1778	0.0473	0.0528	0.1163
1989 Camry Sedan (PFI)	0.0037	0.0013	-0.6486	0.0173	0.0059	-0.6590	0.003	0.0033	0.1000	0.0378	0.0374	-0.0106
1989 Accord Sedan (Carb)	0.0188	0.0216	0.1489	0.0184	0.0122	-0.3370	0.006	0.0052	-0.1333	0.0361	0.0269	-0.2548
1989 Chevy Suburban (TBI)	0.0071	0.0097	0.3662	0.006	0.0171	1.8500	0.0042	0.0065	0.5476	0.0633	0.0557	-0.1201
1989 Pontiac Grand Am (PFI)	0.0065	0.0107	0.6462	0.0186	0.0121	-0.3495	0.0084	0.0056	-0.3333	0.0401	0.0285	-0.2893
1989 Oldsmobile Delta 88 (PFI)	0.0053	0.0091	0.7170	0.0038	0.0097	1.5526	0.007	0.0055	-0.2143	0.0396	0.0452	0.1414
Average	0.0059	0.0126	1.2785	0.0080	0.0104	2.8516	0.0050	0.0047	-0.0302	0.0430	0.0391	-0.1048
Average (without Shadow)			0.3843									
Average (without Aerostar)						1.0573						
Auto/Oil (Fuel W/Industry Avg. +10% EtOH, 9 RVP)												
1989 Plymouth Sundance (TBI)	0.0031	0.0054	0.7419	0.0034	0.0107	2.1471	0.0045	0.0036	-0.2000	0.0458	0.0621	0.3559
1989 Dodge Shadow (TBI)	0.0054	0.0088	0.6296	0.0021	0.0048	1.2857	0.0059	0.0061	0.0339	0.0514	0.0479	-0.0681
1989 Ford Mustang (PFI)	0.0038	0.0096	1.5263	0.0029	0.0176	5.0690	0.0021	0.0026	0.2381	0.0225	0.0219	-0.0267
1989 Ford Taurus (PFI)	0.003	0.0056	0.8667	0.0069	0.0095	0.3768	0.0047	0.0041	-0.1277	0.0463	0.0351	-0.2419
1989 Ford Aerostar (PFI)	0.0022	0.0265	11.0455	0.0005	0.0129	24.8000	0.0045	0.0059	0.3111	0.0473	0.0498	0.0529
1989 Camry Sedan (PFI)	0.0037	0.0049	0.3243	0.0173	0.0045	-0.7399	0.003	0.0037	0.2333	0.0378	0.0379	0.0026
1989 Accord Sedan (Carb)	0.0188	0.0063	-0.6649	0.0184	0.0119	-0.3533	0.006	0.0054	-0.1000	0.0361	0.0307	-0.1496
1989 Chevy Suburban (TBI)	0.0071	0.0102	0.4366	0.006	0.0147	1.4500	0.0042	0.0042	0.0000	0.0633	0.0516	-0.1848
1989 Pontiac Grand Am (PFI)	0.0065	0.0094	0.4462	0.0186	0.0123	-0.3387	0.0084	0.0065	-0.2262	0.0401	0.0331	-0.1746
1989 Oldsmobile Delta 88 (PFI)	0.0053	0.0113	1.1321	0.0038	0.0239	5.2895	0.007	0.0077	0.1000	0.0396	0.0439	0.1086
Average	0.0059	0.0098	1.6484	0.0080	0.0123	3.8986	0.0050	0.0050	0.0263	0.0430	0.0414	-0.0326
Average (without Aerostar)			0.6043			1.5762						
Auto/Oil (Fuel U/Low ole., low T90, low arom., 10% EtOH, 10 RVP)												
1989 Plymouth Sundance (TBI)	0.0031	0.0061	0.9677	0.0034	0.0126	2.7059	0.0045	0.003	-0.3333	0.0458	0.0491	0.0721
1989 Dodge Shadow (TBI)	0.0054	0.0079	0.4630	0.0021	0.0064	2.0476	0.0059	0.0044	-0.2542	0.0514	0.0374	-0.2724
1989 Ford Mustang (PFI)	0.0038	0.008	1.1053	0.0029	0.0049	0.6897	0.0021	0.0014	-0.3333	0.0225	0.0155	-0.3111
1989 Ford Taurus (PFI)	0.003	0.0048	0.6000	0.0069	0.007	0.0145	0.0047	0.0029	-0.3830	0.0463	0.0259	-0.4406
1989 Ford Aerostar (PFI)	0.0022	0.0033	0.5000	0.0005	0.009	17.0000	0.0045	0.0027	-0.4000	0.0473	0.0529	0.1184
1989 Camry Sedan (PFI)	0.0037	0.0007	-0.8108	0.0173	0.0049	-0.7168	0.003	0.0028	-0.0667	0.0378	0.0302	-0.2011
1989 Accord Sedan (Carb)	0.0188	0.0094	-0.5000	0.0184	0.0065	-0.6467	0.006	0.0036	-0.4000	0.0361	0.0209	-0.4211
1989 Chevy Suburban (TBI)	0.0071	0.0003	-0.9577	0.006	0.003	-0.5000	0.0042	0.0009	-0.7857	0.0633	0.0438	-0.3081
1989 Pontiac Grand Am (PFI)	0.0065	0.0153	1.3538	0.0186	0.0157	-0.1559	0.0084	0.0076	-0.0952	0.0401	0.0319	-0.2045
1989 Oldsmobile Delta 88 (PFI)	0.0053	0.0109	1.0566	0.0038	0.0229	5.0263	0.007	0.0073	0.0429	0.0396	0.0421	0.0631
Average	0.0059	0.0067	0.3778	0.0080	0.0093	2.5465	0.0050	0.0037	-0.3391	0.0430	0.0350	-0.2187
Average (without Aerostar)						0.9405						
Auto/Oil (Fuel T/Low ole., low T90, low arom., 10% EtOH, 9 RVP)												
1989 Plymouth Sundance (TBI)	0.0031	0.0052	0.6774	0.0034	0.0104	2.0588	0.0045	0.004	-0.1111	0.0458	0.0658	0.4367
1989 Dodge Shadow (TBI)	0.0054	0.0028	-0.4815	0.0021	0.0079	2.7619	0.0059	0.0044	-0.2542	0.0514	0.0345	-0.3288
1989 Ford Mustang (PFI)	0.0038	0.0052	0.3684	0.0029	0.0084	1.8966	0.0021	0.0016	-0.2381	0.0225	0.0140	-0.3778
1989 Ford Taurus (PFI)	0.003	0.0082	1.7333	0.0069	0.0117	0.6957	0.0047	0.0036	-0.2340	0.0463	0.0397	-0.1425
1989 Ford Aerostar (PFI)	0.0022	0.004	0.8182	0.0005	0.008	15.0000	0.0045	0.0029	-0.3556	0.0473	0.0440	-0.0698
1989 Camry Sedan (PFI)	0.0037	0.0022	-0.4054	0.0173	0.0049	-0.7168	0.003	0.0021	-0.3000	0.0378	0.0308	-0.1852
1989 Accord Sedan (Carb)	0.0188	0.0068	-0.6383	0.0184	0.0073	-0.6033	0.006	0.0043	-0.2833	0.0361	0.0274	-0.2410
1989 Chevy Suburban (TBI)	0.0071	0.0134	0.8873	0.006	0.0047	-0.2167	0.0042	0.0042	0.0000	0.0633	0.0447	-0.2938
1989 Pontiac Grand Am (PFI)	0.0065	0.0148	1.2769	0.0186	0.0132	-0.2903	0.0084	0.0069	-0.1786	0.0401	0.0280	-0.3017
1989 Oldsmobile Delta 88 (PFI)	0.0053	0.009	0.6981	0.0038	0.0088	1.3158	0.007	0.0056	-0.2000	0.0396	0.0350	-0.1162
Average	0.0059	0.0072	0.4935	0.0080	0.0085	2.1902	0.0050	0.0040	-0.2155	0.0430	0.0364	-0.1620
Average (without Aerostar)						0.7669						

Change is defined by solving the equation:
 $\text{TOG frac @ 0\%EtOH} * (1 + (\text{change}/3.5) * \text{Ox}) = \text{TOG frac @ 10\% EtOH}$
 where Ox = 3.5

LDGV (3-WAY -- FTP Data) Cont.

	Formaldehyde			Acetaldehyde			1,3-Butadiene			Benzene		
	0% EtOH TOG Fraction	10% EtOH TOG Fraction	Change	0% EtOH TOG Fraction	10% EtOH TOG Fraction	Change	0% EtOH TOG Fraction	10% EtOH TOG Fraction	Change	0% EtOH TOG Fraction	10% EtOH TOG Fraction	Change
Colorado Department of Health, 1987												
1985 Mercury Marquis (TBI)	0.0077	0.0153	0.9870	0.0048	0.0139	1.8958	N/A	N/A	N/A	0.0268	0.0236	-0.1194
1985 Mercury Marquis (TBI)	0.0071	0.0194	1.7324	0.0056	0.0148	1.6429	N/A	N/A	N/A	0.0193	0.0297	0.5389
1986 Ford Escort (Carb)	0.026	0.0495	0.9038	0.0034	0.0073	1.1471	N/A	N/A	N/A	0.0381	0.0273	-0.2835
1984 Olds Stationwagon (Carb)	0.0105	0.0096	-0.0857	0.0038	0.0072	0.8947	N/A	N/A	N/A	0.0406	0.0326	-0.1970
1984 Buick Skylark (TBI)	0.0173	0.0175	0.0116	0.0061	0.0108	0.7705	N/A	N/A	N/A	0.0740	0.0689	-0.0689
1983 Chev Celebrity (TBI)	0.0276	0.0257	-0.0688	0.0192	0.0141	-0.2656	N/A	N/A	N/A	0.0450	0.0306	-0.3200
Average	0.0160	0.0228	0.5800	0.0072	0.0114	1.0142	N/A	N/A	N/A	0.0406	0.0355	-0.0750

Overall averages (weighted average of the averages)

Formaldehyde	0.4758
Acetaldehyde	1.1369
1,3-Butadiene	-0.1188
Benzene	-0.1299

02/23/1988

	DIURNAL				HOT SOAK			
	0% MTBE TOG Fraction	Benzene MTBE Blend TOG Fraction	Change MTBE Blend/ 0% MTBE	Average of Absolutes	0% MTBE TOG Fraction	Benzene MTBE Blend TOG Fraction	Change MTBE Blend/ 0% MTBE	Average of Absolutes
LDGV -- CARB								
9.0% MTBE								
Arco 91-03								
37 1981 Olsmobile Delta 88 (TWC)	0.0076	0.0071	-6.58		0.0280	0.0177	-36.79	
37 1981 Olsmobile Delta 88 (TWC)	0.0076	N.A.			0.0280	N.A.		
39 1984 Honda Accord (TWC)	0.0380	0.0293	-22.89		0.0599	0.0372	-37.90	
39 1984 Honda Accord (TWC)	0.0380	N.A.			0.0599	N.A.		
48 1985 Ford Mustang (TWC)	N.A.	N.A.			N.A.	N.A.		
48 1985 Ford Mustang (TWC)	N.A.	N.A.			N.A.	N.A.		
58 1989 Toyota Tercel (TWC)	N.A.	N.A.			N.A.	N.A.		
58 1989 Toyota Tercel (TWC)	N.A.	N.A.			N.A.	N.A.		
59 1982 Buick Regal (TWC)	N.A.	N.A.			N.A.	N.A.		
43 1985 Chevrolet Camaro (TWC + OX)	0.0152	0.0266	75.00		0.0117	0.0166	41.88	
Average	0.0106	0.0063	15.18	34.82	0.0188	0.0072	-10.93	38.85
15.0% MTBE								
Auto/Oil Study								
1989 Honda Accord (TWC)	0.0091	0.0118	29.67		0.0223	0.0194	-13.00	
1985 Plymouth Reliant (TWC)	0.0130	0.0126	-3.08		0.0263	0.0229	-12.93	
1985 Honda Accord (TWC)	0.0328	0.0270	-17.68		0.0284	0.0242	-14.79	
1985 Chevrolet Impala (TWC + OX)	0.0069	0.0058	-15.94		0.0293	0.0289	-1.37	
1984 Pontiac Grand Prix (TWC + OX)	0.0082	0.0097	18.29		0.0270	0.0274	1.48	
1984 Chevrolet Suburban (OX)	0.0079	0.0084	6.33		0.0274	0.0261	-4.74	
1983 Ford F-150 (OX)	0.0282	0.0238	-15.60		0.0319	0.0273	-14.42	
Average	0.0152	0.0142	0.28	15.23	0.0275	0.0252	-8.54	8.96
16.4% MTBE								
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)								
1977 Mercury Marquis (OX)	0.0052	0.0050	-3.85		0.0063	0.0086	36.51	
1974 Chevy Impala (Non-cat)	0.0094	0.0093	-1.06		0.0179	0.0130	-27.37	
Average	0.0073	0.0072	-2.45	2.45	0.0121	0.0108	4.57	31.94

