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# Provo City Field Trial of of FPC-1 Fuel Performance Catalyst

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**Provo, Utah**

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**Abstract**

This paper discusses the results of a field test conducted by Provo City fleet management to determine the economic and environmental benefits from fuel treatment with a unique combustion catalyst called FPC-1. The study conducted on a large fleet of both diesel and gasoline powered vehicles documented the following:

(1) The addition of FPC-1 to the diesel fleet created a 7.8% reduction in fuel consumption.

(2) The addition of FPC-1 to the gasoline fleet created an 8.3% reduction in fuel consumption.

(3) FPC-1 treated fuel combusted more completely. Carbon monoxide emissions were reduced 14.2% on a fleet average basis. CO changes generally took place in the high emissions vehicles, and were more profound in the gasoline engines than the diesel engines.

(4) Smoke density was reduced 18.4% after FPC-1 fuel treatment.

These results verify substantial operational cost savings and environmental benefit can be derived from FPC-1 use throughout the entire Provo City fleet operation.

The paper also discusses a unique, recognized test method for determining the benefits of FPC-1 in the field. The method is known as the carbon mass balance, which is central to the EPA standardized Federal Test Procedures and Highway Fuel Economy Test. The method uses exhaust gas analysis under steady-state engine operation to determine both fuel consumption and exhaust emissions. A detailed discussion of the carbon mass balance is found in sections II., III., and IV of the report.

## I. Introduction

FPC-1 Fuel Performance Catalyst is a burn rate modifier or catalyst, proven to reduce fuel consumption and increase engine horsepower in several recognized, independent laboratory tests, and dozens of independent field trials. The catalyst also has a positive impact upon the products of incomplete combustion (smoke and carbon monoxide).

The intent of the current trial at Provo City is to determine the degree of fuel consumption, and emissions reduction resulting from the addition of the FPC-1 catalyst to the # 2 diesel and gasoline fueling a select fleet of compression and spark-ignition engine powered trucks and police cars. The test methodology for determining fuel consumption is the 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. Also, while conducting the cmb procedure, a Bacharach Smoke Spot method is used to determine smoke density in the exhaust of the diesel powered equipment.

This report summarizes the results of baseline and FPC-1 treated fuel consumption and emissions data, and computes and compares the mass flow rates (engine performance factors or PFs) for the same.

## II. Discussion of Carbon Mass Balance Method

The carbon mass balance eliminates virtually all of the variables associated with field testing for fuel consumption changes. The method requires no modifications to fuel lines or engines, and can be conducted in a short period of time at minimal expense.

Instead of measuring fuel flow into the engine (ie., the weight or volume of the fuel), measurements are made of the exhaust gases leaving the engine. More precisely, the carbon containing gases in the exhaust are measured. The method is based upon the Law of Conservation of Matter, which states that atoms can neither be created nor destroyed. Since the engines only source of carbon is the fuel it consumes, the carbon measured in the exhaust must come from the fuel. By measuring the carbon going out of the engine in the form of products of combustion, the amount of carbon entering the engine can be determined.

### Carbon Balance Calculation

The carbon leaving the engine is mainly as carbon dioxide (CO2), carbon monoxide (CO), unburned hydrocarbons (HC), and particulate (smoke). By collecting this data while the engine is operating at a given load and speed, the fuel flow rate into the engine can be accurately determined. When engine load and speed, along with other factors influencing fuel consumption are reproduced and/or monitored to make appropriate corrections, the carbon balance can be used to confidently determine changes in fuel consumption that might result from the use of a fuel catalyst, such as FPC-1.

With the carbon balance, engine efficiency is expressed in terms of engine performance factors. To calculate any change in engine performance, separate measurements are made with the engine running on base fuel (untreated) and FPC-1 treated fuel. Any changes are stated as percentage changes from the baseline.

A copy of the carbon balance equations is found on Figure 1 (Appendix 5). A sample calculation for illustration purposes is also attached (see Figure 2, Appendix 5). Additionally, the carbon balance can be used to determine the effect of FPC-1 upon harmful emissions, such as carbon monoxide and smoke.

## III. Instrumentation

Precision, state-of-the-art instrumentation is used to measure the concentrations of carbon containing gases in the exhaust stream and other factors related to fuel consumption and engine performance. The instruments and their purposes are listed below:

1) A Sun Electric SGA-9000 non-dispersive infrared (NDIR) four gas analyzer - measures the volume percent of CO2, CO, and oxygen (O2) in the exhaust, and the parts per million (ppm) of HC.

2) EPA I/M Calibration Gases - known gases used internally to calibrate the NDIR analyzer.

3) A twenty (20) foot sampling train and stainless steel exhaust gas probe - inserted into the engine exhaust pipe draws a sample of exhaust gases to the analyzer.

4) A Fluke Model 52 hand held digital thermometer and wet/dry thermocouple probe - measures exhaust, ambient, and fuel temperature.

5) A Dwyer Magnehelic 2000 Series Pressure Gauge and pitot tube - measures exhaust air velocity and/or pressure.

6) A Monarch Contact/Noncontact digital tachometer and magnetic tape - measures engine rpm when dash mounted tachometers are unavailable.

7) A hydrometer and flask - determines fuel specific gravity (density).

8) Barometric pressure is acquired from local airport or weather station.

9) A Bacharach Truespot Smokemeter - for smoke density determination.

Except for engine speed, fuel density, and ambient readings, all data are collected by simply inserting probes into the exhaust stream while the engine is running at a fixed rpm and load, and

the vehicle is stationary. No modifications or device installations are made to the fuel system, nor are normal equipment work cycles disrupted.

## IV. Technical Approach

The following technical approach was observed during both test segments:

1) All instruments are calibrated according to accepted protocol.

2) A sample of fuel is drawn from the fuel tank on each piece of equipment. Using a hydrometer and wet/dry temperature probe, fuel specific gravity and temperature are recorded.

3) Each piece of equipment to be tested is parked, brakes locked, and run out-of-gear at a specific engine speed (RPM) until engine water, oil, and exhaust temperature, and exhaust pressure have stabilized. Engine speed is controlled using either a hand held phototach or the tachometer in the cab, and a Snap-On throttle lock.

4) Engine hours (or mileage) are taken from hour meters or odometers installed on the equipment.

5) After engine stabilization, the exhaust gas sampling probe is inserted into the exhaust stream. The Autocal button is depressed and after the LED readouts clear, test personnel take multiple readings of carbon dioxide, carbon monoxide, unburned hydrocarbons, and oxygen, along with engine speed, exhaust temperature and pressure. Smoke readings are taken on the diesel engines after exhaust gas testing.

6) Periodically, ambient air temperature, atmospheric pressure, and relative humidity are recorded. Temperature readings are taken at the test site. Other ambient readings are acquired from local weather information services.

7) All data are recorded until technicians are confident the information is consistent and reproducible.

8) After completing the baseline, the test fleet fuel was *treated with FPC-1. All equipment operated as normal for approximately 400 to 500 hours, at which time the above procedure was reproduced without alteration, except FPC-1 fuel treatment in the test fleet.

*The first treatment of FPC-1 will be done by UHI/Provo City personnel after the baseline test. Treatment of additional fuel delivered to the site during the test will be carried out by Provo City.

## V. Discussion

The data collected during the 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) based upon the carbon mass in the exhaust is computed. The pf is finally corrected for intake air temperature and pressure (barometric), and total exhaust mass yielding a corrected engine performance factor (PF). The PFs for the diesel engines are tabulated on Table 1 of Appendix 3, while the PFs for the gasoline powered vehicles are found on Table 2. The carbon monoxide percentages on tabulated on Table 3 of Appendix 3. The smoke spot (smoke density) numbers for the diesel engines are found on Table 4 of Appendix 3.

Statistical Anomalies and Fleet Exclusions

Two diesel units that were baseline tested are not included in this report. Unit #732 was installed with a new engine since the baseline. Unit #733 was under repair, and not available for testing.

The diesel fleet contained only one anomaly. Unit #812 showed an 8.72% increase in fuel consumption. Also, this same unit was the only engine to have an increase in engine smoke. All of the remaining seven units experienced fuel consumption reductions, and either no change or decreases in engine smoking. Unit #812 was the only engine that would not hold constant rpm during the FPC-1 treated fuel test segment. It was necessary to constantly throttle back up after a rpm fall off, making it difficult to collect reliable data. This behavior likely led to the increase in fuel consumption and smoke emissions. Further, Unit #812 is a statistical anomaly. For both reasons, UHI engineers have removed #812 from consideration.

The gasoline fleet contained three anomalies. The Ford Explorer (#379) saw consistent baseline CO2 emissions data, but the CO2 data were erratic during the treated fuel test. These erratic data make it difficult to detect actual changes in a fuel flow rate, and are likely responsible, at least in part, for the abnormally large reduction in fuel consumption observed in this vehicle.

Unit #319 saw a dramatic reduction in exhaust gas velocity (approximately 67%). No other vehicle experienced such a large change. Typically, exhaust gas velocity is only slightly affected by the changes in combustion created by FPC-1 or by changes in the environment. The radical reduction in fuel consumption observed in this engine must be caused by other factors. The result is also a statistical anomaly and therefore, has been removed from consideration.

Unit #331 also experienced a large reduction in fuel consumption, greater than observed in previous laboratory and field tests. There appears to be no explanation for this. The data are fairly consistent. Rpm was reproduced, as were other engine conditions. Although, no explanation can be given here why #331 saw such a large reduction in fuel consumption, UHI recommends this unit be removed from the test sample and not be included in any conclusions about fuel consumption.

A few individual data points have been removed from the calculation of individual PFs based upon statistical reliability and aberrations in the procedure, such as the loose hose clamp

discovered on Unit #342. These exclusions are noted on the raw data sheets found in the Appendix 2.

With the anomalies removed, the diesel fleet averaged a 7.8% reduction in fuel consumption after FPC-1 fuel treatment. Similarly, the gasoline fleet saw an 8.3% reduction in fuel consumption with FPC-1 treated fuel. The results for each unit tested are tabled on Tables 1 and 2 of Appendix 3.

Note: Fuel samples could not be extracted from the fuel tanks of the gasoline fleet, therefore, the fuel consumption change is not corrected for fuel density.

The Effect of Environmental Conditions

The diesel fleet baseline and treated fuel test segments were run under identical environmental conditions, as were the baseline and treated fuel tests on the first four gasoline powered vehicles tested on August 29th. Therefore, engine performance and exhaust emissions were not influenced by the intake air temperature and pressure (barometric).

Ambient conditions changed slightly for the treated test done on the police cars on September 1st. Although barometric pressure was virtually identical, the day was cloudy and cooler. This led to a reduction in exhaust temperature not caused by changes in combustion, since exhaust gas velocity was unaffected. The cooler, cloudy day prevented to heating up of the rubber hose used to conduct the exhaust gases to the test instrument probes. Therefore, there was more heat transfer from the exhaust gases into the hose material, and the surrounding environment, creating lower exhaust gas temperatures.

Because of this environment related temperature change, and because of the nearly identical baseline and treated temperatures observed while testing the four police cars on August 29th, it was felt by UHI that the baseline exhaust temperatures would be closer to the treated temperatures had all things been equaled. For this reason, UHI determined to use the baseline exhaust gas temperatures in the treated fuel test calculations.

The calculations for each individual unit in the test fleet are found in Appendix 1.

The Effect of FPC-1 on Carbon Monoxide and Smoke Emissions

The addition of FPC-1 to both diesel and gasoline fuel had a positive impact upon carbon monoxide (CO) and smoke emissions. Overall, the CO was reduced in the test units having the highest baseline CO levels, especially for the gasoline fleet. This is consistent with other tests conducted by UHI. Engines performing at a level of high efficiency leave little room for improvement from a CO emissions standpoint. The letter found in Appendix 6 is from Dr. Geoffrey J. Germane, Ph.D. Mechanical Engineering, BYU, to Mr. Vernon Markworth, Principal Engineer for Southwest Research Institute, dated August 1992, explains this phenomenon in more

detail. The fact that FPC-1 has a more profound effect upon engines that produce higher emissions levels means the product will aid in keeping vehicles that are trending above the emission standards in line with the designed performance level of the engine.

The CO reduction averaged 14.2% for the entire fleet, with the gasoline fleet averaging a 30%, and the diesel fleet a 6.7% reduction.

Smoke density emissions were reduced in virtually all diesel engines treated with FPC-1. Smoke reductions were slightly greater than those of CO, averaging 18.4%.

Environmental conditions in terms of intake air pressure and temperature were virtually identical for all tests, and well within those of laboratory standards. These conditions would have little or no effect upon the combustion process, and therefore, the levels of emissions.

The weather data for the treated fuel tests are included in Appendix 4. The weather data for the baseline tests was acquired from the Weather Services at the Provo Airport, and are included on the Excel Pro database sheets in Appendix 1.

## VI. Conclusions

(1) The addition of FPC-1 to the diesel fleet created a 7.8% reduction in fuel consumption.

(2) The addition of FPC-1 to the gasoline fleet created an 8.3% reduction in fuel consumption.

(3) FPC-1 treated fuel combusted more completely. Carbon monoxide emissions were reduced 14.2% on a fleet average basis. CO changes generally took place in the high emissions vehicles, and were more profound in the gasoline engines than the diesel engines.

(4) Smoke density was reduced 18.4% after FPC-1 fuel treatment.

# APPENDIX 1

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Date:* | 6/12/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 4 Inches | | |
| *Engine Type:* | L-10 Cummins | *Mile/Hrs* | 2503 | | |
| *Equipment Type:* | Garbage Truck | *ID #:* | 814 | *Baro* | 30.07 |
| *Fuel Sp. Gravity(SG* | .824 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2200 | 435 | 1.4 | 0.01 | 10 | 2.97 | 15.9 | |
| 2200 | 438 | 1.4 | 0.01 | 10 | 3.03 | 15.7 | |
| 2200 | 442.4 | 1.4 | 0.01 | 10 | 3.05 | 15.9 | |
| 2200 | 443 | 1.4 | 0.01 | 10 | 3.04 | 15.8 | |
| 2200 | 443.6 | 1.4 | 0.01 | 10 | 3.05 | 15.9 | |
| 2200 | 444.6 | 1.4 | 0.01 | 10 | 3.05 | 15.8 | |
| 2200 | 447.2 | 1.4 | 0.01 | 10 | 3.06 | 15.8 | |
| 2200 | 446.2 | 1.4 | 0.01 | 10 | 3.07 | 15.8 | |
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| **2200.000** | **442.500** | **1.400** | **.010** | **10.000** | **3.040** | **15.825** | Mean |
| **0** | **4.109** | **.000** | **.000** | **.000** | **.031** | **.071** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 1.00E-05 | 0.0001 | .030 | .158 | 29.120 | 212,610 | 356,369 |

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|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 8/28/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 4 Inches | | |
| *Engine Type:* | L-10 Cummins | *Mile/Hrs:* | 2864 | | |
| *Equipment Type* | Garbage Truck | *ID #:* | 814 | *Baro:* | 30.05 |
| *Fuel Sp. Gravity:* | .824 | *Temp:* | | | |
| *SG Corr Factor:* | 1.000 | | | *Time:* | 4:15 |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2200 | 423 | 1.4 | 0.01 | 8 | 2.79 | 15.3 | |
| 2200 | 428.2 | 1.4 | 0.01 | 9 | 2.78 | 15.2 | |
| 2200 | 427 | 1.3 | 0.02 | 9 | 2.82 | 15.4 | |
| 2200 | 431.6 | 1.35 | 0.01 | 6 | 2.81 | 15.4 | |
| 2200 | 434 | 1.35 | 0.01 | 8 | 2.81 | 15.5 | |
| 2200 | 434.6 | 1.35 | 0.01 | 8 | 2.81 | 15.4 | |
| 2200 | 434.6 | 1.35 | 0.02 | 9 | 2.85 | 15.4 | |
| 2200 | 435.8 | 1.35 | 0.02 | 9 | 2.8 | 15.4 | |
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| **2200.000** | **431.100** | **1.356** | **.014** | **8.250** | **2.809** | **15.375** | Mean |
| **0** | **4.568** | **.032** | **.005** | **1.035** | **.021** | **.089** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 8.25E-06 | 0.0001375 | .028 | .154 | 29.065 | 229,364 | 388,000 |

Performance factor adjusted for fuel density: 388,000

****% Change PF= 8.88 %**

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

| | | | | | | |
|---|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | | *Date:* | 6/12/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 4 | Inches | | |
| *Engine Type:* | L-10 Cummins | *Mile/Hrs* | 2599 | | | |
| *Equipment Type:* | Garbage Truck | *ID #:* | 812 | | *Baro* | 30.03 |
| *Fuel Sp. Gravity(SG* | .821 | *Temp:* | | | | |
| | | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2200 | 397 | 1 | 0.02 | 23 | 2.16 | 17.1 | |
| 2200 | 397.2 | 1 | 0.02 | 23 | 2.17 | 17.1 | |
| 2200 | 397.4 | 1 | 0.02 | 23 | 2.2 | 17.1 | |
| 2200 | 400.6 | 1 | 0.02 | 23 | 2.15 | 17.2 | |
| 2200 | 400.2 | 1 | 0.02 | 21 | 2.15 | 17.2 | |
| 2200 | 401.2 | 1 | 0.02 | 23 | 2.15 | 17.2 | |
| 2200 | 401.2 | 1 | 0.02 | 22 | 2.15 | 17.1 | |
| 2200 | 401.4 | 1 | 0.02 | 23 | 2.17 | 17.1 | |
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| | | | | | | | |
| **2200.000** | **399.525** | **1.000** | **.020** | **22.625** | **2.163** | **17.138** | Mean |
| **0** | **1.965** | **.000** | **.000** | **.744** | **.018** | **.052** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 2.26E-05 | 0.0002 | .022 | .171 | 29.033 | 294,892 | 570,376 |

