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Wal-Mart Stores, Inc., Fleet Trial
of
FPC-1 Fuel Performance Catalyst

FINAL REPORT

Prepared by UHI Corporation
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I. Introduction

FPC-1 Fuel Performance Catalyst is a burn rate modifier (catalyst) proven to reduce fuel consumption and increase engine horsepower in several recognized, independent laboratory tests, and several hundred independent field trials. The catalyst speeds the rate of flame propagation, thereby reducing combustion time losses. This action is particularly beneficial wherein engine design (engine speed or rpm) and/or operation type (rapid changes in engine speed and load) contribute to efficiency loss, such as the high-speed diesel truck engine.

A test of FPC-1 conducted by Southwest Research Institute in a 2500 horsepower, medium-speed (900 rpm), turbocharged genset, showed the catalyst created a nearly 2% gain in efficiency (under constant load and engine speed). Combustion experts agree that a 2% gain in a test and engine of this type will translate to a 4.0% to 6.0% gain in a similar engine (medium-speed) operating in the field. For high-speed diesels, improvements could be greater still, since the engine has less time to combust the fuel.

The catalyst also has a positive impact upon the products of incomplete combustion, primarily soot (smoke), a fact which further confirms the catalyst improves the rate of combustion.

The intent of the current trial at Wal-Mart Stores, Inc., Bentonville, Arkansas, is to determine the degree of fuel consumption reduction created by the addition of FPC-1 to the diesel fuel supplied to a select fleet of trucks. The test methodology for determining fuel consumption uses "carbon mass balance" (CMB).

The CMB method measures the carbon containing products of the combustion process (CO2, CO, HC) found in the exhaust, rather than directly measuring fuel flow into the engine. The CMB also makes possible the determination of FPC-1's effect upon regulated emissions, specifically smoke for the diesel engine.

This report summarizes and compares the baseline and FPC-1 treated fuel rates of consumption and emissions for a fleet of five (5) Series 60 Detroit powered trucks.

II. Discussion of Carbon Mass Balance Method

The CMB uses state-of-the-art, non-dispersive infrared analysis (NDIR) and the measurement of carbon containing exhaust gases to determine fuel consumption indirectly. The method has been central to the EPA Federal Test Procedures (FTP) and Highway Fuel Economy Test (HFET) since 1974, and is internationally recognized. This method has proven to be at least as accurate as more conventional flowmeter or weigh scale methods (Simpson, SAE Paper 750002, Ford Motor Co.)

All fuel consumption related data used in the CMB calculation are recorded by a technical representative of the testing company, in this case, Mr. Jeff Black. The exhaust gas data collected during the baseline and treated fuel carbon balance tests are summarized on the attached computer printouts (Appendix 1). From these data, the volume fraction (VF) of each gas is determined and the average molecular weight (Mwt) of the exhaust gases computed. Next, the engine performance factor (pf) or the carbon mass in the exhaust is computed. The pf is finally corrected for exhaust temperature and pressure velocity (exhaust density), and intake air pressure (barometric) and fuel density, yielding a engine performance factor (PF) or carbon mass flow rate corrected for total exhaust mass flow and fuel energy content.

The PFs are shown on the bottom of the computer printouts found in Appendix 1. A positive change in PF equates to a reduction in fuel consumption. The CMB calculations and legend are found on Figure 1 under Appendix 2. A sample calculation is found on Figure 2, also under Appendix 2.

These calculations were provided for UHI by Dr. Geoffrey J. Germane, PhD. Mechanical Engineering, and Department Chair at Brigham Young University, as the technical approach for the CMB. Dr. Germane's resume is also included in Appendix 2.

Correction for Fuel Density

Dr. Germane's formula assumes a fuel density of 0.82 (specific gravity of diesel). UHI engineers measure actual fuel specific gravity by taking samples from the rolling tank on each truck. Only the treated fuel-rate of fuel consumption or PF (PF2) is corrected for changes in fuel density (energy content). The baseline fuel density is used as the reference. The correction factor (if applicable) for fuel density is shown on the treated fuel database computer printouts.

Correction for Barometric Pressure and Ambient (intake air) Temperature

The barometric pressure is used in the calculation of both the baseline and treated fuel Pfs. These pressure readings were taken from the National Weather Service for the Bentonville area. The weather data are found under Appendix 3. The corrected barometric pressure is shown on the treated fuel computer printouts.

Ambient temperature changes are corrected for in the calculation of the exhaust mass flowrate since changes in intake air temperature will be reflected in the exhaust temperature.

III. Discussion of Smoke and Carbon Monoxide

Smoke

Smoke is a product of incomplete combustion, and as such, is a measure of engine efficiency. Smoke is simply unburned fuel droplets not consumed during the final phase or tail of combustion when combustion temperatures are significantly lower, and most of the oxygen in the combustion chamber has been expended. The FPC-1 catalyst improves the oxidation of these fuel droplets, extracting more useful energy and reducing smoke emissions.

Smoke from the engines tested during the baseline and treated fuel tests was collected inside a 25 micron in-line filter. The filter has a clear housing making possible a visual comparison between the baseline and treated filters. The baseline filter was much darker than the treated filter, indicating a reduced concentration of the smoke particles in the exhaust of the FPC-1 treated fuel. This is even more remarkable when considering that the intake air temperature was lower, and the fuel density greater for the treated test. Both of these parameters would normally lead to greater smoke density in the exhaust.

Carbon Monoxide

Carbon monoxide (CO) were extremely low during the baseline fuel test (approx. 0.02%). The 0.02% average reading is among the lowest CO concentrations ever registered by UHI Corporation engineers.

During the treated fuel portion of the test, CO concentrations increased. This occurred because of the colder temperatures, and more dense fuel. Both parameters contribute to CO production.

Note: CO even increased in Unit 002, where fuel consumption was reduced 13% after changes made to the injection system (see IV. Discussion, Unit 002).

Had the intact air temperature and fuel density been equal to that of the baseline, CO would have been as low or lower than the baseline. Prior tests on hundreds of trucks, electronically controlled and mechanical, and in independent laboratories show CO is reduced as much as 20% after FPC-1 fuel treatment.

IV. Discussion of Fuel Consumption

Unit 002

Unit 002 showed a large change in fuel consumption during the FPC-1 treated segment of the test. This change fell well outside of the normal pattern of fuel consumption reduction observed in many prior tests with FPC-1 in Series 60 engines.

The aberration was brought the attention of Mr. Jeff Black by Craig Flinders, Technician for UHI Corporation and FPC-1. Mr. Black investigated and found that an overhead had been done on Unit 002 just the Sunday before, and that the injector travel had been adjusted dramatically. Therefore, at least some of the reduction was created by a mechanical alteration to the fuel supply system.

Because it is impossible to know the absolute change in fuel consumption caused by the adjustments and therefore, the degree of change created by FPC-1 alone, UHI recommends Unit 002 be removed from the test sample.

The ability of the CMB method and instruments to pickup a change in fuel consumption created by a mechanical alteration to the injection system reinforces the reliability of the test method and the results obtained.

Units 134, 010, 272, and 285

After correcting for changes in fuel density, intake air temperature, and pressure (barometric) from the baseline, and removing Unit 002 from the sample, the fleet realized a 5.2% reduction in fuel consumption with FPC-1 fuel treatment.

V. Observations by Wal-Mart Personnel

Increased Horsepower

Mr. Jeff Black reported that approximately 70% of the drivers have commented the trucks are more responsive and powerful. The electronic controls on the Series 60 engine (DDEC) carefully control fuel flow and power output, and would electronically reduce the fuel flow to the injectors when using FPC-1 treated fuel. Therefore, any reported increase in power would likely come as a result of FPC-1 removing carbon coking from the injector orifices. The injection plume would be returned to normal, as would the volume of fuel entering the combustion chamber. This would reverse the decline in horsepower and engine efficiency oftentimes observed in electronically controlled diesel engines due to carbon deposits.

Note: The same combustion chemistry responsible for the formation of smoke particles (cold end combustion) is also responsible for the deposition of carbon on injectors, valves, valve seats, piston crowns, and ring zone areas. By reversing the trend towards carbon deposit formation, and preventing future buildup, proper injector performance will be maintained, and engine component life extended.

VI. Conclusions

(1) Fuel consumption was reduced 5.2% after FPC-1 fuel treatment.

(2) Smoke density in the exhaust was reduced after FPC-1 treatment.

(3) Drivers report greater horsepower output with FPC-1 treated fuel, a likely results of FPC-1's ability to removed carbon deposits on injectors and prevent their future buildup.

Appendix 1

Company Name:	Wal-Mart	***Location***	Bentonville	***Date:***	12/13/94
Test Portion:	Baseline	***Stack Diam.***	5	Inches	
Engine Type:	Detroit S-60	***Mile/Hrs***	262365		
Equipment Type:	Over the Road Trucking	***ID #:***	3*134	***Baro***	30.23
Fuel Sp. Gravity(SG	.841	***Temp:***			
				Time:	1040

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	288.8	0.8	0.02	4	1.53	18.2	
1800	284.4	0.9	0.03	6	1.43	18.3	
1800	284.2	0.9	0.03	6	1.48	18.4	
1800	283.8	0.9	0.03	9	1.49	18.3	
1800	286.4	0.9	0.02	6	1.51	18.3	
1800	288.6	0.9	0.02	6	1.53	18.3	
1800	288.8	0.9	0.03	5	1.44	18.3	
1800	285.4	0.9	0.03	6	1.46	18.3	
1800	285.2	0.9	0.03	6	1.48	18.3	
1800.000	**286.178**	**.889**	**.027**	**6.000**	**1.483**	**18.300**	Mean
0	**2.060**	**.033**	**.005**	**1.323**	**.036**	**.050**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw1**	**pf1**	**PF1**
6.00E-06	0.000266667	.015	.183	28.970	427,037	524,147

Company Name:	Wal-Mart	***Location:***	Bentonville	***Test Date:***	3/1/95
Test Portion:	Treated	***Stack Diam:***	5	Inches	
Engine Type:	Detroit S-60	***Mile/Hrs:***	290270		
Equipment Type	Over the Road Trucking	***ID #:***	3*134	***Baro:***	30.37
Fuel Sp. Gravity:	.845	***Temp:***			
SG Corr Factor:	.995			***Time:***	1400

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	255.6	0.88	0.04	6	1.38	18.9	
1800	255.2	0.88	0.04	6	1.38	18.7	
1800	256.4	0.9	0.04	6	1.39	8.9	
1800	256.7	0.9	0.04	6	1.4	18.9	
1800	257.8	0.9	0.04	6	1.4	18.9	
1800	258.4	0.88	0.04	6	1.39	19	
1800	258.6	0.88	0.04	6	1.39	19	
1800	258	0.88	0.04	6	1.4	19	
1800	258.8	0.88	0.04	6	1.39	19	
1800	258.4	0.9	0.04	6	1.39	19	
1800.000	**257.390**	**.888**	**.040**	**6.000**	**1.391**	**17.930**	Mean
0	**1.312**	**.010**	**.000**	**.000**	**.007**	**3.174**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw2**	**pf2**	**PF2**
6.00E-06	0.0004	.014	.179	28.940	450,089	543,204

Performance factor adjusted for fuel density: 540,621

****% Change PF= 3.14 %**

***** A positive change in PF equates to a reduction in fuel consumption.***

Company Name: Wal-Mart ***Location*** Bentonville ***Date:*** 12/13/94

Test Portion: Baseline ***Stack Diam.*** 5 Inches

Engine Type: Detroit S-60 ***Mile/Hrs*** 88852

Equipment Type: Over the Road Trucking ***ID #:*** 3*010 ***Baro*** 30.24

Fuel Sp. Gravity(SG .846 ***Temp:***

Time: 1110

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	275.6	1	0.02	4	1.5	18.2	
1800	276.2	1	0.02	6	1.51	18.3	
1800	276.6	1	0.02	4	1.53	18.3	
1800	277	0.95	0.02	5	1.53	18.3	
1800	286	0.95	0.03	6	1.46	18.4	
1800	277.2	0.95	0.02	6	1.5	18.4	
1800	276.6	0.95	0.02	5	1.5	18.4	
1800	**277.886**	**.971**	**.021**	**5.143**	**1.504**	**18.329**	Mean
0	**3.616**	**.027**	**.004**	**.900**	**.024**	**.076**	Std Dev

