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Pacific Power • Utah Power

PLEASE REFER TO FILE NO.

INTERNAL CORRESPONDENCE

DATE: *October 4, 1990*

TO: *See Distribution List*

FROM: *George E. Baucom* GEB
Manager/Transportation Field & Services

SUBJECT: ***USE OF FPC-1 IN ALL PACIFICORP TRANSPORTATION OPERATIONS***

Dr. Rand Thurgood and Mr. Scott Hassett of Utah Power and Light research and development under my direction have reviewed and successfully tested FPC-1, a fuel performance catalyst. The testing began on January 25, 1990 and continued until May 3, 1990. Test results indicated an average of 8.9% fuel savings in the vehicles tested with a 6% - 7% net cost savings for the Company.

Besides the fuel economy enhancements and other engine maintenance improvements the following is a summary of the environmental benefits derived from the catalyst in treatment of both diesel and gasoline fuels:

Carbon Monoxide Reductions

1. *Tests at two EPA recognized independent laboratories document FPC-1 reduced the emissions of carbon monoxide (CO) up to 48% in gasoline engines. A battery of eight separate tests done at these two EPA category 1 labs show FPC-1 fuel treatment reduces emissions an average of 18.7%.*

2. *The test done by Utah Power and Light at a local university verified carbon monoxide reductions of 17% and 9% respectively, at low and high speed engine cycles.*

3. *Field testing done by Utah Power and Light engineers document a 36% reduction in company emissions in a fleet of diesel power utility trucks operating in Ogden, Utah.*

Smoke Reductions

1. *Field studies conducted by fuel technology international using the Bacharach and Bosch Smokemeters document smoke reductions of up to 30%.*

Unburned Hydrocarbons

1. *EPA lab testing shows an average reduction in unburned hydrocarbons emissions of 7.3%.*

Reports and other documentation of the above are available upon request.

We have determined that FPC-1 provides very direct environmental and financial benefits for the Company. We recommend its use in your fuel, and plan to use this product in Transportation Central in Salt Lake. Representatives of UHI Corporation, (The products manufacturer), and Energy Group Inc. (their marketing organization) will be contacting you to set up a program of implementation in your operation.

cc: Area Managers
District Managers
Operations Managers

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cc: Area Managers
District Managers
Operations Managers

October 29, 1992

Mr. Gary Takenaka
Fuel Resources
Utah Power and Light Company
201 South Main
OUC 2000
Salt Lake City, UT 84140

Dear Gary:

Attached is a summary of FPC-1 testing done by PacifiCorp engineers and consultants. Also enclosed is a letter to Mr. Bart Hyita. We have also contacted Mr. Brett Harvey, who has instructed us to see Mr. Hyita.

As you can see from the attachments included with the summary, FPC-1 continues to prove itself. I will also bring additional and even more convincing information to our meetings with Mr. Hyita. If at all possible, I would like you participate in our meeting with him.

As you know, Dave Bowden has already contacted managers at Bridger and Glenrock mines. I am also approaching Centralia again.

I look forward to seeing you again. In the meantime, if you have any questions, please feel free to call me.

Sincerely,

S. Craig Flinders
VP, Technical Services
UHI Corporation

cc. Dave Bowden

UHI CORPORATION 2230 N. University Parkway, Suite 4B, Provo, Utah 84604
(801) 374-9010 FAX (801) 374-0345

July 10, 1992

Mr. Gary Takenaka
Senior Engineer
Fuel Resources Management
PSB-Utah
One Utah Center
201 So. Main Street, 20th Floor
SLC, UT 84126

Dear Gary:

In our early meetings with you, we mentioned the importance of your tests to UHI and some executives of PacifiCorp who had expressed interest in FPC-1 and UHI. When we first approached Mr. Brett Harvey and Mr. Dee Jense, we had already informed PacifiCorp executives in Portland of the successful tests of FPC-1 and recommendations for it's use by other PacifiCorp engineers, specifically Dr. Rand Thurgood and Mr. Scott Hassett. This group of executives was aware of the Centralia test before it started and have since been informed of the successful completion of the test, and your recommendation that FPC-1 be used by Centralia, and possibly other mining subsidiaries. This all took place before Centralia management turned down your recommendation.

We feel the decision to not treat Centralia fuel was basically a misunderstanding over pricing. We believe this misunderstanding has been corrected.

This same group is awaiting our final report. We hesitate to make that final report until we have recieved your final report and recommendation. We feel your recommendation, along with those already prepared by the aformentioned PacifiCorp engineers, will have a significant impact upon the decision made by the PacifiCorp management.

It is our intention to use the three successful FPC-1 studies, and the recommendations of the engineers who conducted the FPC-1 tests to approach members of the PacifiCorp Executive Committee. Our purpose for contacting the executive committee is twofold; first, to acquire a policy statement for FPC-1 use in all PacifiCorp operations, and second, to discuss other long term interests in UHI previously expressed by PacifiCorp managers.

I understand you have assigned the FPC-1 project to another engineer who has been working full time for three weeks to complete the project. I would like to speak to the project engineer and offer my assistance.

We constantly receive new and valuable information, much like that already forwarded to you, which supports the findings of the three tests by PacifiCorp. I would be happy to make this information available to you and the project engineer. I believe this information will add greater strength to your recommendation for FPC-1 use.

We appreciate your efforts and professionalism. The PacifiCorp engineering staff that we have worked with have been outstanding.

Sincerely,

S. Craig Flinders

UHI CORPORATION 750 North 200 West, Suite 306, Provo, Utah 84601 (801) 374-9010
FAX (801) 374-0345

April 28, 1992

Verl R. Tophan
Executive V.P. Operations
Utah Poper & Light
One Utah Center
201 S. Main , 23rd Floor
S.L.C. Utah 84140

Dear Mr. Tophan:

This letter is in reference to three tests conducted by PacifiCorp subsidiaries over the last ten years with UHI's fuel catalyst FPC-1. FPC-1 is a unique product designed to improve fuel combustion, resulting in less fuel consumed, lower harmful emissions, and reduced visible smoke. The tests include a laboratory evaluation conducted at BYU, and field evaluations with UP&L Transportation and Centraila Mining Co. A summary and discussion of each of the tests is enclosed.

All three evaluations were conducted independent of UHI by PacifiCorp engineers. In each case, a recommendation for system fuel treatment was made by the engineer responsible for the test. Reductions in fuel consumption ranged from 5% to 9%, and significant reductions in carbon monoxide and hydrocarbon emissions were also documented. When compared to the catalyst's cost, fuel savings provide a net 52% to 184% return on investment (approximately $300,000 to $1,000,000 system wide).

It is my understanding that PacifiCorp has incorporated a cost reduction program intended to cut out the "fat", and to implement new projects that further cut operational costs. Assuming that the preceding statement is accurate, I am at a loss as to why PacifiCorp would conduct the most controlled tests possible, and then ignore engineering recommendations to treat its fuel system. Following are several reasons why I recommend that PacifiCorp consider the system wide application of FPC-1.

1. Net Fuel Savings. The average fuel savings for the three tests is 7.42% resulting in a net savings over cost of 134%. Although no maintenance studies were conducted during these tests, long term users of FPC-1 all report extended engine life, and reduced contaminates in the oil, resulting in additional savings.

2. Public Relations. Without spending a dime, PacifiCorp could further improve its public image by voluntarily implementing a program that conserves energy and reduces harmful emissions. The application of FPC-1 will also help PacifiCorp comply with increasing government emission restrictions.

3. No Risk and No Cost. FPC-1 is covered by a liability policy, requires no up front costs, and is fully guaranteed to provide a net savings to the user. Fuel treatment could be handled by your fuel suppliers and additional personnel or time allocations for this project are unnecessary.