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|---|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | | *Test Date:* | 8/28/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 4 | Inches | | |
| *Engine Type:* | L-10 Cummins | *Mile/Hrs:* | 2990 | | | |
| *Equipment Type* | Garbage Truck | *ID #:* | 812 | | *Baro:* | 30.08 |
| *Fuel Sp. Gravity:* | .822 | *Temp:* | | | | |
| *SG Corr Factor:* | .999 | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2200 | 401.4 | 1.2 | 0.02 | 17 | 2.26 | 16.2 | |
| 2200 | 404.2 | 1.2 | 0.02 | 17 | 2.22 | 16.2 | |
| 2200 | 412.2 | 1.1 | 0.02 | 15 | 2.25 | 16.2 | |
| 2200 | 408.2 | 1.2 | 0.02 | 15 | 2.25 | 16.2 | |
| 2200 | 409.4 | 1.2 | 0.02 | 14 | 2.28 | 16.4 | |
| 2200 | 411.8 | 1.1 | 0.02 | 14 | 2.33 | 16.2 | |
| 2200 | 406.8 | 1.1 | 0.02 | 14 | 2.14 | 16.2 | |
| 2200 | 413.4 | 1.2 | 0.02 | 14 | 2.3 | 16.1 | |
| 2000 | 397.8 | 0.9 | 0.02 | 12 | 2.12 | 16.4 | |
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| **2177.778** | **407.244** | **1.133** | **.020** | **14.667** | **2.239** | **16.233** | Mean |
| **66.66666667** | **5.263** | **.100** | **.000** | **1.581** | **.070** | **.100** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 1.47E-05 | 0.0002 | .022 | .162 | 29.008 | 285,384 | 521,256 |

Performance factor adjusted for fuel density: 520,621

****% Change PF = -8.72 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | *Date:* | 6/12/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 4 Inches | | |
| *Engine Type:* | L-10 Cummins | *Mile/Hrs* | 3632 | | |
| *Equipment Type:* | Garbage Truck | *ID #:* | 810 | *Baro* | 30.09 |
| *Fuel Sp. Gravity(SG* | .816 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2200 | 390 | 1 | 0.02 | 22 | 2.2 | 17.1 | |
| 2200 | 395 | 1 | 0.02 | 24 | 2.19 | 17 | |
| 2200 | 400 | 1 | 0.02 | 22 | 2.19 | 17 | |
| 2200 | 401 | 1 | 0.02 | 23 | 2.22 | 17.1 | |
| 2200 | 405 | 1 | 0.02 | 24 | 2.22 | 17 | |
| 2200 | 406 | 1 | 0.02 | 22 | 2.22 | 17 | |
| 2200 | 401 | 1 | 0.02 | 23 | 2.25 | 17.1 | |
| 2200 | 400 | 1 | 0.02 | 22 | 2.23 | 17 | |
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| **2200** | **399.750** | **1.000** | **.020** | **22.750** | **2.215** | **17.038** | Mean |
| **0** | **5.175** | **.000** | **.000** | **.886** | **.021** | **.052** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 2.28E-05 | 0.0002 | .022 | .170 | 29.037 | 288,043 | 557,758 |

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 8/28/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 4 Inches | | |
| *Engine Type:* | L-10 Cummins | *Mile/Hrs:* | | | |
| *Equipment Type* | Garbage Truck | *ID #:* | 810 | *Baro:* | 30.05 |
| *Fuel Sp. Gravity:* | .825 | *Temp:* | | | |
| *SG Corr Factor:* | .989 | | | *Time:* | 3:35 |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2200 | 388 | 0.9 | 0.02 | 24 | 2.15 | 16.3 | |
| 2200 | 390.2 | 0.95 | 0.02 | 24 | 2.15 | 16.3 | |
| 2200 | 392.4 | 0.9 | 0.03 | 24 | 2.13 | 16.6 | |
| 2200 | 400.4 | 0.9 | 0.02 | 25 | 2.09 | 16.5 | |
| 2200 | 391.4 | 0.95 | 0.02 | 24 | 2.1 | 16.6 | |
| 2200 | 398.6 | 0.95 | 0.02 | 24 | 2.05 | 16.6 | |
| 2200 | 400 | 0.95 | 0.02 | 24 | 2.04 | 16.6 | |
| 2200 | 390.8 | 0.95 | 0.02 | 26 | 2.04 | 16.6 | |
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| **2200.000** | **393.975** | **.931** | **.021** | **24.375** | **2.094** | **16.513** | Mean |
| **0** | **4.901** | **.026** | **.004** | **.744** | **.047** | **.136** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 2.44E-05 | 0.0002125 | .021 | .165 | 28.997 | 303,703 | 606,949 |

Performance factor adjusted for fuel density: 600,255

****% Change PF= 7.62 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Date:* | 6/12/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 4 Inches | | |
| *Engine Type:* | CAT 3208T | *Mile/Hrs* | 144204 | | |
| *Equipment Type:* | Dump Truck | *ID #:* | 731 | *Baro* | 30.07 |
| *Fuel Sp. Gravity(SG* | .833 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 1850 | 273.4 | 0.8 | 0.04 | 21 | 1.54 | 18 | |
| 1850 | 274 | 0.8 | 0.04 | 23 | 1.52 | 18 | |
| 1850 | 279.4 | 0.8 | 0.04 | 21 | 1.52 | 18.1 | |
| 1850 | 280 | 0.8 | 0.04 | 21 | 1.53 | 18.1 | |
| 1850 | 282.2 | 0.8 | 0.04 | 22 | 1.52 | 18.2 | |
| 1850 | 282.6 | 0.8 | 0.04 | 22 | 1.52 | 18.1 | |
| 1850 | 283 | 0.8 | 0.04 | 23 | 1.54 | 18.2 | |
| 1850 | 283 | 0.8 | 0.04 | 23 | 1.53 | 18.1 | |
| | | | | | | | |
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| | | | | | | | |
| **1850.000** | **279.700** | **.800** | **.040** | **22.000** | **1.528** | **18.100** | Mean |
| **0** | **3.942** | **.000** | **.000** | **.926** | **.009** | **.076** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 2.20E-05 | 0.0004 | .015 | .181 | 28.970 | 408,744 | 820,525 |

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 8/28/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 4 Inches | | |
| *Engine Type:* | CAT 3208T | *Mile/Hrs:* | 145493 | | |
| *Equipment Type* | Dump Truck | *ID #:* | 731 | *Baro:* | 30.05 |
| *Fuel Sp. Gravity:* | .824 | *Temp:* | 87 | | |
| *SG Corr Factor:* | 1.011 | | | *Time:* | 4 |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 1850 | 281.9 | 0.8 | 0.04 | 17 | 1.51 | 17.5 | |
| 1850 | 286.8 | 0.7 | 0.04 | 17 | 1.51 | 17.5 | |
| 1850 | 292.2 | 0.75 | 0.04 | 17 | 1.51 | 17.8 | |
| 1850 | 295.8 | 0.75 | 0.03 | 18 | 1.54 | 17.7 | |
| 1850 | 290.4 | 0.75 | 0.04 | 15 | 1.55 | 17.7 | |
| 1850 | 299.8 | 0.75 | 0.03 | 17 | 1.54 | 17.7 | |
| 1850 | 301 | 0.75 | 0.04 | 21 | 1.54 | 17.7 | |
| 1850 | 301.8 | 0.75 | 0.03 | 17 | 1.53 | 17.6 | |
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| **1850.000** | **293.713** | **.750** | **.036** | **17.375** | **1.529** | **17.650** | Mean |
| **0** | **7.176** | **.027** | **.005** | **1.685** | **.016** | **.107** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 1.74E-05 | 0.0003625 | .015 | .177 | 28.952 | 409,905 | 857,568 |

Performance factor adjusted for fuel density: 866,834

****% Change PF= 5.64 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | *Date:* | 6/12/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 4 Inches | | |
| *Engine Type:* | CAT 3208T | *Mile/Hrs* | 42717 | | |
| *Equipment Type:* | Dump Truck | *ID #:* | 730 | *Baro* | 30.05 |
| *Fuel Sp. Gravity(SG* | .827 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2200 | 335 | 1.4 | 0.04 | 38 | 1.75 | 17.8 | |
| 2200 | 336 | 1.5 | 0.04 | 38 | 1.75 | 17.8 | |
| 2200 | 336.8 | 1.5 | 0.04 | 38 | 1.75 | 17.8 | |
| 2200 | 338 | 1.5 | 0.04 | 34 | 1.75 | 17.8 | |
| 2200 | 338.2 | 1.5 | 0.04 | 35 | 1.75 | 17.7 | |
| 2200 | 339.2 | 1.5 | 0.04 | 35 | 1.75 | 17.7 | |
| 2200 | 339.4 | 1.5 | 0.04 | 35 | 1.75 | 17.8 | |
| 2200 | 339.8 | 1.5 | 0.04 | 35 | 1.75 | 17.7 | |
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| **2200.000** | **337.800** | **1.488** | **.040** | **36.000** | **1.750** | **17.763** | Mean |
| **0** | **1.724** | **.035** | **.000** | **1.690** | **.000** | **.052** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 3.60E-05 | 0.0004 | .018 | .178 | 28.993 | 356,842 | 545,391 |

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 8/28/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 4 Inches | | |
| *Engine Type:* | CAT 3208T | *Mile/Hrs:* | 44648 | | |
| *Equipment Type* | Dump Truck | *ID #:* | 730 | *Baro:* | 30.05 |
| *Fuel Sp. Gravity:* | .825 | *Temp:* | | | |
| *SG Corr Factor:* | 1.002 | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2200 | 340.2 | 1.35 | 0.04 | 18 | 1.73 | 17.3 | |
| 2200 | 341.6 | 1.35 | 0.04 | 17 | 1.72 | 17.3 | |
| 2200 | 343 | 1.35 | 0.04 | 18 | 1.74 | 17.3 | |
| 2200 | 344.8 | 1.35 | 0.04 | 18 | 1.74 | 17.3 | |
| 2200 | 347.2 | 1.35 | 0.04 | 18 | 1.75 | 17.2 | |
| 2200 | 348.8 | 1.35 | 0.04 | 18 | 1.75 | 17.1 | |
| 2200 | 348.2 | 1.35 | 0.04 | 19 | 1.71 | 17.3 | |
| 2200 | 348.4 | 1.35 | 0.04 | 18 | 1.71 | 17.2 | |
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| **2200.000** | **345.275** | **1.350** | **.040** | **18.000** | **1.731** | **17.250** | Mean |
| **0** | **3.362** | **.000** | **.000** | **.535** | **.016** | **.076** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 1.80E-05 | 0.0004 | .017 | .173 | 28.968 | 362,597 | 584,443 |

Performance factor adjusted for fuel density: 585,857

****% Change PF= 7.42 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Date:* | 6/12/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 4 Inches | | |
| *Engine Type:* | CAT 3208 | *Mile/Hrs* | 45895 | | |
| *Equipment Type:* | Dump Truck | *ID #:* | 153 | *Baro* | 30.07 |
| *Fuel Sp. Gravity(SG* | .832 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2000 | 276 | 0.8 | 0.06 | 21 | 1.4 | 18.3 | |
| 2000 | 276 | 0.8 | 0.06 | 21 | 1.42 | 18.3 | |
| 2000 | 277.8 | 0.8 | 0.06 | 20 | 1.42 | 18.3 | |
| 2000 | 278.2 | 0.8 | 0.06 | 19 | 1.4 | 18.3 | |
| 2000 | 279.4 | 0.8 | 0.06 | 21 | 1.41 | 18.3 | |
| 2000 | 279.6 | 0.8 | 0.06 | 21 | 1.41 | 18.3 | |
| 2000 | 280.4 | 0.8 | 0.06 | 22 | 1.4 | 18.3 | |
| 2000 | 281 | 0.8 | 0.06 | 22 | 1.4 | 18.3 | |
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| **2000.000** | **278.550** | **.800** | **.060** | **20.875** | **1.408** | **18.300** | Mean |
| **0** | **1.888** | **.000** | **.000** | **.991** | **.009** | **.000** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 2.09E-05 | 0.0006 | .014 | .183 | 28.958 | 436,375 | 875,311 |

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 8/28/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 4 Inches | | |
| *Engine Type:* | CAT 3208 | *Mile/Hrs:* | 46403 | | |
| *Equipment Type* | Dump Truck | *ID #:* | 153 | *Baro:* | 30.05 |
| *Fuel Sp. Gravity:* | .834 | *Temp:* | | | |
| *SG Corr Factor:* | .998 | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2000 | 281 | 0.75 | 0.06 | 20 | 1.38 | 17.8 | |
| 2000 | 283.6 | 0.75 | 0.06 | 19 | 1.38 | 17.9 | |
| 2000 | 285.6 | 0.7 | 0.06 | 17 | 1.39 | 17.7 | |
| 2000 | 285.8 | 0.7 | 0.06 | 17 | 1.38 | 17.8 | |
| 2000 | 290.4 | 0.7 | 0.06 | 19 | 1.4 | 17.5 | |
| 2000 | 291.6 | 0.7 | 0.06 | 17 | 1.4 | 17.8 | |
| 2000 | 292.2 | 0.7 | 0.06 | 17 | 1.4 | 17.6 | |
| 2000 | 293.8 | 0.7 | 0.06 | 18 | 1.4 | 17.8 | |
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| **2000.000** | **288.000** | **.713** | **.060** | **18.000** | **1.391** | **17.738** | Mean |
| **0** | **4.613** | **.023** | **.000** | **1.195** | **.010** | **.130** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 1.80E-05 | 0.0006 | .014 | .177 | 28.933 | 441,386 | 943,823 |

Performance factor adjusted for fuel density: 941,554

****% Change PF= 7.57 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | *Date:* | 6/12/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 4 Inches | | |
| *Engine Type:* | CAT 3208 | *Mile/Hrs* | 65758 | | |
| *Equipment Type:* | Boom Truck | *ID #:* | 33 | *Baro* | 30.03 |
| *Fuel Sp. Gravity(SG* | .830 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2000 | 374.6 | 2 | 0.05 | 27 | 2.02 | 17.3 | |
| 2000 | 380 | 2 | 0.05 | 30 | 2.01 | 17.3 | |
| 2000 | 380.2 | 2 | 0.05 | 30 | 2.01 | 17.3 | |
| 2000 | 381.6 | 2 | 0.05 | 31 | 2.01 | 17.2 | |
| 2000 | 381.4 | 2 | 0.05 | 31 | 2.02 | 17.2 | |
| 2000 | 382.6 | 2 | 0.05 | 31 | 2.01 | 17.2 | |
| 2000 | 383.2 | 2 | 0.05 | 31 | 2.01 | 17.1 | |
| 2000 | 384.2 | 2 | 0.05 | 31 | 2.02 | 17.1 | |
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| **2000.000** | **380.975** | **2.000** | **.050** | **30.250** | **2.014** | **17.213** | Mean |
| **0** | **2.946** | **.000** | **.000** | **1.389** | **.005** | **.083** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 3.03E-05 | 0.0005 | .020 | .172 | 29.012 | 310,793 | 420,452 |

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 8/28/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 4 Inches | | |
| *Engine Type:* | CAT 3208 | *Mile/Hrs:* | 66783 | | |
| *Equipment Type* | Boom Truck | *ID #:* | 33 | *Baro:* | 30.05 |
| *Fuel Sp. Gravity:* | .826 | *Temp:* | 87 | | |
| *SG Corr Factor:* | 1.005 | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2000 | 427 | 1.9 | 0.04 | 14 | 1.95 | 16.9 | |
| 2000 | 420.4 | 1.9 | 0.04 | 14 | 2.11 | 16.6 | |
| 2000 | 420.4 | 1.9 | 0.04 | 17 | 1.98 | 16.9 | |
| 2000 | 419.2 | 1.9 | 0.04 | 17 | 1.97 | 16.8 | |
| 2000 | 421.9 | 1.9 | 0.04 | 17 | 2 | 16.8 | |
| 2000 | 423.8 | 1.9 | 0.04 | 17 | 2.12 | 16.5 | |
| 2000 | 417.2 | 1.89 | 0.04 | 17 | 1.97 | 16.9 | |
| 2000 | 410.6 | 1.89 | 0.04 | 17 | 1.97 | 16.7 | |
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| **2000.000** | **420.063** | **1.898** | **.040** | **16.250** | **2.009** | **16.763** | Mean |
| **0** | **4.843** | **.005** | **.000** | **1.389** | **.067** | **.151** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 1.63E-05 | 0.0004 | .020 | .168 | 28.993 | 314,198 | 446,563 |