VFHC	VFCO	VFCO2	VFO2	Mtw1	pf1	PF1
5.14E-06	0.000214286	.015	.183	28.974	422,867	493,804

Company Name: Wal-Mart ***Location:*** Bentonville ***Test Date:*** 3/1/95

Test Portion: Treated ***Stack Diam:*** 5 Inches

Engine Type: Detroit S-60 ***Mile/Hrs:*** 118434

Equipment Type Over the Road Trucking ***ID #:*** 3*010 ***Baro:*** 30.37

Fuel Sp. Gravity: .850 ***Temp:*** 43

SG Corr Factor: .995 ***Time:*** 1330

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	257.2	0.9	0.04	4	1.45	18.9	
1800	253	0.92	0.05	4	1.45	18.9	
1800	253	0.9	0.04	6	1.45	18.9	
1800	253	0.9	0.04	6	1.48	18.9	
1800	255	0.9	0.04	6	1.46	18.9	
1800	257	0.9	0.03	4	1.44	18.9	
1800	259.2	0.9	0.04	6	1.43	18.9	
1800	259	0.9	0.04	6	1.44	18.9	
1800.000	**255.800**	**.903**	**.040**	**5.250**	**1.450**	**18.900**	Mean
0	**2.655**	**.007**	**.005**	**1.035**	**.015**	**.000**	Std Dev

VFHC	VFCO	VFCO2	VFO2	Mtw2	pf2	PF2
5.25E-06	0.0004	.015	.189	28.988	433,172	517,996

Performance factor adjusted for fuel density: 515,547

% Change PF= 4.40 %

***** A positive change in PF equates to a reduction in fuel consumption.***

Company Name:	Wal-Mart	*Location:*	Bentonville		*Date:*	12/13/94
Test Portion:	Baseline	*Stack Diam.*	5	Inches		
Engine Type:	Detroit S-60	*Mile/Hrs*	348004			
Equipment Type:	Over the Road Trucking	*ID #:*	3*282		*Baro*	30.15
Fuel Sp. Gravity(SG	.843	*Temp:*				
					Time:	1400

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	281.4	0.9	0.03	5	1.62	17.7	
1800	282.2	0.9	0.03	5	1.62	18.2	
1800	283.4	0.9	0.03	5	1.62	18.1	
1800	286.4	0.9	0.03	5	1.61	18.2	
1800	288.2	0.85	0.03	5	1.61	18.1	
1800	290.2	0.85	0.03	6	1.61	18	
1800	292	0.85	0.03	5	1.61	18.1	
1800	292	0.85	0.03	5	1.58	18.1	
1800.000	**286.975**	**.875**	**.030**	**5.125**	**1.610**	**18.063**	Mean
0	**4.299**	**.027**	**.000**	**.354**	**.013**	**.160**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw1**	**pf1**	**PF1**
5.13E-06	0.0003	.016	.181	28.980	393,546	486,473

Company Name:	Wal-Mart	*Location:*	Bentonville		*Test Date:*	3/1/95
Test Portion:	Treated	*Stack Diam:*	5	Inches		
Engine Type:	Detroit S-60	*Mile/Hrs:*	386578			
Equipment Type	Over the Road Trucking	*ID #:*	3*282		*Baro:*	30.37
Fuel Sp. Gravity:	.856	*Temp:*				
SG Corr Factor:	.985				*Time:*	1435

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	248.8	0.86	0.05	6	1.45	18.9	
1800	248.8	0.86	0.05	6	1.45	18.9	
1800	248.6	0.86	0.05	5	1.45	18.9	
1800	248.6	0.86	0.05	6	1.45	18.9	
1800	248.4	0.88	0.05	4	1.44	19	
1800	248.8	0.88	0.05	5	1.45	19	
1800	249.6	0.88	0.05	6	1.45	19	
1800	250	0.88	0.05	6	1.44	19	
1800	249.6	0.88	0.05	4	1.44	19	
1800	249.4	0.86	0.05	6	1.44	19	
1800.000	**249.060**	**.870**	**.050**	**5.400**	**1.446**	**18.960**	Mean
0	**.542**	**.011**	**.000**	**.843**	**.005**	**.052**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw2**	**pf2**	**PF2**
5.40E-06	0.0005	.014	.190	28.990	431,437	522,990

Performance factor adjusted for fuel density: 514,925

****% Change PF= 5.85 %**

***** A positive change in PF equates to a reduction in fuel consumption.***

Company Name: Wal-Mart *Location:* Bentonville *Date:* 12/13/94

Test Portion: Baseline *Stack Diam.* 5 Inches

Engine Type: Detroit S-60 *Mile/Hrs* 282696

Equipment Type: Over the Road Trucking *ID #:* 3*275 *Baro* 30.15

Fuel Sp. Gravity(SG .847 *Temp:*

Time: 1430

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	284	0.8	0.03	5	1.54	18.2	
1800	284.8	0.8	0.03	5	1.55	18.3	
1800	283.6	0.85	0.04	6	1.47	18.3	
1800	280	0.85	0.04	5	1.5	18.3	
1800	279.8	0.85	0.03	4	1.5	18.3	
1800	281.8	0.85	0.03	6	1.5	18.3	
1800	283.2	0.85	0.03	5	1.52	18.3	
1800.000	**282.457**	**.836**	**.033**	**5.143**	**1.511**	**18.286**	Mean
0	**1.969**	**.024**	**.005**	**.690**	**.027**	**.038**	Std Dev

VFHC	VFCO	VFCO2	VFO2	Mtw1	pf1	PF1
5.14E-06	0.000328571	.015	.183	28.974	417,784	526,833

Company Name: Wal-Mart *Location:* Bentonville *Test Date:* 3/1/95

Test Portion: Treated *Stack Diam:* 5 Inches

Engine Type: Detroit S-60 *Mile/Hrs:* 330444

Equipment Type Over the Road Trucking *ID #:* 3*275 *Baro:* 30.35

Fuel Sp. Gravity: .851 *Temp:*
SG Corr Factor: .995 *Time:* 1500

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	246	0.82	0.05	6	1.35	19	
1800	245.2	0.82	0.05	6	1.34	19	
1800	244.2	0.84	0.05	6	1.34	19	
1800	244	0.84	0.05	6	1.34	19	
1800	244.2	0.82	0.05	6	1.34	19	
1800	244.4	0.84	0.05	6	1.34	19	
1800	244.6	0.84	0.05	6	1.35	19	
1800	245.4	0.84	0.05	6	1.36	19	
1800	246.2	0.84	0.05	6	1.36	19	
1800	246.6	0.84	0.05	6	1.36	19	
1800.000	**245.080**	**.834**	**.050**	**6.000**	**1.348**	**19.000**	Mean
0	**.939**	**.010**	**.000**	**.000**	**.009**	**.000**	Std Dev

VFHC	VFCO	VFCO2	VFO2	Mtw2	pf2	PF2
6.00E-06	0.0005	.013	.190	28.976	461,256	569,284

Performance factor adjusted for fuel density: 566,595

****% Change PF= 7.55 %**

*** A positive change in PF equates to a reduction in fuel consumption.*

Company Name:	Wal-Mart	*Location:*	Bentonville		*Date:*	12/13/94
Test Portion:	Baseline	*Stack Diam.*	5	Inches		
Engine Type:	Detroit S-60	*Mile/Hrs*	302445			
Equipment Type:	Over the Road Trucking	*ID #:*	3*002		*Baro*	30.22
Fuel Sp. Gravity(SG	.855	*Temp:*				
					Time:	950

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	269.8	0.95	0.03	5	1.58	17.9	
1800	271	0.95	0.03	6	1.55	18.4	
1800	272	0.95	0.03	5	1.58	18.4	
1800	272.8	0.95	0.03	6	1.6	18.4	
1800	273.8	0.95	0.03	6	1.58	18.3	
1800	274.2	0.95	0.03	6	1.58	18.3	
1800	274.6	0.95	0.03	6	1.59	18.2	
1800	275.6	0.95	0.03	6	1.57	18.3	
1800.000	**272.975**	**.950**	**.030**	**5.750**	**1.579**	**18.275**	Mean
0	**1.952**	**.000**	**.000**	**.463**	**.015**	**.167**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw1**	**pf1**	**PF1**
5.75E-06	0.0003	.016	.183	28.984	401,124	471,932

Company Name:	Wal-Mart	*Location:*	Bentonville		*Test Date:*	3/1/95
Test Portion:	Treated	*Stack Diam:*	5	Inches		
Engine Type:	Detroit S-60	*Mile/Hrs:*	325502			
Equipment Type	Over the Road Trucking	*ID #:*	3*002		*Baro:*	30.35
Fuel Sp. Gravity:	.851	*Temp:*				
SG Corr Factor:	1.005				*Time:*	1550

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	239	1	0.04	10	1.29	19.3	
1800	240.2	1.05	0.04	10	1.3	19.3	
1800	240.8	1	0.04	10	1.31	19.3	
1800	241.6	1	0.04	10	1.31	19.3	
1800	242.4	1	0.04	10	1.32	19.3	
1800	243.4	1.05	0.04	10	1.32	19.4	
1800	244.6	1.05	0.04	10	1.31	19.4	
1800	245	1	0.04	10	1.32	19.4	
1800	245.6	1	0.04	10	1.31	19.4	
1800	246	1	0.04	10	1.31	19.4	
1800.000	**242.860**	**1.015**	**.040**	**10.000**	**1.310**	**19.350**	Mean
0	**2.433**	**.024**	**.000**	**.000**	**.009**	**.053**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw2**	**pf2**	**PF2**
1.00E-05	0.0004	.013	.194	28.984	476,842	532,630

Performance factor adjusted for fuel density: 535,122

****% Change PF= 13.39 %**

***** A positive change in PF equates to a reduction in fuel consumption.***

Appendix 2

Figure 1
CARBON MASS BALANCE FORMULAE

ASSUMPTIONS:

$C_{12}H_{26}$ and SG = 0.82
Time is constant
Load is constant

DATA:

Mwt = Molecular Weight
pf1 = Calculated Performance Factor (Baseline)
pf2 = Calculated Performance Factor (Treated)
PF1 = Performance Factor (adjusted for Baseline exhaust mass)
PF2 = Performance Factor (adjusted for Treated exhaust mass)
CFM = Volumetric Flow Rate of the Exhaust
SG = Specific Gravity of the Fuel
VF = Volume Fraction
d = Exhaust stack diameter in inches
Pv = Velocity pressure in inches of H_20
Pb = Barometric pressure in inches of mercury
Te = Exhaust temperature °F
VFHC = "reading" ÷ 1,000,000
VFCO = "reading" ÷ 100
$VFCO_2$ = "reading" ÷ 100
VFO_2 = "reading" ÷ 100

EQUATIONS:

$$Mwt = (VFHC)(86)+(VFCO)(28)+(VFCO_2)(44)+(VFO_2)(32)+[(1-VFHC-VFCO-VFCO_2-VFO_2)(28)]$$

$$pf1 \text{ or } pf2 = \frac{3099.6 \times Mwt}{86(VFHC)+13.89(VFCO)+13.89(VFCO_2)}$$

$$CFM = \frac{(d/2)^2\pi}{144}\left(1096.2\sqrt{\frac{Pv}{1.325(Pb/Te+460)}}\right)$$

$$PF1 \text{ or } PF2 = \frac{pf \times (Te+460)}{CFM}$$

FUEL ECONOMY:
PERCENT INCREASE (OR DECREASE)

$$\frac{PF2 - PF1}{PF1} \times 100$$

Figure 2.