LDGV -- TBI

9.0% MTBE

Arco 91-03								
1983 Ford Thunderbird (TWC + OX)	0.0016	0.0029	81.25		0.0413	0.0232	-43.83	

15.0% MTBE

Arco 91-06 (Test Blend 1)								
352 1990 Plymouth Sundance (TWC)	0.0066	0.0000	-100.00		0.0125	0.0118	-5.60	

Arco 91-06 (Test Blend 2)								
352 1990 Plymouth Sundance (TWC)	0.0066	0.0331	401.52		0.0125	0.0324	159.20	

Auto/Oil Study

1989 Plymouth Sundance (TWC)	N.A.	N.A.			N.A.	N.A.		
1989 Chevrolet Suburban (TWC)	0.0295	0.0223	-24.41		0.0424	0.0365	-13.92	
1985 Ford Tempo (TWC + OX)	0.0197	0.0482	144.67		0.0271	0.0301	11.07	
Average	0.0164	0.0235	60.13	84.54	0.0232	0.0222	-1.42	12.49
AVERAGE (All vehicles)	0.0125	0.0207	105.44	167.65	0.0189	0.0222	37.69	47.45

LDGV -- PFI

5.5% MTBE (EC-1)

Arco 91-02 (Unleaded Reg)**								
21 1989 Toyota Camry (TWC)	0.0286	0.0207	-27.62		0.0585	0.0309	-47.18	
22 1989 Pont. Grand Prix (TWC)	0.0021	0.0130	519.05		0.0270	0.0164	-39.26	
23 1989 Ford Taurus (TWC)	N.A.	N.A.			N.A.	N.A.		
24 1989 Dodge Dynasty (TWC)	0.0103	0.0020	-80.58		0.0102	0.0142	39.22	
25 1989 Nissan Maxima (TWC)	0.0207	0.0175	-15.46		0.0342	0.0221	-35.38	
Average	0.0123	0.0106	98.85	160.68	0.0260	0.0167	-20.65	40.26

9.0% MTBE

Arco 91-03								
35 1988 Pontiac Grand Am (TWC)	N.A.	N.A.			N.A.	N.A.		
35 1988 Pontiac Grand Am (TWC)	N.A.	N.A.			N.A.	N.A.		
40 1987 Nissan 300ZX (TWC)	N.A.	N.A.			N.A.	N.A.		
40 1987 Nissan 300ZX (TWC)	0.0342	0.0322	-5.85		0.0647	0.0500	-22.72	
41 1988 Toyota 4WD Pickup (TWC)	N.A.	N.A.			N.A.	N.A.		
41 1988 Toyota 4WD Pickup (TWC)	0.0346	0.0380	9.83		0.0703	0.0730	3.84	
42 1988 Toyota Celica (TWC)	N.A.	N.A.			N.A.	N.A.		

42 1988 Toyota Celica (TWC)	0.0250	0.0338	35.20		0.0746	0.0574	-23.06	
44 1986 Mercedes 190E (TWC)	N.A.	N.A.			N.A.	N.A.		
44 1986 Mercedes 190E (TWC)	0.0428	0.0291	-32.01		0.0478	0.0380	-20.50	
45 1989 Lincoln Continental (TWC)	N.A.	N.A.			N.A.	N.A.		
45 1989 Lincoln Continental (TWC)	0.0309	0.0241	-22.01		0.0426	0.0430	0.94	
46 1990 Plymouth Acclaim (TWC)	N.A.	N.A.			N.A.	N.A.		
46 1990 Plymouth Acclaim (TWC)	0.0292	0.0290	-0.68		0.0300	0.0382	27.33	
47 1984 Toyota Celica (TWC)	N.A.	N.A.			N.A.	N.A.		
47 1984 Toyota Celica (TWC)	N.A.	N.A.			N.A.	N.A.		
49 1987 Oldsmobile Regency (TWC)	N.A.	N.A.			N.A.	N.A.		
56 1982 Nissan Maxima (TWC)	N.A.	N.A.			N.A.	N.A.		
57 1986 Buick Park Avenue (TWC)	N.A.	N.A.			N.A.	N.A.		
57 1986 Buick Park Avenue (TWC)	N.A.	N.A.			N.A.	N.A.		
Average	0.0098	0.0093	-2.59	17.60	0.0165	0.0150	-5.69	16.40

15.0% MTBE

Arco 91-06 (Test Blend 1)

350 1990 Ford Taurus (TWC)	0.0224	0.0000	-100.00		0.0221	0.0000	-100.00	
351 1990 Toyota Camry (TWC)	0.0187	0.0000	-100.00		0.0178	0.0092	-48.31	
353 1990 Honda Accord (TWC)	0.0102	0.0133	30.39		0.0157	0.0108	-31.21	
354 1990 Nissan Stanza (TWC)	0.0260	0.0226	-13.08		0.0270	0.0171	-36.67	
355 1990 Pontiac Grand Am (TWC)	0.0243	0.0266	9.47		0.0394	0.0436	10.66	
356 1990 Ford Crown Victoria (TWC)	0.0178	0.0010	-94.38		0.0266	0.0284	6.77	
357 1990 Plymouth Voyager (TWC)	0.0080	0.0000	-100.00		0.0380	0.0168	-55.79	
358 1990 Nissan Pickup (TWC)	0.0256	0.0297	16.02		0.0343	0.0311	-9.33	
359 1990 Buick LeSabre (TWC)	0.0116	0.0313	169.83		0.0496	N.A.		
Average	0.0183	0.0138	-20.20	70.35	0.0301	0.0174	-32.99	37.34

Arco 91-06 (Test Blend 2)

350 1990 Ford Taurus (TWC)	0.0224	0.0076	-66.07		0.0221	0.0299	35.29	
351 1990 Toyota Camry (TWC)	0.0187	0.0224	19.79		0.0178	0.0206	15.73	
353 1990 Honda Accord (TWC)	0.0102	0.0469	359.80		0.0157	0.0331	110.83	
354 1990 Nissan Stanza (TWC)	0.0260	0.0200	-23.08		0.0270	0.0238	-11.85	
355 1990 Pontiac Grand Am (TWC)	0.0243	0.0109	-55.14		0.0394	0.0395	0.25	
356 1990 Ford Crown Victoria (TWC)	0.0178	0.0114	-35.96		0.0266	0.0000	-100.00	
357 1990 Plymouth Voyager (TWC)	0.0080	0.0455	468.75		0.0380	0.0094	-75.26	
358 1990 Nissan Pickup (TWC)	0.0256	0.0121	-52.73		0.0343	0.0245	-28.57	
359 1990 Buick LeSabre (TWC)	0.0116	0.0437	276.72		0.0496	0.0426	-14.11	
Average	0.0183	0.0245	99.12	150.89	0.0301	0.0248	-7.52	43.55

Auto/Oil Study

1989 Dodge Shadow (TWC)	0.0095	0.0292	207.37		0.0841	0.0566	-32.70	
1989 Ford Taurus (TWC)	0.0507	0.0323	-36.29		0.0605	0.0401	-33.72	

1989 Ford Aerostar (TWC)	0.0419	0.0391	-6.68		0.0392	0.0036	-90.82	
1989 Toyota Camry (TWC)	0.0157	0.0181	15.29		0.0381	0.0365	-4.20	
1989 Pontiac Grand Am (TWC)	0.0518	0.0360	-30.50		0.0587	0.0423	-27.94	
1989 Oldsmobile Delta 88 (TWC)	0.0278	0.0190	-31.65		0.0503	0.0351	-30.22	
1989 Ford Mustang (TWC + OX)	0.0190	0.0264	38.95		0.0893	0.0655	-26.65	
Average	0.0309	0.0286	22.35	52.39	0.0600	0.0400	-35.18	35.18
AVERAGE (All vehicles)	0.0218	0.0218	34.67	94.32	0.0384	0.0264	-24.08	39.04

02/23/1988

	DIURNAL						HOT SOA					
	0% EtOH TOG Fraction	Benzene EtOH Blend TOG Fraction	MTBE Blend* TOG Fraction	Change EtOH Blend/ 0% EtOH	Change MTBE Blend/ 0% EtOH	Change EtOH Blend/ MTBE Blend	0% EtOH TOG Fraction	Benzene EtOH Blend TOG Fraction	MTBE Blend* TOG Fraction	Change EtOH Blend/ 0% EtOH	Change MTBE Blend/ 0% EtOH	Change EtOH Blend/ MTBE Blend
LDGV -- CARB												
E10												
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)												
1983 Buick Regal (TWC)	0.0121	0.0093	0.0110	-0.2314	-0.0909	-0.1545	0.0313	0.0256	0.0283	-0.1821	-0.0958	-0.0954
1977 Mercury Marquis (Oxy)	0.0052	0.0064	0.0050	0.2308	-0.0385	0.2800	0.0063	0.0042	0.0086	-0.3333	0.3651	-0.5116
1974 Chevy Impala (Noncat)	0.0094	0.0119	0.0093	0.2660	-0.0106	0.2796	0.0179	0.0122	0.0130	-0.3184	-0.2737	-0.0615
Average	0.0089	0.0092	0.0084	0.0884	-0.0467	0.1350	0.0185	0.0140	0.0166	-0.2780	-0.0015	-0.2229
Auto/Oil (Fuel X/Industry + 10% EtOH, 10 RVP)												
1989 Accord Sedan (TWC)	0.0098	0.0101	0.0107	0.0306	0.0918	-0.0561	0.0282	0.0193	0.0171	-0.3156	-0.3936	0.1287
Auto/Oil (Fuel W/Industry + 10% EtOH, 9 RVP)												
1989 Accord Sedan (TWC)	0.0098	0.0121	0.0107	0.2347	0.0918	0.1308	0.0282	0.0207	0.0171	-0.2660	-0.3936	0.2105
Auto/Oil (Fuel U/low ole., low T90, low arom., 10% EtOH, 10 RVP)												
1989 Accord Sedan (TWC)	0.0098	0.0113	0.0107	0.1531	0.0918	0.0561	0.0282	0.0193	0.0171	-0.3156	-0.3936	0.1287
Auto/Oil (Fuel T/low ole., low T90, low arom., 10% EtOH, 9 RVP)												
1989 Accord Sedan (TWC)	0.0098	0.0139	0.0107	0.4184	0.0918	0.2991	0.0282	0.0255	0.0171	-0.0957	-0.3936	0.4912
Overall Avg. (Carb)	0.0094	0.0107	0.0097	0.1574	0.0325	0.1193	0.0240	0.0181	0.0169	-0.2610	-0.2256	0.0415
LDGV -- TBI												
8.1% EtOH												
Stump et al., 1990 (MSERB Oxyfuels Study)												
CO 665 1988 Chevy Corsica (TWC)	0.0032	0.0068	0.0036	1.1250	0.1364	0.8700	0.0209	0.0319	0.0046	0.5263	-0.7792	5.9117
CO322 1987 Chevy Corsica (TWC)	0.0134	0.0102	0.0066	-0.2388	-0.5099	0.5532	0.0217	0.0276	0.0104	0.2719	-0.5214	1.6578
Average	0.0083	0.0085	0.0051	0.4431	-0.1868	0.7116	0.0213	0.0298	0.0075	0.3991	-0.6503	3.7847
E10												
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)												
1990 Chevy Lumina (TWC)	0.0185	0.0097	0.0303	-0.4757	0.6378	-0.6799	0.0308	0.0368	0.0144	0.1948	-0.5325	1.5556
Auto/Oil (Fuel X/Industry + 10% EtOH, 10 RVP)												
1989 Plymouth Sundance (TWC)	0.0086	0.0141	0.0143	0.6395	0.6570	-0.0105	0.0572	0.0382	0.0361	-0.3322	-0.3698	0.0596
1989 Dodge Shadow (TWC)	0.0114	0.0060	0.0098	-0.4737	-0.1404	-0.3878	0.0456	0.0274	0.0522	-0.3991	0.1447	-0.4751
1989 Chevy Suburban (TWC)	0.0247	0.0259	0.0234	0.0486	-0.0526	0.1068	0.0454	0.0356	0.0339	-0.2159	-0.2544	0.0517
Average	0.0149	0.0153	0.0158	0.0715	0.1547	-0.0971	0.0494	0.0337	0.0407	-0.3157	-0.1598	-0.1213
Auto/Oil (Fuel W/Industry + 10% EtOH, 9 RVP)												
1989 Plymouth Sundance (TWC)	0.0086	0.0268	0.0143	2.1163	0.6570	0.8807	0.0572	0.0354	0.0361	-0.3811	-0.3698	-0.0180
1989 Dodge Shadow (TWC)	0.0114	0.0147	0.0098	0.2895	-0.1404	0.5000	0.0456	0.0394	0.0522	-0.1360	0.1447	-0.2452
1989 Chevy Suburban (TWC)	0.0247	0.0249	0.0234	0.0081	-0.0526	0.0641	0.0454	0.0324	0.0339	-0.2863	-0.2544	-0.0428
Average	0.0149	0.0221	0.0158	0.8046	0.1547	0.4816	0.0494	0.0357	0.0407	-0.2678	-0.1598	-0.1020
Auto/Oil (Fuel U/low ole., low T90, low arom., 10% EtOH, 10 RVP)												
1989 Plymouth Sundance (TWC)	0.0086	0.0241	0.0143	1.8023	0.6570	0.6912	0.0572	0.0356	0.0361	-0.3776	-0.3698	-0.0125
1989 Dodge Shadow (TWC)	0.0114	0.0065	0.0098	-0.4298	-0.1404	-0.3367	0.0456	0.0385	0.0522	-0.1557	0.1447	-0.2625
1989 Chevy Suburban (TWC)	0.0247	0.0196	0.0234	-0.2065	-0.0526	-0.1624	0.0454	0.0367	0.0339	-0.1916	-0.2544	0.0842
Average	0.0149	0.0167	0.0158	0.3887	0.1547	0.0640	0.0494	0.0369	0.0407	-0.2417	-0.1598	-0.0636