Performance factor adjusted for fuel density: 448,715

****% Change PF = 6.72 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | *Date:* | 6/12/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 4 Inches | | |
| *Engine Type:* | Int'l 466 DT | *Mile/Hrs* | 5681 | | |
| *Equipment Type:* | Boom Truck | *ID #:* | 18 | *Baro* | 30.03 |
| *Fuel Sp. Gravity(SG* | .826 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2000 | 428.2 | 0.6 | 0.05 | 24 | 3.31 | 15.3 | |
| 2000 | 428.2 | 0.8 | 0.05 | 24 | 3.31 | 15.3 | |
| 2000 | 432.2 | 0.8 | 0.05 | 24 | 3.3 | 15.3 | |
| 2000 | 433.4 | 0.8 | 0.05 | 24 | 3.31 | 15.3 | |
| 2000 | 433.4 | 0.8 | 0.05 | 24 | 3.31 | 15.3 | |
| 2000 | 435.4 | 0.8 | 0.05 | 24 | 3.3 | 15.3 | |
| 2000 | 435 | 0.8 | 0.05 | 24 | 3.3 | 15.3 | |
| 2000 | 436.2 | 0.8 | 0.05 | 25 | 3.3 | 15.3 | |
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| **2000.000** | **432.750** | **.775** | **.050** | **24.125** | **3.305** | **15.300** | Mean |
| **0** | **3.083** | **.071** | **.000** | **.354** | **.005** | **.000** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 2.41E-05 | 0.0005 | .033 | .153 | 29.142 | 192,946 | 432,036 |

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 8/28/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 4 Inches | | |
| *Engine Type:* | Int'l 466 DT | *Mile/Hrs:* | 5843 | | |
| *Equipment Type* | Boom Truck | *ID #:* | 18 | *Baro:* | 30.03 |
| *Fuel Sp. Gravity:* | .825 | *Temp:* | | | |
| *SG Corr Factor:* | 1.001 | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2000 | 422 | 0.75 | 0.04 | 17 | 3.06 | 14.8 | |
| 2000 | 425.6 | 0.75 | 0.04 | 17 | 3.07 | 14.8 | |
| 2000 | 429.6 | 0.7 | 0.04 | 17 | 3.1 | 15 | |
| 2000 | 431.6 | 0.7 | 0.04 | 17 | 3.1 | 14.9 | |
| 2000 | 433.8 | 0.7 | 0.04 | 17 | 3.1 | 15 | |
| 2000 | 434.4 | 0.75 | 0.04 | 16 | 3.07 | 15 | |
| 2000 | 436.4 | 0.75 | 0.04 | 17 | 3.07 | 15 | |
| 2000 | 437.2 | 0.75 | 0.04 | 14 | 3.09 | 14.9 | |
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| **2000.000** | **431.325** | **.731** | **.040** | **16.500** | **3.083** | **14.925** | Mean |
| **0** | **5.327** | **.026** | **.000** | **1.069** | **.017** | **.089** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 1.65E-05 | 0.0004 | .031 | .149 | 29.091 | 207,202 | 477,252 |

Performance factor adjusted for fuel density: 477,830

****% Change PF= 10.60 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | *Date:* | 6/13/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 2.5 Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs* | 69620 | | |
| *Equipment Type:* | Police Car | *ID #:* | 320 | *Baro* | 29.92 |
| *Fuel Sp. Gravity(SG* | 1.000 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 3900 | 158.2 | 0.02 | 0.03 | 19 | | 7.2 | |
| | 163.2 | 0.02 | 0.02 | 19 | | 7.2 | |
| | 169.2 | 0.02 | 0.02 | 19 | 8.01 | 7.2 | |
| 3850 | 171.2 | 0.02 | 0.03 | 19 | 8 | 7.2 | |
| | 174.4 | 0.02 | 0.02 | 18 | 8 | 7.2 | |
| | 176.8 | 0.02 | 0.03 | 19 | 7.99 | 7.2 | |
| 3925 | 179.2 | 0.02 | 0.02 | 19 | 8 | 7.2 | |
| | 180.2 | 0.02 | 0.02 | 19 | 7.95 | 7.2 | |
| | 182 | 0.02 | 0.02 | 15 | 7.94 | 7.2 | |
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| **3891.667** | **172.711** | **.020** | **.023** | **18.444** | **7.984** | **7.200** | Mean |
| **38.18813079** | **8.060** | **.000** | **.005** | **1.333** | **.028** | **.000** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 1.84E-05 | 0.000233333 | .080 | .072 | 29.567 | 82,274 | 2,466,946 |

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| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 8/29/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 2.5 Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs:* | 70785 | | |
| *Equipment Type* | Police Car | *ID #:* | 320 | *Baro:* | 30.07 |
| *Fuel Sp. Gravity:* | 1.000 | *Temp:* | | | |
| *SG Corr Factor:* | 1.000 | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 3860 | 125.8 | 0.02 | 0.01 | 23 | 6.96 | 9 | |
| | 126.2 | 0.02 | 0.01 | 19 | 6.91 | 9 | |
| 3930 | 126.6 | 0.02 | 0.01 | 25 | 6.96 | 8.7 | |
| | 127.1 | 0.02 | 0.01 | 21 | 7.08 | 8.6 | |
| 3965 | 128.6 | 0.02 | 0.01 | 22 | 7.14 | 8.6 | |
| 3980 | 129 | 0.02 | 0.01 | 22 | 7.12 | 8.5 | |
| | 129 | 0.02 | 0.01 | 18 | 7.05 | 8.6 | |
| 3980 | 130.2 | 0.02 | 0.01 | 19 | 7.14 | 8.4 | |
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| **3943.000** | **127.813** | **.020** | **.010** | **21.125** | **7.045** | **8.675** | Mean |
| **50.69516742** | **1.593** | **.000** | **.000** | **2.357** | **.091** | **.219** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 2.11E-05 | 0.0001 | .070 | .087 | 29.475 | 93,054 | 2,696,101 |

Performance factor adjusted for fuel density: 2,696,101

****% Change PF= 9.29 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | *Date:* | 6/13/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 2.5 Inches | | |
| *Engine Type:* | Ford Explorer | *Mile/Hrs* | 43973 | | |
| *Equipment Type:* | Police Car | *ID #:* | 379 | *Baro* | 29.92 |
| *Fuel Sp. Gravity(SG* | 1.000 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2500 | 381.8 | 0.06 | 0.03 | 9 | 13.64 | 1.6 | |
| 2500 | 388.4 | 0.06 | 0.03 | 9 | 13.62 | 1.7 | |
| 2500 | 400.2 | 0.06 | 0.03 | 8 | 13.55 | 2 | |
| 2500 | 406.2 | 0.06 | 0.03 | 8 | 13.51 | 2 | |
| 2500 | 407.8 | 0.06 | 0.03 | 8 | 13.46 | 2.1 | |
| 2500 | 409.6 | 0.08 | 0.02 | 7 | 13.4 | 2.1 | |
| 2500 | 412.6 | 0.08 | 0.03 | 7 | 13.37 | 2.1 | |
| 2500 | 415.8 | 0.08 | 0.03 | 6 | 13.37 | 2.1 | |
| 2500 | 419.2 | 0.08 | 0.03 | 6 | 13.39 | 2.1 | |
| 2500 | 419.4 | 0.08 | 0.03 | 7 | 13.37 | 2.1 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| **2500.000** | **406.100** | **.070** | **.029** | **7.500** | **13.468** | **1.990** | Mean |
| **0** | **12.643** | **.011** | **.003** | **1.080** | **.106** | **.185** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 7.50E-06 | 0.00029 | .135 | .020 | 30.235 | 49,971 | 937,059 |

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 8/29/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 2.5 Inches | | |
| *Engine Type:* | Ford Explorer | *Mile/Hrs:* | 46269 | | |
| *Equipment Type* | Police Car | *ID #:* | 379 | *Baro:* | 30.07 |
| *Fuel Sp. Gravity:* | 1.000 | *Temp:* | | | |
| *SG Corr Factor:* | 1.000 | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 2500 | 377 | 0.06 | 0.03 | 4 | 11.61 | 4 | |
| 2500 | 380 | 0.06 | 0.02 | 4 | 11.52 | 3 | |
| 2500 | 384.6 | 0.06 | 0.03 | 3 | 12.24 | 2 | |
| 2500 | 387.8 | 0.06 | 0.03 | 4 | 12.26 | 1 | |
| 2500 | 390.8 | 0.06 | 0.02 | 4 | 11.51 | 4 | |
| 2500 | 393.2 | 0.06 | 0.02 | 3 | 11.51 | 3 | |
| 2500 | 396.2 | 0.06 | 0.01 | 8 | 12.2 | 2 | |
| 2500 | 398 | 0.06 | 0.01 | 6 | 12.22 | 2 | |
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| **2500.000** | **388.450** | **.060** | **.021** | **4.500** | **11.884** | **2.625** | Mean |
| **0** | **7.532** | **.000** | **.008** | **1.690** | **.372** | **1.061** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 4.50E-06 | 0.0002125 | .119 | .026 | 30.007 | 56,232 | 1,130,113 |

Performance factor adjusted for fuel density: 1,130,113

****% Change PF = 20.60 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | *Date:* | 6/13/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 2.5 Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs* | 63650 | | |
| *Equipment Type:* | Police Car | *ID #:* | 342 | *Baro* | 29.92 |
| *Fuel Sp. Gravity(SG* | 1.000 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 3820 | 133 | 0.02 | 0.01 | 13 | 7.44 | 8.5 | |
| | 139.4 | 0.02 | 0.01 | 9 | 7.44 | 8.3 | |
| | 143.4 | 0.02 | 0.01 | 10 | 7.38 | 8.2 | |
| 3740 | 146.4 | 0.02 | 0.01 | 10 | 7.38 | 8.2 | |
| | 154 | 0.02 | 0.01 | 9 | 7.39 | 8.2 | |
| | 159.9 | 0.02 | 0.01 | 9 | 7.41 | 8.1 | |
| 3985 | 162.6 | 0.02 | 0.01 | 9 | 7.38 | 8.2 | |
| | 168 | 0.02 | 0.01 | 9 | 7.39 | 8.1 | |
| 3820 | 168.4 | 0.02 | 0.01 | 9 | 7.3 | 8.1 | |
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| | | | | | | | |
| **3841.250** | **152.789** | **.020** | **.010** | **9.667** | **7.390** | **8.211** | Mean |
| **102.9866496** | **12.861** | **.000** | **.000** | **1.323** | **.042** | **.127** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 9.67E-06 | 0.0001 | .074 | .082 | 29.511 | 88,920 | 2,623,919 |

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 8/29/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 2.5 Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs:* | 64746 | | |
| *Equipment Type* | Police Car | *ID #:* | 342 | *Baro:* | 30.07 |
| *Fuel Sp. Gravity:* | 1.000 | *Temp:* | 87 | | |
| *SG Corr Factor:* | 1.000 | | | *Time:* | 2 |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 3866 | 137.2 | 0.02 | 0.01 | 10 | | | |
| 3871 | 137.8 | 0.02 | 0.01 | 12 | | | |
| | 137.4 | 0.02 | 0.01 | 12 | | | |
| | 136.6 | 0.02 | 0.01 | 14 | 6.49 | 9.9 | |
| 3890 | 135.8 | 0.02 | 0.01 | 10 | 6.6 | 9.3 | |
| | 135.2 | 0.02 | 0.01 | 10 | 6.6 | 9.1 | |
| | 135.2 | 0.02 | 0.01 | 12 | 6.56 | 9.5 | |
| 3900 | 135.4 | 0.02 | 0.01 | 12 | 6.58 | 9.3 | |
| 3905 | 136 | 0.02 | 0.01 | 12 | 6.56 | 9.3 | |
| | | | | | | | |
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| | | | | | | | |
| **3886.400** | **136.289** | **.020** | **.010** | **11.556** | **6.565** | **9.400** | Mean |
| **17.30028901** | **.996** | **.000** | **.000** | **1.333** | **.041** | **.276** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 1.16E-05 | 0.0001 | .066 | .094 | 29.427 | 99,762 | 2,911,233 |

Performance factor adjusted for fuel density: 2,911,233

****% Change PF= 10.95 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | *Date:* | 6/13/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 2.5 Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs* | 59197 | | |
| *Equipment Type:* | Police Car | *ID #:* | 331 | *Baro* | 29.92 |
| *Fuel Sp. Gravity(SG* | 1.000 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 3600 | 160.8 | 0.02 | 0.02 | 13 | 7.06 | 8.9 | |
| | 163.8 | 0.02 | 0.03 | 14 | 7.08 | 8.9 | |
| | 166.2 | 0.02 | 0.03 | 17 | 7.08 | 8.8 | |
| 3590 | 167.8 | 0.02 | 0.03 | 14 | 7.07 | 8.8 | |
| | 168.8 | 0.02 | 0.03 | 10 | | 8.7 | |
| | 170.8 | 0.02 | 0.04 | 17 | 7.08 | 8.9 | |
| 3600 | 173.6 | 0.02 | 0.03 | 17 | 7.12 | 8.8 | |
| | 175.6 | 0.02 | 0.03 | 17 | 7.08 | 8.7 | |
| 3640 | 177.8 | 0.02 | 0.04 | 14 | 7.12 | 8.8 | |
| | | | | | | | |
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| | | | | | | | |
| **3607.500** | **169.467** | **.020** | **.031** | **14.778** | **7.086** | **8.811** | Mean |
| **22.17355783** | **5.557** | **.000** | **.006** | **2.438** | **.022** | **.078** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 1.48E-05 | 0.000311111 | .071 | .088 | 29.487 | 92,329 | 2,761,355 |

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 8/29/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 2.5 Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs:* | 60367 | | |
| *Equipment Type* | Police Car | *ID #:* | 331 | *Baro:* | 30.07 |
| *Fuel Sp. Gravity:* | 1.000 | *Temp:* | 87 | | |
| *SG Corr Factor:* | 1.000 | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 3620 | 165.4 | 0.03 | 0.01 | 17 | 5.72 | 9.5 | |
| | 160.2 | 0.02 | 0.01 | 17 | 5.72 | 9.5 | |
| 3660 | 157.8 | 0.02 | 0.01 | 19 | | 9.9 | |
| | 153.2 | 0.02 | 0.01 | 19 | 5.82 | 9.8 | |
| 3680 | 150.2 | 0.02 | 0.01 | 15 | 5.8 | 9.7 | |
| 3710 | 148.8 | 0.02 | 0.01 | 22 | 5.86 | 9.6 | |
| | 146 | 0.02 | 0.01 | 17 | 5.77 | 10 | |
| 3655 | 145.4 | 0.02 | 0.01 | 16 | 5.77 | 9.8 | |
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| **3665.000** | **153.375** | **.021** | **.010** | **17.750** | **5.780** | **9.725** | Mean |
| **33.1662479** | **7.169** | **.004** | **.000** | **2.188** | **.051** | **.183** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 1.78E-05 | 0.0001 | .058 | .097 | 29.315 | 112,761 | 3,237,734 |

Performance factor adjusted for fuel density: 3,237,734

****% Change PF= 17.25 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | *Date:* | 6/13/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 2.5 Inches | | |
| *Engine Type:* | 5. L Ford | *Mile/Hrs* | 58444 | | |
| *Equipment Type:* | Crown Victoria 1991 | *ID #:* | 319 | *Baro* | 29.92 |
| *Fuel Sp. Gravity(SG* | 1.000 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 4500 | 173.2 | 0.06 | 0.01 | 15 | 7.17 | 11.2 | |
| | 172.6 | 0.05 | 0.01 | 14 | 7.17 | 11.2 | |
| | 172.3 | 0.06 | 0.01 | 15 | 7.17 | 11.2 | |
| 4400 | 173 | 0.06 | 0.01 | 15 | 7.15 | 11.2 | |
| | 173.4 | 0.06 | 0.01 | 15 | 7.15 | 11.2 | |
| | 173.2 | 0.06 | 0.01 | 14 | 7.12 | 11.1 | |
| 4400 | 172.6 | 0.06 | 0.01 | 14 | 7.16 | 11.2 | |
| | 172.4 | 0.06 | 0.01 | 14 | 7.23 | 11.1 | |
| 4400 | 172.4 | 0.06 | 0.01 | 10 | 7.24 | 11.1 | |
| | | | | | | | |
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| | | | | | | | |
| **4425.000** | **172.789** | **.059** | **.010** | **14.000** | **7.173** | **11.167** | Mean |
| **50** | **.414** | **.003** | **.000** | **1.581** | **.038** | **.050** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 1.40E-05 | 0.0001 | .072 | .112 | 29.595 | 91,824 | 1,604,654 |

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 9/1/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 2.5 Inches | | |
| *Engine Type:* | 5. L Ford | *Mile/Hrs:* | 61304 | | |
| *Equipment Type* | Crown Victoria 1991 | *ID #:* | 319 | *Baro:* | 30.04 |
| *Fuel Sp. Gravity:* | 1.000 | *Temp:* | | | |
| *SG Corr Factor:* | 1.000 | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 4450 | 173.2 | 0.02 | 0.01 | 15 | 6.36 | 10.5 | |
| | 172.6 | 0.02 | 0.01 | 15 | 6.34 | 10.5 | |
| 4500 | 172.3 | 0.02 | 0.01 | 15 | 6.31 | 11 | |
| | 173 | 0.02 | 0.01 | 12 | 6.4 | 10.9 | |
| 4530 | 173.4 | 0.02 | 0.01 | 17 | 6.42 | 10.8 | |
| | 173.2 | 0.02 | 0.01 | 17 | 6.42 | 10.8 | |
| 4530 | 172.6 | 0.02 | 0.01 | 15 | 6.42 | 10.9 | |
| | 172.4 | 0.02 | 0.01 | 15 | 6.42 | 10.8 | |
| | 172.4 | | | | | | |
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| | | | | | | | |
| **4502.500** | **172.789** | **.020** | **.010** | **15.125** | **6.386** | **10.775** | Mean |
| **37.74917218** | **.414** | **.000** | **.000** | **1.553** | **.044** | **.183** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 1.51E-05 | 0.0001 | .064 | .108 | 29.454 | 102,603 | 3,082,871 |