SAMPLE CALCULATION FOR THE CARBON MASS BALANCE

BASELINE:

Equation 1 (Volume Fractions)

$$VFHC = 13.20/1{,}000{,}000 = 0.0000132$$

$$VFCO = 0.017/100 = 0.00017$$

$$VFCO_2 = 1.937/100 = 0.01937$$

$$VFO_2 = 17.10/100 = 0.171$$

Equation 2 (Molecular Weight)

$$Mwt1 = (0.0000132)(86)+(0.00017)(28)+(0.01937)(44)+(0.171)(32) + [(1-0.0000132-0.00017-0.01937-0.171)(28)]$$

$$Mwt1 = 28.995$$

Equation 3 (Calculated Performance Factor)

$$pf1 = \frac{3099.6 \times 28.995}{86(0.0000132)+13.89(0.00017)+13.89(0.01937)}$$

$$pf1 = 329{,}809$$

Equation 4 (CFM Calculations)

$$\text{CFM} = \frac{(d/2)^2\pi}{144}\left(1096.2\sqrt{\frac{Pv}{1.325(Pb/Te+460)}}\right)$$

d =Exhaust stack diameter in inches
Pv =Velocity pressure in inches of H_20
Pb =Barometric pressure in inches of mercury
Te =Exhaust temperature ^{0}F

$$\text{CFM} = \frac{(10/2)^2\pi}{144}\left(1096.2\sqrt{\frac{.80}{1.325(30.00/313.100+460)}}\right)$$

CFM =2358.37

Equation 5 (Corrected Performance Factor)

$$\text{PF1} = \frac{329,809(313.1 \text{ deg F} + 460)}{2358.37 \text{ CFM}}$$

PF1 = 108,115

TREATED:

Equation 1 (Volume Fractions)

VFHC = 14.6/1,000,000
= 0.0000146

VFCO = .013/100
= 0.00013

$VFCO_2$ = 1.826/100
= 0.01826

VFO_2 = 17.17/100
= 0.1717

Equation 2 (Molecular Weight)

$$\text{Mwt2} = (0.0000146)(86)+(0.00013)(28)+(0.01826)(44)+(0.1717)(32) + [(1-0.0000146-0.00013-0.01826-0.1717)(28)]$$

$$\text{Mwt2} = 28.980$$

Equation 3 (Calculated Performance Factor)

$$\text{pf2} = \frac{3099.6 \times 28.980}{86(0.0000146)+13.89(0.00013)+13.89(0.01826)}$$

$$\text{pf2} = 349{,}927$$

Equation 4 (CFM Calculations)

$$\text{CFM} = \frac{(d/2)^2\pi}{144}\left(1096.2\sqrt{\frac{Pv}{1.325(Pb/Te+460)}}\right)$$

d =Exhaust stack diameter in inches

Pv =Velocity pressure in inches of H_20

Pb =Barometric pressure in inches of mercury

Te =Exhaust temperature ^{O}F

$$\text{CFM} = \frac{(10/2)^2\pi}{144}\left(1096.2\sqrt{\frac{.775}{1.325(29.86/309.02+460)}}\right)$$

$$\text{CFM} = 2320.51$$

Equation 5 (Corrected Performance Factor)

$$\text{PF2} = \frac{349{,}927(309.02 \text{ deg F} + 460)}{2320.51 \text{ CFM}}$$

$$= 115{,}966$$

Fuel Specific Gravity Correction Factor

Baseline Fuel Specific Gravity - Treated Fuel Specific Gravity/Baseline Fuel Specific Gravity +1

.840-.837/.840+1=1.0036

PF2 = 115,966 x Specific Gravity Correction

PF2 = 115,966 x 1.0036

PF2 = 116,384

Equation 6 (Percent Change in Engine Performance Factor:)

$$\% \text{ Change PF} = \frac{\text{PF2 - PF1}}{\text{PF1}} \times 100$$

% Change PF = [(116,384 - 108,115)/108,115](100)

= +7.65

Note: A positive change in PF equates to a reduction in fuel consumption.

Abbreviated Resume -- February 1994

Geoffrey J. Germane, Ph.D.
1790 North 120 East
Orem, Utah 84057

Professor and Chair, Department of Mechanical Engineering
242 CB
Brigham Young University
Provo, Utah 84602
(801) 378-6536

Born July 3, 1950 in Cleveland, Ohio; U.S. Citizen; Married

Appointments at Brigham Young University

Assistant Professor of Mechanical Engineering, September 1979
Associate Professor of Mechanical Engineering, September 1984
Professor of Mechanical Engineering, 1993
Chair, Department of Mechanical Engineering, BYU, August 1991 - present

Education

High School - Mayfield High School, Mayfield Village, Ohio, 1968.
B.S. Mechanical Engineering - Rose-Hulman Institute of Technology, May, 1972.
M.S. Mechanical Engineering - Rose-Hulman Institute of Technology, May, 1975.
Ph.D. Mechanical Engineering - Brigham Young University, Apr., 1979.

Honorary and Professional Society Memberships

The Society of Sigma XI
Society of Automotive Engineers
Pi Tau Sigma
Phi Kappa Phi
American Society for Engineering Education

Honors and Awards

- Pi Tau Sigma, National Mechanical Engineering Honorary
- Elected to Phi Kappa Phi, 1977
- Elected to Sigma Xi, 1979
- BYU Sigma Xi Engineering Dissertation of the Year ,1978
- Society of Automotive Engineers Teetor Award for Engineering Educators, 1981
- Outstanding Young Men of America, 1981
- Esquire Registry, "The Best of the New Generation," December, 1984
- Outstanding Teacher, Mechanical Engineering Department, 1985-86
- Outstanding Teacher, Mechanical Engineering Department, 1988-89

Related Experience and Employment

- Consultant to numerous law firms (motor vehicle accident reconstruction, industrial accident reconstruction, power plant accident reconstruction, and mechanical design analysis), 1981 - present
- Consultant, Collision Safety Engineering, Orem, Utah (automotive crash analysis and safety; motor vehicle accident reconstruction and design analyses; safety research), 1980 - 1991
- Board of Scientists, SEMA Foundation (automotive equipment safety specifications), 1980 - 1984
- Technical Advisory Committee, SFI Foundation (motor vehicle aftermarket and racing equipment safety specifications), 1989 - present
- Consultant, National Hot Rod Association (fuels certification supervision and safety), 1973 - present
- Consultant, UHI corporation (manufacturing, supervision of product evaluation and technical personnel), 1980 - present
- Consultant, SNOWMOCROSS (engineering design), 1984
- Consultant, Health Care Group (medical products), 1981 - 1984
- Consultant, Deseret Professional (general engineering development), 1979 - 1985
- Member, Utah Legislative Committee on Alternate Fuels, 1979
- Research advisor to Collision Safety Engineering Bio-headform project, 1985-1991
- Consultant, Utah Power and Light Co., 1980 - 1985
- Consultant, Carvern Petrochemical (fuel additives), 1980 - 1985
- Consultant, Hercules, Inc. (fuels evaluation supervision), 1979 - 1980
- Consultant, Public Service of New Mexico (Coal Pulverizer inerting systems), 1980
- Consultant, H.C. Sleigh, Melbourne, Australia (fuel additives evaluation procedures), 1980
- Consultant, Biomass Inc. (alcohol fuels), 1980

- •Consultant, Angus Chemical Co., Nitromethane combustion in engines, at BYU, 1983 - 1987
- •Member, Utah State Tax Recodification Task Force, member of task committee, 1988
- •Member, Utah Legislative Committee on Alternate Fuels, 1979

Publications

1. Germane, G.J., "The Effect of Acetic Acid Upon the Antiknock Properties of Methylcyclopentadienyl Manganese Tricarbonyl in Hydrocarbon Fuels," M.S. Thesis, Rose-Hulman Institute of Technology, Terre Haute, IN, December, 1974.

2. Germane, G.J., "Computer Controlled Dynamic Tests with Motoring of an Internal combustion Engine with Alternate Fuels," Ph.D. Dissertation, Brigham Young University, Provo, UT, December 1978.

3. Germane, G.J., Free, J.C., and Heaton, H.S., "General Nonlinear Dynamic Characterization of an Internal Combustion Engine Electrical Dynamometer System," Proceedings of the Tenth Annual Pittsburgh Conference, Instrument Society of America, Pittsburgh, PA, March, 1979.

4. Germane, G.J., and Heaton, H.S., "Dynamic Tests with Ethanol and Methanol in Hydrocarbon Fuel," Mechanical Engineering Report ER-1, Brigham Young University, Provo, UT, May, 1979.

5. Smoot, L.D., Germane, G.J., Cannon, J.N., and Trost, L.C., "Pulverized Coal Power Plant Fires and Explosions," Summary Report Part I, Utah Power and Light Co., Salt Lake City, UT, September, 1979.

6. Germane, G.J., and Heaton, H.S., "A Dynamic Engine Test Facility with Motoring Using a Digital Computer," SAE Paper 800412, Society of Automotive Engineers International Congress and Exposition, Detroit, MI, February, 1980.

7. Germane, G.J., Smoot, L.D., Cannon, J.N., and Trost, L.C., "Pulverized Coal Power Plant Fires and Explosions," Summary Report Part II, Utah Power and Light Co., Salt Lake City, UT, January, 1980.

8. Germane, G.J., and Heaton, H.S., "The Effect of Alcohol Fuels Under Dynamic Operating Conditions on Engine Efficiency and Emissions," Fourth International Symposium on Alcohol Fuels Technology, Sao Paulo, Brazil, October, 1980.

9. Germane, G.J., Smoot, L.D., Cannon, J.N., Cutler, R.P., and Schramm, D.E., "Pulverized Coal Power Plant Fires and Explosions," Summary Report Part III, Utah Power and Light Co., Salt Lake City, UT, April, 1981.

10. Cannon, J.N., Germane, G.J., Cutler, R.P. Schramm, D.E., Carr, D.G., and Smoot, L.D., "Pulverized Coal Power Plant Fires and Explosions," Summary Report Part IV, Utah Power and Light Co., Salt Lake City, UT, April, 1981.

11. Germane, G.J., et.al., "Coal-Water Mixture Combustion Studies in a Laboratory Cylindrical Combustor," Proceedings of the Fourth International Symposium on Coal Slurry Combustion, Orlando, FL, May, 1982.

12. Germane, G.J. and Parry, D.L., "Analysis of a Carbon Gasifier for International Combustion Engine Application," Utah Power and Light Co., Salt Lake City, UT, May, 1982.

13. Cannon, J.N., Germane, G.J., Smoot, L.D., Nye, C.N., and Spackman, H.M., "Pulverized Coal Power Plant Fires and Explosions," Summary Report Part VI, Utah Power and Light Co., Salt Lake City, UT, May, 1982.

14. Germane, G.J., et.al., "Reduction in Oil Use in Coal-Fired Utility Boilers," Summary Report Part VII, Utah Power and Light Co., Salt Lake City, UT, August, 1982.

15. Parsons, J.B. and Germane, G.J., "Effect of an Iron-Based Combustion Catalyst on Diesel Fleet Operation," SAE Paper 831204, West Coast International Meeting, Vancouver, B.C., August, 1982. SAE Special Publication SP-548, Fuel Alternatives for Spark Ignition and Diesel Engines.

16. Warner, C.Y., Smith, C.C., James, M.J. and Germane, G.J., "Friction Applications in Automobile Accident Reconstruction," SAE Paper 830612, Society of Automotive Engineers International Congress and Exposition, Detroit, MI, February, 1983.

17. Germane, G.J., "Automotive Racing Fuels - A Technical Analysis and Review," SAE West Coast International Meeting, Vancouver, B.C., August, 1983.

18. Germane, G.J., et.al., "Coal-Water Mixture Laboratory Combustion Studies and Computer Model Predictions," Proceedings of the Fifth International Symposium on Coal Slurry Combustion and Technology, Tampa, FL, April, 1983.

19. Germane, G.J., Smoot, L.D., "Reduction in Oil Use in Coal-Fired Utility Boilers," Paper 83-JPGC-Paper No. 45, Joint Power Generation Conference, Indianapolis, IN, September 26, 1983.

20. Germane, G.J., Smoot, L.D., and Cannon, J.N., "Inerting of Coal Pulverizers," Paper 83-JPGC-Fu-4, ASME Joint Power Generation Conference, Indianapolis, IN, September 27, 1983.

21. Germane, G.J. and Smoot, L.D., "Basic Combustion and Pollutant Formation Processes for Pulverized Fuels," Final Report, U.S. Department of Energy Contract No. FE 22-80PC3033306, October 31, 1983.

22. Germane, G.J., Hess, C.C. and Wood, C.G., "Lean Combustion in Homogeneous Charge Spark Ignition Engines--A Review," SAE Paper 831694, Society of Automotive Engineers Fuels and Lubricants Meeting, San Francisco, CA, November, 1983.

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26. Rawlins, D.C., Richardson, K.H., Germane, G.J., Hedman, P.O., and Smoot, L.D., "Laboratory-Scale Combustion of Coal-Water Mixtures," Western States Section The Combustion Institute, Boulder, CO, April, 1984.

27. Germane, G.J., Rawlins, D.C., Richardson, K.H., and Smoot, L.D., "Space Resolved Coal-Water Mixture Combustion and Pollutant Formation Studies in a Laboratory Scale Furnace," Proceedings of the Sixth International Symposium on Coal Slurry Combustion and Technology, Orlando, Florida, June, 1984.