It seems to me that if you have already taken the time and spent the money to prove that the use of this product will provide a net fuel savings, at no risk, with no cost, and at the same time reduce harmful emissions, that FPC-1 application makes a lot of sense. I respectfully request a meeting with you and other members of the executive committee to discuss the benefits of FPC-1.

Thank you for your consideration. I'll be in touch with you in the near future.

Sincerely,

Lee R. Pope
President

UHI CORPORATION 750 North 200 West, Suite 306, Provo, Utah 84601 (801) 374-9010
FAX (801) 374-0345

SUMMARY OF FPC-1 TESTING

BY

PACIFICORP SUBSIDIARIES

Prepared for PacifiCorp
by
S. Craig Flinders
UHI Corporation
Provo, Utah

April 29, 1992

TABLE OF CONTENTS

ABSTRACT

A series of tests conducted by PacifiCorp engineers and independent consultants confirm fuel savings and regulated emissions reductions in gasoline and diesel powered vehicles with FPC-1 Fuel Performance Catalyst. Fuel savings range from 5% to 9%; Carbon monoxide emissions were reduced an average 23.5%. Visible smoke was also positively effected. These findings agree with recognized laboratory tests. Environmental Protection Agency test procedures document FPC-1 will also reduce oxides of nitrogen and unburned hydrocarbons.

Use of FPC-1 by PacifiCorp will result in significant fuel savings. Additionally, the product can be an effective tool for further improving the public image of PacifiCorp through a program of voluntarily reducing the impact of vehicular emissions on the environment.

I. INTRODUCTION

FPC-1 Fuel Performance Catalyst is a unique product in a market saturated with unproven additives and devices. FPC-1 is a proven combustion improver. Tests by two Environmental Protection Agency (EPA) Category 1 laboratories prove FPC-1 use will create fuel consumption reductions of 2% to 10%, depending on fuel and engine type. The tests for fuel consumption determination are EPA and Society of Automotive Engineers (SAE) recognized procedures, conducted independent of UHI. Procedures include; the EPA standardized Federal Test Procedures (FTP) and Highway Fuel Economy Test (HFET), and the SAE J1082 interstate and suburban road tests.

The EPA procedures include determination of the effect of FPC-1 on regulated emissions, specifically carbon monoxide (CO), unburned hydrocarbons (HC), and oxides of nitrogen (NOx). Data collected from five vehicles during eleven EPA cycles document reductions in CO and HC in gasoline power vehicles of 18.33% and 8.31%, respectively. Nitrogen oxides were reduced 6.4% in diesel power vehicles, and 2.3% in gasoline.

Field studies in hundreds of diesel engines agree with laboratory findings. A recent study of seventy-five diesel engines saw emissions of carbon monoxide, unburned hydrocarbons, and nitrogen oxides reduced an average 18%, 15% and 9%, respectively. Smoke was reduced 20% to 30%.

FPC-1 does not alter fuel properties and, therefore, cannot harm engines. Studies at Southwest Research Institute prove the catalyst has no detrimental effect on engine life. Independent, long term field tests verify the product has a positive effect on engine life by slowly removing engine hard carbon deposits, and preventing hard carbon related engine failures. Lube oils are kept cleaner longer, reducing the abrasive wear created by soot.

II. UP&L TEST CONDUCTED AT BRIGHAM YOUNG UNIVERSITY (1980)

UHI representatives first met with UP&L management in 1980. At that time, Dr. Rand Thurgood was directed by UP&L to conduct laboratory testing to determine if the product would reduce fuel consumption and gasoline emissions. Dr. Thurgood contracted Dr. Geoffrey Germane, PhD., Mechanical Engineering, BYU, to conduct an engine study to that end.

Procedure

The test involved steady-state engine tests at two engine speeds representing suburban and interstate driving. The engine was run at 1250 rpm and 30 foot pounds torque (city driving) and 2200 rpm and 50 foot pounds of torque (highway driving). Engine oil temperature, ambient temperature, and barometric pressure were continuously monitored to calculate the correction factor for engine horsepower.

Several hours of operation were conducted on base fuel to establish a data base for the two power levels. The base fuel was then treated with the FPC-1 catalyst and a series of steady-state tests conducted over the next several hours.

Effect on Fuel Economy

After 1150 miles of testing, the FPC-1 catalyst created an 11.68% reduction in brake specific fuel consumption (BSFC) under suburban conditions, and a 3.64% reduction for interstate driving conditions. The calculated average reduction for both cycles was 8.42%.

Effect on Regulated Emissions

The catalyst had no significant effect on HC and NOx, but produced a nearly 11% reduction in CO.

Recommendation and Action Taken

Dr. Thurgood recommended the UP&L fleet be treated with the catalyst. Shortly thereafter, Mr. Chuck Gwinn and Mr. Bill Fagg, then managers of UP&L transportation, treated the underground bulk fuel tanks in Salt Lake City with the intention of conducting a long term field trial. However, transportation did not have baseline data, nor was the computerized data collecting system on line at the time of treatment. No field data was generated and system treatment of UP&L transportation did not take place.

III. Test Conducted at the Ogden Transportation Center (1990)

With the restructuring of UP&L brought about by PacifiCorp, UHI representatives again contacted UP&L. The project was turned over to Mr. Dee Rees. After several meetings, it was determined to test FPC-1 again, this time in a fleet of diesel powered utility trucks operating out of the Ogden Transportation Center. Mr. Scott Hassett, Principal Engineer for UP&L, conducted the test.

Procedure

Ten trucks were selected as the test fleet. Each truck was tested using base diesel fuel under steady-state conditions, and at no load. The test procedure was a carbon balance method. Engine rpm, oil and water temperature, exhaust temperature and pressure, and carbon containing exhaust gases (CO2, CO, HC) were continuously monitored during each test run. Ambient air temperature, barometric pressure, fuel density and fuel temperature were recorded to calculate correction factors.

After collecting these engine performance data on base fuel, the ten trucks were treated with FPC-1 and allowed to accumulate approximately 250 hours of operation with additive treatment. The above procedure was then repeated. All data was collected by Mr. Hassett.

Effect on Fuel Economy

The addition of FPC-1 created an 8.9% reduction in fuel consumption under steady-state field conditions.

Effect on Regulated Emissions

The field test does not monitor NOx. There was no significant change in HC (HC emissions are extremely low in diesel engines). Carbon monoxide emissions were reduced 36%. Diesel smoking was visibly reduced.

Recommendation and Action Taken

Mr. Hassett recommended the catalyst be used in the transportation system. He specified the product would create a $.06 net savings per gallon of fuel, and help with the public image by voluntarily reducing harmful emissions. The recommendation went out to all transportation operations. Ironically, because of budget cuts, transportation managers recommended we take the product to mining operations.

IV. Test at Centralia Coal Mine (1991)

UP&L mining managers arranged a test of FPC-1 at Centralia Coal Mine. Mr. Gary Takenaka, Senior Engineer for Fuel Resources Management, conducted the test.

Procedure

Five 777B Caterpillar rear dump trucks were selected for the test fleet. A control fleet was also used. The five test and three control units were tested using the same procedure as that of the Ogden transportation fleet. Again, each engine was tested under steady-state conditions, first with base fuel. All engine operating parameters were controlled and ambient conditions recorded. All engine performance and ambient data were recorded by Mr. Takenaka or engineers for Centralia Coal. After base testing, the test fleet was treated with FPC-1. Over the next several months, three tests for fuel economy determination were run by Mr. Takenaka and/or Centralia engineers.