Auto/Oil (Fuel T/low ole., low T90, low arom., 10% EtOH, 9 RVP)												
1989 Plymouth Sundance (TWC)	0.0086	0.0168	0.0143	0.9535	0.6570	0.1789	0.0572	0.0441	0.0361	-0.2290	-0.3698	0.2233
1989 Dodge Shadow (TWC)	0.0114	0.0110	0.0098	-0.0351	-0.1404	0.1224	0.0456	0.0415	0.0522	-0.0899	0.1447	-0.2050
1989 Chevy Suburban (TWC)	0.0247	0.0353	0.0234	0.4291	-0.0526	0.5085	0.0454	0.0437	0.0339	-0.0374	-0.2544	0.2910
Average	0.0149	0.0210	0.0158	0.4492	0.1547	0.2700	0.0494	0.0431	0.0407	-0.1188	-0.1598	0.1031
Overall Avg. (TBI)	0.0143	0.0168	0.0154	0.3702	0.1414	0.1932	0.0444	0.0363	0.0345	-0.1226	-0.0898	0.0630

LDGV -- PFI

E10

Warner-Selph and Smith, 1991 (EPA-460/3-91-02)												
1990 Ford Probe (TWC)	0.0422	0.0458	0.0167	0.0853	-0.6043	1.7425	0.0450	0.0417	0.0379	-0.0733	-0.1578	0.1003

Auto/Oil (Fuel X/Industry + 10% EtOH, 10 RVP)

1989 Ford Mustang (TWC)	0.0074	0.0130	0.0122	0.7568	0.6486	0.0656	0.0692	0.0491	0.0527	-0.2905	-0.2384	-0.0683
1989 Ford Taurus (TWC)	0.0395	0.0396	0.0344	0.0025	-0.1304	0.1528	0.0527	0.0316	0.0375	-0.4004	-0.2894	-0.1562
1989 Ford Aerostar (TWC)	0.0401	0.0355	0.0328	-0.1147	-0.1833	0.0840	0.0384	0.0329	0.0323	-0.1432	-0.1602	0.0202
1989 Camry Sedan (TWC)	0.0130	0.0152	0.0358	0.1692	1.7538	-0.5754	0.0475	0.0361	0.0368	-0.2400	-0.2263	-0.0177
1989 Pontiac Grand Am (TWC)	0.0260	0.0254	0.0452	-0.0231	0.7385	-0.4381	0.0526	0.0431	0.0432	-0.1806	-0.1797	-0.0012
1989 Oldsmobile Delta 88 (TWC)	0.0196	0.0226	0.0302	0.1531	0.5383	-0.2504	0.0410	0.0309	0.0341	-0.2463	-0.1695	-0.0925
Average	0.0243	0.0252	0.0317	0.1573	0.5609	-0.1603	0.0502	0.0373	0.0394	-0.2502	-0.2106	-0.0526

Auto/Oil (Fuel W/Industry + 10% EtOH, 9 RVP)

1989 Ford Mustang (TWC)	0.0074	0.0292	0.0122	2.9459	0.6486	1.3934	0.0692	0.0442	0.0527	-0.3613	-0.2384	-0.1613
1989 Ford Taurus (TWC)	0.0395	0.0416	0.0344	0.0532	-0.1304	0.2111	0.0527	0.0334	0.0375	-0.3662	-0.2894	-0.1081
1989 Ford Aerostar (TWC)	0.0401	0.0398	0.0328	-0.0075	-0.1833	0.2153	0.0384	0.0410	0.0323	0.0677	-0.1602	0.2713
1989 Camry Sedan (TWC)	0.0130	0.0357	0.0358	1.7462	1.7538	-0.0028	0.0475	0.0000	0.0368	-1.0000	-0.2263	-1.0000
1989 Pontiac Grand Am (TWC)	0.0260	0.0367	0.0452	0.4115	0.7385	-0.1881	0.0526	0.0525	0.0432	-0.0019	-0.1797	0.2167
1989 Oldsmobile Delta 88 (TWC)	0.0196	0.0292	0.0302	0.4898	0.5383	-0.0315	0.0410	0.0413	0.0341	0.0073	-0.1695	0.2129
Average	0.0243	0.0354	0.0317	0.9399	0.5609	0.2662	0.0502	0.0354	0.0394	-0.2757	-0.2106	-0.0948

Auto/Oil (Fuel U/low ole., low T90, low arom., 10% EtOH, 10 RVP)

1989 Ford Mustang (TWC)	0.0074	0.0179	0.0122	1.4189	0.6486	0.4672	0.0692	0.0466	0.0527	-0.3266	-0.2384	-0.1157
1989 Ford Taurus (TWC)	0.0395	0.0347	0.0344	-0.1215	-0.1304	0.0102	0.0527	0.0332	0.0375	-0.3700	-0.2894	-0.1135
1989 Ford Aerostar (TWC)	0.0401	0.0357	0.0328	-0.1097	-0.1833	0.0901	0.0384	0.0185	0.0323	-0.5182	-0.1602	-0.4264
1989 Camry Sedan (TWC)	0.0130	0.0279	0.0358	1.1462	1.7538	-0.2207	0.0475	0.0455	0.0368	-0.0421	-0.2263	0.2381
1989 Pontiac Grand Am (TWC)	0.0260	0.0480	0.0452	0.8462	0.7385	0.0619	0.0526	0.0433	0.0432	-0.1768	-0.1797	0.0035
1989 Oldsmobile Delta 88 (TWC)	0.0196	0.0265	0.0302	0.3520	0.5383	-0.1211	0.0410	0.0431	0.0341	0.0512	-0.1695	0.2658
Average	0.0243	0.0318	0.0317	0.5887	0.5609	0.0479	0.0502	0.0384	0.0394	-0.2304	-0.2106	-0.0247

Auto/Oil (Fuel T/low ole., low T90, low arom., 10% EtOH, 9 RVP)

1989 Ford Mustang (TWC)	0.0074	0.0127	0.0122	0.7162	0.6486	0.0410	0.0692	0.0429	0.0527	-0.3801	-0.2384	-0.1860
1989 Ford Taurus (TWC)	0.0395	0.0364	0.0344	-0.0785	-0.1304	0.0597	0.0527	0.0364	0.0375	-0.3093	-0.2894	-0.0280
1989 Ford Aerostar (TWC)	0.0401	0.0382	0.0328	-0.0474	-0.1833	0.1664	0.0384	0.0369	0.0323	-0.0391	-0.1602	0.1442
1989 Camry Sedan (TWC)	0.0130	0.0293	0.0358	1.2538	1.7538	-0.1816	0.0475	0.0337	0.0368	-0.2905	-0.2263	-0.0830
1989 Pontiac Grand Am (TWC)	0.0260	0.0326	0.0452	0.2538	0.7385	-0.2788	0.0526	0.0512	0.0432	-0.0266	-0.1797	0.1866
1989 Oldsmobile Delta 88 (TWC)	0.0196	0.0327	0.0302	0.6684	0.5383	0.0846	0.0410	0.0431	0.0341	0.0512	-0.1695	0.2658
Average	0.0243	0.0303	0.0317	0.4611	0.5609	-0.0181	0.0502	0.0407	0.0394	-0.1657	-0.2106	0.0499
Overall Avg. (PFI)	0.0250	0.0313	0.0311	0.5187	0.5143	0.1023	0.0500	0.0381	0.0393	-0.2242	-0.2085	-0.0253
AVG., TBI and PFI	0.0210	0.0259	0.0252	0.4630	0.3745	0.1364	0.0479	0.0374	0.0375	-0.1861	-0.2241	0.1985

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*Auto/Oil data an average for 9 and 8 RVP blends (fuels MM and N2)

	Formaldehyde			Acetaldehyde			1,3-Butadiene			Benzene		
	0% MTBE TOG Fraction	15% MTBE TOG Fraction	Change	0% MTBE TOG Fraction	15% MTBE TOG Fraction	Change	0% MTBE TOG Fraction	15% MTBE TOG Fraction	Change	0% MTBE TOG Fraction	15% MTBE TOG Fraction	Change
LDGV (3-WAY+OX -- FTP Data)												
Auto/Oil Study												
1989 Ford Mustang (SFI)	0.0112	0.0175	0.5625	0.0039	0.0051	0.3077	0.0026	0.0025	-0.0385	0.0256	0.0290	0.1328
1985 Chevrolet Impala (Carb)	0.015	0.0107	-0.2867	0.0029	0.0024	-0.1724	0.0031	0.0033	0.0645	0.0376	0.0398	0.0585
1984 Pontiac Grand Prix (Carb)	0.0055	0.0089	0.6182	0.0021	0.0026	0.2381	0.0013	0.0012	-0.0769	0.0276	0.0296	0.0725
1985 Ford Tempo (TBI)	0.0103	0.0121	0.1748	0.0047	0.0032	-0.3191	0.0032	0.0032	0.0000	0.0435	0.0427	-0.0184
AVERAGE	0.0105	0.0123	0.2672	0.0034	0.0033	0.0136	0.0026	0.0026	-0.0127	0.0336	0.0353	0.0613
LDGV (OX-CAT --FTP Data)												
Auto/Oil Study												
1984 Chevrolet Suburban (Carb)	0.0391	0.0581	0.4859	0.0157	0.0183	0.1656	0.0033	0.0031	-0.0606	0.0351	0.0319	-0.0912
1983 Ford F-150 (Carb)	0.0231	0.0592	1.5628	0.007	0.0088	0.2571	0.0043	0.0061	0.4186	0.0300	0.0313	0.0433
AVERAGE	0.0311	0.0587	1.0244	0.0114	0.0136	0.2114	0.0038	0.0046	0.1790	0.0326	0.0316	-0.0239
LDGV (NON-CAT --FTP Data)												
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)												
1974 Chevy Impala (Carb)	0.0101	0.0159	0.5743	0.0023	0.0034	0.4783	0.0073	0.0092	0.2603	0.0507	0.0381	-0.2485
16.4% Adjusted to 15%		0.0154	0.5256		0.0033	0.4377		0.0090	0.2382		0.0392	-0.2275

Change is defined by solving the equation:

$$\text{TOG frac @ 0\%MTBE} * (1 + (\text{change}/2.7) * \text{Ox}) = \text{TOG frac @ 15\% MTBE}$$
 where Ox = 2.7