28. Wille, M.G., and Germane, G.J., "The Conversion Process," Sidney B. Sperry Symposium, Brigham Young University, Provo, UT, January, 1985.

29. Germane, G.J., Smoot, L.D., Rawlins, D.C., Jones, R.G., and Eatough, C.N., "Characterization and Combustion of Low Rank Coal-Water Slurries," Proceedings of the Seventh International Symposium on Coal Slurry Fuels Preparation and Utilization, New Orleans, LA, May, 1985.

30. Germane, G.J., "A Technical Review of Automotive Racing Fuels," SAE Paper 852129, Society of Automotive Engineers Fuels and Lubricants Meeting, Tulsa, OK, October, 1985.

31. Bush, K.C., Germane, G.J. and Hess, G.L., "Improved Utilization of Nitromethane as an Internal Combustion Engine Fuel," SAE Paper 852130,Society of Automotive Engineers Fuels and Lubricants Meeting, Tulsa, OK, October, 1985.

32. Rawlins, D.C., Germane, G.J., Hedman, P.O. and Smoot, L.D., "Laboratory-Scale Combustion of Coal-Water Mixtures," Combustion and Flame, 63: 59-72 (1986).

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34. Germane, G.J., "A Technical Review of Automotive Racing Fuels," Society of Automotive Engineers Transactions (1985), Society of Automotive Engineers Fuels and Lubricants Journal, 1, 876-878, 1985.

35. Vorwaller, M.A. and Germane, G.J., "Aerodynamic Drag Studies on Rolling Vehicles by Underwater Tow Testing," Society of Automotive Engineers Transactions , (1986).

36. Warner, C.Y., Allsop, D.L. and Germane, G.J., "Frontal Structural Crush Rate Sensitivity," Society of Automotive Engineers Transactions , (1986).

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39. Rawlins, D.C., Germane, G.J. and Smoot, L.D., "Low Rank Coal-Water Fuel Combustion in a Laboratory Scale Furnace," Combustion and Flame, 74(3):255-266 (1988).

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42. Eatough, C.N., Boardman, R.D., Germane, G.J., and Smoot, L.D., "Comparison of Combustion Measurements and Model Predictions of Thermal NOx, Temperatures, Velocities and Major Species in a Swirling Natural Gas Diffusion Flame," First International Confernece on Combustion Technologies for a Clean Environment, Vilamoura - Portugal, 3-6 September 1991.

43. Cope, R.F., Monson, C.R., Hecker, W.C., and Germane, G.J., "Improved Temperature, Velocity and Diameter Measurements for Char Particles in Drop-Tube Reactors," Western States Section of the Combustion Institute, Los Angeles, CA, October, 1991.

44. Boardman, R.D., Eatough, C.N., Germane, G.J., and Smoot, L.D., "Comparison of Measurements and Predictions of Flame Structure and Thermal NOx in a Swirling, Natural Gas Diffusion Flame", Combust. Sci. and Tech. 93, 1-6, 193.

45. Monson, C. R., Germane, G. J., Blackham, A. U., and Smoot, L. D., "Experimental Char Oxidation at Atmospheric and Elevated Pressures," Western States Section/The Combustion Institute, Berkeley, CA, 12 October 1992.

46. Pyper, D., Blackham, S., Warren, D., Hansen, L., Christensen, J., Haslam, J., Germane, G.J., and Hedman, P.O., "CARS Temperature Measurements in the BYU Controlled Profile Reactor in Natural Gas and Natural Gas-Assisted Coal Flames," Western States Section/The Combustion Institute, Berkeley, CA, 12 October 1992.

47. Germane, G. J., "Thrust Area 6: Model Evaluation Data and Process Strategies," *Energy & Fuels*, 7(6):906-909, November/December 1993.

48. Monson, C. R., and Germane, G. J., "A High Pressure Drop-Tube Facility for Coal Combustion Studies," *Energy & Fuels*, 7(6):928-936, November/December 1993.

49. Sanderson, D. K., and Germane, G. J., "Composition of Combustion Gases and Particles in a Pulverized Coal-Fired Reactor," *Energy & Fuels*, 7(6):910-918, November/December 1993.

50. Monson, C.R., Germane, G. J., Blackham, A. U., and Smoot, L. D., "Char Oxidation at Elevated Pressures," accepted for publication in Combustion and Flame.

51. Cope, R.F., Monson, C.R., Hecker, W.C., and Germane, G.J., "Improved Temperature, Velocity and Diameter Measurements for Char Particles in Drop-Tube Reactors," accepted for publication in Energy and Fuels.

Patents

1. "Nitromethane Fuel Compositions," U. S. Patent 4,583,991 granted to Geoff J. Germane and Gary L. Hess, 1986.

2. "Dispenser for Slender Objects, " U. S. Patent granted to Geoff J. Germane, Richard D. Ulrich and David B. Anderson, 1982.

Appendix 3

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Item: 2   Code: CAR

9 ~~8AM~~ Tue 13 December   ARKANSAS this hour   TODAY'S DATA

TOWN	WEATHER	TEMP	WIND	FLSLK	VIS	HUM	BRMTR	HI	LOW	PCPN
Springdale	....									
Fayetteville	cloudy	31	CALM	31	15	89%	30.26r	31	27	
Fort Smith	light fog	35	NE 5	32	5	85%	30.30r	35	32	
Harrison	light fog	30	NW 6	24	5	82%	30.28r	30	26	
Jonesboro	light fog	31	NE 7	23	5	96%	30.34r	31	26	
Blytheville	....									
Hot Springs	cloudy	35	NE 10	22	11	82%	30.31r	35	31	
Little Rock	haze	34	E 7	26	3	92%	30.31f	34	30	
Jacksonville	light fog	36	NE 8	27	4	89%	30.32s	36	29	
Pine Bluff	light fog	35	NE 6	30	5	92%	30.31s	35	31	
Texarkana	cloudy	38	E 7	31	10	82%	30.28s	38	35	
El Dorado	light fog	37	E 5	34	6	89%	30.31r	37	33	
Stuttgart	no report	34	NE 6	29	7	82%	30.35s	34	30	
Walnut Ridge	....									
Batesville	ptly cldy	31	CALM	31	10	82%	30.34r	31	27	
Flippin	no report	30	E 3	30	7	82%	30.31s	30	26	
Rogers	no report	33	SE 3	33	10	82%	30.23r	33	28	
Siloam Sprngs	no report	32	E 5	29	10	79%	30.25r	32	28	
Bentonville	no report	33	CALM	33	10	82%	30.22r	33	27	

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Item: 2    Code: CAR
10 ~~9~~AM Tue 13 December    ARKANSAS this hour                 TODAY'S DATA
  TOWN             WEATHER    TEMP  WIND   FLSLK VIS   HUM  BRMTR     HI   LOW   PCPN
Springdale        ............................................................
Fayetteville      cloudy      31 CALM       31    15    89% 30.26r    31   27
Fort Smith        light fog   35 NE 5       32     5    85% 30.30r    35   32
Harrison          light fog   30 NW 6       24     5    82% 30.28r    30   26
Jonesboro         light fog   31 NE 7       23     5    96% 30.34r    31   26
Blytheville       ............................................................
Hot Springs       cloudy      35 NE 10      22    11    82% 30.31r    35   31
Little Rock       haze        34 E   7      26     3    92% 30.31f    34   30
Jacksonville      light fog   36 NE 8       27     4    89% 30.32s    36   29
Pine Bluff        light fog   35 NE 6       30     5    92% 30.31s    35   31
Texarkana         cloudy      38 E   7      31    10    82% 30.28s    38   35
El Dorado         light fog   37 E   5      34     6    89% 30.31r    37   33
Stuttgart         no report   34 NE 6       29     7    82% 30.35s    34   30
Walnut Ridge      ............................................................
Batesville        ptly cldy   31 CALM       31    10    82% 30.34r    31   27
Flippin           no report   30 E   3      30     7    82% 30.31s    30   26
Rogers            no report   33 SE 3       33    10    82% 30.23r    33   28
Siloam Sprngs     no report   32 E   5      29    10    79% 30.25r    32   28
Bentonville       no report   33 CALM       33    10    82% 30.22r    33   27
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Item: 2   Code: CAR
11 ~~10~~AM Tue 13 December    ARKANSAS this hour                    TODAY'S DATA
  TOWN          WEATHER    TEMP  WIND   FLSLK VIS  HUM  BRMTR    HI  LOW  PCPN
Springdale      mstly cldy 39 E  6      34   10   62% 30.24f
Fayetteville    mstly cldy 37 CALM      37   15   62% 30.26f   37  27
Fort Smith      no report  38 E  7      31    7   76% 30.30s   38  32
Harrison        cloudy     35 E  5      32   10   79% 30.27f   35  26
Jonesboro       cloudy     35 NE 8      25    8   79% 30.36f   35  26
Blytheville     .............................................................
Hot Springs     cloudy     42 E  11     29   12   63% 30.31f   42  31
Little Rock     haze       40 E  8      31    6   73% 30.33f   40  30
Jacksonville    haze       41 E  8      33    6   70% 30.33s   41  29
Pine Bluff      ptly cldy  43 E  7      37    7   68% 30.32f   43  31
Texarkana       cloudy     43 E  8      35   10   71% 30.28s   43  35
El Dorado       cloudy     45 SE 7      39    7   63% 30.30f   45  33
Stuttgart       no report  37 NE 6      32   10   76% 30.35f   37  30
Walnut Ridge    no report  31 NE 5G94   28   10       30.33s
Batesville      no report  33 CALM      33   10   82% 30.34s   33  27
Flippin         ptly cldy  32 CALM      32   10   79% 30.33r   32  26
Rogers          no report  36 SE 6      31   10   73% 30.26s   36  28
Siloam Sprngs   no report  35 SE 3      35   10   73% 30.26f   35  28
Bentonville     no report  36 SE 3      36   10   76% 30.24s   36  27
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Item: 2 Code: CAR

~~12~~PM Tue 13 December ARKANSAS this hour TODAY'S DATA

TOWN	WEATHER	TEMP	WIND	FLSLK	VIS	HUM	BRMTR	HI	LOW	PCPN
Springdale	cloudy	42	SE 6	37	10	55%	30.23f			
Fayetteville	mstly cldy	45	CALM	45	15	54%	30.22f	45	27	
Fort Smith	ptly cldy	42	E 6	37	10	71%	30.25f	42	32	
Harrison	cloudy	37	E 6	32	10	73%	30.23f	37	26	
Jonesboro	mstly cldy	37	NE 8	28	8	79%	30.31f	37	26	
Blytheville	....									
Hot Springs	cloudy	46	E 9	37	12	58%	30.25f	46	31	
Little Rock	cloudy	42	E 7	35	7	68%	30.29f	42	29	
Jacksonville	light fog	42	E 5	40	6	65%	30.28f	42	29	
Pine Bluff	cloudy	44	E 3	44	10	58%	30.28f	44	31	
Texarkana	mstly cldy	45	E 6	41	10	65%	30.22f	45	35	
El Dorado	cloudy	47	NE 7	41	7	56%	30.26f	47	33	
Stuttgart	no report	41	NE 5	38	10	60%	30.31f	42	30	
Walnut Ridge	ptly cldy	33	NE 5	30	10		30.32f			
Batesville	ptly cldy	36	CALM	36	10	73%	30.31s	36	27	
Flippin	no report	36	CALM	36	10	67%	30.27f	36	26	
Rogers	no report	43	CALM	43	10	56%	30.21s	43	28	
Siloam Sprngs	no report	41	S 3	41	10	62%	30.23f	41	28	
Bentonville	no report	43	S 6	38	10	56%	30.19s	43	27	