Effect on Fuel Economy

The three FPC-1 treated fuel tests documented a steady trend in fuel consumption reduction culminating with a 4.94% fuel savings after approximately 1200 hours of use. While the FPC-1 fleet experienced a fuel consumption reduction, the control saw a general increase in fuel consumption indicating the actual fuel savings could be much greater than 4.94%.

Effect on Regulated Emissions

Visible smoke was reduced. There was no significant change in CO and HC emissions. However, CO and HC levels were extremely low in this fleet. HC (measured as hexane gas) emissions averaged 3 to 5 parts per million. CO emissions never exceeded 0.035%.

Recommendation and Action Taken

Mr. Takenaka presented his findings to the management of Centralia Coal and recommended FPC-1 fuel treatment. Centralia managers determined FPC-1 was not cost effective, (although the following Cost Savings Analysis indicates the contrary) and, therefore, the product will not be used at this time.

V. Cost Savings Analysis

The aforementioned PacifiCorp tests were designed to provide reliable information regarding FPC-1's cost effectiveness and impact on vehicular emissions. In every case, FPC-1 proved cost effective. Even at Centralia Coal were fuel prices are only $.60 per gallon, FPC-1 use would create a minimum one cent net cost savings per gallon of fuel. This mine, consuming approximately six million gallons of fuel per year, will net a $63,000 or 52% return on investment with FPC-1 treatment. However, savings at one mine alone is not the real issue.

The following Cost Savings Analysis reflects savings available from system wide treatment of PacifiCorp and is based upon the following assumptions, and the combined average fuel savings from the three tests of 7.42% {(8.42% + 8.90% + 4.94%)/3}.

1) Annual fuel consumption of 30 million gallons by PacifiCorp and its subsidiaries.

2) An average fuel cost of $.65 per gallon*.

3) A $0.018 cost to treat a gallon of fuel with FPC-1.

* Although the great bulk of PacifiCorp's fuel usage is in the mining subsidiaries, the higher cost of fuel in over-the-road fleets would justify an average fuel cost slightly higher than the per gallon cost in off-road fleets.

COST SAVINGS ANALYSIS

I. 30,000,000 x $.65 = $ 19,500,000 (Annual Fuel Cost)

II. $19,500,000 x .0742 = $ 1,446,900 (Annual Gross Savings)

III. $ 1,446,000 - $ 540,000 (est. cost of FPC-1) = $ 906,000 (Annual Net Savings)

VI. Summary Statement

FPC-1 has been tested by recognized independent laboratories proving catalyst treatment will create fuel savings of 2% to 10%, while simultaneously reducing regulated emissions. Three tests by PacifiCorp engineers produced results that agree with recognized tests. Based upon these and other studies, the use of FPC-1 will provide the following benefits to PacifiCorp:

1) Fuel savings of 4.94% to 8.90% (average 7.42%).

2) Reductions in CO and HC emissions in gasoline power vehicles.

3) Reductions in smoke, NOx, and CO in diesel power vehicles.

Through system wide fuel treatment with FPC-1, PacifiCorp would further improve the company's public image by voluntarily reducing harmful emissions. FPC-1 will assist transportation and mining operations meet the increasingly strict air quality requirements of regulatory agencies and environmentalists. And, although only briefly mentioned above, FPC-1 can reduce maintenance and downtime costs.

PacifiCorp engineers have done what they were asked to do, prove FPC-1. FPC-1 has done what it was asked to do, reduce PacifiCorp costs.

April 8, 1992

Mr. Gary Takenaka
Senior Engineer
Fuel Resources Management
PSB-Utah
201 So. Main Street, 20th Floor
SLC, UT 84126

Dear Gary:

As we discussed during our recent luncheon meeting, UHI will contact the fuel supplier for Centralia Coal Mine and make arrangements for the supplier to treat fuel shipments with FPC-1. The product can be shipped to the fuel supplier and held there for treatment of each fuel shipment. Your FPC-1 field representative will monitor FPC-1 inventory, and verify that the product is being added to Centralia's fuel at the proper mixing ratio. He will update you on this inventory quarterly.

With this arrangement, Centralia need not store or handle FPC-1. We will arrange this service without added charges to Centralia.

In order to make this arrangement, we will need someone from Centralia purchasing to indicate to your supplier that the fuel must be treated with FPC-1. We will make sure that the supplier is trained and properly remunerated for services rendered.

Also, UHI is prepared to purchase the product liability policy for Centralia as soon as a purchase order for FPC-1 fuel system treatment is received by our offices.

Thank you for all the time you have put into this project.

Sincerely,

S. Craig Flinders

cc. Dave Bowden
Lee Pope

UHI CORPORATION 750 North 200 West, Suite 306, Provo, Utah 84601 (801) 374-9010
FAX (801) 374-0345

TREATED FLEET RESULTS

Table 1 Result of Carbon Balance Calculation for Unit 3470

	Baseline	Treated 2	Treated 3
Mwt	29.2685	29.2610	29.2849
pf	143,850	145,785	141,645
PF	74,495	77,007(+3.37%)	78,092 (+4.83%)

Table 2 Result of Carbon Balance Calculation for *Unit 3480

	Baseline	Treated 2	Treated 3
Mwt	29.2765	29.2588	29.3200
pf	141,756	145,852	132,292
PF	72,494	73,768 (+1.76%)	64,676 (-10.80%)

* There is indication that Unit 3480 was not treated regularly with FPC-1

Table 3 Result of Carbon Balance Calculation for Unit 3003

	Baseline	Treated 2	Treated 3
Mwt	29.3048	29.2838	29.3453
pf	132,223	136,632	128,769
PF	60,311	64,264 (+6.55%)	63,941 (+6.02%)

Table 4 Result of Carbon Balance Calculation for Unit 3002

	Baseline	Treated 2	Treated 3
Mwt	29.3611	29.3327	29.3935
pf	119,939	124,364	115,839
PF	60,380	74,767 (+23.83%)	63,279 (+4.80%)

Table 5 Result of Carbon Balance Calculation for Unit 3004

	Baseline	Treated 2	Treated 3
Mwt	29.3323	29.3012	29.3668
pf	126,643	132,400	121,763
PF	81,210	82,458 (+1.54%)	71,394 (-12.09%)

TREATED FLEET

Table 1 Test Data for Unit 3004 (ave.)

	Baseline	Treated 1	Treated 2	Treated 3
Temp(F)	555.1	484.1	499.1	488.1
Pv("H20)	0.66	0.60	0.67	0.75
CO%	0.02	0.022	0.02	0.022
HC(ppm)	3.67	5.33	4.83	5.33
C02%	4.90	5.05	4.68	5.10
02%	13.70	13.55	13.80	13.76
Hours	2073	2411	2770	3232
Baro	29.54	29.96	30.17	30.03
Fuel SG	0.860	0.858	0.860	0.865
Air Temp (F)	55.0	65.0	59.0	62.4

Table 2 Test Data for Unit 3002 (ave.)

	Baseline	Treated 1	Treated 2	Treated 3
Temp(F)	488.1	455.8	492.9	528.2
Pv("H20)	1.0	0.50	0.72	0.90
CO%	0.02	0.02	0.02	0.02
HC(ppm)	4.00	5.75	4.00	4.16
C02%	5.18	4.56	4.99	5.37
02%	13.30	14.18	13.35	13.35
Hours	2173	2579	3001	3518
Baro	29.54	29.96	30.17	30.03
Fuel SG	0.860	0.858	0.860	0.865
Air Temp (F)	54.4	65.0	59.0	61.0

Table 3 Test Data for Unit 3003 (ave.)