	Formaldehyde			Acetaldehyde			1,3-Butadiene			Benzene		
	0% EtOH TOG Fraction	10% EtOH TOG Fraction	Change	0% EtOH TOG Fraction	10% EtOH TOG Fraction	Change	0% EtOH TOG Fraction	10% EtOH TOG Fraction	Change	0% EtOH TOG Fraction	10% EtOH TOG Fraction	Change
LDGV (3-WAY+OX -- FTP Data)												
Colorado Department of Health, 1987												
1981 Chev Caprice (Carb)	0.0153	0.0188	0.2288	0.0053	0.0119	1.2453	N/A	N/A	N/A	0.0618	0.0321	-0.4806
LDGV (OX-CAT --FTP Data)												
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)												
1977 Mercury Marquis	0.0346	0.0399	0.1532	0.0119	0.0201	0.6891	0.0016	0.0015	-0.0625	0.0189	0.0119	-0.3704
Colorado Department of Health, 1987												
1976 Dodge Cornet Wgn (Cart	0.0056	0.0092	0.6429	0.0028	0.0117	3.1786	N/A	N/A	N/A	0.0439	0.0386	-0.1207
1977 Cadillac Seville (PFI)	0.0733	0.0673	-0.0819	0.0209	0.0369	0.7656	N/A	N/A	N/A	0.0344	0.0262	-0.2384
1978 Lincoln Cntinentl (Carb)	0.0111	0.0092	-0.1712	0.0024	0.0130	4.4167	N/A	N/A	N/A	0.0351	0.0293	-0.1652
1977 Chev MntCarlo (Carb)	0.0118	0.0147	0.2458	0.0042	0.0119	1.8333	N/A	N/A	N/A	0.0430	0.0264	-0.3860
1978 VW Rabbit (Carb)	0.0096	0.0133	0.3854	0.0022	0.0084	2.8182	N/A	N/A	N/A	0.0349	0.0190	-0.4556
1978 Chev Impala (Carb)	0.0293	0.0404	0.3788	0.0081	0.0173	1.1358	N/A	N/A	N/A	0.0260	0.0221	-0.1500
1978 Chevy MntCarlo (Carb)	0.0278	0.0377	0.3561	0.0055	0.0093	0.6909	N/A	N/A	N/A	0.0276	0.0205	-0.2572
Average	0.0241	0.0274	0.2509	0.0066	0.0155	2.1199	N/A	N/A	N/A	0.0350	0.0260	-0.2533
AVERAGE			0.2400			1.9609			-0.0625			-0.2663
LDGV (NON-CAT --FTP Data)												
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)												
1974 Chevy Impala (Carb)	0.0101	0.0097	-0.0396	0.0023	0.0032	0.3913	0.0073	0.0082	0.1233	0.0507	0.0400	-0.2110
Colorado Department of Health, 1987												
1974 Ford Squire (Carb)	0.0060	0.0055	-0.0833	0.0033	0.0083	1.5152	N/A	N/A	N/A	0.0316	0.0258	-0.1835
1974 Ford Pinto (Carb)	0.0033	0.0053	0.6061	0.0023	0.0055	1.3913	N/A	N/A	N/A	0.0296	0.0192	-0.3514
1973 VW Fastback (EFI)	0.0089	0.0092	0.0337	0.0038	0.0100	1.6316	N/A	N/A	N/A	0.0248	0.0234	-0.0565
1979 Honda Civic (Carb)	0.0097	0.0097	0.0000	0.0029	0.0052	0.7931	N/A	N/A	N/A	0.0258	0.0194	-0.2481
Average	0.0070	0.0074	0.1391	0.0031	0.0073	1.3328	N/A	N/A	N/A	0.0280	0.0220	-0.2099
AVERAGE	0.0076	0.0079	0.1034	0.0029	0.0064	1.1445			0.1233	0.0325	0.0256	-0.2101

Change is defined by solving the equation:
 $TOG\ frac\ @\ 10\%EtOH * (1 + (change/3.5) * Ox) = TOG\ frac\ @\ 10\%EtOH$
 where Ox = 3.5

Actual Versus Predicted Benzene Comparisons

Study	Catalyst	Fuel	# of Vehicles	RVP, psi	Fuel Specifications			Olefins	% Benzene Adjustment	Benzene (% Total) Predicted (w/adj.)*	Benzene (% Total) Predicted (no adj.)*	Actual	% Change (w/adj.)	% Change (no adj.)
					Aromatics	Benzene								
Gasoline/MTBE Blends														
ARCO 91-02	TWC	Unleaded Reg.	5	8.8	33.6	1.8	12.3	0.0000	5.61	5.61	5.24	-6.55	-6.55	
ARCO 91-03	TWC	Unleaded Prem.	16	8.9	41.5	1.9	6.8	0.0000	6.45	6.45	5.42	-16.03	-16.03	
ARCO 91-06	TWC	Ind. Avg.	10	8.6	34.4	1.0	9.7	0.0000	5.15	5.15	5.79	12.50	12.50	
Auto/Oil (TB#1)	TWC	A	7	8.7	32.0	1.5	9.2	0.0000	5.25	5.25	5.71	8.82	8.82	
Auto/Oil (TB#6)	TWC	A	10	8.7	32.0	1.5	9.2	0.0000	5.25	5.25	4.30	-18.05	-18.05	
Colorado Dept. of Health, 1987	TWC	UL Base	6	10.7	30.4	1.7	14.4	0.0000	5.20	5.20	4.06	-21.88	-21.88	
ARCO 91-02	TWC	5.5% MTBE	5	7.6	33.6	0.8	12.0	-0.0505	4.68	4.93	2.92	-37.66	-40.81	
ARCO 91-03	TWC	9.0% MTBE	16**	7.6	32.9	1.2	11.0	-0.0826	4.71	5.13	4.16	-11.67	-18.97	
ARCO 91-03	TWC	12.5% MTBE	13	8.1	23.6	1.0	12.5	-0.1148	3.61	4.08	3.17	-12.25	-22.32	
ARCO 91-06	TWC	15% MTBE (Blend 1)	10	7.9	21.2	0.7	5.1	-0.1377	3.14	3.64	3.70	17.83	1.60	
ARCO 91-06	TWC	15% MTBE (Blend 2)	10	6.7	21.6	0.7	5.5	-0.1377	3.17	3.68	4.48	41.14	21.70	
Auto/Oil (TB#1)	TWC	15% MTBE (Pooled)**	9	8.4-8.8	18.0-47.6(34.43)	1.28-1.52(1.43)	3.3-21.8	-0.1377	4.69	5.44	5.17	10.22	-4.96	
Auto/Oil (TB#6)	TWC	15% MTBE (N2)	10	8.8	21.4	1.3	4.9	-0.1377	3.51	4.07	3.49	-0.46	-14.17	
Auto/Oil (TB#6)	TWC	15% MTBE (MM)	10	8.0	22.2	1.4	5.4	-0.1377	3.63	4.21	3.34	-8.05	-20.71	
Urban, 1980b, 1980c (EPA-460/3-80-004, 005)	TWC+Oxy	Gasoline	2	8.9	28.0	2.0	8.0	0.0000	2.92	2.92	3.11	6.54	6.54	
Sigsby, et al., 1987 (46 car study)	TWC+Oxy	Gasoline	8	8.8-12.2	31.23-44.2	1.76-1.96	9.33-10.54	0.0000						
Stump et al., 1989 (MSERB Low Temp.)	TWC+Oxy	Gasoline	6	11.5	30.3	0.9	4.6	0.0000	2.33	2.33	2.67	14.68	14.68	
Stump et al., unpublished (MSERB High Temp.)	TWC+Oxy	Gasoline	1	10.2	37.9	1.4	10.3	0.0000	3.19	3.19	1.65	-48.20	-48.20	
Warner-Selph and DeVita, 1989 (Carb Toxics Study)	TWC+Oxy	Gasoline	1	8.4	37.0	2.4	7.9	0.0000	3.83	3.83	4.76	24.25	24.25	
ARCO 91-03	TWC+Oxy	Unleaded Prem.	3	8.9	41.5	1.9	6.8	0.0000	3.77	3.77	3.83	1.58	1.58	
Auto/Oil (TB#1)	TWC+Oxy	A	4	8.7	32.0	1.5	9.2	0.0000	2.85	2.85	3.36	17.82	17.82	
Colorado Dept. of Health, 1987	TWC+Oxy	UL Base	1	10.7	30.4	1.7	14.4	0.0000	2.85	2.85	6.18	116.72	116.72	
ARCO 91-03	TWC+Oxy	9% MTBE	4***	7.6	32.9	1.2	11.0	0.0368	2.81	2.71	2.69	-4.23	-0.71	
ARCO 91-03	TWC+Oxy	12.5% MTBE	1	8.1	23.6	1.0	12.5	0.0511	2.04	1.94	1.92	-5.84	-1.03	
Auto/Oil (TB#1)	TWC+Oxy	15% MTBE (Pooled)**	4	8.4-8.8	18.0-47.6(34.43)	1.28-1.52(1.43)	3.3-21.8	0.0613	3.15	2.97	3.53	12.00	18.87	
Urban, 1980a (EPA-460/3-80-003)	Oxy	Gasoline	3	8.9	28.0	2.0	8.0	0.0000	3.96	3.96	4.16	4.97	4.97	
Sigsby et al., 1987 (46 car study)	Oxy	Gasoline	24	8.8-12.2	31.23-44.2	1.76-1.96	9.33-10.54	0.0000						
Smith, 1981 (EPA-460/3-81-024)	Oxy	Gasoline	7****	8.9	28.0	2.0	8.0	0.0000	3.96	3.96	4.27	7.75	7.75	
Stump et al., 1989 (MSERB Low Temp.)	Oxy	Gasoline	1	11.5	30.3	0.9	4.6	0.0000	3.30	3.30	3.95	19.59	19.59	
Auto/Oil (TB#1)	Oxy	A	2	8.7	32.0	1.5	9.2	0.0000	4.02	4.02	3.25	-19.22	-19.22	
ARCO 91-03	Oxy	Unleaded Prem.	1	8.9	41.5	1.9	6.8	0.0000	5.52	5.52	2.96	-46.42	-46.42	
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)	Oxy	Gasoline	1	9.5	35.1	1.6	6.8	0.0000	4.49	4.49	1.89	-57.88	-57.88	
Colorado Dept. of Health, 1987	Oxy	UL Base	7	10.7	30.4	1.7	14.4	0.0000	3.97	3.97	3.50	-11.73	-11.73	
ARCO 91-03	Oxy	9.0% MTBE	1	7.6	32.9	1.2	11.0	-0.0143	3.82	3.88	2.92	-23.58	-24.68	
Auto/Oil (TB#1)	Oxy	15% MTBE (Pooled)**	2	8.4-8.8	18.0-47.6(34.43)	1.28-1.52(1.43)	3.3-21.8	-0.0239	4.16	4.26	3.16	-24.00	-25.82	
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)	Oxy	16.4% MTBE	1	9.5	20.4	1.2	5.4	-0.0261	2.32	2.39	1.13	-51.37	-52.64	
Urban, 1980a, 1981 (EPA-460/3-80-003)	Non-cat	Gasoline	5	8.9	28.0	2.0	8.0	0.0000	3.96	3.96	3.33	-15.97	-15.97	
Sigsby et al., 1987 (46 car study)	Non-cat	Gasoline	5	8.8-12.2	31.23-44.2	1.76-1.96	9.33-10.54	0.0000						
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)	Non-cat	Gasoline	1	9.5	35.1	1.6	6.8	0.0000	4.49	4.49	5.07	12.99	12.99	
Colorado Dept. of Health, 1987	Non-cat	UL Base	4	10.7	30.4	1.7	14.4	0.0000	3.97	3.97	2.80	-29.38	-29.38	
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)	Non-cat	16.4% MTBE	1	9.5	20.4	1.2	5.4	-0.2485	1.79	2.39	3.81	112.47	59.67	
EtOH														
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)	TWC	10% EtOH	3	10.2	22.8	1.4	7.3	-0.1299	3.69	4.24	3.56	-3.46	-16.00	
Auto/Oil (TB#6)	TWC	X	10	9.6	27.2	1.5	8.1	-0.1299	4.15	4.77	3.91	-5.86	-18.09	
Auto/Oil (TB#6)	TWC	W	10	9.0	29.0	1.4	8.1	-0.1299	4.25	4.88	4.14	-2.57	-15.23	
Auto/Oil (TB#6)	TWC	U	10	9.6	19.1	1.4	3.1	-0.1299	3.40	3.91	3.50	2.97	-10.41	
Auto/Oil (TB#6)	TWC	T	10	9.3	18.1	1.4	3.6	-0.1299	3.31	3.81	3.64	9.87	-4.41	
Colorado Dept. of Health, 1987	TWC	10% EtOH	6	10.1	25.4	1.3	14.7	-0.1299	3.85	4.43	3.55	-7.84	-19.81	