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Item: 2    Code: CAR
  2PM Tue 13 December    ARKANSAS this hour                    TODAY'S DATA
  TOWN           WEATHER    TEMP  WIND    FLSLK VIS   HUM   BRMTR     HI   LOW   PCPN
Springdale       cloudy      45 SW 5        43    10   49% 30.18f
Fayetteville     cloudy      45 SW 6        41    15   54% 30.19f     46   27
Fort Smith       mstly cldy 43 E  5        41    10   65% 30.22f     43   32
Harrison         mstly cldy 42 SE 8        34    10   65% 30.21f     42   26
Jonesboro        cloudy      38 NE 8        29     8   76% 30.28f     38   26
Blytheville      ..............................................................
Hot Springs      cloudy      46 E  8        38    12   58% 30.23f     47   31
Little Rock      cloudy      42 E  6        37     7   63% 30.26f     43   29
Jacksonville     haze        43 NE 5        41     6   65% 30.25f     43   29
Pine Bluff       mstly cldy 45 CALM        45    10   58% 30.24f     45   31
Texarkana        cloudy      47 NE 6        43    10   63% 30.21f     47   35
El Dorado        cloudy      47 N  5        45     7   61% 30.24r     47   33
Stuttgart        no report   42 NE 5        40    10   58% 30.28r     43   30
Walnut Ridge     ptly cldy   35 N  6        30    10  100% 30.29s     35   30   0.04
Batesville       no report   38 E  3        38         65% 30.27s     38   27
Flippin          no report   39 NE 3        39    10   60% 30.25s     40   26
Rogers           no report   43 SW 3        43    10   53% 30.17s     44   28
Siloam Sprngs    no report   43 CALM        43    10   56% 30.18s     43   28
Bentonville      no report   43 CALM        43    10   53% 30.15f     44   27
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Item: 2   Code: CAR

15 ~~3~~PM Tue 13 December

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                          ARKANSAS this hour                   TODAY'S DATA
  TOWN          WEATHER   TEMP  WIND  FLSLK VIS  HUM  BRMTR    HI  LOW  PCPN
Springdale      cloudy     45 SW 5      43    10   49% 30.18f
Fayetteville    cloudy     45 CALM      45    15   51% 30.18f   46  27
Fort Smith      cloudy     43 E  7      37    10   68% 30.22s   43  32
Harrison        mstly cldy 39 SE 6      34    10   67% 30.21s   42  26
Jonesboro       cloudy     37 NE 7      30     8   82% 30.30r   38  26
Blytheville     ............................................................
Hot Springs     cloudy     45 SE 6      41    12   63% 30.24r   47  31
Little Rock     cloudy     42 E  5      40     7   65% 30.26s   43  29
Jacksonville    haze       42 NE 7      35     6   68% 30.26r   43  29
Pine Bluff      cloudy     45 NE 5      43    10   58% 30.25r   45  31
Texarkana       cloudy     45 NE 7      39    10   74% 30.21s   47  35
El Dorado       cloudy     47 N  6      43     7   63% 30.24s   47  33
Stuttgart       no report  42 NE 3      42    10   58% 30.28s   43  30
Walnut Ridge    no report  35 N  5      32    10  100% 30.29s   35  30  0.04
Batesville      no report  37 CALM      37    10   67% 30.27f   38  27
Flippin         no report  37 CALM      37    10   65% 30.25r   40  26
Rogers          ptly cldy  42 S  3      42    10   58% 30.17s   44  28
Siloam Sprngs   ptly cldy  42 CALM      42    10   60% 30.19s   43  28
Bentonville     no report  43 CALM      43    10   56% 30.15s   44  27
*******************************************************************************
```