	Baseline	Treated 1	Treated 2	Treated 3
Temp(F)	450.0	459.1	452.3	454.6
Pv("H20)	1.17	0.90	1.12	1.00
CO%	0.033	0.03	0.03	0.028
HC(ppm)	9.71	8.17	6.83	5.83
C02%	4.67	4.56	4.52	4.83
02%	13.92	13.88	14.00	14.3
Hours	11872	12242	12693	13305
Baro	29.54	29.96	30.17	30.03
Fuel SG	0.860	0.858	0.860	0.865
Air Temp (F)	54.4	65.0	59.0	65.0

Table 4 Test Data for Unit 3480 (ave.)

	Baseline	Treated 1	Treated 2	*Treated 3
Temp(F)	488.0	482.6	477.2	468.3
Pv("H20)	0.97	0.94	1.00	1.05
CO%	0.015	0.015	0.02	0.017
HC(ppm)	5.90	3.33	4.83	4.67
C02%	4.37	4.59	4.24	4.69
02%	14.42	14.37	14.50	14.23
Hours	9032	9324	9550	9878
Baro	29.54	29.96	30.17	30.03
Fuel SG	0.860	0.858	0.860	0.865
Air Temp (F)	59.0	65.0	59.0	62.4

Table 5 Test Data for Unit 3470 (ave.)

	Baseline	Treated 1	Treated 2	Treated 3
Temp(F)	452.9	447.9	449.6	434.8
Pv("H20)	0.91	0.98	0.89	0.80
CO%	0.020	0.020	0.020	0.02
HC(ppm)	5.80	6.67	7.66	5.50
C02%	4.30	4.48	4.24	4.37
02%	14.50	14.45	14.55	14.63
Hours	978	1359	1755	2303
Baro	29.54	29.96	30.17	30.03
Fuel SG	0.860	0.858	0.860	0.865
Air Temp (F)	59.0	65.0	59.0	62.4

F L U I D A N A L Y S I S S A M P L E R E P O R T

For UNIT 3002, Fluidtype 'EN' ENGINE OIL, 12/01/90 Through 06/21/91

Class: TRUCKS
Sub-Class: CAT 777 Unit: 3002 CAT 777 END DUMP TRUCK

	A	B	C	D	E	F	G	H	I	J	K	L
Lab/Fl Type	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN		
Sample Date	06/11/91	05/20/91	05/01/91	04/12/91	03/21/91	02/28/91	02/12/91	01/18/91	01/04/91	12/04/90		
Operating Hrs	48716	48464	48195	47958	47692	47424	47250	46965	46733	46439		
Fluid Used Hr	268	291	259	285	290	189	300	251	301	269		
Fluid Locn												
Lead---------	2	4	6	3	4	1	1	5	10	4		
Copper-------	1	1	3	1	1	4	5	6	4	4		
Iron---------	53	46	53	63	48	57	77	44	57	49		
Chromium-----	2	2	3	5	4	7	21	5	8	3		
Aluminum-----	7	5	4	4	5	7	8	5	7	5		
Silicon------	20	5	18	2	1	1	1	1	14	5		
Tin----------	15	15	14	13	16	20	14	15	19	15		
Sodium-------	31	24	20	20	15	14	15	25	33	29		
Calsium------	1628	1546	1380	1892	1539	1457	1893	1690	1948	1421		
Zinc---------												
Magnesium----												
Molybendnum--												
Nickel-------												
Boron--------												
Potassium----												
Soot---------	M	M	M	M	M	M	M	M	M	M		
Water %------	1	1	1	1	1	1	1	1	1	1		
Glycol-------												
% Fuel-------	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Susp. Solids-												
Visc210------	72.0	68.0	67.0	70.0	66.0	65.0	65.0	63.0	64.0	64.0		
SAE Grade----												
Oxidation----												
Acid---------												
Flash Point--												
Fluid Mfg----	CV	CV	CV	CV	CV	CV	CV	CV	CV	MO		
Sample Code--												

Comments/Repairs:

A>

B>

C>

D>

E>

F>

G> HIGH Cr ; Fe

H>

I>

J>

K>

L>

F L U I D A N A L Y S I S S A M P L E R E P O R T

For UNIT 3003, Fluidtype 'EN' ENGINE OIL, 12/01/90 Through 06/21/91

Class: TRUCKS
Sub-Class: CAT 777 Unit: 3003 CAT 777 END DUMP TRUCK

	A	B	C	D	E	F	G	H	I	J	K	L
Lab/Fl Type	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN			
Sample Date	05/29/91	05/08/91	04/25/91	04/04/91	03/15/91	01/31/91	01/16/91	12/18/90	12/03/90			
Operating Hrs	49879	49605	49407	49144	48922	48628	48468	48134	47941			
Fluid Used Hr	288	211	283	244	316	173	348	208	454			
Fluid Locn												
Lead	10	1	9	6	11	12	29	5	7			
Copper	1	2	4	3	1	111	247	1	7			
Iron	22	25	30	26	27	33	49	28	42			
Chromium	1	1	1	1	1	1	1	1	1			
Aluminum	6	3	8	6	6	8	8	9	7			
Silicon	1	2	6	1	2	6	20	28	19			
Tin	16	11	16	14	21	19	14	18	8			
Sodium	3	4	3	5	9	62	392	92	49			
Calsium	1663	1717	1764	1615	1560	1577	1676	1614	1830			
Zinc												
Magnesium												
Molybendnum												
Nickel												
Boron												
Potassium												
Soot	M	M	M	M	M	M	M	M	M			
Water %	1	1	1	1	1	1	1	1	1			
Glycol							+					
% Fuel	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Susp. Solids												
Visc210	60.0	62.0	60.0	59.0	63.0	64.0	65.0	62.0	66.0			
SAE Grade												
Oxidation												
Acid												
Flash Point												
Fluid Mfg	CV	CV	CV	CV	CV	CV	CV	MO	MO			
Sample Code												

Comments/Repairs:

A>

B>

C>

D>

E>

F> HIGH Cu

G> POSITIVE GLYCOL,HIGH Cu

H> Na

I>

J>

K>

L>

F L U I D A N A L Y S I S S A M P L E R E P O R T

For UNIT 3004, Fluidtype 'EN' ENGINE OIL, 12/01/90 Through 06/21/91

Class: TRUCKS
Sub-Class: CAT 777 Unit: 3004 CAT 777 END DUMP TRUCK

	A	B	C	D	E	F	G	H	I	J	K	L
Lab/Fl Type	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN					
Sample Date	06/06/91	05/01/91	03/25/91	03/04/91	02/05/91	01/03/91	12/12/90					
Operating Hrs	49408	49149	48912	48653	48397	48162	47925					
Fluid Used Hr	274	247	266	279	252	260	317					
Fluid Locn												
Lead	5	5	6	3	1	9	6					
Copper	9	5	2	8	34	86	139					
Iron	41	43	22	37	34	48	38					
Chromium	5	7	1	1	2	4	2					
Aluminum	4	9	4	7	5	7	6					
Silicon	12	27	1	4	1	25	21					
Tin	7	14	16	20	15	11	25					
Sodium	30	27	19	46	44	269	83					
Calsium	1864	1239	1451	1641	1732	2098	1591					
Zinc												
Magnesium												
Molybendnum												
Nickel												
Boron												
Potassium												
Soot	M	M	M	M	M	M	M					
Water %	1	1	1	1	1	1	1					
Glycol						+						
% Fuel	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Susp. Solids												
Visc210	65.0	65.0	65.0	66.0	66.0	66.0	65.0					
SAE Grade												
Oxidation												
Acid												
Flash Point												
Fluid Mfg	CV	CV	CV	CV	CV	CV	MO					
Sample Code												