Stump et al., 1990 (MSERB Oxyfuels Study)	TWC	8.1% EtOH	2	10.5	34.9	1.3	9.5	-0.1052	4.81	4.18	4.17	-13.39	-0.34
Colorado Dept. of Health, 1987	TWC+Oxy	10% EtOH	1	10.1	25.4	1.3	14.7	-0.4806	1.16	2.23	3.21	176.84	43.79
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)	Oxy	10% EtOH	1	10.2	22.8	1.4	7.3	-0.2633	2.04	2.77	1.19	-41.75	-57.09
Colorado Dept. of Health, 1987	Oxy	10% EtOH	7	10.1	25.4	1.3	14.7	-0.2633	2.21	3.00	2.60	17.46	-13.47
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)	Non-cat	10% EtOH	1	10.2	22.8	1.4	7.3	-0.2101	2.19	2.77	4.00	82.62	44.25
Colorado Dept. of Health, 1987	Non-cat	10% EtOH	4	10.1	25.4	1.3	14.7	-0.2101	2.37	3.00	2.20	-7.30	-26.78

*The exhaust benzene fractions were calculated using the following equations:

$$\text{TWC Bz\%HC} = [1.077 + 0.7732 * (\text{volume \% benzene}) + 0.0987 * (\text{volume \% aromatics} - \text{volume \% benzene})] * (1 + \% \text{ benzene adjustment})$$

$$\text{TWC+Oxy Bz\%HC} = [0.6796 * (\text{volume \% benzene}) + 0.0681 * (\text{volume \% aromatics}) - 0.3468] * (1 + \% \text{ benzene adjustment})$$

$$\text{other Bz\%HC} = 0.8551 * (\text{volume \% benzene}) + 0.12198 * (\text{volume \% aromatics}) - 1.1626 * (1 + \% \text{ benzene adjustment})$$

**Vehicles were tested for several 15% MTBE blends, and data was pooled. A range of fuel specifications is given here, with mean values in parentheses.

***Some vehicles were tested twice, in two separate experiments.

****Two sets of measurements were taken for each vehicle.

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Actual Versus Predicted Benzene Comparisons

Study	Fuel System	Fuel	# of Vehicles	RVP, psi	Fuel Specifications				Diurnal Benzene (% Total)		Hot Soak Benzene (% Total)	
					Aromatics	Benzene	Paraffins	Olefins	Predicted*	Actual	Predicted**	Actual
Arco 91-03	Carb	Gasoline	6	8.9	41.5	1.9	50.5	6.8	1.26	2.03	1.39	3.32
Auto/Oil	Carb	Gasoline	7	8.5-8.9	20.0-47.8	0.52-1.53	34.5-76.8	3.2-22.3	0.34-1.06	1.52	0.38-1.17	2.75
Stump et al., unpublished (MSERB High Temp.)	Carb	Gasoline	1	10.2	37.93	1.39	48.62	10.33	0.77	0.75	0.87	1.08
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)	Carb	Gasoline	2	9.5	35.1	1.6	58.1	6.8	0.98	0.73	1.10	1.21
Arco 91-03	Carb	9.0% MTBE	3	7.6	32.9	1.2	41.1	11	0.86	1.97	0.93	2.38
Auto Oil	Carb	15.0% MTBE	7	8.4-8.8	18.0-46.7	1.28-1.52	19.4-59.7	3.3-21.8	0.76-0.95	1.42	0.83-1.03	2.52
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)	Carb	16.4% MTBE	2	9.45	20.4	1.24	56.8	6.4	0.66	0.72	0.72	1.08
Arco 91-03	TBI	Gasoline	1	8.9	41.5	1.9	50.5	6.8	1.26	0.16	1.39	4.13
Arco 91-06	TBI	Gasoline	1	8.6	34.4	1	49.4	9.7	0.69	0.66	0.75	1.25
Auto/Oil	TBI	Gasoline	3	8.5-8.9	20.0-47.8	0.52-1.53	34.5-76.8	3.2-22.3	0.34-1.06	2.46	0.38-1.17	3.47
Arco 91-03	TBI	9.0% MTBE	1	7.6	32.9	1.2	41.1	11	0.86	0.29	0.93	2.32
Arco 91-06 (Blend 1)	TBI	15.0% MTBE	1	7.9	21.2	0.7	60.4	5.1	0.46	0.00	0.50	1.18
Arco 91-06 (Blend 2)	TBI	15.0% MTBE	1	6.7	21.6	0.7	61.2	5.5	0.53	3.31	0.57	3.24
Auto/Oil	TBI	15.0% MTBE	3	8.4-8.8	18.0-46.7	1.28-1.52	19.4-59.7	3.3-21.8	0.76-0.95	3.53	0.83-1.03	3.33
Arco 91-02	PFI	Gasoline	5	8.8	33.6	1.8	43.7	12.3	1.20	1.54	1.33	3.25
Arco 91-03	PFI	Gasoline	6	8.9	41.5	1.9	50.5	6.8	1.26	3.28	1.39	5.50
Arco 91-06	PFI	Gasoline	9	8.6	34.4	1	49.4	9.7	0.69	1.83	0.75	3.01
Auto/Oil***	PFI	Gasoline	7	8.7	32	1.53	58.8	9.2	1.04	3.09	1.14	6.00
Arco 91-02	PFI	5.5% MTBE	5	7.6	20.9	0.8	50.7	12	0.59	1.33	0.64	2.09
Arco 91-03	PFI	9.0% MTBE	6	7.6	32.9	1.2	41.1	11	0.86	3.10	0.93	4.99
Arco 91-06 (Blend 1)	PFI	15.0% MTBE	9	7.9	21.2	0.7	60.4	5.1	0.46	1.38	0.50	1.96
Arco 91-06 (Blend 2)	PFI	15.0% MTBE	9	6.7	21.6	0.7	61.2	5.5	0.53	2.45	0.57	2.48
Auto/Oil	PFI	15.0% MTBE	7	8.4-8.8	18.0-46.7	1.28-1.52	19.4-59.7	3.3-21.8	0.76-0.95	2.86	0.83-1.03	4.00

*Predictions obtained using diurnal evaporative emissions equation from SDSB's reformulated gasoline NPRM:

$$\text{Diurnal Benzene} = [(1.3758 - (0.0579 * (\text{Weight \% Oxygen} / 2.0) - (0.080274 * \text{RVP})) * (\text{Volume \% Benzene})$$

**Predictions obtained using hot soak evaporative emissions equation from SDSB's reformulated gasoline NPRM:

$$\text{Hot Soak Benzene} = [(1.4448 - (0.0684 * (\text{Weight \% Oxygen} / 2.0) - (0.080274 * \text{RVP})) * (\text{Volume \% Benzene})$$

***Only data for fuel A considered.

Actual Versus Predicted Benzene Comparisons

Study	Fuel System	Fuel	# of Vehicles	RVP, psi	Fuel Specifications			Diurnal Benzene (% Total)			Hot Soak Benzene (% Total)		
					Aromatics	Benzene	Olefins	Predicted*	Actual	% Change	Predicted**	Actual	% Change
Auto/Oil	Carb	A (Indust. Avg.)	1	8.7	32.0	1.5	9.2	1.02	0.98	-3.56	1.12	0.91	-18.72
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)	Carb	Gasoline	3	9.5	35.1	1.6	6.8	0.98	0.92	-6.23	1.09	1.40	28.26
Auto/Oil	Carb	X	1	9.6	27.2	1.5	8.1	0.91	1.01	11.26	1.01	1.93	90.85
Auto/Oil	Carb	W	1	9.0	29.0	1.4	8.1	0.91	1.21	32.29	1.01	2.07	104.69
Auto/Oil	Carb	U	1	9.6	19.1	1.4	3.1	0.85	1.13	33.37	0.94	1.93	104.48
Auto/Oil	Carb	T	1	9.3	18.1	1.4	3.6	0.88	1.39	57.78	0.98	2.55	160.86
Auto/Oil	TBI	A (Indust. Avg.)	3	8.7	32.0	1.5	9.2	1.02	1.49	46.64	1.12	4.94	341.22
Stump et al., 1990 (MSERB Oxyfuels Study)	TBI	8.1% EtOH	2	10.5	34.9	1.3	9.5	0.68	0.85	24.61	0.77	2.98	286.78
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)	TBI	10% EtOH	1	10.2	22.8	1.4	7.3	0.76	0.97	28.07	0.85	3.68	332.67
Auto/Oil	TBI	X	3	9.6	27.2	1.5	8.1	0.91	1.53	68.55	1.01	3.37	233.25
Auto/Oil	TBI	W	3	9.0	29.0	1.4	8.1	0.91	2.21	141.62	1.01	3.57	253.02
Auto/Oil	TBI	U	3	9.6	19.1	1.4	3.1	0.85	1.67	97.11	0.94	3.69	290.96
Auto/Oil	TBI	T	3	9.3	18.1	1.4	3.6	0.88	2.10	138.38	0.98	4.31	340.90
Auto/Oil	PFI	A (Indust. Avg.)	6	8.7	32.0	1.5	9.2	1.02	2.43	139.14	1.12	5.02	348.36
Warner-Selph and Smith, 1991 (EPA-460/3-91-02)	PFI	10% EtOH	1	10.2	22.8	1.4	7.3	0.76	4.58	504.72	0.85	4.17	390.29
Auto/Oil	PFI	X	6	9.6	27.2	1.5	8.1	0.91	2.52	177.61	1.01	3.73	268.85
Auto/Oil	PFI	W	6	9.0	29.0	1.4	8.1	0.91	3.54	287.03	1.01	3.54	250.06
Auto/Oil	PFI	U	6	9.6	19.1	1.4	3.1	0.85	3.18	275.34	0.94	3.84	306.85
Auto/Oil	PFI	T	6	9.3	18.1	1.4	3.6	0.88	3.03	243.95	0.98	4.07	316.35

*Predictions obtained using diurnal evaporative emissions equation from SDSB's reformulated gasoline NPRM:
 $Diurnal\ Benzene = [1.3758 - (0.080274 * RVP)] * (Volume\ \% Benzene)$

**Predictions obtained using hot soak evaporative emissions equation from SDSB's reformulated gasoline NPRM:
 $Hot\ Soak\ Benzene = [(1.4448 - (0.080274 * RVP)) * (Volume\ \% Benzene)]$

13-BUTAD Vehicle class/ technology	Baseline (gasoline)(1)		Winter oxygenates(2)		10% Ethanol(3)		Reformulated gasoline				California NMOG standards (exhaust only)(6)					
	Exhaust	Evap	Exhaust	Evap	Exhaust	Evap	CY 1995-1999(4)		CY 2000+(5)		0.3900	0.2500	TLEV 0.1250	LEV 0.0750	ULEV 0.0400	ZEV 0.0000
							Exhaust	Evap	Exhaust	Evap						
LDGV																
3-way																
CARB	0.0057	0.0000	0.0056	0.0000	0.0050	0.0000	0.0056	0.0000	0.0056	0.0000	0.0056	0.0056	0.0056	0.0056	0.0056	0.0000
TBI	0.0057	0.0000	0.0056	0.0000	0.0050	0.0000	0.0056	0.0000	0.0056	0.0000	0.0056	0.0056	0.0056	0.0056	0.0056	0.0000
PFI	0.0057	0.0000	0.0056	0.0000	0.0050	0.0000	0.0056	0.0000	0.0056	0.0000	0.0056	0.0056	0.0056	0.0056	0.0056	0.0000
3-way + ox																
CARB	0.0044	0.0000	0.0043	0.0000	0.0041	0.0000	0.0044	0.0000	0.0044	0.0000	0.0044	0.0044	0.0044	0.0044	0.0044	0.0000
TBI	0.0044	0.0000	0.0043	0.0000	0.0041	0.0000	0.0044	0.0000	0.0044	0.0000	0.0044	0.0044	0.0044	0.0044	0.0044	0.0000
PFI	0.0044	0.0000	0.0043	0.0000	0.0041	0.0000	0.0044	0.0000	0.0044	0.0000	0.0044	0.0044	0.0044	0.0044	0.0044	0.0000
ox cat																
CARB	0.0044	0.0000	0.0052	0.0000	0.0041	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
TBI	0.0044	0.0000	0.0052	0.0000	0.0041	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
PFI	0.0044	0.0000	0.0052	0.0000	0.0041	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
non-cat																
CARB	0.0098	0.0000	0.0121	0.0000	0.0110	0.0000	0.0115	0.0000	0.0115	0.0000	0.0115	0.0115	0.0115	0.0115	0.0115	0.0000
LDGT																
3-way																
CARB	0.0057	0.0000	0.0056	0.0000	0.0050	0.0000	0.0056	0.0000	0.0056	0.0000	0.0056	0.0056	0.0056	0.0056	0.0056	0.0000
TBI	0.0057	0.0000	0.0056	0.0000	0.0050	0.0000	0.0056	0.0000	0.0056	0.0000	0.0056	0.0056	0.0056	0.0056	0.0056	0.0000
PFI	0.0057	0.0000	0.0056	0.0000	0.0050	0.0000	0.0056	0.0000	0.0056	0.0000	0.0056	0.0056	0.0056	0.0056	0.0056	0.0000
3-way + ox																
CARB	0.0044	0.0000	0.0043	0.0000	0.0041	0.0000	0.0044	0.0000	0.0044	0.0000	0.0044	0.0044	0.0044	0.0044	0.0044	0.0000
TBI	0.0044	0.0000	0.0043	0.0000	0.0041	0.0000	0.0044	0.0000	0.0044	0.0000	0.0044	0.0044	0.0044	0.0044	0.0044	0.0000
PFI	0.0044	0.0000	0.0043	0.0000	0.0041	0.0000	0.0044	0.0000	0.0044	0.0000	0.0044	0.0044	0.0044	0.0044	0.0044	0.0000
ox cat																
CARB	0.0044	0.0000	0.0052	0.0000	0.0041	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
TBI	0.0044	0.0000	0.0052	0.0000	0.0041	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
PFI	0.0044	0.0000	0.0052	0.0000	0.0041	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
non-cat																
CARB	0.0098	0.0000	0.0121	0.0000	0.0110	0.0000	0.0115	0.0000	0.0115	0.0000	0.0115	0.0115	0.0115	0.0115	0.0115	0.0000
HDGV																
TWC	0.0057	0.0000	0.0056	0.0000	0.0050	0.0000	0.0056	0.0000	0.0056	0.0000	0.0056	0.0056	0.0056	0.0056	0.0056	0.0000
non-cat	0.0098	0.0000	0.0121	0.0000	0.0110	0.0000	0.0115	0.0000	0.0115	0.0000	0.0115	0.0115	0.0115	0.0115	0.0115	0.0000
LDDV	0.0103	0.0000														
LDDT	0.0103	0.0000														
HDDV	0.0158	0.0000														

Footnotes given on the following page.

Footnotes:

- (1) For baseline gasoline, the LDGV 3-way fraction was based on FTP data from 55 in-use vehicles tested by CARB. THC as measured by the FID in these studies was converted to TOG using a single TOG/THC conversion factor of 1.0125, which is consistent with what is used in MOBILE 4.1. This was done because the fractions are applied to MOBILE 4.1 TOG.

The LDGV 3-way + ox fraction was assumed to equal the LDGV ox cat fraction.

The LDGV ox cat fraction was based on FTP data from 7 in-use vehicles tested by CARB. A TOG/THC conversion factor of 1.0170 was used.

The LDGV non cat fraction was based on FTP data from 16 in-use vehicles tested by CARB. A TOG/THC conversion factor of 1.0333 was used.

LDGTs are assumed to have the same fractions as LDGVs.

The LDDV fraction was based on FTP data from two vehicles tested by CARB. A TOG/THC conversion factor of 1.0490 was used. LDDTs are assumed to have the same fractions as LDDVs.

The HDDV fraction was based on transient data from one engine tested by CARB. A TOG/THC conversion factor of 1.0342 was used.

The HDGV non-cat and 3-way fractions were assumed to equal those for LDGV, due to lack of data. A TOG/THC conversion factor of 1.0358 was used.

- (2) For the winter oxygenate program, it is assumed that 15% MTBE (2.7 weight % O₂) will be the major oxygenate used in the CO non-attainment areas. Changes in the 1,3-butadiene TOG fraction from 0% to 15% MTBE were estimated based on vehicle data. (As with baseline gasoline, MOBILE4.1 TOG/THC conversion factors were used to calculate 1,3-butadiene TOG fractions. The conversion factors for baseline gasoline by catalyst type were each multiplied by 1.0197 to estimate TOG/THC conversion factors by catalyst type for 15% MTBE blends.) The baseline gasoline fractions were multiplied by the following to estimate fractions for 15% MTBE: 0.9798 for 3-way, 0.9873 for 3-way + ox, 1.1790 for ox cat, and 1.2382 for non- cat. These numbers were estimated using data from Auto/Oil and Arco 91-06 for 3-way, Auto/Oil for 3-way+ox and ox cat, and the 1990 SwRI report for non-cat.
- (3) Changes in the 1,3-butadiene TOG fraction from 0% to 10% ethanol were estimated based on vehicle data. (As with baseline gasoline, MOBILE4.1 TOG/THC conversion factors were used to calculate 1,3-butadiene TOG fractions. The conversion factors for baseline gasoline by catalyst type were each multiplied by 1.0232 to estimate TOG/THC conversion factors by catalyst type for 10% ethanol.) The baseline gasoline fractions were multiplied by the following to estimate fractions for 10% ethanol: 0.8812 for 3-way, 0.9375 for 3-way + ox, 0.9375 for ox cat, and 1.1233 for non- cat. These numbers were estimated using data from Auto/Oil, and the 1990 SwRI report for 3-way, the 1990 SwRI report for ox cat, and the 1990 SwRI report for non-cat. Due to lack of data, 3-way+ox was assumed to equal ox cat.
- (4) The composition of reformulated gasoline in CY1995-1999 is assumed to be 2% oxygen, 1.0% benzene and 25% aromatics. The percent changes in the 1,3-butadiene TOG fractions from 0% to 15% MTBE (2.7 wt% O₂) were multiplied by 2/2.7, the ratio of oxygen contents by weight for reformulated gasoline and 15% MTBE, to obtain changes in the 1,3-butadiene TOG fractions with reformulated gasoline.
- (5) For reformulated gasoline in CY 2000+, the fraction of 1,3-butadiene is assumed to remain the same relative to CY1995-1999. However, the mass of TOG will be reduced. As a result, the mass of 1,3-butadiene is assumed to be reduced proportionately to TOG.
- (6) The 1,3-butadiene fractions for the California vehicles are assumed to be those for reformulated gasoline. As a result, the mass of 1,3-butadiene is assumed to be reduced proportionately to TOG.

Remaining CAAA provisions not included in this table are the clean fuel fleet program and the California pilot program. These will not be considered.

ACETALDE Vehicle class/ technology	Baseline (gasoline)(1)		Winter oxygenates(2)		10% Ethanol(3)		Reformulated gasoline				California NMOG standards (exhaust only)(6)					
	Exhaust	Evap	Exhaust	Evap	Exhaust	Evap	CY 1995-1999(4)		CY 2000+(5)		0.3900	0.2500	TLEV 0.1250	LEV 0.0750	ULEV 0.0400	ZEV 0.0000
							Exhaust	Evap	Exhaust	Evap						
LDGV																
3-way																
CARB	0.0047	0.0000	0.0051	0.0000	0.0100	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
TBI	0.0047	0.0000	0.0051	0.0000	0.0100	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
PFI	0.0047	0.0000	0.0051	0.0000	0.0100	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
3-way + ox																
CARB	0.0045	0.0000	0.0046	0.0000	0.0101	0.0000	0.0045	0.0000	0.0045	0.0000	0.0045	0.0045	0.0045	0.0045	0.0045	0.0000
TBI	0.0045	0.0000	0.0046	0.0000	0.0101	0.0000	0.0045	0.0000	0.0045	0.0000	0.0045	0.0045	0.0045	0.0045	0.0045	0.0000
PFI	0.0045	0.0000	0.0046	0.0000	0.0101	0.0000	0.0045	0.0000	0.0045	0.0000	0.0045	0.0045	0.0045	0.0045	0.0045	0.0000
ox cat																
CARB	0.0044	0.0000	0.0053	0.0000	0.0130	0.0000	0.0051	0.0000	0.0051	0.0000	0.0051	0.0051	0.0051	0.0051	0.0051	0.0000
TBI	0.0044	0.0000	0.0053	0.0000	0.0130	0.0000	0.0051	0.0000	0.0051	0.0000	0.0051	0.0051	0.0051	0.0051	0.0051	0.0000
PFI	0.0044	0.0000	0.0053	0.0000	0.0130	0.0000	0.0051	0.0000	0.0051	0.0000	0.0051	0.0051	0.0051	0.0051	0.0051	0.0000
non-cat																
CARB	0.0062	0.0000	0.0089	0.0000	0.0133	0.0000	0.0082	0.0000	0.0082	0.0000	0.0082	0.0082	0.0082	0.0082	0.0082	0.0000
LDGT																
3-way																
CARB	0.0047	0.0000	0.0051	0.0000	0.0100	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
TBI	0.0047	0.0000	0.0051	0.0000	0.0100	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
PFI	0.0047	0.0000	0.0051	0.0000	0.0100	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
3-way + ox																
CARB	0.0045	0.0000	0.0046	0.0000	0.0101	0.0000	0.0045	0.0000	0.0045	0.0000	0.0045	0.0045	0.0045	0.0045	0.0045	0.0000
TBI	0.0045	0.0000	0.0046	0.0000	0.0101	0.0000	0.0045	0.0000	0.0045	0.0000	0.0045	0.0045	0.0045	0.0045	0.0045	0.0000
PFI	0.0045	0.0000	0.0046	0.0000	0.0101	0.0000	0.0045	0.0000	0.0045	0.0000	0.0045	0.0045	0.0045	0.0045	0.0045	0.0000
ox cat																
CARB	0.0044	0.0000	0.0053	0.0000	0.0130	0.0000	0.0051	0.0000	0.0051	0.0000	0.0051	0.0051	0.0051	0.0051	0.0051	0.0000
TBI	0.0044	0.0000	0.0053	0.0000	0.0130	0.0000	0.0051	0.0000	0.0051	0.0000	0.0051	0.0051	0.0051	0.0051	0.0051	0.0000
PFI	0.0044	0.0000	0.0053	0.0000	0.0130	0.0000	0.0051	0.0000	0.0051	0.0000	0.0051	0.0051	0.0051	0.0051	0.0051	0.0000
non-cat																
CARB	0.0062	0.0000	0.0089	0.0000	0.0133	0.0000	0.0082	0.0000	0.0082	0.0000	0.0082	0.0082	0.0082	0.0082	0.0082	0.0000
HDGV																
TWC	0.0047	0.0000	0.0051	0.0000	0.0100	0.0000	0.0050	0.0000	0.0050	0.0000	0.0050	0.0050	0.0050	0.0050	0.0050	0.0000
non-cat	0.0063	0.0000	0.0091	0.0000	0.0135	0.0000	0.0083	0.0000	0.0083	0.0000	0.0083	0.0083	0.0083	0.0083	0.0083	0.0000
LDDV	0.0125	0.0000														
LDDT	0.0125	0.0000														
HDDV	0.0075	0.0000														

Footnotes given on the following page.

Footnotes:

- (1) For baseline gasoline, the LDGV 3-way fraction was based on FTP data from 38 vehicles tested in four studies (Arco 91-02, Arco 91-03, Arco 91-06, and Auto/Oil). THC as measured by the FID in these studies was converted to TOG using a single TOG/THC conversion factor of 1.0125, which is consistent with what is used in MOBILE 4.1. This was done because the fractions are applied to MOBILE 4.1 TOG.

The LDGV 3-way + ox fraction was based on FTP data from 25 vehicles tested in eight studies (SwRI 80-004, SwRI 80-005, MSERB 46 car study, MSERB low temp study, MSERB high temp study, 1989 CARB toxics study, Arco 91-03, and Auto/Oil). A TOG/THC conversion factor of 1.0175 was used.

The LDGV ox cat fraction was based on FTP data from 41 vehicles tested in eight studies (SwRI 80-003, SwRI 79-007, MSERB 46 car study, SwRI 81-024, MSERB low temp study, Auto/Oil study, Arco 91-03, and 1990 SwRI report). A TOG/THC conversion factor of 1.0170 was used.

The LDGV non cat fraction was based on FTP data from 11 vehicles tested in four studies (SwRI 81-020, SwRI 80-003, MSERB 46 car study, and 1990 SwRI report). A TOG/THC conversion factor of 1.0333 was used.

LDGTs are assumed to have the same fractions as LDGVs.

The LDDV fraction was based on FTP data from seven vehicles tested in two studies (SwRI 76-034 and SwRI 79-007). A TOG/THC conversion factor of 1.0490 was used. LDDTs are assumed to have the same fractions as LDDVs.

The HDDV fraction was based on 13-mode data from two engines tested in one study (SwRI 79-007). A TOG/THC conversion factor of 1.0342 was used.

The HDGV non-cat fraction was based on 13-mode data from one engine tested in one study (SwRI 79-007). A TOG/THC conversion factor of 1.0358 was used. The HDGV 3-way fraction is assumed to equal the LDGV 3-way fraction.

- (2) For the winter oxygenate program, it is assumed that 15% MTBE (2.7 weight % O₂) will be the major oxygenate used in the CO non-attainment areas. Changes in the acetaldehyde TOG fraction from 0% to 15% MTBE were estimated based on vehicle data. (As with baseline gasoline, MOBILE4.1 TOG/THC conversion factors were used to calculate acetaldehyde TOG fractions. The conversion factors for baseline gasoline by catalyst type were each multiplied by 1.0197 to estimate TOG/THC conversion factors by catalyst type for 15% MTBE blends.) The baseline gasoline fractions were multiplied by the following to estimate fractions for 15% MTBE: 1.0826 for 3-way, 1.0136 for 3-way + ox, 1.2114 for ox cat, and 1.4377 for non- cat. These numbers were estimated using data from Auto/Oil and Arco 91-06 for 3-way, Auto/Oil for 3-way+ox and ox cat, and the 1990 SwRI report for non-cat.
- (3) Changes in the acetaldehyde TOG fraction from 0% to 10% ethanol were estimated based on vehicle data. (As with baseline gasoline, MOBILE4.1 TOG/THC conversion factors were used to calculate acetaldehyde TOG fractions. The conversion factors for baseline gasoline by catalyst type were each multiplied by 1.0232 to estimate TOG/THC conversion factors by catalyst type for 10% ethanol.) The baseline gasoline fractions were multiplied by the following to estimate fractions for 10% ethanol: 2.1369 for 3-way, 2.2453 for 3-way + ox, 2.9609 for ox cat, and 2.1445 for non- cat. These numbers were estimated using data from Auto/Oil, 1990 SwRI report, and CDH data for 3-way, CDH data for 3-way+ox, 1990 SwRI report and CDH data for ox cat, and the 1990 SwRI report and CDH data for non-cat.
- (4) The composition of reformulated gasoline in CY1995-1999 is assumed to be 2% oxygen, 1.0% benzene and 25% aromatics. The percent changes in the acetaldehyde TOG fractions from 0% to 15% MTBE (2.7 wt% O₂) were multiplied by 2/2.7, the ratio of oxygen contents by weight for reformulated gasoline and 15% MTBE, to obtain changes in the acetaldehyde TOG fractions with reformulated gasoline.
- (5) For reformulated gasoline in CY 2000+, the fraction of acetaldehyde is assumed to remain the same relative to CY1995-1999. However, the mass of TOG will be reduced. As a result, the mass of acetaldehyde is assumed to be reduced proportionately to TOG.
- (6) The acetaldehyde fractions for the California vehicles are assumed to be those for reformulated gasoline. As a result, the mass of acetaldehyde is assumed to be reduced proportionately to TOG.

Remaining CAAA provisions not included in this table are the clean fuel fleet program and the California pilot program. These will not be considered.

03/02/1988

BENZENET Vehicle class/ technology	Baseline (gasoline) (1)			Winter oxygenates (4)			10% Ethanol (5)			CY 1995-1999 (6)			CY 2000+ (7)			California NMOG standards (exhaust only)(8)					
	Exhaust(2)	Diurnal(3)	Hot Soak(3)	Exhaust	Diurnal	Hot Soak	Exhaust	Diurnal	Hot Soak	Exhaust	Diurnal	Hot Soak	Exhaust	Diurnal	Hot Soak	0.3900	0.2500	TLEV	LEV	ULEV	ZEV
LDGV																					
3-way																					
CARB	0.0527	0.0104	0.0114	0.0396	0.0000	0.0000	0.0486	0.0084	0.0093	0.0422	0.0067	0.0073	0.0422	0.0069	0.0075	0.0422	0.0422	0.0422	0.0422	0.0422	0.0000
TBI	0.0527	0.0104	0.0114	0.0396	0.0000	0.0000	0.0486	0.0084	0.0093	0.0422	0.0067	0.0073	0.0422	0.0069	0.0075	0.0422	0.0422	0.0422	0.0422	0.0422	0.0000
PFI	0.0527	0.0104	0.0114	0.0396	0.0000	0.0000	0.0486	0.0084	0.0093	0.0422	0.0067	0.0073	0.0422	0.0069	0.0075	0.0422	0.0422	0.0422	0.0422	0.0422	0.0000
3-way + ox																					
CARB	0.0287	0.0104	0.0114	0.0186	0.0000	0.0000	0.0257	0.0084	0.0093	0.0204	0.0067	0.0073	0.0204	0.0069	0.0075	0.0204	0.0204	0.0204	0.0204	0.0204	0.0000
TBI	0.0287	0.0104	0.0114	0.0186	0.0000	0.0000	0.0257	0.0084	0.0093	0.0204	0.0067	0.0073	0.0204	0.0069	0.0075	0.0204	0.0204	0.0204	0.0204	0.0204	0.0000
PFI	0.0287	0.0104	0.0114	0.0186	0.0000	0.0000	0.0257	0.0084	0.0093	0.0204	0.0067	0.0073	0.0204	0.0069	0.0075	0.0204	0.0204	0.0204	0.0204	0.0204	0.0000
ox cat																					
CARB	0.0405	0.0104	0.0114	0.0242	0.0000	0.0000	0.0355	0.0084	0.0093	0.0274	0.0067	0.0073	0.0274	0.0069	0.0075	0.0274	0.0274	0.0274	0.0274	0.0274	0.0000
TBI	0.0405	0.0104	0.0114	0.0242	0.0000	0.0000	0.0355	0.0084	0.0093	0.0274	0.0067	0.0073	0.0274	0.0069	0.0075	0.0274	0.0274	0.0274	0.0274	0.0274	0.0000
PFI	0.0405	0.0104	0.0114	0.0242	0.0000	0.0000	0.0355	0.0084	0.0093	0.0274	0.0067	0.0073	0.0274	0.0069	0.0075	0.0274	0.0274	0.0274	0.0274	0.0274	0.0000
non-cat																					
CARB	0.0405	0.0104	0.0114	0.0242	0.0000	0.0000	0.0355	0.0084	0.0093	0.0274	0.0067	0.0073	0.0274	0.0069	0.0075	0.0274	0.0274	0.0274	0.0274	0.0274	0.0000
LDGT																					
3-way																					
CARB	0.0527	0.0104	0.0114	0.0396	0.0000	0.0000	0.0486	0.0084	0.0093	0.0422	0.0067	0.0073	0.0422	0.0069	0.0075	0.0422	0.0422	0.0422	0.0422	0.0422	0.0000
TBI	0.0527	0.0104	0.0114	0.0396	0.0000	0.0000	0.0486	0.0084	0.0093	0.0422	0.0067	0.0073	0.0422	0.0069	0.0075	0.0422	0.0422	0.0422	0.0422	0.0422	0.0000
PFI	0.0527	0.0104	0.0114	0.0396	0.0000	0.0000	0.0486	0.0084	0.0093	0.0422	0.0067	0.0073	0.0422	0.0069	0.0075	0.0422	0.0422	0.0422	0.0422	0.0422	0.0000
3-way + ox																					
CARB	0.0287	0.0104	0.0114	0.0186	0.0000	0.0000	0.0257	0.0084	0.0093	0.0204	0.0067	0.0073	0.0204	0.0069	0.0075	0.0204	0.0204	0.0204	0.0204	0.0204	0.0000
TBI	0.0287	0.0104	0.0114	0.0186	0.0000	0.0000	0.0257	0.0084	0.0093	0.0204	0.0067	0.0073	0.0204	0.0069	0.0075	0.0204	0.0204	0.0204	0.0204	0.0204	0.0000
PFI	0.0287	0.0104	0.0114	0.0186	0.0000	0.0000	0.0257	0.0084	0.0093	0.0204	0.0067	0.0073	0.0204	0.0069	0.0075	0.0204	0.0204	0.0204	0.0204	0.0204	0.0000
ox cat																					
CARB	0.0405	0.0104	0.0114	0.0242	0.0000	0.0000	0.0355	0.0084	0.0093	0.0274	0.0067	0.0073	0.0274	0.0069	0.0075	0.0274	0.0274	0.0274	0.0274	0.0274	0.0000
TBI	0.0405	0.0104	0.0114	0.0242	0.0000	0.0000	0.0355	0.0084	0.0093	0.0274	0.0067	0.0073	0.0274	0.0069	0.0075	0.0274	0.0274	0.0274	0.0274	0.0274	0.0000
PFI	0.0405	0.0104	0.0114	0.0242	0.0000	0.0000	0.0355	0.0084	0.0093	0.0274	0.0067	0.0073	0.0274	0.0069	0.0075	0.0274	0.0274	0.0274	0.0274	0.0274	0.0000
non-cat																					
CARB	0.0405	0.0104	0.0114	0.0242	0.0000	0.0000	0.0355	0.0084	0.0093	0.0274	0.0067	0.0073	0.0274	0.0069	0.0075	0.0274	0.0274	0.0274	0.0274	0.0274	0.0000
HDGV																					
TWC	0.0527	0.0104	0.0114	0.0396	0.0000	0.0000	0.0486	0.0084	0.0093	0.0422	0.0067	0.0073	0.0422	0.0069	0.0075	0.0422	0.0422	0.0422	0.0422	0.0422	0.0000
Non-Cat	0.0405	0.0104	0.0114	0.0242	0.0000	0.0000	0.0355	0.0084	0.0093	0.0274	0.0067	0.0073	0.0274	0.0069	0.0075	0.0274	0.0274	0.0274	0.0274	0.0274	0.0000
LDDV	0.0229	0.0000	0.0000																		
LDDT	0.0229	0.0000	0.0000																		
HDDV	0.0106	0.0000	0.0000																		

Footnotes given on the following page.

Footnotes:

- (1) The composition of baseline gasoline in 1990+ is assumed to be 1.53% benzene, 32.0% aromatics, 0% oxygen, and 8.7 psi RVP, as given in Section 219 of the Clean Air Act and used as the baseline fuel (Fuel A) in the Auto/Oil program.
- (2) The baseline gasoline exhaust benzene fractions for LDGV and LDGT were calculated using the following equations:
3-way: $Bz\%HC = 1.077 + 0.7732*(\text{volume \% benzene}) + 0.0987*(\text{volume \% aromatics} - \text{volume \% benzene})$
3-way + ox: $Bz\%HC = 0.6796*(\text{volume \% benzene}) + 0.0681*(\text{volume \% aromatics}) - 0.3468$
other: $Bz\%HC = 0.8551*(\text{volume \% benzene}) + 0.12198*(\text{volume \% aromatics}) - 1.1626$
The equation for 3-way catalysts was taken from the reformulated gasoline NPRM (July 9, 1991). The equations for the other catalyst types were taken from the RIA for the RVP regulations. It was assumed that the benzene exhaust fractions for the HDGV categories were equal to those corresponding LDGV categories. The benzene fractions for LDDV, LDDT, and HDDV are based on the benzene fractions of THC used in the 1987 EPA motor vehicle air toxics report (0.0240 for LDDV and LDDT; 0.0110 for HDDV). These were then adjusted to give benzene fractions of TOG using TOG/THC ratios (1.0490 for LDD; 1.0342 for HDD).
- (3) The baseline gasoline diurnal and hot soak benzene fractions are based on the following equations taken from the reformulated gasoline NPRM.
Diurnal benzene = $[(1.3758 - (0.0579*(\text{weight \% oxygen}/2.0) - (0.080274*RVP))]*(\text{volume \% benzene})$
Hot soak benzene = $[(1.4448 - (0.0684*(\text{weight \% oxygen}/2.0) - (0.080274*RVP))]*(\text{volume \% benzene})$
- (4) For the winter oxygenate program, it is assumed that 15% MTBE will be the major oxygenate used in the CO non-attainment areas. The composition of the fuel is assumed to be 2.7% oxygen, 22% aromatics, 1.05% benzene, and an arbitrary 8.7 psi RVP (although a winter fuel would have higher RVP, RVP has a minor effect on this fraction). The estimate of 22% aromatics resulted from an examination of the composition of 15% MTBE fuels from existing test programs. The %aromatic level was fairly consistent. The % reduction in aromatics from the baseline of 32% to 22% was then applied to the baseline benzene level of 1.53% to obtain the estimate of 1.05% benzene. The equations for calculating benzene fractions for exhaust are the same as those used for baseline gasoline. It is assumed that evaporative emissions are zero, since it is a winter program.
- (5) The composition of 10% ethanol is assumed to be 1.4% benzene, 28.8% aromatics, and 9.7 psi RVP. The composition was estimated by assuming a 10% reduction of benzene and aromatics, and an increase of 1 psi, applied to the baseline gasoline specifications. The equations for calculating benzene fractions for exhaust, diurnal, and hot soak are the same as those used for baseline gasoline, except the weight % oxygen term is eliminated in the hot soak and diurnal equations.
- (6) The composition of reformulated gasoline in CY1995-1999 is assumed to be 2% oxygen, 1.0% benzene, 25% aromatics, and 8.1 psi RVP. The oxygen, benzene, and aromatic contents are minimum requirements specified in the Clean Air Act. The RVP level is an estimate for Class C areas.
- (7) For reformulated gasoline in CY 2000+, the fraction of exhaust benzene (and the other toxics mentioned in CAAA Section 219) is assumed to remain the same relative to CY1995-1999. However, the mass of TOG will be reduced. As a result, the mass of benzene is assumed to be reduced proportionately to TOG for exhaust. An RVP of 7.8 psi is used, which is an estimate for Class C areas. This different RVP assumption results in slightly higher diurnal and hot soak benzene fractions for CY 2000+ compared to 1995-1999. However, evaporative TOG will be reduced by a greater amount, resulting in an overall decrease in the mass of evaporative benzene.
- (8) The benzene exhaust fractions for the California vehicles are assumed to be those for reformulated gasoline, since the fuel characteristics are similar. The benzene diurnal and hot soak fractions for the vehicles meeting the 0.39, 0.25, and 0.125 standards are assumed to equal those for 1995-1999 reformulated gasoline. The benzene diurnal and hot soak fractions for LEVs and ULEVs are handled differently, since these vehicles will be phased in after CARB's proposed Phase 2 gasoline specifications take effect. Phase 2 gasoline includes limits of 7.0 psi RVP, 1.8-2.2 wt% O2, 25% aromatics, and 1% benzene. Therefore, the diurnal and hot soak fractions for LEVs and ULEVs are 0.0076 and 0.0081, respectively, based on the Phase 2 gasoline specifications, assuming 2% O2.

Remaining CAAA provisions not included in this table are the clean fuel fleet program and the California pilot program. These will not be considered.

HCHOTOGF Vehicle class/ technology	Baseline (gasoline)(1)		Winter oxygenates(2)		10% Ethanol(3)		Reformulated gasoline				California NMOG standards (exhaust only)(6)					
	Exhaust	Evap	Exhaust	Evap	Exhaust	Evap	CY 1995-1999(4)		CY 2000+(5)		0.3900	0.2500	TLEV	LEV	ULEV	ZEV
							Exhaust	Evap	Exhaust	Evap			0.1250	0.0750		
LDGV																
3-way																
CARB	0.0087	0.0000	0.0146	0.0000	0.0128	0.0000	0.0130	0.0000	0.0130	0.0000	0.0130	0.0130	0.0130	0.0130	0.0130	0.0000
TBI	0.0087	0.0000	0.0146	0.0000	0.0128	0.0000	0.0130	0.0000	0.0130	0.0000	0.0130	0.0130	0.0130	0.0130	0.0130	0.0000
PFI	0.0087	0.0000	0.0146	0.0000	0.0128	0.0000	0.0130	0.0000	0.0130	0.0000	0.0130	0.0130	0.0130	0.0130	0.0130	0.0000
3-way + ox																
CARB	0.0137	0.0000	0.0174	0.0000	0.0168	0.0000	0.0164	0.0000	0.0164	0.0000	0.0164	0.0164	0.0164	0.0164	0.0164	0.0000
TBI	0.0137	0.0000	0.0174	0.0000	0.0168	0.0000	0.0164	0.0000	0.0164	0.0000	0.0164	0.0164	0.0164	0.0164	0.0164	0.0000
PFI	0.0137	0.0000	0.0174	0.0000	0.0168	0.0000	0.0164	0.0000	0.0164	0.0000	0.0164	0.0164	0.0164	0.0164	0.0164	0.0000
ox cat																
CARB	0.0139	0.0000	0.0281	0.0000	0.0172	0.0000	0.0244	0.0000	0.0244	0.0000	0.0244	0.0244	0.0244	0.0244	0.0244	0.0000
TBI	0.0139	0.0000	0.0281	0.0000	0.0172	0.0000	0.0244	0.0000	0.0244	0.0000	0.0244	0.0244	0.0244	0.0244	0.0244	0.0000
PFI	0.0139	0.0000	0.0281	0.0000	0.0172	0.0000	0.0244	0.0000	0.0244	0.0000	0.0244	0.0244	0.0244	0.0244	0.0244	0.0000
non-cat																
CARB	0.0269	0.0000	0.0410	0.0000	0.0297	0.0000	0.0374	0.0000	0.0374	0.0000	0.0374	0.0374	0.0374	0.0374	0.0374	0.0000
LDGT																
3-way																
CARB	0.0087	0.0000	0.0146	0.0000	0.0128	0.0000	0.0130	0.0000	0.0130	0.0000	0.0130	0.0130	0.0130	0.0130	0.0130	0.0000
TBI	0.0087	0.0000	0.0146	0.0000	0.0128	0.0000	0.0130	0.0000	0.0130	0.0000	0.0130	0.0130	0.0130	0.0130	0.0130	0.0000
PFI	0.0087	0.0000	0.0146	0.0000	0.0128	0.0000	0.0130	0.0000	0.0130	0.0000	0.0130	0.0130	0.0130	0.0130	0.0130	0.0000
3-way + ox																
CARB	0.0137	0.0000	0.0174	0.0000	0.0168	0.0000	0.0164	0.0000	0.0164	0.0000	0.0164	0.0164	0.0164	0.0164	0.0164	0.0000
TBI	0.0137	0.0000	0.0174	0.0000	0.0168	0.0000	0.0164	0.0000	0.0164	0.0000	0.0164	0.0164	0.0164	0.0164	0.0164	0.0000
PFI	0.0137	0.0000	0.0174	0.0000	0.0168	0.0000	0.0164	0.0000	0.0164	0.0000	0.0164	0.0164	0.0164	0.0164	0.0164	0.0000
ox cat																
CARB	0.0139	0.0000	0.0281	0.0000	0.0172	0.0000	0.0244	0.0000	0.0244	0.0000	0.0244	0.0244	0.0244	0.0244	0.0244	0.0000
TBI	0.0139	0.0000	0.0281	0.0000	0.0172	0.0000	0.0244	0.0000	0.0244	0.0000	0.0244	0.0244	0.0244	0.0244	0.0244	0.0000
PFI	0.0139	0.0000	0.0281	0.0000	0.0172	0.0000	0.0244	0.0000	0.0244	0.0000	0.0244	0.0244	0.0244	0.0244	0.0244	0.0000
non-cat																
CARB	0.0269	0.0000	0.0410	0.0000	0.0297	0.0000	0.0374	0.0000	0.0374	0.0000	0.0374	0.0374	0.0374	0.0374	0.0374	0.0000
HDGV																
TWC	0.0100	0.0000	0.0167	0.0000	0.0148	0.0000	0.0150	0.0000	0.0150	0.0000	0.0150	0.0150	0.0150	0.0150	0.0150	0.0000
non-cat	0.0310	0.0000	0.0473	0.0000	0.0342	0.0000	0.0431	0.0000	0.0431	0.0000	0.0431	0.0431	0.0431	0.0431	0.0431	0.0000
LDDV	0.0391	0.0000														
LDDT	0.0391	0.0000														
HDDV	0.0280	0.0000														

Footnotes given on the following page.

Footnotes:

- (1) For baseline gasoline, the LDGV 3-way fraction was based on FTP data from 38 vehicles tested in four studies (Arco 91-02, Arco 91-03, Arco 91-06, and Auto/Oil). THC as measured by the FID in these studies was converted to TOG using a single TOG/THC conversion factor of 1.0125, which is consistent with what is used in MOBILE 4.1. This was done because the fractions are applied to MOBILE 4.1 TOG.

The LDGV 3-way + ox fraction was based on FTP data from 25 vehicles tested in eight studies (SwRI 80-004, SwRI 80-005, MSERB 46 car study, MSERB low temp study, MSERB high temp study, 1989 CARB toxics study, Arco 91-03, and Auto/Oil). A TOG/THC conversion factor of 1.0175 was used.

The LDGV ox cat fraction was based on FTP data from 41 vehicles tested in eight studies (SwRI 80-003, SwRI 79-007, MSERB 46 car study, SwRI 81-024, MSERB low temp study, Auto/Oil study, Arco 91-03, and 1990 SwRI report). A TOG/THC conversion factor of 1.0170 was used.

The LDGV non cat fraction was based on FTP data from 11 vehicles tested in four studies (SwRI 81-020, SwRI 80-003, MSERB 46 car study, and 1990 SwRI report). A TOG/THC conversion factor of 1.0333 was used.

LDGTs are assumed to have the same fractions as LDGVs.

The LDDV fraction was based on FTP data from seven vehicles tested in two studies (SwRI 76-034 and SwRI 79-007). A TOG/THC conversion factor of 1.0490 was used. LDDTs are assumed to have the same fractions as LDDVs.

The HDDV fraction was based on 13-mode data from two engines tested in one study (SwRI 79-007). A TOG/THC conversion factor of 1.0342 was used.

The HDGV non-cat fraction was based on 13-mode data from one engine tested in one study (SwRI 79-007). A TOG/THC conversion factor of 1.0358 was used. To estimate the 3-way fraction, the non-cat to 3-way fraction reduction for LDGV was applied to the HDGV non-cat fraction.

- (2) For the winter oxygenate program, it is assumed that 15% MTBE (2.7 weight % O₂) will be the major oxygenate used in the CO non-attainment areas. Changes in the formaldehyde TOG fraction from 0% to 15% MTBE were estimated based on vehicle data. (As with baseline gasoline, MOBILE4.1 TOG/THC conversion factors were used to calculate formaldehyde TOG fractions. The conversion factors for baseline gasoline by catalyst type were each multiplied by 1.0197 to estimate TOG/THC conversion factors by catalyst type for 15% MTBE blends.) The baseline gasoline fractions were multiplied by the following to estimate fractions for 15% MTBE: 1.6746 for 3-way, 1.2672 for 3-way + ox, 2.0244 for ox cat, and 1.5256 for non- cat. These numbers were estimated using data from Auto/Oil and Arco 91-06 for 3-way, Auto/Oil for 3-way+ox and ox cat, and the 1990 SwRI report for non-cat.
- (3) Changes in the formaldehyde TOG fraction from 0% to 10% ethanol were estimated based on vehicle data. (As with baseline gasoline, MOBILE4.1 TOG/THC conversion factors were used to calculate formaldehyde TOG fractions. The conversion factors for baseline gasoline by catalyst type were each multiplied by 1.0232 to estimate TOG/THC conversion factors by catalyst type for 10% ethanol.) The baseline gasoline fractions were multiplied by the following to estimate fractions for 10% ethanol: 1.4758 for 3-way, 1.2288 for 3-way + ox, 1.2400 for ox cat, and 1.1034 for non- cat. These numbers were estimated using data from Auto/Oil, 1990 SwRI report, and CDH data for 3-way, CDH data for 3-way+ox, 1990 SwRI report and CDH data for ox cat, and the 1990 SwRI report and CDH data for non-cat.
- (4) The composition of reformulated gasoline in CY1995-1999 is assumed to be 2% oxygen, 1.0% benzene and 25% aromatics. The percent changes in the formaldehyde TOG fractions from 0% to 15% MTBE (2.7 wt% O₂) were multiplied by 2/2.7, the ratio of oxygen contents by weight for reformulated gasoline and 15% MTBE, to obtain changes in the formaldehyde TOG fractions with reformulated gasoline.
- (5) For reformulated gasoline in CY 2000+, the fraction of formaldehyde is assumed to remain the same relative to CY1995-1999. However, the mass of TOG will be reduced. As a result, the mass of formaldehyde is assumed to be reduced proportionately to TOG.
- (6) The formaldehyde fractions for the California vehicles are assumed to be those for reformulated gasoline. As a result, the mass of formaldehyde is assumed to be reduced proportionately to TOG.

Remaining CAAA provisions not included in this table are the clean fuel fleet program and the California pilot program. These will not be considered.