Performance factor adjusted for fuel density: 3,082,871

**% Change PF= 92.12 %

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

| | | | | | | |
|---|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | | *Date:* | 6/13/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 2.5 | Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs* | 74276 | | | |
| *Equipment Type:* | Police Car | *ID #:* | 363 | | *Baro* | 29.92 |
| *Fuel Sp. Gravity(SG* | 1.000 | *Temp:* | | | | |
| | | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 3890 | 118.4 | 0.02 | 0.01 | 24 | 7.26 | 8.6 | |
| 3940 | 128.6 | 0.02 | 0.01 | 14 | 7.3 | 8.4 | |
| | 133.8 | 0.02 | 0.01 | 15 | 7.25 | 8.4 | |
| | 137.8 | 0.02 | 0.01 | 14 | 7.23 | 8.3 | |
| 3900 | 142.2 | 0.02 | 0.01 | 15 | 7.25 | 8.2 | |
| | 147 | 0.02 | 0.01 | 17 | 7.2 | 8.2 | |
| | 150.4 | 0.02 | 0.01 | 15 | 7.23 | 8.1 | |
| 3930 | 154 | 0.02 | 0.01 | 15 | 7.14 | 8.2 | |
| | | | | | | | |
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| **3915.000** | **139.025** | **.020** | **.010** | **16.125** | **7.233** | **8.300** | Mean |
| **23.80476143** | **11.894** | **.000** | **.000** | **3.314** | **.047** | **.160** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 1.61E-05 | 0.0001 | .072 | .083 | 29.490 | 90,735 | 2,647,231 |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | | *Test Date:* | 9/1/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 2.5 | Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs:* | 74276 | | | |
| *Equipment Type* | Police Car | *ID #:* | 363 | | *Baro:* | 30.08 |
| *Fuel Sp. Gravity:* | 1.000 | *Temp:* | | | | |
| *SG Corr Factor:* | 1.000 | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 3820 | 118.4 | 0.02 | 0.01 | 39 | 6.71 | 10.4 | |
| | 128.6 | 0.02 | 0.01 | 35 | 6.71 | 10.4 | |
| 3830 | 133.8 | 0.02 | 0.01 | 35 | 6.67 | 10.6 | |
| | 137.8 | 0.02 | 0.01 | 35 | 6.69 | 10.5 | |
| 3850 | 142.2 | 0.02 | 0.01 | 32 | 6.62 | 10.6 | |
| | 147 | 0.02 | 0.01 | 32 | 6.6 | 10.5 | |
| 3860 | 150.4 | 0.02 | 0.01 | 33 | 6.62 | 10.7 | |
| | 154 | 0.02 | | 28 | 6.62 | 10.5 | |
| | | | | | | | |
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| | | | | | | | |
| **3840.000** | **139.025** | **.020** | **.010** | **33.625** | **6.655** | **10.525** | Mean |
| **18.25741858** | **11.894** | **.000** | **.000** | **3.204** | **.045** | **.104** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 3.36E-05 | 0.0001 | .067 | .105 | 29.488 | 98,411 | 2,878,860 |

Performance factor adjusted for fuel density: 2,878,860

****% Change PF= 8.75 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | *Date:* | 6/13/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 2.5 Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs* | 74794 | | |
| *Equipment Type:* | Police Car | *ID #:* | 361 | *Baro* | 29.92 |
| *Fuel Sp. Gravity(SG* | 1.000 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 3950 | 153 | 0.02 | 0.01 | 9 | 7.4 | 8.4 | |
| | 157 | 0.02 | 0.01 | 9 | 7.36 | 8.2 | |
| | 162.2 | 0.02 | 0.01 | 9 | 7.4 | 8.1 | |
| 3960 | 165.1 | 0.02 | 0.01 | 9 | 7.36 | 8.2 | |
| | 169.4 | 0.02 | 0.01 | 9 | 7.36 | 8.2 | |
| | 169.9 | 0.02 | 0.01 | 7 | 7.33 | 8.3 | |
| 3960 | 175.8 | 0.02 | 0.01 | 9 | 7.35 | 8.3 | |
| | 178.8 | 0.02 | 0.01 | 9 | 7.34 | 8.2 | |
| 3960 | 180.2 | 0.02 | 0.01 | 10 | 7.35 | 8.1 | |
| | | | | | | | |
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| | | | | | | | |
| | | | | | | | |
| **3957.500** | **167.933** | **.020** | **.010** | **8.889** | **7.361** | **8.222** | Mean |
| **5** | **9.486** | **.000** | **.000** | **.782** | **.024** | **.097** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 8.89E-06 | 0.0001 | .074 | .082 | 29.507 | 89,261 | 2,666,345 |

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 9/1/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 2.5 Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs:* | 77248 | | |
| *Equipment Type* | Police Car | *ID #:* | 361 | *Baro:* | 30.08 |
| *Fuel Sp. Gravity:* | 1.000 | *Temp:* | | | |
| *SG Corr Factor:* | 1.000 | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 3960 | 153 | 0.02 | 0.01 | 17 | 7.12 | 9.9 | |
| | 157 | 0.02 | 0.01 | 15 | 7.08 | 9.9 | |
| 3900 | 162.2 | 0.02 | 0.01 | 15 | 7.32 | 9.6 | |
| | 165.1 | 0.02 | 0.01 | 13 | 7.33 | 9.6 | |
| | 169.4 | 0.02 | 0.01 | 14 | 7.25 | 9.7 | |
| | 169.9 | 0.02 | 0.01 | 14 | 7.32 | 9.5 | |
| 3930 | 175.8 | 0.02 | 0.01 | 13 | 7.25 | 9.5 | |
| | 178.8 | 0.02 | 0.01 | 14 | 7.22 | 9.5 | |
| | 180.2 | | | | | | |
| | | | | | | | |
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| | | | | | | | |
| **3930.000** | **167.933** | **.020** | **.010** | **14.375** | **7.236** | **9.650** | Mean |
| **30** | **9.486** | **.000** | **.000** | **1.302** | **.094** | **.169** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 1.44E-05 | 0.0001 | .072 | .097 | 29.545 | 90,869 | 2,721,627 |

Performance factor adjusted for fuel density: 2,721,627

****% Change PF= 2.07 %**

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

| | | | | | | |
|---|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | | *Date:* | 6/13/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 2.5 | Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs* | 70601 | | | |
| *Equipment Type:* | Police Car | *ID #:* | 344 | | *Baro* | 29.92 |
| *Fuel Sp. Gravity(SG* | 1.000 | *Temp:* | | | | |
| | | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 4100 | 133.4 | 0.02 | 0.01 | 18 | 7.09 | 8.9 | |
| | 140 | 0.02 | 0.01 | 15 | 7.08 | 8.7 | |
| | 147 | 0.02 | 0.01 | 14 | 6.97 | 8.6 | |
| 4390 | 156.6 | 0.02 | 0.01 | 12 | 6.98 | 8.5 | |
| | 160.6 | 0.02 | 0.01 | 10 | 6.98 | 8.5 | |
| | 165.5 | 0.02 | 0.01 | 10 | 6.99 | 8.5 | |
| 4450 | 165.4 | 0.02 | 0.01 | 10 | 6.98 | 8.5 | |
| | 169 | 0.02 | 0.01 | 10 | 6.99 | 8.5 | |
| | 171.4 | 0.02 | 0.01 | 10 | 6.98 | 8.5 | |
| | | | | | | | |
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| | | | | | | | |
| **4313.333** | **156.544** | **.020** | **.010** | **12.111** | **7.004** | **8.578** | Mean |
| **187.1719352** | **13.469** | **.000** | **.000** | **2.934** | **.046** | **.139** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 1.21E-05 | 0.0001 | .070 | .086 | 29.465 | 93,633 | 2,771,458 |

| | | | | | | |
|---|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | | *Test Date:* | 9/1/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 2.5 | Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs:* | 73772 | | | |
| *Equipment Type* | Police Car | *ID #:* | 344 | | *Baro:* | 30.06 |
| *Fuel Sp. Gravity:* | 1.000 | *Temp:* | | | | |
| *SG Corr Factor:* | 1.000 | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 4320 | 133.4 | 0.02 | 0.01 | 18 | 6.7 | 10.3 | |
| | 140 | 0.02 | 0.01 | 15 | 6.6 | 10.5 | |
| | 147 | 0.02 | 0.01 | 15 | 6.6 | 10.5 | |
| 4460 | 156.6 | 0.02 | 0.01 | 10 | 6.62 | 10.3 | |
| | 160.6 | 0.02 | 0.01 | 10 | 6.69 | 10.4 | |
| | 165.5 | 0.02 | 0.01 | 10 | 6.69 | 10.2 | |
| 4160 | 165.4 | 0.02 | 0.01 | 13 | 6.71 | 10.2 | |
| | 169 | 0.02 | 0.01 | 12 | 6.75 | 10.1 | |
| | 171.4 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| **4313.333** | **156.544** | **.020** | **.010** | **12.875** | **6.670** | **10.313** | Mean |
| **150.11107** | **13.469** | **.000** | **.000** | **2.949** | **.056** | **.146** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 1.29E-05 | 0.0001 | .067 | .103 | 29.480 | 98,361 | 2,918,217 |

Performance factor adjusted for fuel density: 2,918,217

****% Change PF= 5.30 %**

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

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location* | Provo, Utah | *Date:* | 6/13/95 |
| *Test Portion:* | Baseline | *Stack Diam.* | 2.5 Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs* | 66653 | | |
| *Equipment Type:* | Police Car | *ID #:* | 322 | *Baro* | 29.92 |
| *Fuel Sp. Gravity(SG* | 1.000 | *Temp:* | | | |
| | | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 3980 | 161 | 0.02 | 0.01 | 10 | 7.71 | 8 | |
| | 165 | 0.02 | 0.01 | 10 | 7.73 | 7.9 | |
| | 168.8 | 0.02 | 0.01 | 10 | 7.67 | 7.9 | |
| 4200 | 174.4 | 0.02 | 0.01 | 9 | 7.59 | 8 | |
| | 177 | 0.02 | 0.01 | 9 | 7.6 | 7.9 | |
| | 181.4 | 0.02 | 0.01 | 8 | 7.62 | 7.9 | |
| 4170 | 184.2 | 0.02 | 0.01 | 9 | 7.62 | 7.9 | |
| | 188 | 0.02 | 0.01 | 9 | 7.62 | 7.8 | |
| 4165 | 191.4 | 0.02 | 0.01 | 9 | 7.56 | 7.8 | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| **4128.750** | **176.800** | **.020** | **.010** | **9.222** | **7.636** | **7.900** | Mean |
| **100.3639211** | **10.447** | **.000** | **.000** | **.667** | **.056** | **.071** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw1 | pf1 | PF1 |
|---|---|---|---|---|---|---|
| 9.22E-06 | 0.0001 | .076 | .079 | 29.538 | 86,148 | 2,591,442 |

| | | | | | |
|---|---|---|---|---|---|
| *Company Name:* | Provo City | *Location:* | Provo, Utah | *Test Date:* | 9/1/95 |
| *Test Portion:* | Treated | *Stack Diam:* | 2.5 Inches | | |
| *Engine Type:* | 5.0 Ford | *Mile/Hrs:* | 68976 | | |
| *Equipment Type* | Police Car | *ID #:* | 322 | *Baro:* | 30.06 |
| *Fuel Sp. Gravity:* | 1.000 | *Temp:* | | | |
| *SG Corr Factor:* | 1.000 | | | *Time:* | |

| RPM | Exh Temp | Pv Inch | CO | HC | CO2 | O2 | |
|---|---|---|---|---|---|---|---|
| 3970 | 161 | 0.02 | 0.01 | 12 | 6.6 | 10.5 | |
| | 165 | 0.02 | 0.01 | 10 | 6.68 | 10.4 | |
| 4030 | 168.8 | 0.02 | 0.01 | 10 | 6.7 | 10.2 | |
| | 174.4 | 0.02 | 0.01 | 10 | 6.7 | 10.2 | |
| 4090 | 177 | 0.02 | 0.01 | 10 | 6.81 | 10.3 | |
| | 181.4 | 0.02 | 0.01 | 10 | 6.76 | 10.2 | |
| 4080 | 184.2 | 0.02 | 0.01 | 9 | 6.7 | 10.3 | |
| | 188 | 0.02 | 0.01 | 9 | 6.75 | 10.1 | |
| | 191.4 | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| | | | | | | | |
| **4042.500** | **176.800** | **.020** | **.010** | **10.000** | **6.713** | **10.275** | Mean |
| **55** | **10.447** | **.000** | **.000** | **.926** | **.063** | **.128** | Std Dev |

| VFHC | VFCO | VFCO2 | VFO2 | Mtw2 | pf2 | PF2 |
|---|---|---|---|---|---|---|
| 1.00E-05 | 0.0001 | .067 | .103 | 29.486 | 97,784 | 2,948,360 |

Performance factor adjusted for fuel density: 2,948,360

****% Change PF= 13.77 %**

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

**APPENDIX 2**

# Carbon Mass Balance Field Data Form

Company: PNW city Location: PNW Test Date: 6/16/95
Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: 4 Inches

Engine Make/Model: LT-10 Cummin 21193 Miles/Hours: 8503 I.D.#: 814 (16233 total)
Type of Equipment: Garbage Truck

Fuel Specific Gravity: .864 @: _____ (°F)
Barometric Pressure: 30.07 Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2200 | 435 | 1.4 | .01 | 10 | 2.97 | 15.9 | 6.0 |
| | 438 | 1.4 | .01 | 10 | 3.03 | 15.7 | |
| | 442.4 | 1.4 | .01 | 10 | 3.05 | 15.9 | |
| | 443 | 1.4 | .01 | 10 | 3.04 | 15.8 | |
| | 443.6 | 1.4 | .01 | 10 | 3.05 | 15.9 | |
| | 444.6 | 1.4 | .01 | 10 | 3.05 | 15.8 | |
| | 447.2 | 1.4 | .01 | 10 | 3.06 | 15.8 | |
| | 446.2 | 1.4 | .01 | 10 | 3.07 | 15.8 | |
| | | | | | | | |
| | | | | | | | |

Fan on

Water temp 180°

Oil pressure 40 psi

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo, UT Test Date: 8-28-95
Test Portion: Baseline:_____ Treated: X Exhaust Stack Diameter: ___Inches
Engine Make/Model: L-10 Cummins Miles/Hours: 24120 2864 I.D.#: 814
Type of Equipment: Garbage Truck

Fuel Specific Gravity: .824 @:_____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: 4:05

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2200 | 423 | 1.4 | .01 | 8 | 279 | 153 | 5 |
| | 428.2 | 1.4 | 01 | 9 | 278 | 152 | |
| | 427 | 1.3 | 02 | 9 | 282 | 154 | |
| | 431.6 | 1.35 | 01 | 6 | 281 | 154 | |
| | 434 | 1.35 | 01 | 8 | 281 | 155 | |
| | 434.6 | 1.35 | 01 | 8 | 281 | 154 | |
| | 434.6 | 1.35 | 02 | 9 | 285 | 154 | |
| | 435.8 | 1.35 | 02 | 9 | 286 | 154 | |
| | | | | | | | |
| | | | | | | | |

End Time 4:15

**Names of Customer Personnel Participating in Test:**

Craig & Dave

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 6/11/95

Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: ___ Inches

Engine Make/Model: LT - Cummins Miles/Hours: 22677 → 25099 I.D.#: 812

Type of Equipment: Garbage Truck

Fuel Specific Gravity: .821 @: _____ (°F)

Barometric Pressure: 30.03 Inches of Mercury

Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2200 | 397 | 1.0 | .02 | 23 | 2.16 | 17.1 | 4.5 |
| | 397.2 | 1.0 | .02 | 23 | 2.17 | 17.1 | |
| | 397.4 | 1.0 | .02 | 23 | 2.20 | 17.1 | |
| | 400.6 | 1.0 | .02 | 23 | 2.15 | 17.2 | |
| | 400.2 | 1.0 | .02 | 21 | 2.15 | 17.2 | |
| | 401.2 | 1.0 | .02 | 23 | 2.15 | 17.2 | |
| | 401.2 | 1.0 | .02 | 22 | 2.15 | 17.1 | |
| | 401.4 | 1.0 | .02 | 23 | 2.17 | 17.1 | |
| | | | | | | | |
| | | | | | | | |

Water Temp @ 180

Oil Pressure 45 psi

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo, UT Test Date: 8-28-95
Test Portion: Baseline:_____ Treated: X Exhaust Stack Diameter: ___Inches

Engine Make/Model: L-10 Cummins Miles/Hours: 2990 I.D.#: 812
Type of Equipment: Garbage Truck

Fuel Specific Gravity: .822 @:_____ (°F)
Barometric Pressure: 30.08 Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: 2135