Comments/Repairs:

A>

B>

C>

D>

E> Cu

F> GLY POS, HIGH Cu

G> HIGH Cu ; Na

H>

I>

J>

K>

L>

F L U I D A N A L Y S I S S A M P L E R E P O R T

For UNIT 3470, Fluidtype 'EN' ENGINE OIL, 12/01/90 Through 06/21/91

Class: TRUCKS
Sub-Class: CAT 777 Unit: 3470 CAT 777 END DUMP TRUCK

	A	B	C	D	E	F	G	H	I	J	K	L
Lab/Fl Type	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN		
Sample Date	06/13/91	05/23/91	05/06/91	04/15/91	03/22/91	03/04/91	02/12/91	01/23/91	01/09/91	12/18/90		
Operating Hrs	61405	61189	60918	60656	60412	60106	59869	59628	59441	59172		
Fluid Used Hr	239	284	277	265	321	259	261	195	284	275		
Fluid Locn												
Lead	3	7	6	3	7	5	3	4	10	7		
Copper	9	5	7	2	1	1	5	4	3	5		
Iron	25	25	27	27	22	32	24	29	42	29		
Chromium	2	1	3	8	8	3	2	2	3	1		
Aluminum	4	7	3	4	4	7	4	6	4	8		
Silicon	4	14	6	4	6	10	1	7	10	16		
Tin	14	20	7	15	15	20	13	13	16	7		
Sodium	46	50	64	14	14	33	41	65	118	68		
Calsium	1491	1605	1543	1688	1617	1512	1687	1460	1153	1694		
Zinc												
Magnesium												
Molybendnum												
Nickel												
Boron												
Potassium												
Soot	M	M	M	M	M	M	M	M	M	M		
Water %	1	1	1	1	1	1	1	1	1	1		
Glycol									+			
% Fuel	.0	.0	.0	.0	.0	.0	.0	6.5	.0	2.5	.0	.0
Susp. Solids												
Visc210	59.0	62.0	58.0	65.0	61.0	59.0	59.0	58.0	60.0	58.0		
SAE Grade												
Oxidation												
Acid												
Flash Point												
Fluid Mfg	CV	CV	CV	CV	CV	CV	CV	CV	CV	MO		
Sample Code												

C ments/Repairs:

A>

B>

C>

D>

E> Cr

F>

G>

H> FUEL DILUTION

I> POSITIVE GLYCOL

J> FUEL DILUTION (SLIGHT) ; Ne

K>

L>

F L U I D A N A L Y S I S S A M P L E R E P O R T

For UNIT 3480, Fluidtype 'EN' ENGINE OIL, 12/01/90 Through 06/21/91

Class: TRUCKS
Sub-Class: CAT 777 Unit: 3480 CAT 777 END DUMP TRUCK

	A	B	C	D	E	F	G	H	I	J	K	L
Lab/Fl Type	W / EN	W / EN	W / EN	W / EN	W / EN	W / EN						
Sample Date	05/06/91	04/03/91	03/04/91	02/12/91	01/16/91	12/12/90						
Operating Hrs	48890	48620	48350	48098	47893	47625						
Fluid Used Hr	285	280	262	228	283	316						
Fluid Locn												
Lead	6	7	8	7	12	8						
Copper	5	1	1	6	16	7						
Iron	51	51	45	48	59	52						
Chromium	1	2	1	2	1	1						
Aluminum	6	8	8	6	7	7						
Silicon	16	12	8	6	11	1						
Tin	12	19	22	18	15	15						
Sodium	3	4	4	8	23	26						
Calsium	1592	1924	1400	1655	1535	1712						
Zinc												
Magnesium												
Molybendnum												
Nickel												
Boron												
Potassium												
Soot	H	H	H	H	H	H						
Water %	1	1	1	1	1	1						
Glycol												
% Fuel	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
Susp. Solids												
Visc210	71.0	68.0	65.0	66.0	74.0	72.0						
SAE Grade												
Oxidation												
Acid												
Flash Point												
Fluid Mfg	CV	CV	CV	CV	CV	MO						
Sample Code												

Comments/Repairs:

A> HIGH SOOT

B> High Soot

C> HIGH SOOT

D> HIGH SOOT

E> HIGH SOOT

F> SOOT

G>

H>

I>

J>

K>

L>

Summary of Exhaust Gas Data

Deer Creek Mine Underground Equipment

Baseline Averages				Treated Averages			
CO%	HCppm	NOxppm	NOppm	CO%	HCppm	NOxppm	NOppm
0.0323	18.16	45.0	4.0	0.040	10.79	46.7	2.66
				*0.0326	7.91		
**0.0250	13.26			**0.0240	4.99		

* Virtually all the increase in CO was generated by Unit 084 during the second treated test. If the CO reading taken during the first treated test is used alone, the average is 0.0326, which represents no change in CO. This would also result in a 56.44% reduction in HC.

** If Unit 084 is removed from consideration because of the large change in CO between the first and second treated tests, the result is a 4.0% decrease in CO. This would also result in a 62% reduction in HC.

Summary of Average Fuel Consumption Changes

Control	*Treated
-8.22%	-12.09% ^
-3.40%	+ 1.54%
-2.12%	+ 3.37%
+1.35%	+ 4.80%
+3.24%	+ 4.83%
+5.15%	+ 6.02%
+16.96% ^	+ 6.55%
	+23.83% ^

Control average: +1.85% (all averages)
-0.67% (outliers excluded)

Treated average: +4.85% (all averages)
+4.51% (outliers excluded)

* Unit 3480 not included
^ Outliers

-12.57
- 3.45
- 2.68
- 1.86
2.0
11.34

-1.2 %

-12.1
- 7.2
- 1.08
+ 1.55
+ 2.93
+ 4.4
+ 4.75
+ 5.96
+ 6.15
17.93
37.28

6.78 %

A 7.68 %

CONTROL FLEET RESULTS

Table 6 Result of Carbon Balance Calculation for Unit 4571

	Control 1	Control 2	Control 4
Mwt	29.2225	29.1893	29.2552
pf	157,526	176,531	153,563
PF	93,816	109,724 (+16.96%)	86,108 (-8.22%)

Table 7 Result of Carbon Balance Calculation for Unit 4580

	Control 1	Control 2	Control 3	Control 4
Mwt	29.1507	29.1529	29.1282	29.1502
pf	195,061	192,756	204,590	201,460
PF	200,983	211,340 (+5.15%)	207,495 (+3.24%)	203,704 (+1.35%)

Table 8 Result of Carbon Balance Calculation for Unit 3006

	Control 1	Control 2	Control 3
Mwt	29.3200	29.3243	29.2819
pf	130,184	125,851	134,929
PF	37,331	36,540 (-2.12%)	36,103 (-3.40%)

CONTROL FLEET

Table 6 Test Data for Unit 3006 (ave.)

	Control 1	Control 2	Control 3	Control 4
Temp(F)	419.5	432.7	458.3	
Pv("H20)	0.80	0.80	0.98	
CO%	0.022	0.020	0.020	
HC(ppm)	?3.2	3.17	3.33	
C02%	4.76	4.93	4.59	
02%	13.96	13.38	13.68	
Hours	9089	9462	9860	
Baro	29.54	29.96	30.17	
Fuel SG	0.860	0.858	0.860	
Air Temp (F)	59.0	65.0	59.0	

Table 7 Test Data for Unit 4571 (ave.)