```
********************************************************************************
Item: 2   Code: CAR
   8AM Wed   1 March       ARKANSAS this hour                   TODAY'S DATA
  TOWN          WEATHER   TEMP  WIND  FLSLK VIS  HUM  BRMTR    HI  LOW  PCPN
Springdale      .............................................................
Fayetteville    cloudy     27 NE 15      5   15   72% 30.42r   30  27
Fort Smith      cloudy     35 N  14     17   10   73% 30.42r   37  35
Harrison        cloudy     26 N  11      9   15   66% 30.42r   35  26
Jonesboro       cloudy     33 N  17     11    7   89% 30.41r   36  33
Blytheville     .............................................................
Hot Springs     cloudy     37 N  11G21  23   12   76% 30.39r   40  37
Little Rock     cloudy     37 NE 13     21    7   76% 30.39r   39  37
Jacksonville    light fog  29 N  14      9    6   92% 30.40r   40  29
Pine Bluff      cloudy     39 N  17     19    7   76% 30.37r   41  39
Texarkana       cloudy     39 NE 16     20    7   76% 30.36r   47  39
El Dorado       cloudy     40 N  14G18  23   10   73% 30.35r   45  39
Stuttgart       cloudy     37 N  18     16   10   70% 30.38s   39  37
Walnut Ridge    mstly cldy 33 N  15     13   10   67% 30.43s   36  32
Batesville      cloudy     33 N  9G16   21   10   59% 30.42s   37  33
Flippin         cloudy     29 N  8      18   10   53% 30.44s   34  29
Rogers          cloudy     23 N  14      1   10   68% 30.42s   28  22
Siloam Sprngs   mstly cldy 25 NE 14G17   4   10   60% 30.44s   29  24
Bentonville     cloudy     25 N  14      4   10   63% 30.41r   29  24
********************************************************************************
```

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********************************************************************************
Item: 2   Code: CAR
  10AM Wed  1 March       ARKANSAS this hour                   TODAY'S DATA
  TOWN          WEATHER   TEMP  WIND   FLSLK VIS  HUM  BRMTR    HI  LOW  PCPN
Springdale      cloudy     27 NE 14      6   15   55% 30.42s
Fayetteville    cloudy     29 NE 14      9   15   63% 30.42f   30  27
Fort Smith      cloudy     36 N  9      25   10   70% 30.42s   37  35
Harrison        cloudy     25 N  11      8   15   72% 30.45r   35  25
Jonesboro       cloudy     35 N  14     17    9   64% 30.42s   36  33
Blytheville     .............................................................
Hot Springs     cloudy     38 NE 15     20   12   67% 30.41r   40  37
Little Rock     cloudy     38 N  13     22    7   70% 30.41s   39  37
Jacksonville    cloudy     39 N  11     26    7   67% 30.41s   40  29
Pine Bluff      cloudy     39 N  17     19    7   76% 30.38s   41  39
Texarkana       cloudy     42 NE 14     26    7   71% 30.37s   47  39
El Dorado       cloudy     42 N  13     27   10   68% 30.37rr  45  39
Stuttgart       cloudy     38 N  21     15   10   62% 30.39s   39  37
Walnut Ridge    cloudy     32 N  15     12   10   59% 30.44s   36  32
Batesville      cloudy     34 NW 9      23   10   54% 30.43r   37  33
Flippin         cloudy     29 N  11     13   10   47% 30.47s   34  29
Rogers          ptly cldy  27 N  11G16  11   10   58% 30.43s   28  22
Siloam Sprngs   cloudy     27 NE 11     11   10   61% 30.44s   29  24
Bentonville     cloudy     27 N  13G16   8   10   58% 30.41s   29  24
********************************************************************************
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********************************************************************************
Item: 2    Code: CAR
  11AM Wed   1 March          ARKANSAS this hour                     TODAY'S DATA
  TOWN              WEATHER    TEMP  WIND     FLSLK VIS   HUM   BRMTR     HI   LOW   PCPN
Springdale        cloudy       29 NE 14         9   15    53% 30.41f
Fayetteville      cloudy       31 NE 15        10   15    56% 30.43r     31   26
Fort Smith        cloudy       39 E  11        26   10    60% 30.41f     39   35
Harrison          cloudy       28 N  10        13   20    53% 30.43f     35   25
Jonesboro         cloudy       33 NE 13        15    9    61% 30.42s     36   31
Blytheville       .............................................................
Hot Springs       cloudy       39 NE 14        22   12    65% 30.39f     40   37
Little Rock       cloudy       39 N  11        26    7    65% 30.41s     39   37
Jacksonville      cloudy       40 N  10        28    7    60% 30.41s     40   29
Pine Bluff        cloudy       39 N  15        21    7    76% 30.39r     41   39
Texarkana         cloudy       44 NE 9         35    7    65% 30.36f     47   39
El Dorado         cloudy       42 N  13        27   10    68% 30.37rr    45   39
Stuttgart         cloudy       38 N  17        18   10    62% 30.40r     39   37
Walnut Ridge      cloudy       32 NE 17        10   10    54% 30.44s     36   32
Batesville        cloudy       34 N  7         26   10    52% 30.44r     37   33
Flippin           cloudy       31 N  7         23   10    47% 30.45f     34   29
Rogers            ptly cldy    29 NE 14G20      9   10    56% 30.42f     29   22
Siloam Sprngs     mstly cldy   29 N  11G16     13   10    58% 30.44s     29   24
Bentonville       ptly cldy    28 NE 14         8   10    51% 30.40f     29   24
********************************************************************************
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********************************************************************************
Item: 2   Code: CAR
  12PM Wed  1 March       ARKANSAS this hour                   TODAY'S DATA
  TOWN          WEATHER   TEMP  WIND  FLSLK VIS  HUM  BRMTR    HI  LOW  PCPN
Springdale      cloudy     29 NE 14       9   15   53% 30.41f
Fayetteville    cloudy     33 NE 11      18   15   54% 30.40f   33  26
Fort Smith      cloudy     39 NE 10      27   10   55% 30.40f   39  35
Harrison        cloudy     28 N  10      13   20   53% 30.43f   35  25
Jonesboro       cloudy     35 N  15      16   10   64% 30.41f   36  31
Blytheville     .............................................................
Hot Springs     cloudy     39 NE 14      22   15   65% 30.38f   40  37
Little Rock     cloudy     40 NE 11      27    7   60% 30.39f   40  37
Jacksonville    cloudy     40 N  10      28    7   60% 30.41s   40  29
Pine Bluff      cloudy     39 N  16      20    7   76% 30.37f   41  39
Texarkana       cloudy     44 NE 9       35    7   65% 30.36f   47  39
El Dorado       cloudy     44 NE 8       36   10   68% 30.35f   45  39
Stuttgart       cloudy     38 N  17      18   10   60% 30.39f   39  37
Walnut Ridge    cloudy     33 N  13      15   10   52% 30.44s   36  32
Batesville      cloudy     35 NW 8       25   10   52% 30.44s   37  33
Flippin         cloudy     31 N  7       23   10   45% 30.45s   34  29
Rogers          mstly cldy 28 NE 11      12   10   53% 30.41f   29  22
Siloam Sprngs   mstly cldy 29 NE 13      10   10   56% 30.43f   29  24
Bentonville     ptly cldy  29 NE 10      15   10   51% 30.40s   29  24
********************************************************************************
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********************************************************************************
Item: 2   Code: CAR
   2PM Wed  1 March       ARKANSAS this hour                   TODAY'S DATA
  TOWN          WEATHER   TEMP  WIND  FLSLK VIS  HUM  BRMTR    HI  LOW  PCPN
Springdale      cloudy     31 N  17      8   15   45% 30.35f
Fayetteville    cloudy     33 N  14     14   15   54% 30.36f   33  26
Fort Smith      cloudy     41 NE 10     29   10   51% 30.35f   41  35
Harrison        cloudy     32 N  13     14   20   42% 30.37f   35  25
Jonesboro       cloudy     39 NE 15     21   12   45% 30.36f   39  31
Blytheville     .............................................................
Hot Springs     cloudy     41 NE 7      34   25   55% 30.33s   41  37
Little Rock     cloudy     41 NE 9      31    7   49% 30.36r   42  37
Jacksonville    cloudy     41 N  16     23    7   51% 30.35f   41  29
Pine Bluff      cloudy     41 N  16     23    7   62% 30.33f   41  39
Texarkana       cloudy     45 NE 9      36    7   65% 30.30f   47  39
El Dorado       cloudy     42 N  8      34   10   71% 30.32s   45  39
Stuttgart       cloudy     39 N  18     18   10   53% 30.34f   39  37
Walnut Ridge    cloudy     37 N  10     25   10   46% 30.38f   37  32
Batesville      cloudy     36 N  5      33   10   42% 30.38s   37  33
Flippin         cloudy     36 NW 3      36   10   37% 30.38s   36  29
Rogers          cloudy     28 N  13G21   9   10   51% 30.37r   29  22
Siloam Sprngs   mstly cldy 29 N  14      9   10   49% 30.38s   30  24
Bentonville     ptly cldy  29 NE 13     10   10   49% 30.35s   30  24
********************************************************************************
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********************************************************************************
Item: 2   Code: CAR
   3PM Wed  1 March       ARKANSAS this hour                   TODAY'S DATA
  TOWN          WEATHER   TEMP  WIND  FLSLK VIS  HUM  BRMTR    HI  LOW  PCPN
Springdale      cloudy      30 NE 14      10   15    45% 30.35s
Fayetteville    cloudy      33 N  14      14   15    54% 30.36f   33  26
Fort Smith      cloudy      40 NE 10      28   10    51% 30.35s   41  35
Harrison        cloudy      33 N  11      18   20    44% 30.36f   35  25
Jonesboro       cloudy      39 NE 15      21   12    45% 30.36f   39  31
Blytheville     .............................................................
Hot Springs     cloudy      41 NE 7       34   25    55% 30.33s   41  37
Little Rock     cloudy      41 NE 9       31    7    49% 30.36r   42  37
Jacksonville    cloudy      40 E  11      27    7    49% 30.37r   41  29
Pine Bluff      cloudy      42 N  9G18    32    7    63% 30.33s   42  39
Texarkana       cloudy      45 E  11      33    7    65% 30.29f   47  39
El Dorado       cloudy      42 N  11      29   10    71% 30.30f   45  39
Stuttgart       cloudy      38 N  15      20   10    50% 30.34s   39  37
Walnut Ridge    ptly cldy  40 N  13G18   24   10    43% 30.37f   40  32
Batesville      cloudy      36 N  7       29   10    40% 30.37f   37  33
Flippin         cloudy      37 NE 3       37   10    36% 30.38s   37  29
Rogers          mstly cldy 28 NE 14G20    8   10    49% 30.36f   29  22
Siloam Sprngs   cloudy      28 NE 13G18    9   10    53% 30.38s   30  24
Bentonville     mstly cldy 29 N  14       9   10    51% 30.35s   30  24
********************************************************************************
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********************************************************************************
Item: 2   Code: CAR
   4PM Wed  1 March       ARKANSAS this hour                   TODAY'S DATA
  TOWN          WEATHER   TEMP  WIND  FLSLK VIS  HUM  BRMTR    HI  LOW  PCPN
Springdale      cloudy     29 N  14      9   15   53% 30.34f   32  26
Fayetteville    lgt snow   32 NE 11     17   15   54% 30.35f   33  26
Fort Smith      cloudy     40 NE 10     28   10   51% 30.35s   41  35
Harrison        cloudy     32 N  14     13   20   40% 30.36s   35  25
Jonesboro       ptly cldy  40 NE 16     21   12   41% 30.36s   40  31
Blytheville      ............................................................
Hot Springs     cloudy     41 NE 10     29   25   53% 30.33s   41  37
Little Rock     cloudy     39 NE 10     27    7   51% 30.35f   42  37
Jacksonville    cloudy     40 N  11     27    7   45% 30.36f   41  29
Pine Bluff      cloudy     40 N  14G22  23    7   62% 30.34r   42  39
Texarkana       cloudy     44 NE 9      35    7   68% 30.29s   47  39
El Dorado       cloudy     42 NE 8      34   10   71% 30.31r   45  39
Stuttgart       cloudy     37 N  17     16   10   50% 30.35s   39  37
Walnut Ridge    no report  39 NE 13     23   10   43% 30.38r   40  32
Batesville      cloudy     36 NW 6      31   10   40% 30.38s   37  33
Flippin         cloudy     36 N  8      27   10   35% 30.38s   38  29
Rogers          mstly cldy 27 NE 14G22   6   10   51% 30.35f   29  22
Siloam Sprngs   no report  28 NE 11G16  12   10   56% 30.37s   30  24
Bentonville     no report  28 NE 13G18   9   10   51% 30.33f   30  24
********************************************************************************
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********************************************************************************
Item: 2   Code: CAR
   5PM Wed  1 March       ARKANSAS this hour                   TODAY'S DATA
  TOWN          WEATHER   TEMP  WIND  FLSLK VIS  HUM  BRMTR    HI  LOW  PCPN
Springdale      cloudy     29 N  14      9   15   53% 30.34f   32  26
Fayetteville    lgt snow   32 NE 11     17   15   54% 30.35f   33  26