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2200 | 401.4 ~~388.8~~ | 1.2 | .02 | 17 | 2.26 | 16.2 | 5 |
| 2200 | 404.2 | 1.2 | .02 | 17 | 2.22 | 16.2 | |
| 2200 | 412.2 | 1.1 | .02 | 15 | 225 | 16.2 | |
| 2200 | 408.2 | 1.2 | .02 | 15 | 225 | 16.2 | |
| 2200 | 409.4 | 1.2 | .02 | 14 | 228 | 16.4 | |
| 2200 | 411.8 | 1.1 | 02 | 14 | 233 | 162 | |
| 2200 | 406.8 | 1.1 | 02 | 14 | 214 | 162 | |
| 2200 | 413.4 | 1.2 | 02 | 14 | 230 | 161 | |
| 2000 | 397.8 | .9 | .02 | 12 | 2.12 | 16.4 | |
| | | | | | | | |

End Time 2155

**Names of Customer Personnel Participating in Test:**

Craig & Dave Brent

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo, UT Test Date: 8-28-95
Test Portion: Baseline:_____ Treated: X Exhaust Stack Diameter: ___Inches
38836?
Engine Make/Model: L-10 Cummins Miles/Hours: 3992 I.D.#: 810
Type of Equipment: Garbage Truck

Fuel Specific Gravity: .825 @:_____ (°F)
Barometric Pressure: 30.05 Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: 3:25

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2200 | 388.0 | .9 | .02 | 24 | 2.15 | 16.3 | 4 |
| | 390.2 | .95 | .02 | 24 | 2.15 | 16.3 | |
| | 392.4 | .9 | .03 | 24 | 2.13 | 16.6 | |
| | 400.4 | .9 | .02 | 25 | 2.09 | 16.5 | |
| | 391.4 | .95 | .02 | 24 | 2.10 | 16.6 | |
| | 398.6 | .95 | 02 | 24 | 2.05 | 16.6 | |
| | 400 | .95 | 02 | 24 | 2.04 | 16.6 | |
| V | 390.8 | .95 | .02 | 26 | 2.04 | 16.6 | |
| | | | | | | | |
| | | | | | | | |

End Time 3:35

**Names of Customer Personnel Participating in Test:**

Craig + Dave

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo city Location: Provo Test Date: 6/11/95
Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: ___ Inches
Engine Make/Model: CT Cummin Miles/Hours: 35443 miles 3632 I.D.#: 810 (20853 Utah
Type of Equipment: Garbage Truck

Fuel Specific Gravity: .814 @: _____ (°F)
Barometric Pressure: 30.09 Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

180° water Temp
0.1
40psi

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2400 | 390 | ~~1.0~~ | 02 | 22 | 2.20 | 17.1 | 5 5 |
| | 395 | 1.0 | 02 | 24 | 2.19 | 17.0 | |
| | 400 | 1.0 | 02 | 22 | 2.19 | 17.0 | |
| | 401 | 1.0 | 02 | 23 | 2.22 | 17.1 | |
| | 405 | 1.0 | 02 | 24 | 2.22 | 17.0 | |
| | 406 | 1.0 | 02 | 22 | 2.22 | 17.0 | |
| | ~~400~~ 401 | 1.0 | 02 | 23 | 2.25 | 17.1 | |
| | 400 | 1.0 | 02 | 22 | 2.23 | 17.0 | |
| | | | | | | | |
| | | | | | | | |

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo, UT Test Date: 8-28-95
Test Portion: Baseline:_____ Treated: X Exhaust Stack Diameter: ___Inches

Engine Make/Model: Cat 3208 T Miles/~~Hours~~: 145493 I.D.#: 731
Type of Equipment: Dump Truck

Fuel Specific Gravity: .824 @:_____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time:_____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 1850 | 281.9 | .8 | 04 | 17 | 151 | 175 | 3 |
| | 286.8 | .7 | 04 | 17 | 151 | 175 | |
| | 292.2 | .75 | 04 | 17 | 151 | 178 | |
| | 295.8 | .75 | 03 | 18 | 154 | 177 | |
| | 290.4 | .75 | 04 | 15 | 155 | 177 | |
| | 299.8 | .75 | .03 | 17 | 154 | 177 | |
| | 301.0 | .75 | 04 | 21 | 154 | 177 | |
| " | 301.8 | .75 | 03 | 17 | 153 | 176 | |
| | | | | | | | |
| | | | | | | | |

End Time_____

**Names of Customer Personnel Participating in Test:**

Craig & Dave _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 6/11/95
Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: 4 Inches
Turbo Ford 3258 T CAT
Engine Make/Model: ~~[illegible]~~ Miles/~~Hours~~: 144201 I.D.#: 731
Type of Equipment: ~~[illegible]~~ Dump Truck

Fuel Specific Gravity: .833 @: _____ (°F)
Barometric Pressure: 30.07 Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 1850 | 273.4 | .8 | .04 | 21 | 1.54 | 18.0 | 3.5 |
| | 274.0 | .8 | .04 | 23 | 1.52 | 18.0 | |
| | 279.4 | .8 | .04 | 21 | 1.52 | 18.1 | |
| | 280.0 | .8 | .4 | 21 | 1.53 | 18.1 | |
| | 282.2 | .8 | .04 | 22 | 1.52 | 18.2 | |
| | 282.6 | .8 | .04 | 22 | 1.52 | 18.1 | |
| | 283 | .8 | .04 | 23 | 1.54 | 18.2 | |
| | 283 | .8 | .04 | 23 | 1.53 | 18.1 | |
| | | | | | | | |
| | | | | | | | |

Oil Temp Temp Center

Smoke #s

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 6/11/95

Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: Turbo 3208 CAT Miles/~~Hours~~: 42717 I.D.#: 730

Type of Equipment: Dump Truck

Fuel Specific Gravity: 1827 @: _____ (°F)

Barometric Pressure: 30.05 Inches of Mercury

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

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2200 | 335 | 1.4 | .04 | 38 | 1.75 | 17.8 | 4.5 |
| | 336 | 1.5 | .04 | 38 | 1.75 | 17.8 | |
| | 336.8 | 1.5 | .04 | 38 | 1.75 | 17.8 | |
| | 338 | 1.5 | .04 | 34 | 1.75 | 17.8 | |
| | 338.2 | 1.5 | .04 | 35 | 1.75 | 17.7 | |
| | 339.2 | 1.5 | .04 | 35 | 1.75 | 17.7 | |
| | 339.4 | 1.5 | .04 | 35 | 1.75 | 17.8 | |
| | 339.8 | 1.5 | .04 | 35 | 1.75 | 17.7 | |
| | | | | | | | |
| | | | | | | | |

End Time 3:10

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo, UT Test Date: 8-28-95
Test Portion: Baseline:_____ Treated: X Exhaust Stack Diameter: ___Inches

Engine Make/Model: Cat 3208 T Miles/Hours: 44648 I.D.#: 730
Type of Equipment: Dump Truck

Fuel Specific Gravity: .825 @:_____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: 3:15

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2210 | 340.2 | 1.35 | .04 | 18 | 1.73 | 173 | 4 |
| " | 341.6 | 1.3 | .04 | 17 | 1.72 | 173 | |
| " | 343 | 1.35 | .04 | 18 | 1.74 | 173 | |
| | 344.8 | 1.35 | .04 | 18 | 1.74 | 173 | |
| | 347.2 | 1.35 | .04 | 18 | 1.75 | 172 | |
| | 348.8 | 1.35 | .04 | 18 | 1.75 | 171 | |
| " | 3482 | 1.35 | .04 | 19 | 171 | 173 | |
| " | 3484 | 1.35 | .04 | 18 | 171 | 172 | |
| | | | | | | | |
| | | | | | | | |

End Time 3:22

**Names of Customer Personnel Participating in Test:**

Craig & Dave [redacted]

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: PNW City Location: PNW Test Date: 6/11/15
Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: 4 Inches

Engine Make/Model: CAT 3208 Miles/Hours: 45895 I.D.#: ~~0~~ 153
Type of Equipment: Dump Truck

Fuel Specific Gravity: .832 @: _____ (°F)
Barometric Pressure: 30.07 Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2000 | 276 | .8 | .06 | 21 | 1.40 | 18.3 | 2.5 |
| | 276 | .8 | .06 | 21 | 1.42 | 18.3 | |
| | 277.8 | .8 | .06 | 20 | 1.42 | 18.3 | |
| | 278.2 | .8 | .06 | 19 | 1.40 | 18.3 | |
| | 279.4 | .8 | .06 | 21 | 1.41 | 18.3 | |
| | 279.6 | .8 | .06 | 21 | 1.41 | 18.3 | |
| | 280.4 | .8 | .06 | 22 | 1.40 | 18.3 | |
| | 281 | .8 | .06 | 22 | 1.40 | 18.3 | |
| | | | | | | | |
| | | | | | | | |

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo, UT Test Date: 9-28-95
Test Portion: Baseline:_____ Treated: X Exhaust Stack Diameter: ___Inches

Engine Make/Model: Cat 3208 Miles/Hours: 4483 I.D.#: 153
Type of Equipment: Dump Truck

Fuel Specific Gravity: .834 (2) @: 95.2 (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: 2:15

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2000 | 281. | .75 | .06 | 20 | 1.38 | 178 | 1.5 |
| 2000 | 283.6 | 75 | .06 | 19 | 1.38 | 179 | |
| 2000 | 285.6 | .7 | .06 | 17 | 1.39 | 177 | |
| 2000 | 285.8 | 7 | .06 | 17 | 1.38 | 178 | |
| 2000 | 290.4 | .7 | .06 | 19 | 1.40 | 175 | |
| 2000 | 291.6 | .7 | .06 | 17 | 1.40 | 178 | |
| 2000 | 292.2 | .7 | .06 | 17 | 1.40 | 176 | |
| 2000 | 293.8 | .7 | .06 | 18 | 1.40 | 178 | |
| | | | | | | | |
| | | | | | | | |

End Time 2:25

**Names of Customer Personnel Participating in Test:**

Craig & Dave [redacted] Brent

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: PROVO Test Date: 6/11/95
Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: 4 Inches

Engine Make/Model: CAT 3208 Miles/~~Hours~~: 65756 I.D.#: 33
Type of Equipment: Boom Truck

Fuel Specific Gravity: .830 @: _____ (°F)
Barometric Pressure: 30.03 Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2000 | 374.6 | 2.0 | .05 | 27 | 2.02 | 17.3 | 5.0 |
| | 380 | 2.0 | .05 | 30 | 2.01 | 17.3 | |
| | 380.2 | 2.0 | .05 | 30 | 2.01 | 17.3 | |
| | 381.6 | 2.0 | .05 | 31 | 2.01 | 17.2 | |
| | 381.4 | 2.0 | .05 | 31 | 2.02 | 17.2 | |
| | 382.6 | 2.0 | .05 | 31 | 2.01 | 17.2 | |
| | 383.4 | 2.0 | .05 | 31 | 2.01 | 17.1 | |
| | 384.2 | 2.0 | .05 | 31 | 2.02 | 17.1 | |
| | | | | | | | |
| | | | | | | | |

Water & Oil centered Normal

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo, UT Test Date: 8-28-95
Test Portion: Baseline:_____ Treated: X Exhaust Stack Diameter: ___Inches

Engine Make/Model: Cat 3208 Miles/~~Hours~~: 16783 I.D.#: 33
Type of Equipment: Boom Truck

Fuel Specific Gravity: 8.26 @:_____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time:_____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2000 | 427 | 1.9 | 04 | 14 | 195 | 169 | 4 |
| | 420.4 | 1.9 | 04 | 14 | 211 F | 166 | |
| | 420.4 | 1.9 | 04 | 17 | 198 | 169 | |
| | 419.2 | 1.9 | 04 | 17 | 197 | 168 | |
| | 421.9 | 1.9 | 04 | 17 | 200 F | 168 | |
| | 423.8 | 1.9 | 04 | 17 | 212 F | 165 | |
| | 417.2 | 1.89 | 04 | 17 | 197 | 169 | |
| ↓ | 410.6 | 1.89 | 04 | 17 | 197 | 167 | |
| | | | | | | | |
| | | | | | | | |

End Time_____

**Names of Customer Personnel Participating in Test:**

Craig & Dave _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: PNW city Location: PNW Test Date: 6/11/25

Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: 4 Inches

Engine Make/Model: INTI 466 DT Miles/Hours: 30837 → 5681 I.D.#: 18

Type of Equipment: Boom Truck

Fuel Specific Gravity: ~~.8~~ .826 @: _____ (°F)

Barometric Pressure: 30.03 Inches of Mercury

Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2000 | 428.2 | ~~.8~~.6 | .05 | 24 | 3.31 | 15.3 | 4.0 |
| | 428.2 | .8 | .05 | 24 | 3.31 | 15.3 | |
| | 432.2 | .8 | .05 | 24 | 3.30 | 15.3 | |
| | 433.4 | .8 | .05 | 24 | 3.31 | 15.3 | |
| | 433.4 | .8 | .05 | 24 | 3.31 | 15.3 | |
| | 435.4 | .8 | .05 | 24 | 3.30 | 15.3 | |
| | 435 | .8 | .05 | 24 | 3.30 | 15.3 | |
| | 436.2 | .8 | .05 | 25 | 3.3 | 15.3 | |
| | | | | | | | |
| | | | | | | | |

Oil Pressure 60

Water Temp 170

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 6/11/15
Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: 4 Inches

Engine Make/Model: Cummin LT-10 Miles/Hours: 153910 I.D.#: 732
Type of Equipment: Dump Truck

Fuel Specific Gravity: .822 @: _____ (°F)
Barometric Pressure: 30.05 Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2200 | 478. | 3.0 | .10 | 269 | 2.36 | 16.7 | 8.5 |
| | 480 | 3.0 | .10 | 278 | 2.36 | 16.7 | |
| | 480.2 | 3.0 | .10 | 280 | 2.36 | 16.7 | |
| | 480.2 | 3.0 | .10 | 280 | 2.36 | 16.7 | |
| | 478.4 | 3.0 | .10 | 280 | 2.37 | 16.7 | |
| | 482.6 | 3.0 | .10 | 265 | 2.35 | 16.7 | |
| | 482.6 | 3.0 | .10 | 269 | 237 | 16.6 | |
| | 483.2 | 3.0 | .10 | 273 | 2.37 | 16.6 | |
| | | | | | | | |
| | | | | | | | |

End Time _____

Lot of white smoke

Water 150 170

0.1 30PSI

Five! Very Dark Might have high water Content

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 6/11/95
Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: 4 Inches

Engine Make/Model: Dump Truck Miles/~~Hours~~: 164257 I.D.#: 733
Type of Equipment: ~~International~~ ~~466~~ 7 Cummins

Fuel Specific Gravity: .825 @: _____ (°F)
Barometric Pressure: 30.05 Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

Water Temp 180°
Oil press 30psi

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| ~~2000~~ 1120 | 480.4 | 3.0 | .06 | 92 | 2.78 | 16.1 | 6.5 |
| | 481.4 | 3.0 | .06 | 92 | 2.78 | 16.2 | |
| | 482 | 2.8 | .06 | 90 | 2.79 | 16.1 | |
| | 483.4 | 3.0 | .06 | 90 | 2.80 | 16.1 | |
| | 484.8 | 3.0 | .06 | 80 | 2.78 | 16.2 | |
| | 485.2 | 3.0 | .06 | 84 | 2.79 | 16.2 | |
| | 482.4 | 2.8 | .06 | 84 | 2.79 | 16.2 | |
| | 484.8 | 2.8 | .05 | 85 | 2.78 | 16.2 | |
| | | | | | | | |
| | | | | | | | |

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo, UT Test Date: 8-28-95
Test Portion: Baseline:_____ Treated: X Exhaust Stack Diameter: ___Inches
Engine Make/Model: Int'l 466 DT Miles/Hours: 5843 (31261) I.D.#: 18
Type of Equipment: Boom Truck

Fuel Specific Gravity: .825 @:_____ (°F)
Barometric Pressure: 30.03 Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time:_____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2000 | 422. | .75 | 04 | 17 | 306 | 148 | 4 |
| | 425.6 | .75 | 04 | 17 | 307 | 148 | |
| | 429.6 | .7 | 04 | 17 | 310 | 150 | |
| | 431.6 | .7 | 04 | 17 | 310 | 149 | |
| | 433.8 | .7 | 04 | 17 | 310 | 150 | |
| | 434.4 | .75 | 04 | 16 | 307 | 150 | |
| | 436.4 | .75 | 04 | 17 | 307 | 150 | |
| ↓ | 437.2 | .75 | 04 | 14 | 309 | 149 | |
| | | | | | | | |
| | | | | | | | |

End Time_____

**Names of Customer Personnel Participating in Test:**

Craig & Dave

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 8.29

Test Portion: Baseline:_____ Treated:_____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: _____ Miles/Hours: 46269 I.D.#: 379

Type of Equipment: EXPLORER

Fuel Specific Gravity: 3007 @:_____ (°F)

Barometric Pressure: _____ Inches of Mercury

Intake Air Temperature: _____ (°F) Start Time: 2:15

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2500 | 377 ~~373.2~~ | .06 | 03 | 4 | 1161 | 4 | |
| ↓ | 380. | .06 | 02 | 4 | 1152 | 3 | |
| | 384.6 | .06 | 03 | 3 | 1224 | 2 | |
| | 387.8 | .06 | 03 | 4 | 1226 | 1 | |
| | 390.8 | .06 | 02 | 4 | 1151 | 4 | |
| | 393.2 | .06 | 02 | 3 | 1151 | 3 | |
| | 396.2 | .06 | 01 | 8 | 1220 | 2 | |
| ↓ | 398 | | 01 | 6 | 1222 | 2 | |
| | | | | | | | |
| | | | | | | | |

End Time_____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 6/12/95
Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: Ford Explor Miles/~~Hours~~: 43973 I.D.#: 379
Type of Equipment: Police Car

Fuel Specific Gravity: _____ @: _____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: 1:15 Pm

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 2500 | 381.8 | .06 | .03 | 9 | 13.64 | 1.6 | |
| ✓ | 388.4 | .06 | .03 | 9 | 13.62 | 1.7 | |
| ✓ | 400.2 | .06 | .03 | 8 | 13.55 | 2.0 | |
| ✓ | 406.2 | .06 | .03 | 8 | 13.51 ~~13.44~~ | 2.0 | |
| ✓ | 407.8 | .06 | .03 | 8 | 13.46 | 2.1 | |
| ✓ | 409.6 | .08 | .02 | 7 | 13.46 | 2.1 | |
| ✓ | 412.6 | .08 | .03 | 7 | 13.37 | 2.1 | |
| ✓ | 415.8 | .08 | .03 | 6 | 13.37 | 2.1 | |
| ✓ | 419.2 | .08 | .03 | 6 | 13.39 | 2.1 | |
| ✓ | 419.4 | .08 | .03 | 7 | 13.37 | 2.1 | |

No AC

End Time 1:30 Pm

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: P-City Location: _____ Test Date: 6-13-95
Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: 5.0 FORD Miles/Hours: 63650 I.D.#: 342
Type of Equipment: CROWN VICTORIA

Fuel Specific Gravity: _____ @: _____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 3820 | 133.0 | .02 | 01 | 13 | 7.44 | 8.5 | |
| | 139.4 | .02 | .01 | 9 | 744 | 8.3 | |
| | 143.4 | .02 | .01 | 10 | 738 | 8.2 | |
| 3740 | 146.4 | .02 | .01 | 10 | 738 | 8.2 | |
| | 154.6 | .02 | .01 | 9 | 739 | 8.2 | |
| | 159.9 | .02 | .01 | 9 | 741 | 8.1 | |
| 3985 | 162.6 | .02 | 01 | 9 | 738 | 8.2 | |
| | 168.0 | 02 | 01 | 9 | 739 | 8.1 | |
| 3820 | 168.4 | 02 | 01 | 9 | 730 | 8.1 | |
| | | | | | | | |

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 8-29-95
Test Portion: Baseline:_____ Treated: X Exhaust Stack Diameter: ___Inches

Engine Make/Model: 5.0 Ford Miles/Hours: 64746 I.D.#: 342
Type of Equipment: Police car

No A.C. on

Fuel Specific Gravity: _____ @:_____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time:_____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 3866 | 137.2 | .02 | .01 | 10 | ~~426~~ | ~~234~~ | |
| 3871 | 137.8 | .02 | .01 | 12 | ~~428~~ | ~~234~~ | |
| | 138.4 | .02 | .01 | 12 | ~~605~~ | ~~TIGHTENED~~ 106 | |
| | 136.6 | .02 | .01 | 14 | 649 | 9.9 | |
| 3890 | 135.8 | .02 | .01 | 10 | 660 | 9.3 | |
| | 135.2 | .02 | .01 | 10 | 660 | 9.1 | |
| | 135.2 | .02 | .01 | 12 | 656 | 9.5 | |
| 3900 | 135.4 | .02 | .01 | 12 | 658 | 9.3 | |
| | 136 | .02 | .01 | 12 | 656 | 9.3 | |
| 3905 | | | | | | | |

Tightened Hose Clamp

End Time_____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: PCTY Location: _____ Test Date: 6-13-95
Test Portion: Baseline: _____ Treated: _____ Exhaust Stack Diameter: 2.5 Inches

Engine Make/Model: 5.0 FORD Miles/Hours: 59197 I.D.#: 331
Type of Equipment: CROWN VICTORIA

Fuel Specific Gravity: _____ @: _____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 3600 | 160.8 | .02 | .02 | 13 | 7.06 | 8.9 | |
| | 163.8 | .02 | .03 | 14 | 7.08 | 8.9 | |
| | 166.2 | .02 | .03 | 17 | 7.08 | 8.8 | |
| 3590 | 167.8 | .02 | .03 | 14 | 7.07 | 8.8 | |
| | 168.8 | .02 | .03 | 10 | ~~7.21~~ | 8.7 | ? |
| 3 | 170.8 | .02 | .04 | 17 | 7.08 | 8.9 | |
| 3600 | 173.6 | .02 | .03 | 17 | 7.12 | 8.8 | |
| | 175.6 | .02 | .03 | 17 | 7.08 | 8.7 | |
| 3640 | 177.8 | .02 | .04 | 14 | 7.12 | 8.8 | |
| | | | | | | | |

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 8.29

Test Portion: Baseline:_____ Treated:_____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: 5.0 Ford Miles/Hours: 60367 I.D.#: 331

Type of Equipment: Crown Vic

Fuel Specific Gravity: _____ @:_____ (°F)

Barometric Pressure: _____ Inches of Mercury

Intake Air Temperature: _____ (°F) Start Time:_____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 3620 | 165.4 | .03 | 01 | 17 | 572 | 95 | |
| 3 | 160.2 | .02 | 01 | 17 | 572 | 95 | |
| 3660 | 157.8 | .02 | 01 | 19 | 582 | 99 | ? |
| | 153.2 | .02 | 01 | 19 | 582 | 98 | |
| 3680 | 150.2 | .02 | 01 | 15 | 580 | 97 | |
| 3710 | 148.8 | .02 | 01 | 22 | 586 | 96 | |
| | 146.0 | .02 | 01 | 17 | 577 | 100 | |
| 3655 | 145.4 | 02 | 01 | 16 | 577 | 98 | |
| | | | | | | | |
| | | | | | | | |

End Time_____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: P City Location: _____ Test Date: 6-13
Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: ?.5 Inches

Engine Make/Model: Ford 5.0 Miles/Hours: 69620 I.D.#: 320
Type of Equipment: Crown Victoria

Fuel Specific Gravity: _____ @: _____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 3900 | 158.2 | .02 | .03 | 19 | 8.26 | 7.2 | 1 |
| | 163.2 | .02 | .02 | 19 | 8.12 | 7.2 | ? |
| | 169.2 | .02 | .02 | 19 | 8.01 | 7.2 | |
| 3850 | 171.2 | .02 | .03 | 19 | 8.00 | 7.2 | |
| | 174.4 | .02 | .02 | 18 | 8.00 | 7.2 | |
| | 176.8 | .02 | .03 | 19 | 7.99 | 7.2 | |
| 3925 | 179.2 | .02 | .02 | 19 | 8.00 | 7.2 | |
| | 180.2 | .02 | .02 | 19 | 7.95 | 7.2 | |
| | 182.0 | .02 | .02 | 15? | 7.94 | 7.2 | |
| | | | | | | | |

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 8 29 95
Test Portion: Baseline:_____ Treated: X Exhaust Stack Diameter: ___Inches

Engine Make/Model: 5.0 Ford Miles/Hours: 70785 I.D.#: 320
Type of Equipment: Police Car

Fuel Specific Gravity: _____ @:_____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time:_____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 3860 | 125.8 | .02 | 01 | 23 | 696 | 90 | |
| | 126.2 | .02 | 01 | 19 | 691 | 90 | |
| 3930 | 126.6 | .02 | 01 | 25 | 696 | 8.7 | |
| | 127.1 | 02 | 01 | 21 | 708 | 86 | |
| 3965 | 128.6 | .02 | 01 | 22 | 714 | 86 | |
| 3980 | 129 | .02 | 01 | 22 | 712 | 85 | |
| | 129 | .02 | 01 | 18 | 705 | 86 | |
| 3980 | 130.2 | .02 | 01 | 19 | 714 | 84 | |
| | | | | | | | |
| | | | | | | | |

No A/C

End Time_____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Pacy Location: _____ Test Date: 6-13-95
Test Portion: Baseline: x Treated: _____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: 5.0 FORD Miles/Hours: 74276 I.D.#: ~~355~~ 363
Type of Equipment: CROWN VICTORIA

Fuel Specific Gravity: _____ @: _____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 3890 | 118.4 | .02 | .01 | 24 | 7.26 | 8.6 | |
| 3940 | 128.6 | .02 | .01 | 14 | 7.30 | 8.4 | |
| | 133.8 | .02 | .01 | 15 | 725 | 8.4 | |
| | 137.8 | .02 | .01 | 14 | 723 | 8.3 | |
| 3900 | 142.2 | .02 | 01 | 15 | 725 | 8.2 | |
| | 147.0 | .02 | .01 | 17 | 720 | 8.2 | |
| | 150.4 | .02 | .01 | 15 | 723 | 8.1 | |
| 3930 | 154.0 | .02 | 01 | 15 | 7.14 | 8.2 | |
| | | | | | | | |
| | | | | | | | |

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 9-1-95
Test Portion: Baseline:_____ Treated:_____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: 5.0 Ford Miles/Hours: 77282 I.D.#: 363
Type of Equipment: Crown V.I.C

Fuel Specific Gravity: _____ @:_____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time:_____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 3820 | 108.4 | .02 | 01 | 39 | 671 | 104 | |
| | 108.8 | .02 | 01 | 35 | 671 | 104 | |
| 3830 | 109.2 | .02 | 01 | 35 | 667 | 106 | |
| | 109.4 | .02 | 01 | 35 | 669 | 10.5 | |
| 3850 | 1096 | .02 | 01 | 32 | 662 | 106 | |
| | 1098 | .02 | 01 | 32 | 660 | 105 | |
| 3860 | 110. | .02 | 01 | 33 | 662 | 10.7 | |
| | 110.2 | .02 | 00 | 28 | 662 | 10.5 | |
| | | | | | | | |
| | | | | | | | |

End Time_____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 9-1

Test Portion: Baseline:_____ Treated:_____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: 5.0 Ford Miles/Hours: 77248 I.D.#: 361

Type of Equipment: Crown Vic

Fuel Specific Gravity: _____ @:_____ (°F)

Barometric Pressure: _____ Inches of Mercury

Intake Air Temperature: _____ (°F) Start Time: 4:15

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 3960 | 1094 | 02 | 01 | 17 | 712 | 99 | |
| | 1094 | 02 | 01 | 15 | 708 | 99 | |
| 3900 | 1098 | 02 | 01 | 15 | 732 | 96 | |
| | 1102 | 02 | 01 | 13 | 733 | 96 | |
| | 1106 | 02 | 01 | 14 | 725 | 97 | |
| | 1108 | 02 | 01 | 14 | 732 | 95 | |
| 3930 | 1116 | 02 | 01 | 13 | 725 | 95 | |
| | 1120 | 02 | 01 | 14 | 722 | 95 | |
| | | | | | | | |
| | | | | | | | |

End Time_____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: P C.TY Location: _____ Test Date: 6·13
Test Portion: Baseline: _____ Treated: _____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: 5·0 FORD Miles/Hours: 74794 I.D.#: 361
Type of Equipment: CROWN VICTORIA

Fuel Specific Gravity: _____ @: _____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 3950 | 153. | .02 | .01 | 9 | 7.40 | 8.4 | |
| | 157 | .02 | .01 | 9 | 7.36 | 8.2 | |
| | 162.2 | .02 | .01 | 9 | 7.40 | 8.1 | |
| 3960 | 165.1 | .02 | .01 | 9 | 7.36 | 8.2 | |
| | 169.4 | .02 | .01 | 9 | 7.36 | 8.2 | |
| | 169.9 | .02 | .01 | 7 | 7.33 | 8.3 | |
| 3960 | 175.8 | .02 | .01 | 9 | 7.35 | 8.3 | |
| | 178.8 | .02 | .01 | 9 | 7.34 | 8.2 | |
| 3960 | 180.2 | .02 | .01 | 10 | 7.35 | 8.1 | |
| | | | | | | | |

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 9-1
Test Portion: Baseline:_____ Treated:_____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: 5.0 FORD Miles/Hours: 73772 I.D.#: 344
Type of Equipment: CROWN VIC

Fuel Specific Gravity: _____ @:_____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: 405

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 4320 | 106.6 | 02 | 01 | 18 | 676 | 103 | |
| | 105.2 | 02 | 01 | 15 | 660 | 105 | |
| | 1054 | 02 | 01 | 15 | 660 | 105 | |
| 4460 | 107 | 02 | 01 | 10 | 662 | 103 | |
| | 1074 | 02 | 01 | 10 | 669 | 104 | |
| | 108 | 02 | 01 | 10 | 669 | 102 | |
| 4160 | 1086 | 02 | 01 | 13 | 671 | 10.2 | |
| | 109 | 02 | 01 | 12 | 675 | 101 | |
| | | | | | | | |
| | | | | | | | |

End Time_____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: P City Location: _____ Test Date: 6-13-95

Test Portion: Baseline: _____ Treated: _____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: 5.0 FORD Miles/Hours: 70601 I.D.#: 344

Type of Equipment: CROWN VICTORIA

Fuel Specific Gravity: _____ @: _____ (°F)

Barometric Pressure: _____ Inches of Mercury

Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 4100 | 133.4 | .02 | 01 | 18 | 7.09 | 8.9 | |
| | 140.0 | .02 | .01 | 15 | 7.08 | 8.7 | |
| | 147.0 | .02 | .01 | 14 | 697 | 8.6 | |
| 4390 | 156.6 | .02 | .01 | 12 | 698 | 8.5 | |
| | 160.6 | .02 | .01 | 10 | 698 | 8.5 | |
| | 165.5 | .02 | 01 | 10 | 699 | 8.5 | |
| 4450 | 165.4 | .02 | .01 | 10 | 698 | 8.5 | |
| | 1690 | .02 | .01 | 10 | 699 | 8.5 | |
| | 1714 | 02 | 01 | 10 | 698 | 8.5 | |
| | | | | | | | |

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: PROVO CITY Location: PROVO Test Date: 9-1

Test Portion: Baseline:_____ Treated:_____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: 50 FORD Miles/Hours: 68976 I.D.#: 322

Type of Equipment: CROWN

Fuel Specific Gravity: _____ @:_____ (°F)

Barometric Pressure: 30.06 Inches of Mercury

Intake Air Temperature: _____ (°F) Start Time:_____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 3970 | 1130 | 02 | 01 | 12 | 660 | 10.5 | |
| | 115 | 02 | 01 | 10 | 668 | 10.4 | |
| 4030 | 1168 | 02 | 01 | 10 | 670 | 10.2 | |
| | 1174 | 02 | 01 | 10 | 670 | 10.2 | |
| 4090 | 1184 | 02 | 01 | 10 | 681 | 10.3 | |
| | 119 | 02 | 01 | 10 | 676 | 10.2 | |
| 4080 | 1198 | 02 | 01 | 9 | 670 | 10.3 | |
| | 120.4 | 02 | 01 | 9 | 675 | 10.1 | |
| | | | | | | | |
| | | | | | | | |

End Time_____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: P City Location: _____ Test Date: 6-13-95
Test Portion: Baseline: _____ Treated: _____ Exhaust Stack Diameter: 2.5 Inches

Engine Make/Model: 5.0 FORD Miles/Hours: 66653 I.D.#: 322
Type of Equipment: CROWN VICTORIA

Fuel Specific Gravity: _____ @: _____ (°F)
Barometric Pressure: _____ Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 3980 | 161.0 | .02 | .01 | 10 | 7.71 | 8.0 | |
| | 165.0 | .02 | .01 | 10 | 7.73 | 7.9 | |
| | 168.8 | .02 | .01 | 10 | 7.67 | 7.9 | |
| 4200 | 174.4 | .02 | .01 | 9 | 7.59 | 8.0 | |
| | 177.0 | .02 | .01 | 9 | 7.60 | 7.9 | |
| | 181.4 | .02 | .01 | 8 | 7.62 | 7.9 | |
| 4170 | 184.2 | .02 | .01 | 9 | 762 | 7.9 | |
| [illegible] | 188.0 | .02 | .01 | 9 | 7.62 | 7.8 | |
| 4165 | 191.4 | .02 | .01 | 9 | 756 | 7.8 | |
| | | | | | | | |

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: Provo City Location: Provo Test Date: 9-1-95
Test Portion: Baseline:_____ Treated:_____ Exhaust Stack Diameter: ___Inches

Engine Make/Model: 5.0 Ford Miles/Hours: 61304 I.D.#: 319
Type of Equipment: Crown Vic

Fuel Specific Gravity: _____ @:_____ (°F)
Barometric Pressure: 30.04 Inches of Mercury
Intake Air Temperature: _____ (°F) Start Time:_____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 4450 | 117.6 | .02 | 61 | 15 | 636 | 10.5 | |
| | 117.6 | .02 | 01 | 15 | 634 | 10.5 | |
| 4500 | 118.6 | .02 | 01 | 15 | 631 | 110 | |
| | 117.6 | .02 | 01 | 12 | 640 | 109 | |
| 4530 | 117.2 | 02 | 01 | 17 | 642 | 10.8 | |
| | 1172 | .02 | 01 | 17 | 642 | 108 | |
| 4530 | 1174 | .02 | 01 | 15 | 642 | 109 | |
| | 1176 | 02 | 01 | 15 | 642 | 10.8 | |
| | | | | | | | |
| | | | | | | | |

End Time_____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# Carbon Mass Balance Field Data Form

Company: PCIT4 Location: _____ Test Date: 6-13-95

Test Portion: Baseline: X Treated: _____ Exhaust Stack Diameter: 2.5 Inches

Engine Make/Model: 5.0L Ford Miles/Hours: 58,445 I.D.#: 319

Type of Equipment: Crown Victoria (1991)

Fuel Specific Gravity: _____ @: _____ (°F)

Barometric Pressure: _____ Inches of Mercury

Intake Air Temperature: _____ (°F) Start Time: _____

| RPM | Exhaust Temp °F | P Inches of $H_2O$ | % CO | HC ppm | % $CO_2$ | % $O_2$ | Smoke Number |
|---|---|---|---|---|---|---|---|
| 4500 ON | 173.2 | .06 | .01 | 15 | 7.17 | 11.2 | |
| Accelerate | 172.6 | .05 | .01 | 14 | 7.17 | 11.2 | |
| | 172.3 | .06 | .01 | 15 | 7.17 | 11.2 | |
| 4400 | 173.0 | .06 | .01 | 15 | 7.15 | 11.2 | |
| | 173.4 | .06 | .01 | 15 | 7.15 | 11.2 | |
| | 173.2 | .06 | .01 | 14 | 7.12 | 11.1 | |
| 4400 | 172.6 | .66 | .01 | 14 | 7.10 | 11.2 | |
| | 172.4 | .06 | .01 | 14 | 7.23 | 11.1 | |
| 4400 | 172.4 | .06 | 01 | 10 | 7.24 | 11.1 | |
| | | | | | | | |

Passenger side exh. AC on

End Time _____

**Names of Customer Personnel Participating in Test:**

_____ _____

**Signature of Technicians:**

# APPENDIX 3

## TABLE I - DIESEL

| UNIT # | ENGINE TYPE | BASE Pf | FPC Pf | %CHG |
|---|---|---|---|---|
| 814 | L-10 Cummins | 356,369 | 388,000 | 8.88 |
| *812 | L-10 Cummins | 570,376 | 521,256 | -8.72 |
| 810 | L-10 Cummins | 557,758 | 606,949 | 7.62 |
| 731 | CAT 3208T | 820,525 | 857,568 | 5.64 |
| 730 | CAT 3208T | 545,391 | 584,443 | 7.42 |
| 153 | CAT 3208T | 875,311 | 943,823 | 7.57 |
| 33 | CAT 3208T | 420,452 | 446,563 | 6.72 |
| 18 | Int'l 466 DT | 432,036 | 477,252 | 10.60 |
| | | | **AVG:** | **7.78%** |

* Could not reproduce rpm, and not included in average

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

## TABLE II - GASOLINE

| UNIT # | ENGINE TYPE | BASE Pf | FPC Pf | %CHG |
|---|---|---|---|---|
| *379 | Ford Explorer | 937,059 | 1,130,113 | 20.60 |
| 363 | 5.0 Ford | 2,647,231 | 2,878,860 | 8.75 |
| 361 | 5.0 Ford | 2,666,345 | 2,721,627 | 2.07 |
| 344 | 5.0 Ford | 2,771,458 | 2,918,217 | 5.30 |
| 342 | 5.0 Ford | 2,623,919 | 2,911,233 | 10.95 |
| +331 | 5.0 Ford | 2,761,355 | 3,237,734 | 17.25 |
| 322 | 5.0 Ford | 2,591,442 | 2,948,360 | 13.77 |
| 320 | 5.0 Ford | 2,466,946 | 2,696,101 | 9.29 |
| >319 | 5.0 Ford | 1,604,654 | 3,082,871 | 92.12 |
| | | | **AVG:** | **8.35%** |

* Inconsistent CO2 Data **
\+ Statistical Outlier **
\> Radical Drop in Pressure Velocity **
** Not included in average
NOTE: A positive change in PF equates to a reduction in fuel consumption.

## TABLE III - CARBON MONOXIDE

| UNIT # | ENGINE TYPE | BASE CO | FPC CO | |
|---|---|---|---|---|
| 814 | L-10 Cummins | .010 | .014 | |
| *812 | L-10 Cummins | .020 | .020 | |
| 810 | L-10 Cummins | .020 | .021 | |
| 731 | CAT 3208T | .040 | .036 | |
| 730 | CAT 3208T | .040 | .040 | |
| 153 | CAT 3208T | .060 | .060 | |
| 33 | CAT 3208T | .050 | .040 | |
| 18 | Int'l 466 DT | .050 | .040 | |
| 379 | Ford Explorer | .029 | .021 | |
| 342 | 5.0 Ford | .010 | .010 | |
| 331 | 5.0 Ford | .031 | .010 | |
| 320 | 5.0 Ford | .023 | .010 | |
| 363 | 5.0 Ford | .010 | .010 | |
| 361 | 5.0 Ford | .010 | .010 | |
| 344 | 5.0 Ford | .010 | .010 | |
| 322 | 5.0 Ford | .010 | .010 | |
| 319 | 5.0 Ford | .010 | .010 | |
| | | | | **%CHG** |
| | **AVERAGE** | **.0255** | **.0219** | **-14.2%** |

* Could not reproduce rpm, and not included in average

## TABLE IV - SMOKE SPOT NUMBERS (EXHAUST SMOKE DENSITY)

| UNIT # | ENGINE TYPE | BASE SS | FPC SS | %CHG |
|---|---|---|---|---|
| 18 | Int'l 466 DT | 4.0 | 4.0 | 00 |
| 33 | CAT 3208T | 5.0 | 4.0 | -20 |
| 731 | CAT 3208T | 3.5 | 3.0 | -14 |
| 814 | L-10 Cummins | 6.0 | 5.0 | -17 |
| 810 | L-10 Cummins | 5.5 | 4.0 | -27 |
| 730 | CAT 3208T | 4.5 | 4.0 | -11 |
| *812 | L-10 Cummins | 4.5 | 5.0 | 11 |
| 153 | CAT 3208T | 2.5 | 1.5 | -40 |
| | | | **AVG:** | **-18.4** |

* Could not reproduce rpm, and not included in average

# APPENDIX 4

Item: 26 Code: CUT

4PM Fri 1 September UTAH this hour — TODAY'S DATA

| TOWN | WEATHER | TEMP | WIND | FLSLK | VIS | HUM | BRMTR | HI | LOW | PCPN |
|---|---|---|---|---|---|---|---|---|---|---|
| Wendover | no report | 91 | E 8 | 91 | 10 | 17% | 29.98f | 91 | 63 | |
| Lakeside | ..... | | | | | | | | | |
| Clover | ..... | | | | | | | | | |
| Logan AP | ..... | | | | | | | | | |
| Logan 2NW | dry | 87 | NE 3G11 | 90 | | 29% | 30.03f | 90 | 51 | |
| Randolph | ..... | | | | | | | | | |
| Garland | ..... | | | | | | | | | |
| Perry | ..... | | | | | | | | | |
| Brigham City | ..... | | | | | | | | | |
| Ogden | mstly cldy | 96 | CALM | 96 | 20 | 17% | 30.01f | 96 | 69 | |
| Hill AFB | dry | 91 | SW 3 | 92 | 50 | 22% | 30.08s | 91 | 69 | |
| Clearfield | ..... | | | | | | | | | |
| Kaysville | no report | 96 | NW 3G7 | 96 | | 12% | | 98 | 60 | |
| Farmington | ..... | | | | | | | | | |
| W Bountiful | mstly cldy | 69 | S 6 | 70 | 10 | 53% | 29.99f | 71 | 42 | |
| Bountiful | ..... | | | | | | | | | |
| Salt Lake City | mstly cldy | 92 | S 18G25 | 95 | 25 | 25% | 30.01s | 98 | 68 | |
| Magna | ..... | | | | | | | | | |
| Herriman | ..... | | | | | | | | | |
| Olympus Cove | dry | 90 | | | | | | 90 | 74 | |
| Pt of Mountain | dry | 95 | S 9G18 | 99 | | 24% | | 99 | 74 | |
| Solitude | ..... | | | | | | | | | |
| Alta 10500 ft | ..... | | | | | | | | | |
| Alta 9500 ft | ..... | | | | | | | | | |
| SnwBrd 11000' | ..... | | | | | | | | | |
| SnwBrd 9200' | ..... | | | | | | | | | |
| Park City | ..... | | | | | | | | | |
| Jupiter Peak | ..... | | | | | | | | | |
| Provo | ptly cldy | 85 | SE 11 | 89 | 10 | 32% | 30.06r | 94 | 60 | |
| Santaquin | ..... | | | | | | | | | |
| Dugway | ..... | | | | | | | | | |
| Delta | ..... | | | | | | | | | |
| Milford | ..... | | | | | | | | | |
| Cedar City | rain shwr | 70 | W 11 | 70 | 30 | 59% | 30.24s | 87 | 60 | |
| Bryce Canyon | mstly cldy | 78 | W 8 | 80 | 30 | 35% | | 78 | 49 | |
| St George AP | no report | 90 | E 7 | 94 | 10 | 28% | 29.99f | 94 | 77 | |
| Zion Ntl Park | ..... | | | | | | | | | |
| Clay Basin | ..... | | | | | | | | | |
| Flaming Gorge | ..... | | | | | | | | | |
| Myton | ..... | | | | | | | | | |
| Vernal | mstly cldy | 86 | CALM | 86 | 40 | 24% | 30.11f | 86 | 51 | |
| Price | ..... | | | | | | | | | |
| Moab | ..... | | | | | | | | | |
| La Sal | ..... | | | | | | | | | |
| Canyonlands | ..... | | | | | | | | | |
| Green River | ..... | | | | | | | | | |
| Hanksville | mstly cldy | 90 | NW 6 | 92 | 60 | 24% | 30.10f | | 58 | |
| Bullfrog | ..... | | | | | | | | | |
| Lake Powell | no report | 96 | N 5G11 | 96 | | 17% | 30.05f | 97 | 76 | |
| Blanding | ..... | | | | | | | | | |

Item: 26 Code: CUT

3PM Fri 1 September UTAH this hour

| TOWN | WEATHER | TEMP | WIND | FLSLK | VIS | HUM | BRMTR | TODAY'S DATA HI | LOW | PCPN |
|---|---|---|---|---|---|---|---|---|---|---|
| Wendover | no report | 90 | E 9 | 90 | 10 | 17% | 30.01f | 90 | 63 | |
| Lakeside | ..... | | | | | | | | | |
| Clover | ..... | | | | | | | | | |
| Logan AP | ..... | | | | | | | | | |
| Logan 2NW | dry | 87 | NE 3G11 | 90 | | 29% | 30.03f | 90 | 51 | |
| Randolph | ..... | | | | | | | | | |
| Garland | ..... | | | | | | | | | |
| Perry | ..... | | | | | | | | | |
| Brigham City | ..... | | | | | | | | | |
| Ogden | mstly cldy | 93 | S 6 | 94 | 20 | 21% | 30.03f | 93 | 69 | |
| Hill AFB | mstly cldy | 91 | SW 3 | 92 | 50 | 22% | 30.08f | 91 | 69 | |
| Clearfield | ..... | | | | | | | | | |
| Kaysville | ..... | | | | | | | | | |
| Farmington | ..... | | | | | | | | | |
| W Bountiful | ptly cldy | 71 | S 10 | 74 | 10 | 48% | 30.02f | 71 | 42 | |
| Bountiful | ..... | | | | | | | | | |
| Salt Lake City | mstly cldy | 98 | SE 9 | 101 | 25 | 20% | 30.01f | 98 | 68 | |
| Magna | ..... | | | | | | | | | |
| Herriman | ..... | | | | | | | | | |
| Olympus Cove | dry | 90 | | | | | | 90 | 74 | |
| Pt of Mountain | dry | 97 | SE 2G9 | 102 | | 24% | | 99 | 74 | |
| Solitude | ..... | | | | | | | | | |
| Alta 10500 ft | ..... | | | | | | | | | |
| Alta 9500 ft | ..... | | | | | | | | | |
| SnwBrd 11000' | ..... | | | | | | | | | |
| SnwBrd 9200' | ..... | | | | | | | | | |
| Park City | ..... | | | | | | | | | |
| Jupiter Peak | ..... | | | | | | | | | |
| Provo | no report | 91 | SE 11 | 95 | 10 | 26% | 30.05f | 94 | 60 | |
| Santaquin | ..... | | | | | | | | | |
| Dugway | ..... | | | | | | | | | |
| Delta | ..... | | | | | | | | | |
| Milford | ..... | | | | | | | | | |
| Cedar City | cloudy | 87 | E 9 | 89 | 50 | 26% | 30.19s | 87 | 60 | |
| Bryce Canyon | ptly cldy | 76 | NE 17 | 78 | 30 | 37% | | 76 | 49 | |
| St George AP | ptly cldy | 85 | NW 9 | 92 | 10 | 40% | 30.01f | 94 | 77 | |
| Zion Ntl Park | ..... | | | | | | | | | |
| Clay Basin | ..... | | | | | | | | | |
| Flaming Gorge | ..... | | | | | | | | | |
| Myton | ..... | | | | | | | | | |
| Vernal | mstly cldy | 86 | CALM | 86 | 40 | 24% | 30.11f | 86 | 51 | |
| Price | ..... | | | | | | | | | |
| Moab | ..... | | | | | | | | | |
| La Sal | ..... | | | | | | | | | |
| Canyonlands | ..... | | | | | | | | | |
| Green River | ..... | | | | | | | | | |
| Hanksville | mstly cldy | 90 | NW 6 | 92 | 60 | 24% | 30.10f | | 58 | |
| Bullfrog | ..... | | | | | | | | | |
| Lake Powell | no report | 97 | NE 8G13 | 98 | | 16% | 30.07f | 97 | 76 | |
| Blanding | ..... | | | | | | | | | |

Item: 26 Code: CUT

2PM Tue 29 August — UTAH this hour — TODAY'S DATA

| TOWN | WEATHER | TEMP | WIND | FLSLK | VIS | HUM | BRMTR | HI | LOW | PCPN |
|---|---|---|---|---|---|---|---|---|---|---|
| Wendover | no report | 88 | NE 11G20 | 87 | 10 | 11% | 30.02f | 88 | 65 | |
| Lakeside | ..... | | | | | | | | | |
| Clover | ..... | | | | | | | | | |
| Logan AP | ..... | | | | | | | | | |
| Logan 2NW | dry | 83 | E 13G23 | 85 | | 30% | 30.03s | 84 | 47 | |
| Randolph | ..... | | | | | | | | | |
| Garland | ..... | | | | | | | | | |
| Perry | ..... | | | | | | | | | |
| Brigham City | ..... | | | | | | | | | |
| Ogden | clear | 87 | SW 10 | 86 | 30 | 18% | 30.05f | 87 | 66 | |
| Hill AFB | ptly cldy | 86 | NW 16 | 92 | 50 | 36% | 30.10s | 86 | 68 | |
| Clearfield | ..... | | | | | | | | | |
| Kaysville | no report | 87 | NW 6G15 | 87 | | 16% | | 88 | 70 | |
| Farmington | ..... | | | | | | | | | |
| W Bountiful | no report | 68 | E 11G21 | 69 | 10 | 71% | 30.08f | 68 | 54 | |
| Bountiful | ..... | | | | | | | | | |
| Salt Lake City | ptly cldy | 92 | NW 13 | 92 | 35 | 16% | 30.04s | 92 | 68 | |
| Magna | ..... | | | | | | | | | |
| Herriman | ..... | | | | | | | | | |
| Olympus Cove | dry | 85 | | | | | | 85 | 69 | |
| Pt of Mountain | dry | 89 | SE 9G21 | 91 | | 24% | | 91 | 73 | |
| Solitude | ..... | | | | | | | | | |
| Alta 10500 ft | ..... | | | | | | | | | |
| Alta 9500 ft | ..... | | | | | | | | | |
| SnwBrd 11000' | ..... | | | | | | | | | |
| SnwBrd 9200' | ..... | | | | | | | | | |
| Park City | ..... | | | | | | | | | |
| Jupiter Peak | ..... | | | | | | | | | |
| Provo | no report | 86 | SW 10 | 90 | 10 | 31% | 30.07s | 87 | 57 | |
| Santaquin | ..... | | | | | | | | | |
| Dugway | clear | 94 | W 6G16 | 94 | 50 | 9% | 30.04f | 94 | 58 | |
| Delta | ptly cldy | 88 | SW 11 | 89 | 50 | 23% | | | 55 | |
| Milford | ..... | | | | | | | | | |
| Cedar City | clear | 88 | S 21 | 87 | 60 | 18% | 30.18f | 88 | 61 | |
| Bryce Canyon | clear | 78 | W 11G21 | 75 | 30 | 25% | | 78 | 43 | |
| St George AP | no report | 100 | W 32G38 | 105 | 10 | 12% | 29.94f | 100 | 72 | |
| Zion Ntl Park | ..... | | | | | | | | | |
| Clay Basin | ..... | | | | | | | | | |
| Flaming Gorge | ..... | | | | | | | | | |
| Myton | ..... | | | | | | | | | |
| Vernal | ptly cldy | 85 | W 9 | 84 | 40 | 23% | 30.07f | 85 | 54 | |
| Price | ..... | | | | | | | | | |
| Moab | ..... | | | | | | | | | |
| La Sal | ..... | | | | | | | | | |
| Canyonlands | ..... | | | | | | | | | |
| Green River | ..... | | | | | | | | | |
| Hanksville | ..... | | | | | | | | | |
| Bullfrog | ..... | | | | | | | | | |
| Lake Powell | no report | 92 | NE 13G14 | 92 | | 16% | 30.10f | 92 | 70 | |
| Blanding | ..... | | | | | | | | | |

Item: 27 Code: CUT

1PM Tue 29 August — UTAH this hour — TODAY'S DATA

| TOWN | WEATHER | TEMP | WIND | FLSLK | VIS | HUM | BRMTR | HI | LOW | PCPN |
|---|---|---|---|---|---|---|---|---|---|---|
| Wendover | no report | 86 | NE 7 | 85 | 10 | 11% | 30.03f | 86 | 65 | |
| Lakeside | ..... | | | | | | | | | |
| Clover | ..... | | | | | | | | | |
| Logan AP | ..... | | | | | | | | | |
| Logan 2NW | dry | 83 | E 13G23 | 85 | | 30% | 30.03s | 84 | 47 | |
| Randolph | ..... | | | | | | | | | |
| Garland | ..... | | | | | | | | | |
| Perry | ..... | | | | | | | | | |
| Brigham City | ..... | | | | | | | | | |
| Ogden | clear | 87 | SW 10 | 86 | 30 | 18% | 30.05f | 87 | 66 | |
| Hill AFB | ptly cldy | 86 | NW 16 | 92 | 50 | 36% | 30.10s | 86 | 68 | |
| Clearfield | ..... | | | | | | | | | |
| Kaysville | no report | 87 | NW 6G15 | 87 | | 16% | | 88 | 70 | |
| Farmington | ..... | | | | | | | | | |
| W Bountiful | no report | 67 | E 11G20 | 67 | 10 | 70% | 30.09f | 68 | 54 | |
| Bountiful | ..... | | | | | | | | | |
| Salt Lake City | ptly cldy | 92 | NW 13 | 92 | 35 | 16% | 30.04s | 92 | 68 | |
| Magna | ..... | | | | | | | | | |
| Herriman | ..... | | | | | | | | | |
| Olympus Cove | dry | 85 | | | | | | 85 | 69 | |
| Pt of Mountain | dry | 89 | SE 9G21 | 91 | | 24% | | 91 | 73 | |
| Solitude | ..... | | | | | | | | | |
| Alta 10500 ft | ..... | | | | | | | | | |
| Alta 9500 ft | ..... | | | | | | | | | |
| SnwBrd 11000' | ..... | | | | | | | | | |
| SnwBrd 9200' | ..... | | | | | | | | | |
| Park City | ..... | | | | | | | | | |
| Jupiter Peak | ..... | | | | | | | | | |
| Provo | no report | 87 | SW 14 | 91 | 10 | 30% | 30.07f | 87 | 57 | |
| Santaquin | ..... | | | | | | | | | |
| Dugway | clear | 94 | W 6G16 | 94 | 50 | 9% | 30.04f | 94 | 58 | |
| Delta | ptly cldy | 88 | SW 11 | 89 | 50 | 23% | | | 55 | |
| Milford | ..... | | | | | | | | | |
| Cedar City | clear | 88 | S 21 | 87 | 60 | 18% | 30.18f | 88 | 61 | |
| Bryce Canyon | clear | 78 | W 11G21 | 75 | 30 | 25% | | 78 | 43 | |
| St George AP | no report | 100 | W 13G22 | 103 | 10 | 14% | 29.96f | 100 | 72 | |
| Zion Ntl Park | ..... | | | | | | | | | |
| Clay Basin | ..... | | | | | | | | | |
| Flaming Gorge | ..... | | | | | | | | | |
| Myton | ..... | | | | | | | | | |
| Vernal | ptly cldy | 85 | W 9 | 84 | 40 | 23% | 30.07f | 85 | 54 | |
| Price | ..... | | | | | | | | | |
| Moab | ..... | | | | | | | | | |
| La Sal | ..... | | | | | | | | | |
| Canyonlands | ..... | | | | | | | | | |
| Green River | ..... | | | | | | | | | |
| Hanksville | ..... | | | | | | | | | |
| Bullfrog | ..... | | | | | | | | | |
| Lake Powell | no report | 92 | NE 13G14 | 92 | | 16% | 30.10f | 92 | 70 | |
| Blanding | ..... | | | | | | | | | |

**********

Item: 27 Code: CUT

4PM Mon 28 August — UTAH this hour — TODAY'S DATA

| TOWN | WEATHER | TEMP | WIND | FLSLK | VIS | HUM | BRMTR | HI | LOW | PCPN |
|---|---|---|---|---|---|---|---|---|---|---|
| Wendover | no report | 90 | E 20G26 | 89 | 10 | 13% | 29.97f | 90 | 62 | |
| Lakeside | ..... | | | | | | | | | |
| Clover | ..... | | | | | | | | | |
| Logan AP | ptly cldy | 90 | S 17 | 89 | 40 | 16% | 30.00f | | | |
| Logan 2NW | ..... | | | | | | | | | |
| Randolph | ..... | | | | | | | | | |
| Garland | ..... | | | | | | | | | |
| Perry | ..... | | | | | | | | | |
| Brigham City | ..... | | | | | | | | | |
| Ogden | ptly cldy | 92 | S 11 | 92 | 25 | 16% | 30.00f | 92 | 63 | |
| Hill AFB | ptly cldy | 90 | S 11 | 94 | 60 | 27% | 30.06f | 90 | 64 | |
| Clearfield | ..... | | | | | | | | | |
| Kaysville | ..... | | | | | | | | | |
| Farmington | ..... | | | | | | | | | |
| W Bountiful | no report | 77 | CALM | 87 | 10 | 62% | 30.01r | 80 | 61 | |
| Bountiful | ..... | | | | | | | | | |
| Salt Lake City | ptly cldy | 93 | S 16 | 94 | 15 | 18% | 30.00f | 93 | 68 | |
| Magna | ..... | | | | | | | | | |
| Herriman | ..... | | | | | | | | | |
| Olympus Cove | dry | 88 | | | | | | 88 | 69 | |
| Pt of Mountain | dry | 91 | SE 8G21 | 94 | | 25% | | 92 | 72 | |
| Solitude | ..... | | | | | | | | | |
| Alta 10500 ft | ..... | | | | | | | | | |
| Alta 9500 ft | ..... | | | | | | | | | |
| SnwBrd 11000' | ..... | | | | | | | | | |
| SnwBrd 9200' | ..... | | | | | | | | | |
| Park City | ..... | | | | | | | | | |
| Jupiter Peak | ..... | | | | | | | | | |
| Provo | no report | 88 | E 3 | 88 | 10 | 20% | 30.05f | 88 | 56 | |
| Santaquin | ..... | | | | | | | | | |
| Dugway | clear | 95 | S 16G30 | 96 | 50 | 9% | 29.99s | 95 | 51 | 0.15 |
| Delta | ..... | | | | | | | | | |
| Milford | ..... | | | | | | | | | |
| Cedar City | clear | 87 | S 14 | 86 | 60 | 17% | 30.16f | 87 | 61 | |
| Bryce Canyon | ..... | | | | | | | | | |
| St George AP | no report | 99 | W 15G23 | 102 | 10 | 13% | 29.95f | 99 | 72 | |
| Zion Ntl Park | ..... | | | | | | | | | |
| Clay Basin | ..... | | | | | | | | | |
| Flaming Gorge | ..... | | | | | | | | | |
| Myton | ..... | | | | | | | | | |
| Vernal | ..... | | | | | | | | | |
| Price | ..... | | | | | | | | | |
| Moab | ..... | | | | | | | | | |
| La Sal | ..... | | | | | | | | | |
| Canyonlands | ..... | | | | | | | | | |
| Green River | ptly cldy | 90 | S 5 | 95 | 50 | 31% | | | 62 | |
| Hanksville | ..... | | | | | | | | | |
| Bullfrog | ..... | | | | | | | | | |
| Lake Powell | no report | 92 | NE 8G15 | 92 | | 16% | 30.07f | 92 | 70 | |
| Blanding | mstly cldy | 83 | SW 11 | 88 | 50 | 38% | | | 59 | |

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Item: 27 Code: CUT

2PM Mon 28 August — UTAH this hour — TODAY'S DATA

| TOWN | WEATHER | TEMP | WIND | FLSLK | VIS | HUM | BRMTR | HI | LOW | PCPN |
|---|---|---|---|---|---|---|---|---|---|---|
| Wendover | no report | 90 | E 20G26 | 89 | 10 | 13% | 29.97f | 90 | 62 | |
| Lakeside | ..... | | | | | | | | | |
| Clover | ..... | | | | | | | | | |
| Logan AP | ..... | | | | | | | | | |
| Logan 2NW | ..... | | | | | | | | | |
| Randolph | ..... | | | | | | | | | |
| Garland | ..... | | | | | | | | | |
| Perry | ..... | | | | | | | | | |
| Brigham City | ..... | | | | | | | | | |
| Ogden | ptly cldy | 92 | S 11 | 92 | 25 | 16% | 30.02f | 92 | 63 | |
| Hill AFB | ptly cldy | 90 | S 16 | 98 | 60 | 35% | 30.07s | 90 | 64 | |
| Clearfield | ..... | | | | | | | | | |
| Kaysville | ..... | | | | | | | | | |
| Farmington | ..... | | | | | | | | | |
| W Bountiful | no report | 80 | N 5 | 89 | 10 | 52% | 30.00s | 80 | 61 | |
| Bountiful | ..... | | | | | | | | | |
| Salt Lake City | ptly cldy | 91 | SE 17 | 91 | 15 | 19% | 30.02f | 93 | 68 | |
| Magna | ..... | | | | | | | | | |
| Herriman | ..... | | | | | | | | | |
| Olympus Cove | ..... | | | | | | | | | |
| Pt of Mountain | dry | 91 | SE 9G20 | 94 | | 25% | | 92 | 72 | |
| Solitude | ..... | | | | | | | | | |
| Alta 10500 ft | ..... | | | | | | | | | |
| Alta 9500 ft | ..... | | | | | | | | | |
| SnwBrd 11000' | ..... | | | | | | | | | |
| SnwBrd 9200' | ..... | | | | | | | | | |
| Park City | ..... | | | | | | | | | |
| Jupiter Peak | ..... | | | | | | | | | |
| Provo | no report | 88 | E 3 | 88 | 10 | 20% | 30.05f | 88 | 56 | |
| Santaquin | ..... | | | | | | | | | |
| Dugway | mod rain | 94 | SW 16G30 | 95 | 50 | 9% | 30.02s | 94 | 51 | 0.15 |
| Delta | ..... | | | | | | | | | |
| Milford | ..... | | | | | | | | | |
| Cedar City | ptly cldy | 86 | SW 15 | 84 | 40 | 18% | 30.18f | 86 | 61 | |
| Bryce Canyon | ..... | | | | | | | | | |
| St George AP | no report | 99 | W 15G23 | 102 | 10 | 13% | 29.95f | 99 | 72 | |
| Zion Ntl Park | ..... | | | | | | | | | |
| Clay Basin | ..... | | | | | | | | | |
| Flaming Gorge | ..... | | | | | | | | | |
| Myton | ..... | | | | | | | | | |
| Vernal | ..... | | | | | | | | | |
| Price | ..... | | | | | | | | | |
| Moab | ..... | | | | | | | | | |
| La Sal | ..... | | | | | | | | | |
| Canyonlands | ..... | | | | | | | | | |
| Green River | ptly cldy | 90 | S 5 | 95 | 50 | 31% | | | 62 | |
| Hanksville | ..... | | | | | | | | | |
| Bullfrog | ..... | | | | | | | | | |
| Lake Powell | no report | 92 | NE 2G9 | 92 | | 16% | 30.08f | 92 | 70 | |
| Blanding | mstly cldy | 83 | SW 11 | 88 | 50 | 38% | | | 59 | |

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Item: 27 Code: CUT

5PM Mon 28 August — UTAH this hour — TODAY'S DATA

| TOWN | WEATHER | TEMP | WIND | FLSLK | VIS | HUM | BRMTR | HI | LOW | PCPN |
|---|---|---|---|---|---|---|---|---|---|---|
| Wendover | no report | 91 | SE 18 | 91 | 10 | 13% | 29.94f | 91 | 62 | |
| Lakeside | ..... | | | | | | | | | |
| Clover | ..... | | | | | | | | | |
| Logan AP | ptly cldy | 89 | S 17 | 92 | 40 | 26% | 29.98f | | | |
| Logan 2NW | dry | 87 | E 14G25 | 86 | | 23% | 30.00fr | 88 | 44 | |
| Randolph | ..... | | | | | | | | | |
| Garland | ..... | | | | | | | | | |
| Perry | ..... | | | | | | | | | |
| Brigham City | ..... | | | | | | | | | |
| Ogden | ptly cldy | 92 | S 11 | 92 | 25 | 16% | 29.98f | 92 | 63 | |
| Hill AFB | ptly cldy | 89 | S 9 | 91 | 60 | 24% | 30.04f | 90 | 64 | |
| Clearfield | ..... | | | | | | | | | |
| Kaysville | no report | 88 | SW 6G13 | 88 | | 13% | | 91 | 59 | |
| Farmington | ..... | | | | | | | | | |
| W Bountiful | no report | 78 | CALM | 89 | 10 | 62% | 30.01s | 80 | 61 | |
| Bountiful | ..... | | | | | | | | | |
| Salt Lake City | ptly cldy | 92 | S 16 | 92 | 15 | 19% | 29.97f | 93 | 68 | |
| Magna | ..... | | | | | | | | | |
| Herriman | ..... | | | | | | | | | |
| Olympus Cove | dry | 87 | | | | | | 88 | 69 | |
| Pt of Mountain | dry | 91 | SE 10G21 | 94 | | 25% | | 92 | 72 | |
| Solitude | ..... | | | | | | | | | |
| Alta 10500 ft | ..... | | | | | | | | | |
| Alta 9500 ft | ..... | | | | | | | | | |
| SnwBrd 11000' | ..... | | | | | | | | | |
| SnwBrd 9200' | ..... | | | | | | | | | |
| Park City | ..... | | | | | | | | | |
| Jupiter Peak | ..... | | | | | | | | | |
| Provo | no report | 89 | SW 3 | 89 | 10 | 21% | 30.02f | 89 | 56 | |
| Santaquin | ..... | | | | | | | | | |
| Dugway | clear | 95 | SW 9 | 96 | 50 | 9% | 29.98f | 95 | 51 | 0.15 |
| Delta | clear | 82 | S 9 | 84 | 50 | 32% | | | | |
| Milford | ..... | | | | | | | | | |
| Cedar City | clear | 88 | SW 16G24 | 87 | 60 | 17% | 30.14f | 88 | 61 | |
| Bryce Canyon | ..... | | | | | | | | | |
| St George AP | no report | 101 | SW 16G23 | 104 | 10 | 13% | 29.93f | 101 | 72 | |
| Zion Ntl Park | ..... | | | | | | | | | |
| Clay Basin | ..... | | | | | | | | | |
| Flaming Gorge | ..... | | | | | | | | | |
| Myton | ..... | | | | | | | | | |
| Vernal | ptly cldy | 88 | S 9 | 92 | 40 | 29% | 30.04fr | 88 | 58 | |
| Price | ..... | | | | | | | | | |
| Moab | ..... | | | | | | | | | |
| La Sal | ..... | | | | | | | | | |
| Canyonlands | ..... | | | | | | | | | |
| Green River | ptly cldy | 90 | S 5 | 95 | 50 | 31% | | | 62 | |
| Hanksville | ..... | | | | | | | | | |
| Bullfrog | ..... | | | | | | | | | |
| Lake Powell | no report | 93 | N 8G15 | 93 | | 15% | 30.05s | 94 | 70 | |
| Blanding | mstly cldy | 83 | SW 11 | 88 | 50 | 38% | | | 59 | |

**APPENDIX 5**

# 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 $H_20$ |
| $P_B$ | = | Barometric pressure in inches of mercury |
| Te | = | Exhaust temperature $^oF$ |
| 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 or pf2 =

$$\frac{3099.6 \times Mwt}{86(VFHC)+13.89(VFCO)+13.89(VFCO_2)}$$

CFM =

$$\frac{(d/2)^2\pi}{144}\left(1096.2\sqrt{\frac{Pv}{1.325(PB/ET+460)}}\right)$$

PF1 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)**

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

d = Exhaust stack diameter in inches
Pv = Velocity pressure in inches of $H_20$
$P_B$ = Barometric pressure in inches of mercury
Te = Exhaust temperature $^oF$

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

CFM = 2358.37

**Equation 5 (Corrected Performance Factor)**

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

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)**

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

Mwt2 $= 28.980$

**Equation 3 (Calculated Performance Factor)**

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

pf2 $\doteq 349{,}927$

**Equation 4 (CFM Calculations)**

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

d = Exhaust stack diameter in inches
Pv = Velocity pressure in inches of $H_20$
$P_B$ = Barometric pressure in inches of mercury
Te = Exhaust temperature $^oF$

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

CFM = 2320.51

**Equation 5 (Corrected Performance Factor)**

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

$= 115{,}966$

**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:)**

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

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

= +7.65

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

**APPENDIX 6**