	Control 1	Control 2	Control 3	Control 4
Temp(F)	506.0	459.8		491.0
Pv("H20)	2.30	2.04		2.60
CO%	0.038	0.030		0.035
HC(ppm)	6.20	5.60		5.33
C02%	3.90	3.48		4.01
02%	14.95	15.80		15.33
Hours	5174	5337		5712
Baro	29.54	29.96		30.03
Fuel SG	0.860	0.858		0.865
Air Temp (F)	59.0	65.0		61.0

Table 8 Test Data for Unit 4580 (ave.)

	Control 1	Control 2	Control 3	Control 4
Temp(F)	418.9	427.8	418.3	411.6
Pv("H20)	1.45	1.31	1.53	1.52
CO%	0.040	0.040	0.040	0.04
HC(ppm)	8.00	5.80	7.70	6.83
C02%	3.13	3.17	2.98	3.03
02%	16.23	16.13	16.27	16.62
Hours	1749	1927	2166	2343
Baro	29.54	29.96	30.17	30.03
Fuel SG	0.860	0.858	0.860	0.865
Air Temp (F)	59.0	65.0	59.0	61.0

UHC 1000 HR TEST 6/21/91

1) BAROMETRIC PRESSURE: (FOR KEZA RADIO STATION)
@ 7:58 AM : 30.03 ↓
12:43 pm 30.02 ↓

2) AMBIENT AIR TEMP: 61.4° F (BEGINNING OF TEST, 8:45 AM)
65.0° F - 8:50 AM
61.0° F - 11:20 AM
62.4° F - 11:53 AM

3) CALIBRATION GAS: 10.97
CO_2 10.97
CO : 1.6

4) CALIBRATION - OBSERVED
CO_2 11.00
CO 1.60
HC 3.09

5) FUEL
Sp Gr .865
Temp. 67° F

3003 ✓ 3004 -
3006 (DOWN) 3002
4571 (480) - 4580 109 -
347 -
348 (DOWN)

ORDER 3003
3002
DISARM

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 6/21/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 4580 16G Miles _____ I.D. # _____

Engine Type _____ Hours 2343 I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 11:05

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	~~1030~~							
2	1031	407.8	1.60	0.04	6	3.08	16.6	CAL
3	1031	406.8	1.60	0.04	6	3.06	16.5	
4		409.6	1.55	0.04	6	3.01	16.7	CAL
5		414.2	1.60	0.04	8	3.01	16.7	
6	1031	413.8	1.40	0.04	8	3.03	16.6	CMC
7		~~418~~						
8		417.6	1.40	0.04	7	3.03	16.6	
9		411.6	1.52	0.04	6.83	3.03	16.62	28.1502
10		(411.67)	(41.609)					201,460

Finish Time: 11:14 (1.35)

Signature of Technicians: [signature] 203,703 (~~1.554~~)

AV = 6,725 (1.011)

GR = 862

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 6/21/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 347 Miles 84857 I.D. # _____

Engine Type _____ Hours 2303 I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 12:18 pm

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	2000	427.4	0.70	0.02	5	4.42	14.6	
2		434.6	0.80	0.02	6	4.42	14.5	— CAL
3		437.8	0.85	0.02	5	4.43	14.7	
4		436.2	0.80	0.02	5	4.36	14.6	— CAL
5		436.8	0.80	0.02	6	4.49 / 4.29-4.39	14.7	
6		436.0	0.85	0.02	6	4.34	14.7	
7		434.8	0.80	.02	5.5	4.37	14.63	29 2847
8		(13.8%)	(1.12%)					141,645
9								78,092 (4.7%)
10								

Finish Time: 12:25 p

Signature of Technicians: [signature]

AV = 4,649

CFM = 1,623 (0.5513)

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 6/21/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 3003 Miles 439894 I.D: # _____

Engine Type _____ Hours 13305 I.D: # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 9:25 AM

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	2000	431	0.85	0.03	5	4.72-4.76	14.4	
2	2000	~~446~~ 441	0.90	0.03	6	4.75	14.4	- CAL
3	2000	453.0		0.03	6	4.83	14.4	
4	2000	464.8	1.10	0.03	6	4.90-	14.2	- CAL
5	2000	468.0	1.05	0.04	6	5.02 / 4.69-4.95	14.1	
6	2000	470.0	1.10	0.03	6	4.84-4.92	14.3	Fuel cutting RPM
7		454.6	1.0	0.028	5.83	4.83	14.3	29.3453
8		(1.027)	(1.147)					128,759
9								63,941 (26.01)
10								

Finish Time: 10:37 AM

Signature of Technicians: Falz, CC

AV = 5255

Cm = 1,834

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 6/21/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 3004 Miles 39550 I.D. # _____

Engine Type _____ Hours 3232 I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 11:40 AM

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks	
1	2000	480.8	0.70	0.03	5	5.23	13.7		
2		483.0	0.75	0.03	8	5.19	13.7		-CAL
3		488.0	0.75	0.02	5	5.12	13.7		
4		492.4	0.80	0.02	4	5.03	13.8		-CAL
5		492.0	0.80	0.02	6	5.05	13.9		
6		492.8	0.75	0.02	4	5.03	13.8		
7		488.1	0.75	0.02	5.33	5.10	13.76	22,366	
8		(~~4.102~~)	(~~1.25~~)					121,762	
9		(4.102)	(1.138)					71,393	(-12.09)
10									

Finish Time: 11:48

Signature of Technicians: _____

N = 4,634 (0.5863)

Cm = 1,617

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMAC Test Date: 6-21-91

Test Portion: Baseline _____ Treated [illegible]

Equipment Tested: 3480 Miles 58166 I.D: # _____

Engine Type _____ Hours 9978 I.D: # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 13:06

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	2000	454.0	1.10	0.01	5	4.85	14.1	
2		464.6	1.00	0.02	5	4.72	14.2	
3		469.8	1.00	0.02	4	4.65	14.4	
4		469.6	1.10	0.01	4	4.69	14.2	
5		~~47~~						
6		475.8	1.00	0.02	5	4.69	14.3	
7		476.0	1.10	0.02	5	4.58	14.2	
8		468.3	1.05	0.07	4.67	4.69	14.23	29.3200
9								132,292
10								64,703

Finish Time: 13:13

Signature of Technicians: [signature]

1V = 5,425 (0.4889)

Cfm: 1,898.8

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 6/21/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 4571 480 Miles _____ I.D. # _____

Engine Type _____ Hours 5712 I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: _____

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	2060	488	2.8	0.04	3	4.06	15.3	
2	2058	501	2.8	0.04	5	4.03	15.3	
3	2059	495	2.6	0.03	6	4.00	15.4	
4	2059	489	2.6	0.04	6	4.00	15.4	
5	2060	488	2.4	0.03	6	4.02	15.3	
6	2059	485.2	2.4	0.03	6	3.99	15.3	
7		491	2.6	0.035	5.33	4.01	15.33	29,553
8		(12.93)	(11.58)					153,583
9								86,107 (-8.28)
10								

Finish Time: 10:10 AM

Signature of Technicians: _____

AV = 8,641 (0.5607)

CFM = 1,696

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 6/21/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 3002 Miles 319871 I.D. # _____

Engine Type _____ Hours 3518. I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 10:23 AM

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks	
1	2000	529.4	0.85	0.02	4	5.58	13.2		CAL
2		533.8	0.90	0.02	3	5.40	13.3		CAL
3		531.2	0.90	0.02	4	5.37	13.4		
4									
5		523.6	0.90	0.02	4	5.31	13.5		CAL
6		526.8	1.00	0.02	5	5.36	13.3		
7		524.6	0.90	0.02	5	5.30	13.4		
8		528.23	0.90	0.02	4.16	5.87	13.35	29.3935	
9		(18.27)	(6.107)					115,838	
10								63,278	(4.78%)

Finish Time: 10:31 AM

Signature of Technicians: _____

AV = 5,182 (0.5463)

Corr = 1,809

5/14/91

EFZ

UHI Test

1) Barometric Pressure: 30.17

2) Ambient Air Temp.