Fort Smith      cloudy     40 NE 10     28   10   51% 30.35s   41  35
Harrison        cloudy     32 N  14     13   20   40% 30.36s   35  25
Jonesboro       ptly cldy  40 NE 16     21   12   41% 30.36s   40  31
Blytheville     ............................................................
Hot Springs     cloudy     41 NE 10     29   25   53% 30.33s   41  37
Little Rock     cloudy     39 NE 10     27    7   51% 30.35f   42  37
Jacksonville    cloudy     40 N  11     27    7   45% 30.36f   41  29
Pine Bluff      cloudy     40 N  14G22  23    7   62% 30.34r   42  39
Texarkana       cloudy     44 NE 9      35    7   68% 30.29s   47  39
El Dorado       cloudy     42 NE 8      34   10   71% 30.31r   45  39
Stuttgart       cloudy     37 N  17     16   10   50% 30.35s   39  37
Walnut Ridge    no report  39 NE 13     23   10   43% 30.38r   40  32
Batesville      cloudy     36 NW 6      31   10   40% 30.38s   37  33
Flippin         cloudy     36 N  8      27   10   35% 30.38s   38  29
Rogers          mstly cldy 27 NE 14G22   6   10   51% 30.35f   29  22
Siloam Sprngs   no report  28 NE 11G16  12   10   56% 30.37s   30  24
Bentonville     no report  28 NE 13G18   9   10   51% 30.33f   30  24
********************************************************************************
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Carbon Mass Balance Field Data Form

Company: Wal-Mart Location: Bentonville Test Date: 12-13-94

Test Portion: Baseline: ✓ Treated: ______ Exhaust Stack Diameter: 5 Inches

Engine Make/Model: Detroit Miles/Hours: 88832 I.D.#: 3-010

Type of Equipment: ______

Fuel Specific Gravity: .846 @: ______ (°F)

Barometric Pressure: 30.24 Inches of Mercury

Intake Air Temperature: ______ (°F) Start Time: 11:10

After Fuel Filter change

RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
1800	275.6	1.0	.02	4	1.50	18.2	
	276.2	1.0	.02	6	1.51	18.3	
	276.6	1.0	.02	4	1.53	18.3	
	277.0	.95	.02	5	1.53	18.3	
	~~277.8~~	~~.95~~	~~0.2~~	~~6~~	~~2.39~~	~~17.0~~	
	286.0	.95	.03	6	1.46	18.4	
	277.2	.95	.02	6	1.50	18.4	
	276.6	.95	.02	5	1.50	18.4	
1800	277.89	.971	.021	5.14	1.504	18.34	

Ave. :

1800 RPM Programmed by DDR ✓

eng. fan on

Cruise on

Fast idle on

End Time 11:24

Names of Customer Personnel Participating in Test:

______ ______

Signature of Technicians:

Carbon Mass Balance Field Data Form

Company: Wal-Mart Location: Butte Test Date: 3-1-95
Test Portion: Baseline: Treated: ✓ Exhaust Stack Diameter: 5 Inches

Engine Make/Model: 60 series Miles/Hours: 325502 I.D.#: 3-018
Type of Equipment:

Fuel Specific Gravity: .851 @: (°F)
Barometric Pressure: Inches of Mercury
Intake Air Temperature: (°F) Start Time: 3:50

RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
	239	1.0	.04	10	1.29	19.3	
	240.2	1.05	.04	10	1.30	19.3	
	240.8	1.0	.04	10	1.31	19.3	
	241.6	1.0	.04	10	1.31	19.3	
	242.4	1.0	.04	10	1.32	19.3	
	243.4	1.05	.04	10	1.32	19.4	
	244.6	1.05	.04	10	1.31	19.4	
	245.0	1.0	.04	10	1.32	19.4	
	245.6	1.0	.04	10	1.31	19.4	
	246.0	1.0	.04	10	1.31	19.4	

End Time

CHANGED INJECTOR TIMING
[illegible] SUNDAY MARCH 26th

✓

Names of Customer Personnel Participating in Test:

Signature of Technicians:

13.516

Carbon Mass Balance Field Data Form

Company: Wal-Mart Location: Bentonville Test Date: 3 1-95

Test Portion: Baseline: ____ Treated: ✓ Exhaust Stack Diameter: ___Inches

Engine Make/Model: 60 Series DDC Miles/Hours: 118,434 I.D.#: 3-010

Type of Equipment: ____

Fuel Specific Gravity: .85 @: ____ (°F)

Barometric Pressure: 30.4 Inches of Mercury

Intake Air Temperature: 43° (°F) Start Time: 1:30Pm

RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
1500	237.2	.9	.04	4	1.45	18.9	
	253.0	.92	.05	4	1.45	18.9	
	253.0	.9	.04	6	1.45	18.9	
	253.0	.9	.04	6	1.48	18.9	
	255.0	.9	.04	6	1.46	18.9	
	257.0	.9	.03	4	1.44	18.9	
	259.2	.9	.4	6	1.43	18.9	
	259.0	.9	.4	6	1.44	18.9	

End Time ____

Names of Customer Personnel Participating in Test:

4.578

____ ____

Signature of Technicians:

Carbon Mass Balance Field Data Form

Company: Wal-Mart Location: Bentonville Test Date: 12-13-94
Test Portion: Baseline: ✓ Treated: ______ Exhaust Stack Diameter: 5 Inches

Engine Make/Model: Detroit 60 Series Miles/Hours: 348,004 I.D.#: 3-282
Type of Equipment: ______

Fuel Specific Gravity: .843 @: ______ (°F)
Barometric Pressure: 30.15 Inches of Mercury
Intake Air Temperature: ______ (°F) Start Time: 2 pm

	RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
	1800	281.4	.9	.03	5	1.62	17.7	
		282.2	.9	.03	5	1.62	18.2	
		283.4	.9	.03	5	1.62	18.1	
		286.4	.9	.03	5	1.61	18.2	
		288.2	.85	.03	5	1.61	18.1	
		290.2	.85	.03	6	1.61	18.0	
		292.0	.85	.03	5	1.61	18.1	
		292.0	.85	.03	5	1.58	18.1	
Ave. :	1800	286.97	.875	.03	5.12	1.610	18.06	

1800 RPM set by DDR

✓

Cruse on

Fast idle on

End Time 2:15 pm

Names of Customer Personnel Participating in Test:

______ ______

Signature of Technicians:

Carbon Mass Balance Field Data Form

Company: Wal-Mart Location: Bentonville Test Date: 3-1-95

Test Portion: Baseline:______ Treated: ✓ Exhaust Stack Diameter: 5 Inches

Engine Make/Model: Series 60 Detroit Miles/Hours: 336578 I.D.#: 3-282

Type of Equipment: ______

Fuel Specific Gravity: .856 @:______ (°F)

Barometric Pressure: ______ Inches of Mercury

Intake Air Temperature: ______ (°F) Start Time: 2:35

RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
1800	248.8	.86	.05	6	1.45	18.9	
	248.8	.86	.05	6	1.45	18.9	
	248.6	.86	.05	5	1.45	18.9	
	248.6	.86	.05	6	1.45	18.9	
	248.4	.88	.05	4	1.44	19.0	
	248.8	.88	.05	5	1.45	19.0	
	249.6	.88	.05	6	1.45	19.0	
	250.0	.88	.05	6	1.44	19.0	
	249.6	.88	.05	4	1.44	19.0	
	249.4	.86	.05	6	1.44	19.0	

End Time 2:45

Names of Customer Personnel Participating in Test:

5.878

____________ ____________

Signature of Technicians:

Carbon Mass Balance Field Data Form

Company: Wal-mart Location: Bentonville Test Date: 12-13-94
Test Portion: Baseline: ✓ Treated: ______ Exhaust Stack Diameter: 5 Inches

Engine Make/Model: Detroit 60 series Miles/Hours: 282,696 I.D.#: 3-275
Type of Equipment: ______

Fuel Specific Gravity: .847 @: ______ (°F)
Barometric Pressure: 30.15 Inches of Mercury
Intake Air Temperature: ______ (°F) Start Time: 2:30

Set w/ DDR

Cruise Fast idle on

RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
1800	284	.8	.03	5	1.54	18.2	
	284.8	.8	.03	5	1.55	18.3	
	~~246.8~~	~~.85~~	~~.04~~	~~6~~	~~1.46~~	~~18.4~~	
	283.6	.85	.04	6	1.47	18.3	
	280.0	.85	.04	5	1.50	18.3	
	279.8	.85	.03	4	1.51	18.3	
	281.8	.85	.03	6	1.50	18.3	
	283.2	.85	.03	5	1.52	18.3	
	~~286.8~~	~~.85~~	~~.04~~	~~5~~	~~1.46~~	~~18.4~~	
1800	282.46	.836	.033	5.14	1.513	18.28	

eng fan on

eng fan on after readings

AVE. :

End Time 2:50

Names of Customer Personnel Participating in Test:

______ ______

Signature of Technicians:

Carbon Mass Balance Field Data Form

Company: Wal-Mart Location: B'ville Test Date: 3-1-95

Test Portion: Baseline: ______ Treated: ✓ Exhaust Stack Diameter: 5 Inches

Engine Make/Model: Series 60 DDC Miles/Hours: 330444 I.D.#: 3-275

Type of Equipment: ______

Fuel Specific Gravity: .851 @: ______ (°F)

Barometric Pressure: ______ Inches of Mercury

Intake Air Temperature: ______ (°F) Start Time: 3:00 PM

RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
1800	246.-	.82	.05	6	1.35	19.0	
	245.2	.82	.05	6	1.34	19.0	
	244.2	.84	.05	6	1.34	19.0	
	244.0	.84	.05	6	1.34	19.0	
	244.2	.82	.05	6	1.34	19.0	
	244.4	.84	.05 ~~6~~	6	1.34	19.0	
	244.6	.84	.05	6	1.35	19.0	
	245.4	.84	.05	6	1.36	19.0	
	246.2	.84	.05	6	1.36	19.0	
	246.6	.84	.05	6	1.36	19.0	

End Time 3:30 PM

Names of Customer Personnel Participating in Test:

7.086

______ ______

Signature of Technicians:

Carbon Mass Balance Field Data Form

Company: Wal-Mart Location: Bentonville Test Date: 12-13-94

Test Portion: Baseline: ✓ Treated: ______ Exhaust Stack Diameter: 5 Inches

Engine Make/Model: Detroit 60 series Miles/Hours: 262365 I.D.#: 3-134

Type of Equipment: ______

Fuel Specific Gravity: .841 @: ______ (°F)

Barometric Pressure: 30.23 Inches of Mercury

Intake Air Temperature: ______ (°F) Start Time: 10:40 AM

RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
1800	288.8	.80	.02	4	1.53	18.2	
	284.4	.90	.03	6	1.43	18.3	
	284.2	.90	.03	6	1.48	18.4	
	283.8	.90	.03	9	1.49	18.3	
	286.4	.90	.02	6	1.51	18.3	
	288.6	.90	.02	6	1.53	18.3	
	288.8	.90	.03	5	1.44	18.3	
	285.4	.90	.03	6	1.46	18.3	
	285.2	.90	.03	6	1.48	18.3	
AVE -	286.18	.889	.027	6.0	1.483	18.3	

1800 RPM w/ DOR

- eng fan cycled @ end

- Another truck pulled in

✓

Cruise on
Fast idle on

End Time 10:55

Names of Customer Personnel Participating in Test:

______ ______

Signature of Technicians:

Carbon Mass Balance Field Data Form

Company: Wal-Mart Location: Bentonville Test Date: 3-1-95

Test Portion: Baseline: ________ Treated: ✓ Exhaust Stack Diameter: ___Inches

Engine Make/Model: Series 60 Miles/Hours: 290270 I.D.#: 3-134

Type of Equipment: ____________

Fuel Specific Gravity: .845 per Craig @: ________ (°F)

Barometric Pressure: ________ Inches of Mercury

Intake Air Temperature: ________ (°F) Start Time: 2:00 PM

RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
1800	255.6	.88	.04	6	1.38	18.9	
	255.2	.88	.04	6	1.38	18.7	
	256.4	.9	.04	6	1.39	18.9	
	256.7	.9	.04	6	1.40	1.89	
	257.8	.9	.04	6	1.40	.185	
	258.4	.88	.04	6	1.39	1.90	
	258.6	.88	.04	6	1.39	1.90	
	258.0	.88	.04	6	1.40	19.0	
	258.8	.88	.04	6	1.39	19.0	
	258.4	.90	.04	6	1.39	19.0	

End Time____________

Names of Customer Personnel Participating in Test:

____________________ ____________________

Signature of Technicians:

3 96 8

Company Name:	Wal-Mart	*Location:*	Bentonville, AK		*Date:*	12/13/94
Test Portion:	Baseline	*Stack Diam.*	5	Inches		
Engine Type:	Detroit 60 Series	*Mile/Hrs*	302445			
Equipment Type:	Over the Road Trucking	*ID #:*	3-002		*Baro*	30.22
Fuel Sp. Gravity(SG	.855	*Temp:*				
					Time:	950

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	269.8	0.95	0.03	6	1.58	17.9	
1800	271	0.95	0.03	6	1.55	18.4	
1800	272	0.95	0.03	5	1.58	18.4	
1800	272.8	0.95	0.03	6	1.6	18.4	
1800	273.8	0.95	0.03	6	1.58	18.3	
1800	274.2	0.95	0.03	6	1.58	18.3	
1800	274.6	0.95	0.03	6	1.59	18.2	
1800	275.6	0.95	0.03	6	1.57	18.3	
1800.000	**272.975**	**.950**	**.030**	**5.875**	**1.579**	**18.275**	Mean
0	**1.952**	**.000**	**.000**	**.354**	**.015**	**.167**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw1**	**pf1**	**PF1**
5.88E-06	0.0003	.016	.183	28.984	401,104	471,909

Company Name:	Wal-Mart	*Location:*	Bentonville, AK		*Test Date:*	
Test Portion:	Treated	*Stack Diam:*	5	Inches		
Engine Type:	Detroit 60 Series	*Mile/Hrs:*				
Equipment Type	Over the Road Trucking	*ID #:*	3-002		*Baro:*	
Fuel Sp. Gravity:		*Temp:*				
SG Corr Factor:	#VALUE!				*Time:*	

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Mean
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw2**	**pf2**	**PF2**
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Performance factor adjusted for fuel density: #DIV/0!

****% Change PF= ##### %**

***** A positive change in PF equates to a reduction in fuel consumption.***

Carbon Mass Balance Field Data Form

Company: Wal-Mart Location: Bentonville Test Date: 12-13-94

Test Portion: Baseline: ✓ Treated: ______ Exhaust Stack Diameter: ___Inches

Engine Make/Model: Detroit 60 series Miles/Hours: 302,445 I.D.#: 3-002

Type of Equipment: ______

Fuel Specific Gravity: .855 @: ______ (°F)

Barometric Pressure: 30.22 Inches of Mercury

Intake Air Temperature: ______ (°F) Start Time: 9:50 A.M

	RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
	1800	269.8	.95	.03	5	1.58	17.9	
		271.0	.95	.03	6	1.55	18.4	
		272.0	.95	.03	5	1.58	18.4	
		272.8	.95	.03	6	1.60	18.4	
		273.8	.95	.03	6	1.58	18.3	
		274.2	.95	.03	6	1.58	18.3	
		274.6	.95	.03	6	1.59	18.2	
		275.6	.95	.03	6	1.57	18.3	
AVE:	1800	272.97	.950	.030	5.87	1.579	18.27	

cruise on

fast idle on

End Time 10:10 AM

Names of Customer Personnel Participating in Test:

______ ______

Signature of Technicians:

Test Portion: Baseline *Stack Diam.* 5 Inches

Engine Type: Detroit 60 Series *Mile/Hrs* 282696

Equipment Type: Over the Road Trucking *ID #:* 3-275 *Baro* 30.15

Fuel Sp. Gravity(SG .847 *Temp:*

Time: 1430

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	284	0.8	0.03	5	1.54	18.2	
1800	284.8	0.8	0.03	5	1.55	18.3	
~~1800~~	~~296.8~~	~~0.85~~	~~0.04~~	~~6~~	~~1.46~~	~~18.4~~	
1800	283.6	0.85	0.04	6	1.47	18.3	
1800	280	0.85	0.04	5	1.5	18.3	
1800	279.8	0.85	0.03	4	1.51	18.3	
1800	281.8	0.85	0.03	6	1.5	18.3	
1800	283.2	0.85	0.03	5	1.52	18.3	
~~1800~~	~~285.8~~	~~0.85~~	~~0.04~~	~~5~~	~~1.46~~	~~18.4~~	
	282.46	.836	.033	5.14	1.513	18.28	
1800.000	~~**284.422**~~	~~**.839**~~	~~**.034**~~	~~**5.222**~~	~~**1.501**~~	~~**18.311**~~	Mean
0	**5.067**	**.022**	**.005**	**.667**	**.033**	**.060**	Std Dev