Beginning Testing	56°F
End of Test	62°F

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: EMC Test Date: 5/14/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 3004 Miles 37093.5 I.D. # _____

Engine Type _____ Hours 2770 I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 11:32

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	2000	546.8	0.60	0.02	4	4.50-4.62	14.0	-CAL
2		508.4	~~0.75~~	0.02	4	4.62	13.7	
3			0.65					-CAL
4		486.6	0.70	0.02	5	4.77-4.81	13.8	
5		486.4	0.70	0.02	6	4.68	13.7	
6		483.6	0.70	0.02	5	4.75	13.8	-CAL
7		~~482~~		0.02	5	4.68-4.75		
8		483.0	0.70				13.8	
9		489.1	0.675	0.02	7.83	4.68	13.8	29,302
10								132,400

AV = 4,411

CAL = 1,590 (0.6028)

82,457 (1.38)

(1,451)

Finish Time: 11:44

Signature of Technicians: EHZ

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 5/14/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 3003 Miles 483747 I.D. # _____

Engine Type _____ Hours 12693 I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 11:49

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks	
1	2000	440.6	1.10	0.03	5	4.54	13.6		- CAL
2		~~450~~ 448.2	1.15	0.03	6	4.54	13.6		
3		453.2	1.15	0.03	6	4.51	14.3		- CAL
4		~~455.4~~							
5		457.0	1.05	0.03	6	4.49	14.2		
6		460.0	1.15	0.03	9	4.60	14.0		- CAL
7		454.8	1.15	0.03	9	4.47	14.3		
8		452.3	1.125	0.03	6.83	4.52	14.0	29.2838	
9								~~13,286~~ 13,436 13,632	
10							64,285	~~64,418~~	(7,092)

NV = 5,554

CM = 1,539

Finish Time: 12:02

Signature of Technicians: EFZ

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 5/14/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 4580 166 Miles _____ I.D. # _____

Engine Type _____ Hours 2166 I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 13:15

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	1029	403.6	~~1.51~~	0.04	6	2.99	16.0	— CAL
2			1.60					
3	1042	422.6	1.50	0.04	6	2.97	15.8	— CAL
4	1029	416.8	1.50	0.04	9	2.98	16.4	
5	1020	416.0	1.50	0.04	9	2.97	16.2	— CAL
6	1028	421.8	1.60	0.04	8	2.98	16.8	
7	1025	429.2	1.50	0.04	8	2.99	16.4	
8		418.33	1.53	0.04	7.67	2.98	16.27	29 1282
9								20K 590 ~~207,500~~
10								207,500 (3.29%) ~~208,000~~

AV = 6,335

Cn = 866

Finish Time: 13:25

Signature of Technicians: EHE

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 5/14/91

Test Portion: Baseline _____ Treated _____ 83408

Equipment Tested: 347 Miles ~~175~~ I.D. # _____

Engine Type _____ Hours 1755 I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 11:17

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks	
1	2000	452.4	0.90	0.02	8	4.22	14.5		CAL
2		450.4	0.90	0.02	6	4.26	14.4		
3		451.6	0.85	0.02	8	4.27	14.6		CAL
4		450.8	0.90	0.02	8	4.25	14.5		
5		448.2	0.90	0.02	8	4.25	14.7		CAL
6		444.2	0.90	0.02	8	4.22	14.6		
7		449	0.89	0.02	7.66	4.24	14.5	29.260	CAL
8								~~46,000~~ 795 785	
9								~~24,684~~ ~~22,445~~ 37000	(3.409)
10									

AV = 4,933
CAL = 1,722 (0.5282)

Finish Time: 11:25

Signature of Technicians: EFZ

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 5/14/91

Test Portion: Baseline _____ Treated _____ No Mileage Reading

Equipment Tested: 348 Miles ~~9550~~ I.D. # _____

Engine Type _____ Hours 9550 I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 12:12

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	2000	496.0	0.95	0.02	4	4.27-4.36	14.6	- CAL
2		483.2	0.85	0.02	4	4.20	14.3	
3		478.0	1.10	0.02	4	4.26	14.6	- CAL
4		473.2	1.00	0.02	4	4.23	14.4	
5		469.6	1.00	0.02	5	4.09-4.11	~~15~~ 14.7	- CAL
6		463.2	1.10	0.02	8	4.30-4.39	14.4	
7		473.20	1.0	0.02	4.83	4.24	14.5	25,258
8								73,852 ~~46,850~~
9								~~78,043~~
10								73,767 (1.589)

AV = 5,308

Cm = 1,853 (0.5058

Finish Time: 12:23

Signature of Technicians: EVZ

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 5/14/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 3006 BELLY Miles 130112 I.D. # _____

Engine Type _____ Hours 9860 I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 13:35

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks	
1	2000	478.6	1.30	0.02	3	4.61	13.5		- CAL
2		463.0	0.80	0.02	3	4.61	13.3		
3		456.0	0.95	0.02	3	4.60	13.8		- CAL
4		453.4	0.90	0.02	3	4.60	13.8		
5		451.0	0.95	0.02	4	4.60	13.9		- CAL
6		447.8	1.00	0.02	4	4.57	13.8		
7		458.3	.98	0.02	3.33	4.59	13.68	29.2819	
8						29.2818		~~135~~ 134,929	~~36,121~~ 36,107
9						134,946		36,108	(-14)
10						36,102			(-3.24)

NV = 5,201
CAL = 3,932 (0.2676)

Finish Time: 13:45

Signature of Technicians: EH2

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 5/14/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 3002 Miles 314913.6 I.D. # _____

Engine Type _____ Hours 3001 I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 10:48 ~~10:45~~

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks	
1	2000	500.2	0.75	0.02	4	5.16	12.9		CAL
2	"	498.2	0.75	0.02	4	5.12	12.8		CAL
3		495.6	0.65	0.02	4	4.89	13.7		
4		489.0	0.65	0.02	5	4.89	13.6		CAL
5		486.6	0.75	0.02	3	4.97	13.6		
6		488.0	0.75	0.02	4	4.96	13.5		
7		492.9	0.72	0.02	4	4.99	13.35	29.3327	
8								~~124,960~~ 124,364	
9								24,548	(23.4%)
10									

Av = 4,541

Cor = 1,585 (0.601²)

Finish Time: 11:02

Signature of Technicians: EFZ

UHI Fuel Additive Test
Data Sheet

4/16/91
EFZ

1) Calibration Gas

CO_2	10.95
CO	1.59
Propane	600.2(0.515) = 309

Check 9:58 AM

CO	1.6 %
CO2	10.6 %
ppm H	309

2) Ambient Air Temp - Beginning of Test 58°
" " " - End of Test 72.4°

3) Fuel

Specific Gravity (End of Test) = 0.858
Temp. (End of Test) = 79.2°

4) Barometric Pressure 29.96

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 4/16/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 4580 - 16 Miles _____ I.D: # _____

Engine Type _____ Hours 1927 I.D: # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 11:55

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	~~1030~~	~~416.6~~	1.4	.04	3	3.19	16.2	
2		423.8	1.45	.04	5	3.19	15.8	CAL
3		430	1.43	.04	6	3.18	16.2	
4		424	1.2	.04	6	3.16	16.2	CAL
5		432.6	1.2	.04	9	3.17	16.2	
6	1026	435.2	1.2	.04	6	3.16	16.2	
7		407	1.31	.04	5.8	3.17	16.13	29.1527
8								92,156 ~~193,000~~
9								~~5,948~~ 6.4%
10								~~21,340~~ 5,508 (5.15%)

Finish Time: 12:11

AV = 5,930

CFM = 808

Signature of Technicians: _____

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 4/16/97

Test Portion: Baseline _____ Treated _____

Equipment Tested: 3006 Belly Miles 129282 I.D: # _____

Engine Type _____ Hours 9462 I.D: # _____

Exhaust Stack Diam 11" Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 1:23

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks	
1	7000	419	0.80	.02	3	5.06	13.2		
2		429.4	.80	.02	2	4.97	12.9		CAL
3		431.6	.75	.02	5	4.95	13.5		
4		438.2	.75	.02	5	4.92	13.5		CAL
5		442.0	.87	.02	2	4.88	13.6		
6		435.8	.85	.02	2	4.81	13.6		
7		432.66	.80	.02	3.17	4.93	13.38	29.3242	
8						125,865		~~125,581~~ 12,160	-2.07
9						36,617		36,554 ~~36,554~~	1.49
10								~~69,558~~	

Finish Time: 1:35

AV = 4647
CM = 4,622 3,068 (0.291)

Signature of Technicians: _____

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 4/16/91

Test Portion: Baseline _____ Treated _____ 0353557

Equipment Tested: 3004 Miles ~~350~~7 I.D.: # _____

Engine Type _____ Hours 2411 I.D.: # _____

Exhaust Stack Diam _____ Inches 338 hrs

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 11:20

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	2000	481	.60 ~~.65~~	.102	4	5.08	13.4	
2		481.8	.60	.02	4	5.04	13.2	CAL.
3		485.6	.60	.03	6	5.04	13.8	
4		485.2	.55	.02	6	5.03	13.6	CAL
5		484.0	.65	.02	6	5.08	13.7	
6		487.0	.60	.02	6	5.05	13.6	
7		484.1	.60	.022	5.33	5.08	13.55	28.350K
8								~~83,000~~ 122,893
9								~~7079~~ ~~7891~~
10								80,292 -1.34

AV = 4,140.9

Corr = 1,444.4

Finish Time: 11:29

Signature of Technicians: _____

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 4/16/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 3002 Miles 310427.5 I.D. # _____

Engine Type _____ Hours 2579 I.D. # _____

Exhaust Stack Diam _____ Inches 406 hrs

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 12:27

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	2000	515.6	0.80	0.02	6	5.31	13.7	— CAL
2		~~514~~ 512.8	0.85	0.02	8	5.31	12.7	
3		518.0	1.00	0.02	5	5.27	13.1	— CAL
4		515.2	0.85	0.02	4	5.28	13.0	
5		~~536.8~~ ?	0.55	0.02	5	4.54	14.2	— CAL
6	2000	466.0	0.55	0.02	8	4.58	14.0	
7	CONSTANT 2WD	452.8	0.50	0.02	6	4.51	14.3	— CAL
8		451.2	0.45	0.02	5	4.59	14.1	
9		453.0	0.50	0.02	4	4.56	14.3	— CAL
10		455.8	.50	0.02	5.75	4.56	14.18	29.2973

Finish Time: 12:40

N = 3,723

C_{FM} = 1,299.58

136,000 ~~3,000~~

~~3,000~~ (59%)

~~(1,740)~~

55,836

Signature of Technicians: _____

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 4/16/91

Test Portion: Baseline _____ Treated ~~X~~

Equipment Tested: 347 Miles 22311 I.D. # _____

Engine Type _____ Hours 1359 I.D. # _____

Exhaust Stack Diam 8 Inches 38 hrs

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 10:41

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	2000	445.4	0.95	0.02	4	4.47	14.2	
2		452.2	1.00	0.02	6	~~4.44~~ 4.50	14.0	
3		448.6	0.95	0.02	6	4.50	14.6	CAL
4		448.0	1.00	0.02	6	4.44	14.5	
5		446.0	0.95	0.02	9	4.48	14.8	
6		447.2	1.05	0.02	9	4.48	14.6	CAL
7		447.9	.98	.02	6.67	4.48	14.75	29.2554
8								138,600
9								2,362
10								~~29~~ (-7.254)

AV = 5,199.7
CM = 1,811.5

Finish Time: 10:51

Signature of Technicians: _____ GJ 164

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 4-16-91

Test Portion: Baseline _____ Treated X

Equipment Tested: 348 Miles _____ I.D. # _____

Engine Type _____ Hours 9324 I.D. # _____

Exhaust Stack Diam 8 Inches 292 cfm

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 10:25

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	2000	485.2	1.0	0.01	4	4.58	13.9	
2		482.6	0.95	0.02	4	4.61	13.8	CAL
3		481.4	0.95	0.01	2	4.59	14.6	
4		482.2	0.90	0.01	2	4.61	14.6	CAL
5		483.6	0.90	0.02	4	4.56	14.7	
6		480.8	0.95	0.02	4	4.58	14.6	
7		492.6	.94	0.015	3.33	4.59	14.37	28.308
8								135,000
9								~~2458~~
10								70,417.2

AV = 5,178.9

CFM = 1,807.1

Finish Time: 10:33

Signature of Technicians: _____

~~70,417.2~~

(-3.03%)

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 4/16/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 3003 Miles 429709 I.D. # _____

Engine Type _____ Hours 12242 I.D. # _____

Exhaust Stack Diam _____ Inches 370 hrs

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 13:54

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks	
1	2000	469.6	0.95	0.03	5	4.73	13.3		— CAL
2		466.0	0.95	0.03	8	4.66	13.0		
3		461.0	0.85	0.03	10	4.47	14.4		— CAL
4		456.0	0.85	0.02	9	4.48	14.0		
5		452.6	0.90	0.03	8	4.53	14.3		— CAL
6		449.6	0.90	0.03	9	4.52	14.3		
7		455.1	0.90	0.03	8.17	4.56	13.88	29.28.15	
8								135,000	~~[illegible]~~
9								~~2,489~~	~~[illegible]~~
10								71,036	~~[illegible]~~

Finish Time: 14.02 (17.69)

AV = 5,003.9

CFM = 1,746.7

Signature of Technicians: _____

UHI CORPORATION
PROVO, UTAH

CARBON MASS BALANCE
FIELD DATA FORM

Company: CMC Test Date: 4/16/91

Test Portion: Baseline _____ Treated _____

Equipment Tested: 4571 980 Miles _____ I.D. # _____

Engine Type _____ Hours 5337 I.D. # _____

Exhaust Stack Diam _____ Inches

BP: _____ Inches Hg @ _____ °F

Fuel: _____ SG @ _____ °F

Ambient Temp: _____ °F Start Time: 11:40

	RPM	Exh Temp °F	P_v Inch H_2O	CO	HC	CO_2	O_2	Remarks
1	2038	~~1500~~ 4	2.2	.03	6	350	16.3	
2	2028	458	2.0	.03	6	3.48	15.6	CAL
3		462	2.0	.03	6	3.50	15.8	
4		458	2.1	.03	6	350	15.8	CAL
5	2029	462.2	2.1	.03	5	3.45	15.8	
6		459.2	2.0	.03	5	3.44	15.9	
7		459.8	2.07	.03	5.6	3.48	15.8	29.1883
8								~~126,000~~ 126,531
9								~~27,720~~ 5.586
10								~~102,600~~ 102,723 (15.960)

Finish Time: 11:50

Av = 7537

Cm = 1,480 (0.6216)

Signature of Technicians: _____