VFHC	VFCO	VFCO2	VFO2	Mtw1	pf1	PF1
5.22E-06	0.000344444	.015	.183	28.973	420,131 357,518	~~529,489~~ 525,980

Denominator pf1 (d/2)^2*3.1 Denominator F

Company Name: Wal-Mart *Location:* Bentonville, AK *Test Date:*

Test Portion: Treated *Stack Diam:* 5 Inches

Engine Type: Detroit 60 Series *Mile/Hrs:*

Equipment Type Over the Road Trucking *ID #:* 3-275 *Baro:*

Fuel Sp. Gravity: *Temp:*

SG Corr Factor: #VALUE! *Time:*

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Mean
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Std Dev

VFHC	VFCO	VFCO2	VFO2	Mtw2	pf2	PF2
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Denominator pf1 (d/2)^2*3.1 Denominator F

%

*** A positive change in PF equates to a reduction in fuel consumption.*

Test Portion: Baseline *Stack Diam.* 5 Inches

Engine Type: Detroit 60 Series *Mile/Hrs* 348004

Equipment Type: Over the Road Trucking *ID #:* 3-282 *Baro* 30.15

Fuel Sp. Gravity(SG .843 *Temp:*

Time: 1400

RPM	**Exh Temp**	**Pv Inch**	**CO**	**HC**	**CO2**	**O2**	
1800	281.4	0.9	0.03	5	1.62	17.7	
1800	282.2	0.9	0.03	5	1.62	18.2	
1800	283.4	0.9	0.03	5	1.62	18.1	
1800	286.4	0.9	0.03	5	1.61	18.2	
1800	288.2	0.85	0.03	5	1.61	18.1	
1800	290.2	0.85	0.03	6	1.61	18	
1800	292	0.85	0.03	5	1.61	18.1	
1800	292	0.85	0.03	5	1.58	18.1	
1800.000	**286.975**	**.875**	**.030**	**5.125**	**1.610**	**18.063**	Mean
0	**4.299**	**.027**	**.000**	**.354**	**.013**	**.160**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw1**	**pf1**	**PF1**
5.13E-06	0.0003	.016	.181	28.980	393,546	486,473

Denominator pf1 (d/2)^2*3.1 Denominator F

Company Name: Wal-Mart *Location:* Bentonville, AK *Test Date:*

Test Portion: Treated *Stack Diam:* 5 Inches

Engine Type: Detroit 60 Series *Mile/Hrs:*

Equipment Type Over the Road Trucking *ID #:* 3-282 *Baro:*

Fuel Sp. Gravity: *Temp:*
SG Corr Factor: #VALUE! *Time:*

RPM	**Exh Temp**	**Pv Inch**	**CO**	**HC**	**CO2**	**O2**	
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Mean
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw2**	**pf2**	**PF2**
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Denominator pf1 (d/2)^2*3.1 Denominator F

%

***** *A positive change in PF equates to a reduction in fuel consumption.***

Company Name: Wal-Mart *Location* Bentonville, AK *Date:* 12/13/94

Company Name:	Wal-Mart	*Location:*	Bentonville, AK		*Date:*	12/13/94
Test Portion:	Baseline	*Stack Diam.*	5	Inches		
Engine Type:	Detroit 60 Series	*Mile/Hrs*	88852			
Equipment Type:	Over the Road Trucking	*ID #:*	3-010		*Baro*	30.20
Fuel Sp. Gravity(SG	.846	*Temp:*				
					Time:	11:30

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	275.6	1	0.02	4	1.5	18.2	
1800	276.2	1	0.02	6	1.51	18.3	
1800	276.6	1	0.02	4	1.53	18.3	
1800	277	0.95	0.02	5	1.53	18.3	
1800	286	0.95	0.03	6	1.46	18.4	
1800	277.2	0.95	0.02	6	1.5	18.4	
1800	276.6	0.95	0.02	5	1.5	18.4	
						18.4	
1800.000	**277.886**	**.971**	**.021**	**5.143**	**1.504**	**18.338**	Mean
0	**3.616**	**.027**	**.004**	**.900**	**.024**	**.074**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw1**	**pf1**	**PF1**
5.14E-06	0.000214286	.015	.183	28.974	422,872	493,483

Denominator pf1 (d/2)^2*3.1 Denominator F

Company Name:	Wal-Mart	*Location:*	Bentonville, AK		*Test Date:*	
Test Portion:	Treated	*Stack Diam:*	5	Inches		
Engine Type:	Detroit 60 Series	*Mile/Hrs:*				
Equipment Type	Over the Road Trucking	*ID #:*	3-010		*Baro:*	
Fuel Sp. Gravity:		*Temp:*				
SG Corr Factor:	#VALUE!				*Time:*	

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Mean
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw2**	**pf2**	**PF2**
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Denominator pf1 (d/2)^2*3.1 Denominator F

%

*** A positive change in PF equates to a reduction in fuel consumption.*

Company Name:	Wal-Mart	*Location*	Bentonville, AK	*Date:*	12/13/94

Test Portion: Baseline *Stack Diam.* 5 Inches

Engine Type: Detroit 60 Series *Mile/Hrs* 294690

Equipment Type: Over the Road Trucking *ID #:* 3-003 *Baro* 30.19

Fuel Sp. Gravity(SG .843 *Temp:*

Time: 1300

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	270.4	0.8	0.02	6	1.51	18.1	
1800	271.4	0.8	0.03	6	1.51	18.3	
1800	272.2	0.85	0.03	6	1.51	18.2	
1800	273	0.8	0.03	6	1.51	18.2	
1800	274.4	0.8	0.02	6	1.51	18.3	
1800	275.6	0.8	0.03	6	1.52	18.2	
1800	276.8	0.8	0.02	6	1.51	18.2	
1800	277.8	0.8	0.02	6	1.51	18.2	
1800.000	**273.950**	**.806**	**.025**	**6.000**	**1.511**	**18.213**	Mean
0	**2.644**	**.018**	**.005**	**.000**	**.004**	**.064**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw1**	**pf1**	**PF1**
6.00E-06	0.00025	.015	.182	28.971	419,773	536,186

Denominator pf1 (d/2)^2*3.1 Denominator F

Company Name: Wal-Mart *Location:* Bentonville, AK *Test Date:*

Test Portion: Treated *Stack Diam:* 5 Inches

Engine Type: Detroit 60 Series *Mile/Hrs:*

Equipment Type Over the Road Trucking *ID #:* 3-003 *Baro:*

Fuel Sp. Gravity: *Temp:*
SG Corr Factor: #VALUE! *Time:*

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Mean
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw2**	**pf2**	**PF2**
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Denominator pf1 (d/2)^2*3.1 Denominator F

%

***** A positive change in PF equates to a reduction in fuel consumption.***

Company Name: Wal-Mart *Location* Bentonville, AK *Date:* 12/13/94

Test Portion: Baseline *Stack Diam.* 5 Inches

Engine Type: Detroit 60 Series *Mile/Hrs* 216625

Equipment Type: Over the Road Trucking *ID #:* 3-133 *Baro* 30.22

Fuel Sp. Gravity(SG .854 *Temp:*

Time: 1015

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	274	1	0.03	4	1.52	19.1	
1800	275.2	1	0.04	6	1.56	18.3	
1800	275.6	1	0.03	6	1.55	18.3	
1800	276.2	1	0.03	6	1.56	18.2	
1800	276.6	0.95	0.03	6	1.55	18.2	
1800	277	0.95	0.03	6	1.57	18.2	
1800	277.4	0.95	0.03	6	1.56	18.2	
1800	277.4	0.95	0.03	6	1.56	18.2	
1800.000	**276.175**	**.975**	**.031**	**5.750**	**1.554**	**18.338**	Mean
0	**1.188**	**.027**	**.004**	**.707**	**.015**	**.311**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw1**	**pf1**	**PF1**
5.75E-06	0.0003125	.016	.183	28.982	407,100	473,813

Denominator pf1 (d/2)^2*3.1 Denominator F

Company Name: Wal-Mart *Location:* Bentonville, AK *Test Date:*

Test Portion: Treated *Stack Diam:* 5 Inches

Engine Type: Detroit 60 Series *Mile/Hrs:*

Equipment Type Over the Road Trucking *ID #:* 3-133 *Baro:*

Fuel Sp. Gravity: *Temp:*
SG Corr Factor: #VALUE! *Time:*

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Mean
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw2**	**pf2**	**PF2**
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Denominator pf1 (d/2)^2*3.1 Denominator F

%

*** A positive change in PF equates to a reduction in fuel consumption.*

Company Name: Wal-Mart *Location* Bentonville, AK *Date:* 12/13/94

Company Name: Wal-Mart ***Location*** Bentonville, AK ***Date:*** 12/13/94

Test Portion: Baseline ***Stack Diam.*** 5 Inches

Engine Type: Detroit 60 Series ***Mile/Hrs*** 262365

Equipment Type: Over the Road Trucking ***ID #:*** 3-134 ***Baro*** 30.23

Fuel Sp. Gravity(SG .841 ***Temp:***

Time: 1040

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	288.8	0.8	0.02	4	1.53	18.2	
1800	284.4	0.9	0.03	6	1.43	18.3	
1800	284.2	0.9	0.03	6	1.48	18.4	
1800	283.8	0.9	0.03	9	1.49	18.3	
1800	286.4	0.9	0.02	6	1.51	18.3	
1800	288.6	0.9	0.02	6	1.53	18.3	
1800	288.8	0.9	0.03	5	1.44	18.3	
1800	285.4	0.9	0.03	6	1.46	18.3	
1800	285.2	0.9	0.03	6	1.48	18.3	
1800	**286.178**	**.889**	**.027**	**6.000**	**1.483**	**18.300**	Mean
0	**2.060**	**.033**	**.005**	**1.323**	**.036**	**.050**	Std Dev

VFHC	VFCO	VFCO2	VFO2	Mtw1	pf1	PF1
6.00E-06	0.000266667	.015	.183	28.970	427,037	524,147

Company Name: Wal-Mart ***Location:*** Bentonville, AK ***Test Date:***

Test Portion: Treated ***Stack Diam:*** 5 Inches

Engine Type: Detroit 60 Series ***Mile/Hrs:***

Equipment Type Over the Road Trucking ***ID #:*** 3-134 ***Baro:***

Fuel Sp. Gravity: ***Temp:***

SG Corr Factor: #VALUE! ***Time:***

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Mean
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Std Dev

VFHC	VFCO	VFCO2	VFO2	Mtw2	pf2	PF2
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Performance factor adjusted for fuel density: #DIV/0!

****% Change PF= ##### %**

***** A positive change in PF equates to a reduction in fuel consumption.***

Company Name:	Wal-Mart	*Location:*	Bentonville, AK	*Date:*	12/13/94
Test Portion:	Baseline	*Stack Diam.*	5 Inches		
Engine Type:	Detroit 60 Series	*Mile/Hrs*	88851		
Equipment Type:	Over the Road Trucking	*ID #:*	3-010	*Baro*	30.22
Fuel Sp. Gravity(SG	.844	*Temp:*	38		
				Time:	910

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
1800	259	0.95	0.02	4	1.46	18.4	
1800	259.2	0.95	0.02	4	1.46	18.4	
1800	260.1	0.95	0.02	4	1.45	18.5	
1800	261	0.9	0.03	4	1.46	18.5	
~~1800~~	~~261~~	~~0.9~~	~~0.03~~	~~4~~	~~1.35~~	~~18.5~~	
1800	260.8	0.9	0.04	4	1.41	18.6	
1800	261.2	0.9	0.04	4	1.45	18.4	
1800	262	0.9	0.02	4	1.47	18.4	
1800.000	**~~260.538~~**	**~~.919~~**	**~~.028~~**	**4.000**	**~~1.439~~**	**~~18.463~~**	Mean
0	**1.029**	**.026**	**.009**	**.000**	**.040**	**.074**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw1**	**pf1**	**PF1**		
			~~.027~~					
4.00E-06	0.000275	.014	.185	~~28.969~~	~~440,118~~	~~522,056~~	~~492,483~~	517,107
260.47	.921	.027		28.970	415,920			
					1.451	18.463		

Company Name:	Wal-Mart	*Location:*	Bentonville, AK	*Test Date:*
Test Portion:	Treated	*Stack Diam:*	5 Inches	
Engine Type:	Detroit 60 Series	*Mile/Hrs:*		
Equipment Type	Over the Road Trucking	*ID #:*	3-010	*Baro:*
Fuel Sp. Gravity:		*Temp:*		
SG Corr Factor:	#VALUE!			*Time:*

RPM	Exh Temp	Pv Inch	CO	HC	CO2	O2	
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Mean
#DIV/0!	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	Std Dev

VFHC	**VFCO**	**VFCO2**	**VFO2**	**Mtw2**	**pf2**	**PF2**
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Performance factor adjusted for fuel density: #DIV/0!

****% Change PF= ##### %**

*** A positive change in PF equates to a reduction in fuel consumption.*

Carbon Mass Balance Field Data Form

Company: Wal-Mart Location: Bentonville Test Date: 12-13-94
Test Portion: Baseline: ✓ Treated: ______ Exhaust Stack Diameter: 5 Inches

Engine Make/Model: Detroit 60 Series Miles/Hours: 858351 I.D.#: 3-010
Type of Equipment: ______

Driver
sporting
on
Power

Fuel Specific Gravity: .844 @: ______ (°F)
Barometric Pressure: 30.22 Inches of Mercury
Intake Air Temperature: 38° (°F) Start Time: 9:10 AM

Set To
00 RPM
ast Idle
Thru
[illegible]

RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
1800	259.0	.95	.02	4	1.46	18.4	
	259.2	.95	.02	4	1.46	18.4	
	260.1	.95	.02	4	1.45	18.5	
	261.0	.90	.03	4	1.46	18.5	
	261.0	.90	.03	4	1.35	18.5	
	260.8	.90	.04	4	1.41	18.6	
	261.2	.90	.04	4	1.45	18.4	
	262.0	.90	.02	4	1.47	18.4	

Cruise on
Fast idle on

Just before
fan engaged

End Time 9:20 AM

Names of Customer Personnel Participating in Test:

______ ______

Signature of Technicians:

Carbon Mass Balance Field Data Form

Company: Wal Mart Location: Bentonville Test Date: 12 13 94
Test Portion: Baseline: ✓ Treated: Exhaust Stack Diameter: 5 Inches

Engine Make/Model: Series 60 Detroit Miles/Hours: 294690 I.D.#: 3-008
Type of Equipment:

Fuel Specific Gravity: .843 @: (°F)
Barometric Pressure: 30.19 Inches of Mercury
Intake Air Temperature: (°F) Start Time: 1 PM

Set with DDR

	RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
	1800	270.4	.8	.02	6	1.51	18.1	
		271.4	.8	.03	6	1.51	18.3	
		272.2	.85	.03	6	1.51	18.2	
		273.0	.8	.03	6	1.51	18.2	
		274.4	.8	.02	6	1.51	18.3	
		275.6	.8	.03	6	1.52	18.2	
		276.8	.8	.02	6	1.51	18.2	
		277.8	.8	.02	6	1.51	18.2	
AVE:	1800	273.95	.806	.025	6.0	1.511	18.21	

cruise on

Fast idle on

End Time 1:10 PM

Names of Customer Personnel Participating in Test:

Signature of Technicians:

Carbon Mass Balance Field Data Form

Company: Wal-Mart Location: Bentonville Test Date: 12-13-94

Test Portion: Baseline: ✓ Treated: ______ Exhaust Stack Diameter: 5 Inches

Engine Make/Model: Detroit 60 series Miles/Hours: 216,625 I.D.#: 3133

Type of Equipment: ______

Fuel Specific Gravity: .854 @: ______ (°F)

Barometric Pressure: 30.22 Inches of Mercury

Intake Air Temperature: ______ (°F) Start Time: 10:15

	RPM	Exhaust Temp °F	P Inches of H_2O	% CO	HC ppm	% CO_2	% O_2	Smoke Number
	1800	2740	1.0	.03	4	1.52	19.1	
		275.2	1.0	.04	6	1.56	18.3	
		275.6	1.0	.03	6	1.55	18.3	
		276.2	1.0	.03	6	1.56	18.2	
		276.6	.95	.03	6	1.55	18.2	
		277.0	.95	.03	6	1.57	18.2	
		277.4	.95	.03	6	1.56	18.2	
		277.4	.95	.03	6	1.56	18.2	
AVE.:	1800	276.17	.975	.031	5.75	1.554	18.34	

1800 RPM Set w/ DDR

Cruise on

fast idle on ✓

End Time 10:30

Names of Customer Personnel Participating in Test:

______ ______

Signature of Technicians: