Xtreme Fuel Optimizer Fuel Catalyst Evaluation

For

Fuel Efficiency and Emissions Reductions

With

BFS Services

Utilizing

The Carbon Mass Balance Test Procedure

Final Report
December 2010

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Green Planet
For:

Xtreme Fuel Optimizer

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WHAT IS THE CARBON MASS BALANCE TEST PROCEDURE?

PREFACE

Fuel consumption measurements by reliable and accredited methods have been under constant review for many years. The weight of engineering evidence and scientific theory favors the Carbon Mass Balance method by which carbon measured in the engine exhaust gas is related to the carbon content of the fuel consumed. This method has certainly proven to be the most suitable for field-testing where minimizing equipment down time is a factor.

The inquiries of accuracy and reliability to which we refer include discussions from international commonwealth and government agencies responsible for the test procedure discussed herein. This procedure enumerates the data required for fuel consumption measurements by the “Carbon Mass Balance” or “exhaust gas analysis” method. The studies conducted show that the Carbon Mass Balance has been found to be a more precise fuel consumption test method than the alternative volumetric-gravimetric methods.

The Carbon Mass Balance test is a fundamental part of the Australian Standards **AS2077-1982**. Further, the Carbon Mass Balance test procedure has proven to be an intricate part of the United States EPA, FTP and HFET Fuel Economy Tests. Also, Ford Motor Company characterized the Carbon Mass Balance test procedure as being “at least as accurate as any other method of volumetric-gravimetric testing.” (**SAE Paper No. 750002 Bruce Simpson, Ford Motor Company**) Finally, the Carbon Mass Balance procedure is incorporated in the Federal Register Voluntary Fuel Economy Labeling Program, Volume 39.

The following photographic report captures a few of the applicable steps necessary for conducting a reliable and accurate Carbon Mass Balance test. As will be documented, every effort is made to ensure that each test is consistent, repeatable, and precise. More importantly, it will be even clearer as to why the Carbon Mass Balance Test has such a high degree of acceptance and reliability.

EXECUTIVE SUMMARY

The Xtreme Fuel Optimizer fuel catalyst manufactured and marketed by Xtreme Fuel Optimizer, is a fuel borne catalyst wherein the primary active ingredient is a soluble organo-metallic chemistry that helps to reduce ignition delay by improving combustion chamber mixing through improved molecular dispersion.

The catalyst is comprised of a proprietary organo-metallic compound with the formula $Fe(C_5H_5)_2$. It is the prototypical metallocene, a type of organo-metallic chemical compound consisting of two cyclopentadienyl rings bound on opposite sides of a central soluble metal atom. Such organo-metallic compounds are also known as sandwich compounds. The rapid growth of organo-metallic chemistry is often attributed to the novelty arising from the discovery of the soluble metal crystalline structure and its many analogues.

The proprietary organo-metallic derivative has many niche uses that exploit the unusual structure (ligand scaffolds, pharmaceutical candidates), robustness (anti-knock formulations, precursors to materials), and redox (reagents and redox standards). Such organo-metallic components and its derivatives are antiknock agents used in the fuel for gasoline and diesel engines; they are safer than tetraethyl lead, previously used. The harmless Ferric Oxide deposits formed from the catalysts organo-metallic component can form a conductive coating that assists in catalytic activation of the combustion process.

Following discussions with XFO Representatives, and the, Chief Operating Officer, BFS Services, it was determined that a fuel consumption analysis should be conducted utilizing at least three (3) later model delivery trucks. The designated equipment for this study includes one (1) 1999 Volvo truck with a Cummins 11L engine (unit 0601), one (1) 2001 Chevrolet Club Van 3500 with a 4HE1XS engine (unit 0286) and a 2007 Isuzu NPR with a 6.0 litre gasoline engine (unit 1510). Engines with differing mileage accumulations were evaluated in an attempt to determine the affects of the XFO fuel Catalyst on engines with varying use and horsepower.

It was determined that several engines be evaluated, ranging from relatively low miles, to those with higher miles. A baseline test was conducted after which the equipment was dosed by hand treating the onboard rolling fuel tank with XFO fuel catalyst. Treatment was facilitated through the use of sixteen (16) ounce containers of XFO fuel catalyst, which were used to hand treat each test unit. At a later date, the catalyst treated fuel test was then repeated following the same parameters. The results are contained within the body of this report.

BFS Services is a contract carrier utilizing over 40 trucks. They are a logistics company delivering non-food related packages throughout the greater Dallas, Texas area and surrounding locations. They currently consume approximately 10,000 gallons of fuel monthly.

A baseline test (untreated) was conducted on October 25, 2010, using the Carbon Mass Balance (CMB) test procedure, after which the fuel for the pre-selected test equipment was treated by adding the XFO fuel catalyst to the diesel fuel contained in each individual truck's rolling tank. On December 7, 2010, the test was then repeated (XFO treated) following the same parameters. The results are contained within this report.

The data showed that the average improvement in fuel consumption for all trucks tested was 7.5% during steady state testing, using the CMB test procedure. Further details will be discussed in the body of this report.

The treated engines also demonstrated a large percentage reduction in soot particulates in the range 22% and reductions in harmful exhaust related carbon fractions. Carbon dioxide reductions, based upon the measured reduction in fuel consumption, are also substantial.

INTRODUCTION

Baseline (untreated) fuel efficiency tests were conducted on all three (3) pieces of equipment on October 25, 2010, employing the CMB test procedure. Xtreme Fuel Optimizer supplied a sufficient number of sixteen (16) ounce bottles of XFO fuel catalyst utilized to dose/treat the fuel tank on each individual test unit, by each individual driver or a specified agent with the responsibility to ensure that each truck was properly treated with the catalyst. The sixteen (16) ounce containers had graduated treatment markings, which aided in the convenience of treating each time the test units were fuelled. The test units were then operated on XFO catalyst treated fuel for a specific period of time to generate as many operational miles as possible. Tests conducted provide critical documentation, which proves that equipment operated with less than 2,000 to 3,000 treated miles demonstrate lower fuel consumption improvements because of the catalytic stabilization affects that take place while using XFO fuel combustion catalyst.

At the end of the treated engine-conditioning period (December 7, 2010), the engine tests were repeated, reproducing all engine parameters. The final results, along with the data sheets, are contained within this report.

At the conclusion of the treated segment of the evaluation, catalyst level remnants were retrieved from each truck and evaluated to volumetrically enumerate actual catalyst treatment during the course of the evaluation. The following data applies to each truck along with the final accumulated mileage.

Truck Number	Accumulated Mileage	Catalyst Used	Ounces per Mile
0601	2,971	12 oz.	.0040
0286	4,728	16 oz.	.0034
1510	4,997	26 oz.	.0052

Comparative hours relative to estimated fuel consumption indicates that all of the fuel was adequately dosed/treated with the catalyst during the course of the evaluation. The calculated ounces per mile indicate that each of the test units, based on treatment ratio, was only slightly over treated with the fuel catalyst. This in no way detracts from the accuracy of the test nor does it suggest that any over treatment of this magnitude will damage delicate engine components. This data will be further discussed under the **Conclusion** heading in this final report.

TEST METHOD

Carbon Mass Balance is a procedure whereby the mass of carbon in the exhaust is calculated as a measure of the fuel being burned. The elements measured in this test include the exhaust gas composition, its temperature, and the gas flow rate calculated from the differential pressure and exhaust stack cross sectional area. The CMB is central to both the US-EPA (FTP and HFET) and Australian engineering standard tests (AS2077-1982), although in field-testing we are unable to employ a chassis dynamometer. However, in the case of a stationary equipment test, the engine can be loaded sufficiently to demonstrate fuel consumption trends and potential.

The Carbon Mass Balance formula and equations employed in calculating the carbon flow are a supplied, in part, by doctors' of Combustion Engineering at the university and scientific research facility level.

The Carbon Mass Balance test procedure follows a prescribed regimen, wherein every possible detail of engine operation is monitored to ensure the accuracy of the test procedure. Cursory to performing the test, it is imperative to understand the quality of fuel utilized in the evaluation. As important, the quality of fuel must be consistent throughout the entirety of the process.

Fuel density and temperature tests are performed for both the baseline and treated segments of the evaluation to determine the energy content of the fuel. A .800 to .910 (diesel) and .700 to .800 (gasoline) Precision Hydrometer, columnar flask and Raytek Minitemp are utilized to determine the fuel density for each prescribed segment of the evaluation.

Next, and essential to the Carbon Mass Balance procedure, is test equipment that is mechanically sound and free from defect. Careful consideration and equipment screening is utilized to verify the mechanical stability of each piece of test equipment. Preliminary data is scrutinized to disqualify all equipment that may be mechanically suspect. Once the equipment selection process is complete, the Carbon Mass Balance test takes only 10 to 20 minutes, per unit, to perform.

Once the decision is made to test a certain piece of equipment, pertinent engine criteria needs to be evaluated as the Carbon Mass Balance procedure continues.

When the selection process is complete, engine RPM is increased and locked in position. This allows the engine fluids, block temperature, and exhaust stream gasses to stabilize. Data cannot be collected when there is irregular fluctuation in engine RPM and exhaust constituent levels. Therefore, all engine operating conditions must be stable and consistent.

An aftermarket throttle position lock is utilized, as one method, to secure engine RPM. This provides a steady state condition in which consistent data can be collected. Also, the vehicle cruise control is an ideal source for securing engine RPM. Should the engine RPM fluctuate erratically and uncontrollably, the test unit would be disqualified from further consideration.

Next**,** engine RPM and fluid temperatures are monitored throughout the Carbon Mass Balance evaluation. As important, exhaust manifold temperatures are monitored to ensure that engine combustion is consistent in all cylinders. It is imperative that the engine achieve normal operating conditions before any testing begins.

Once engine fluid levels have reached normal operating conditions the Carbon Mass Balance study may begin. The above photograph shows that the engine speed is locked in place at 1400 RPM. It should be noted that any deviation in

RPM, temperature, either fluid or exhaust, would cause this unit to be eliminated from the evaluation due to mechanical inconsistencies.

Once all of the mechanical criteria are met, data acquisition can commence; it is necessary to monitor the temperature and pressure of the exhaust stream. Carbon Mass Balance data cannot be collected until the engine exhaust temperature has peaked. Exhaust temperature is monitored carefully for this reason.

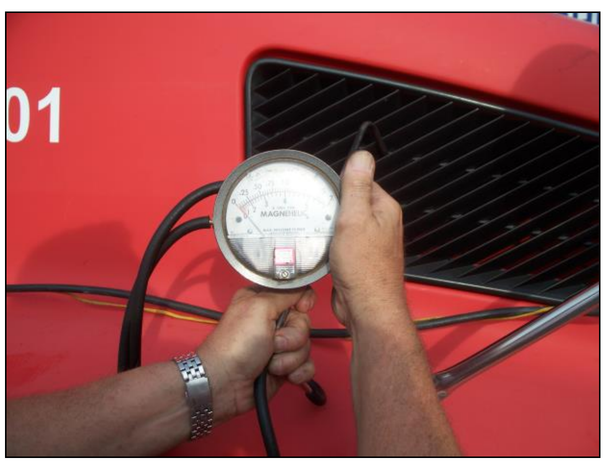
Once the exhaust temperature has stabilized, the test unit has reached its peak operating temperature. Exhaust temperature is critical to the completion of a successful evaluation, since temperature changes identify changes in load and RPM. As previously discussed, RPM and load must remain constant during the Carbon Mass Balance study.

When all temperatures are stabilized, and the desired operating parameters are achieved; it is time to insert the emissions sampling probe into the exhaust tip of each piece of equipment utilized in the study group. The probe has a non-dispersive head, which allows for random exhaust sampling throughout the cross section of the exhaust.

While the emission-sampling probe is in place, and data is being collected, exhaust temperature and pressure are monitored throughout the entirety of the Carbon Mass Balance procedure. The above photograph shows a typical location of the exhaust emissions sampling probe.

While data is being collected, exhaust pressure is monitored, once again, as a tool to monitor load and RPM fluctuations. Exhaust pressure is proportional to load. Therefore, as one increases, or decreases, so in turn does the other. The Carbon Mass Balance test is unique in that all parameters that have a dramatic affect on fuel consumption, in a volumetric test, are controlled and monitored throughout the entire evaluation. This ensures the accuracy of the data being collected. Exhaust pressure is nothing more than an accumulation of combustion events that are distributed through the exhaust matrix.

The above photograph shows one method in which exhaust pressure can be monitored during the Carbon Mass Balance test procedure. In this case, exhaust pressure is ascertained through the use of a Magnahelic gauge. This type of stringent regime further documents the inherent accuracy of the Carbon Mass Balance test.



The same data was collected for air inlet velocities. This procedure is utilized to ensure that engine air inlet velocities are not restricted during the course of the evaluation. This process helps to prevent a lean to rich or converse engine performance condition.

At the conclusion of the Carbon Mass Balance test, a soot particulate test is performed to determine the engine exhaust particulate level. This valuable procedure helps to determine the soot particulate content in the exhaust stream. Soot particulates are the most obvious and compelling sign of pollution. Any attempt to reduce soot particulates places all industry in a favorable position with environmental policy and the general public.

The above photograph demonstrates a typical method in which soot particulate volume is monitored during the Carbon Mass Balance test. This method is the Bacharach Smoke Spot test. It is extremely accurate, portable, and repeatable. It is a valuable tool in smoke spot testing when comparing baseline (untreated) exhaust to catalyst treated exhaust.

Finally, the data being recorded is collected through a non-dispersive, infrared analyzer. Equipment such as this is EPA approved and CFR 40 rated. This analyzer has a high degree of accuracy, and repeatability. It is central to the Carbon Mass Balance procedure in that it identifies baseline carbon and oxygen levels, relative to their change with catalyst treated fuel, in the exhaust stream.

The data accumulated is extremely accurate, as long as the criteria leading up to the accumulation of data is held to the same standards. For this reason, the Carbon Mass Balance test is superior to any other test method utilized. It eliminates a multitude of variables that can adversely affect the outcome and reliability of any fuel consumption evaluation.

The above photograph identifies one type of analyzer used to perform the Carbon Balance test. The analyzer is calibrated with known reference gases before the baseline and treated test segments begin. The data collected from the analyzer for each segment of the evaluation is compared and computed to determine overall carbon change when compared to the carbon contained within the raw diesel fuel. A fuel consumption performance factor is then calculated from the data. The baseline performance factor is compared with the catalyst treated performance factor. The difference between the two performance factors identifies the change in fuel consumption during the Carbon Balance test procedure.

Note: **The Horiba MEXA emissions analyzer is calibrated with the same reference gas for both the baseline and treated segments of the evaluation.**

Essential to performing the aforementioned test procedure is the method in which the task for dosing fuel is performed. It is critical to the success of the Carbon Mass Balance procedure to ensure that the equipment evaluated be given meticulous care and consideration to advance the process of testing.

INSTRUMENTATION

Precision state of the art instrumentation was 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 purpose are listed below:

> *Measurement of exhaust gas constituents HC, CO, CO_2 and O_2, by Horiba Mexa Series, four gas infrared analyser.*

Note: The Horiba MEXA emissions analyser is calibrated with the same reference gas for both the baseline and treated segments of the evaluation. In this case, a

Temperature measurement; by Fluke Model 52K/J digital thermometer.

Exhaust differential pressure by Dwyer Magnahelic.

Ambient pressure determination by use of Brunton ADC altimeter/barometer.

The exhaust soot particulates are also measured during this test program.

Exhaust gas sample evaluation of particulate by use of a Bacharach True Spot smoke meter.

The Horiba infrared gas analyser was serviced and calibrated prior to each series of CMB engine efficiency tests.

TEST RESULTS

Fuel Efficiency

A summary of the CMB fuel efficiency results achieved, in this test program, are provided in the following tables and appendices. **See Table I and Individual Carbon Mass Balance results in Appendix II.**

Table I provides the final test results for all equipment included in the evaluation before and after XFO fuel catalyst treatment **(See Graph II, Appendix I)**.

TABLE I

Test Segment	Miles	Fuel Change by %
0601		
Treated	2,971	**- 7.0%**
0286		
Treated?	4,728	**- 8.1%**
1510		
Treated?	4,997	**- 7.3%**
Average (Absolute)		**- 7.5%**

The computer printouts of the calculated CMB test results are located in **Appendix II.** The raw engine data sheets used to calculate the CMB are contained in **Appendix III**. The raw data sheets, and Carbon Mass Balance sheets show and account for the environmental and ambient conditions during the evaluation.

Soot Particulate Tests

Concurrent with CMB data extraction, soot particulate measurements were conducted. The results of these tests are summarized in **Table II**. Reductions in soot particulates are the most apparent and immediate. Laboratory testing indicates that carbon and solid particulate reductions occur before observed fuel reductions. Studies show that a minimum of 2,000 to 3,000 miles, XFO fuel catalyst treated engine operation, are necessary before the conditioning period is complete. Then, and only then, will fuel consumption improvements be observed. For the purpose of this evaluation, observed stack soot accumulation had diminished significantly between baseline and treated segments of the evaluation.

Table II

Fuel Type Density **Diesel** **.832 @ 16.8 C.** **Gasoline** **.746 @ 16.8 C**	**Soot Particulates**
0601	
Untreated	0.44 mg/m^3
Treated	0.35 mg/m^3
	- 20%
0286	
Untreated	4.41 mg/m^3
Treated	3.16 mg/m^3
	- 28%
1510	
Untreated	0.10 mg/m^3
Treated	.081 mg/m^3
	- 19%
Average	**- 22.3%**

The reduction in soot particulate density (the mass of the smoke particles) was reduced by an average 22.3% after fuel treatment and engine conditioning with XFO fuel catalyst **(See Graph 1, Appendix I).** Concentration levels were provided through the use of a Bacharach Smoke Spot tester.

Volumetric Fuel Consumption Evaluation

There are many potential hazards when trying to perform a volumetric test under real time conditions. Variables such as load, weather, driver error, tire pressure, wind velocity and direction, barometric pressure, incomplete or inaccurate data, ambient temperature, load height, fuel energy and BTU based on fuel supplier, odometer efficiencies, etc., adversely affect quality data collection under the most ideal circumstances.

Understanding the difficult nature of driver and equipment repeatability is certainly a testament to why so many recognized laboratories utilize the CMB test procedure. The CMB test procedure minimizes the affects of uncontrolled variables such as those encountered during the course of a typical volumetric fuel consumption analysis.

Conclusion

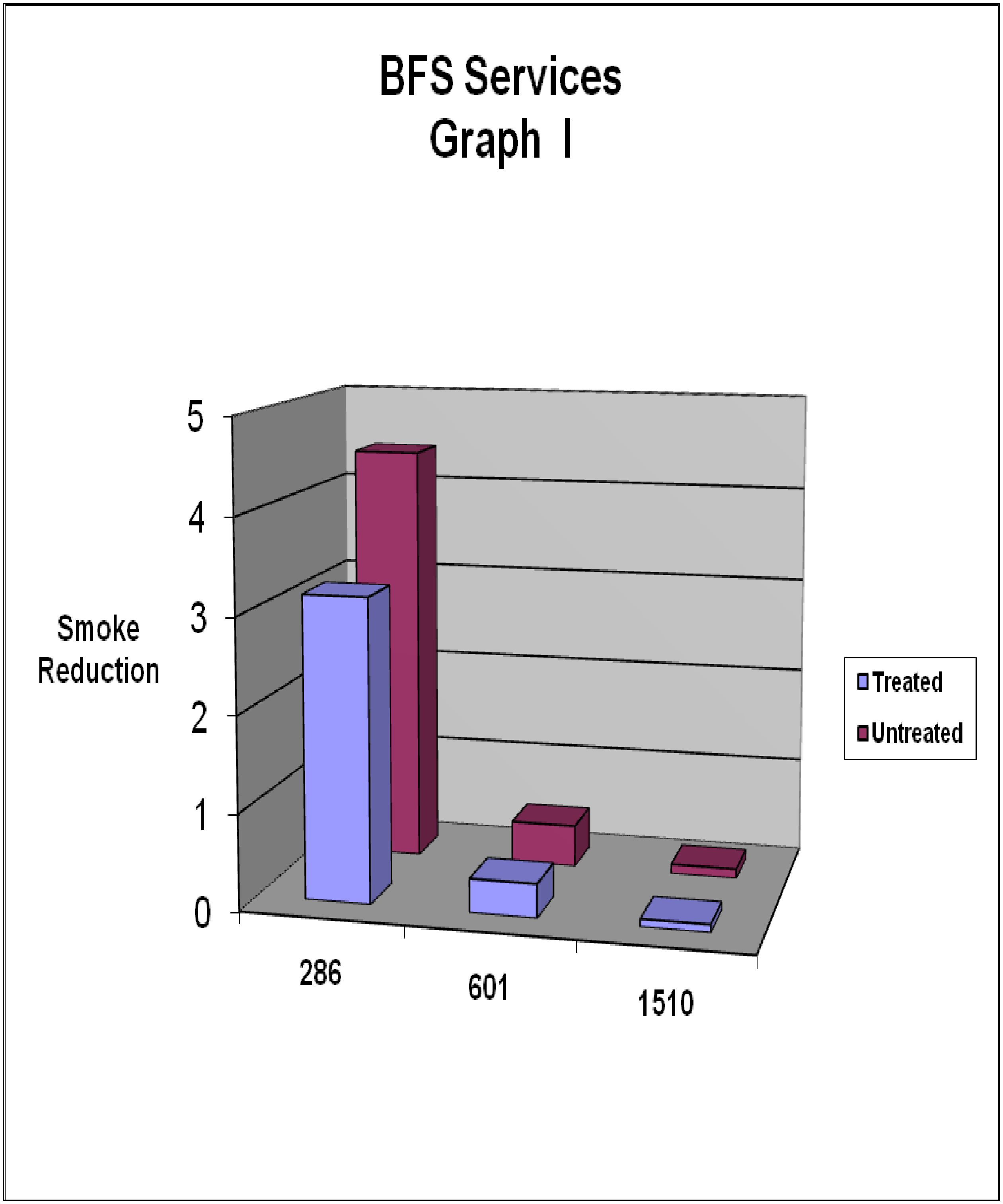
These carefully controlled engineering standard test procedures conducted on all three pieces of test equipment provide clear evidence of reduced fuel consumption in the range of 7.5%. In general, improvements utilizing the Carbon Mass Balance test, under static test conditions, generate results 2% - 3% less than those results generated with an applied load.

The XFO fuel catalyst's effect on improved combustion is also evidenced by the substantial reduction in soot particulates (smoke) in the range of 22% **(see Appendix I, Graph I)**. The similar reductions in other harmful carbon emissions likewise substantiates the improved combustion created by the use of XFO fuel combustion catalyst **(see raw data sheets, Appendix III)**.

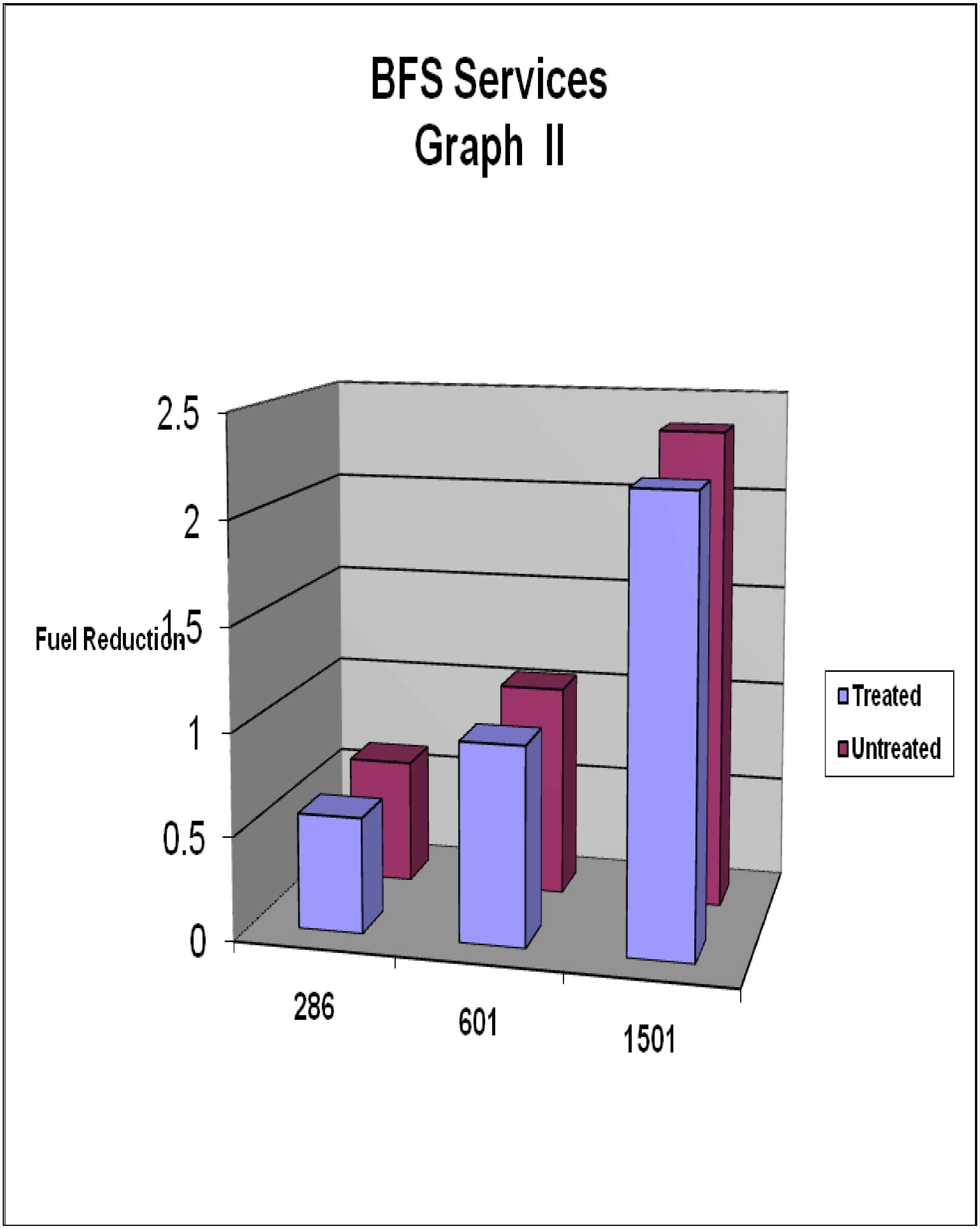
In addition to the fuel consumption analysis, a detailed compilation of carbon emissions reductions were calculated based on estimated fuel consumption. The study documented a significant reduction in annual C02 emissions of 92 metric tonnes. Reductions in Nitrogen and Methane levels were also observed **(see Appendix IV, Carbon Footprint Data)**

Appendix I

Exhaust Particulate and Fuel Graphs



Soot Particulate Graph: Expressed in mg/m^3



Fuel Consumption Graph: Expressed in grams/second

Appendix II

Carbon Mass Balance Compilation Sheets

CARBON BALANCE RESULTS

COMPANY :	BFS Services	LOCATION :	Cappell, Texas
EQUIPMENT :	Chevrolet W3500	UNIT NR. :	286
ENG. TYPE :	4HE1XS-175 H.P.	MODEL :	2001
RATING :		FUEL :	Diesel

BASELINE TEST — **DATE : 10/25/10**

TRUCK MILES	333,464	ENG. RPM:	1500
AMB. TEMP (C) :	26.7	STACK(mm):	86.6
BAROMETRIC (mb)	1030	LOAD:	High Idle

	TEST 1	*TEST 2*	*TEST 3*	*TEST 4*	*TEST 5*	AVERAGE	% ST.DEV
PRES DIFF (Pa):	87.2	87.2	87.2	87.2	87.2	87	0.00
EXHST TEMP (C):	136.6	136.5	136.5	136.4	136.5	137	0.05
HC (ppm) :	14	14	12	14	16	14.0	10.10
CO (%) :	0.02	0.02	0.02	0.02	0.02	0.020	0.00
CO2 (%) :	2.46	2.44	2.44	2.46	2.46	2.45	0.45
O2 (%) :	8.88	8.86	8.90	8.92	8.90	8.89	0.26
CARB FLOW(g/s):	0.613	0.608	0.608	0.613	0.614	0.611	0.46

REYNOLDS NR. : 4.19E+04

TREATED TEST — **DATE : 12/7/10**

TRUCK MILES:	338,192	ENG. RPM:	1500
AMB. TEMP (C) :	13.9	STACK(mm):	86.6
BAROMETRIC(mb):	1028	LOAD:	High Idle

	TEST 1	*TEST 2*	*TEST 3*	*TEST 4*	*TEST 5*	AVERAGE	% ST.DEV
PRES DIFF (Pa):	86.9	86.9	86.9	86.9	86.9	87	0.00
EXHST TEMP (C):	134.6	134.6	134.7	134.7	134.8	135	0.06
HC (ppm) :	10	10	11	10	11	10.4	5.27
CO (%) :	0.02	0.02	0.01	0.02	0.01	0.016	22.00
CO2 (%) :	2.26	2.27	2.24	2.26	2.26	2.26	0.49
O2 (%) :	8.86	8.88	8.89	8.92	8.90	8.89	0.25
CARB FLOW(g/s):	0.563	0.566	0.556	0.563	0.561	0.562	0.66

REYNOLDS NR. : 4.19E+04 TOTAL MILES ON TREATED FUEL: 4728

PERCENTAGE CHANGE IN FUEL CONSUMPTION ((TREATED-BASE)/BASE*100) : **-8.1 %**

REMARKS:

CARBON BALANCE RESULTS

COMPANY :	BFS Services	LOCATION :	Cappell, Texas
EQUIPMENT :	Volvo Tractor	UNIT NR. :	601
ENG. TYPE :	11 L Cummins	MODEL :	1999
RATING :		FUEL :	Diesel

BASELINE TEST — **DATE : 10/25/10**

TRUCK MILES	960,858	ENG. RPM:	1400
AMB. TEMP (C) :	26.9	STACK(mm):	123.75
BAROMETRIC (mb)	1029	LOAD:	High Idle

	TEST 1	*TEST 2*	*TEST 3*	*TEST 4*	*TEST 5*	AVERAGE	% ST.DEV
PRES DIFF (Pa):	112	112	112	112	112	112	0.00
EXHST TEMP (C):	126	126.2	126.4	126.5	126.5	126	0.17
HC (ppm) :	11	12	11	12	12	11.6	4.72
CO (%) :	0.02	0.02	0.02	0.02	0.02	0.020	0.00
CO2 (%) :	1.76	1.76	1.78	1.78	1.78	1.77	0.62
O2 (%) :	8.86	8.90	8.92	8.94	8.88	8.90	0.36
CARB FLOW(g/s):	1.032	1.032	1.043	1.044	1.044	1.039	0.58

REYNOLDS NR. : 4.81E+04

TREATED TEST — **DATE : 12/7/10**

TRUCK MILES:	963,829	ENG. RPM:	1400
AMB. TEMP (C) :	14.1	STACK(mm):	123.75
BAROMETRIC(mb):	1029	LOAD:	High Idle

	TEST 1	*TEST 2*	*TEST 3*	*TEST 4*	*TEST 5*	AVERAGE	% ST.DEV
PRES DIFF (Pa):	111.5	111.5	111.5	111.5	111.5	112	0.00
EXHST TEMP (C):	124.6	124.7	124.8	124.8	124.9	125	0.09
HC (ppm) :	8	9	9	9	8	8.6	6.37
CO (%) :	0.01	0.01	0.01	0.01	0.01	0.010	0.00
CO2 (%) :	1.66	1.65	1.67	1.66	1.65	1.66	0.50
O2 (%) :	8.74	8.76	8.80	8.80	8.79	8.78	0.31
CARB FLOW(g/s):	0.967	0.962	0.973	0.968	0.961	0.966	0.51

REYNOLDS NR. : 4.81E+04 TOTAL MILES ON TREATED FUEL: 2971

PERCENTAGE CHANGE IN FUEL CONSUMPTION ((TREATED-BASE)/BASE*100) : **-7.0 %**

REMARKS:

CARBON BALANCE RESULTS

COMPANY :	BFS Services	LOCATION :	Cappell, Texas
EQUIPMENT :	Isuzu NPR	UNIT NR. :	1510
ENG. TYPE :	6.0 ltr.	MODEL :	2007
RATING :		FUEL :	Diesel

BASELINE TEST | **DATE : 10/25/10**

TRUCK MILES	60,154	ENG. RPM:	1800
AMB. TEMP (C) :	27.1	STACK(mm):	86.6
BAROMETRIC (mb)	1031	LOAD:	High Idle

	TEST 1	*TEST 2*	*TEST 3*	*TEST 4*	*TEST 5*	AVERAGE	% ST.DEV
PRES DIFF (Pa):	37.4	37.4	37.4	37.4	37.4	37	0.00
EXHST TEMP (C):	227.1	227.3	227.4	227.4	227.5	227	0.07
HC (ppm) :	5	6	5	6	5	5.4	10.14
CO (%) :	0.00	0.01	0.00	0.00	0.01	0.004	136.93
CO2 (%) :	16.28	16.24	16.26	16.24	16.24	16.25	0.11
O2 (%) :	8.88	8.96	8.92	8.94	8.90	8.92	0.35
CARB FLOW(g/s):	2.355	2.350	2.351	2.348	2.350	2.351	0.10
REYNOLDS NR. :	2.49E+04						

TREATED TEST | **DATE : 12/7/10**

TRUCK MILES:	65,151	ENG. RPM:	1800
AMB. TEMP (C) :	14.3	STACK(mm):	86.6
BAROMETRIC(mb):	1028	LOAD:	High Idle

	TEST 1	*TEST 2*	*TEST 3*	*TEST 4*	*TEST 5*	AVERAGE	% ST.DEV
PRES DIFF (Pa):	37.4	37.4	37.4	37.4	37.4	37	0.00
EXHST TEMP (C):	226.8	226.9	227	227.1	227.2	227	0.07
HC (ppm) :	8	9	9	9	8	8.6	6.37
CO (%) :	0.01	0.00	0.00	0.00	0.00	0.000	0.00
CO2 (%) :	15.08	15.06	15.08	15.07	15.09	15.08	0.08
O2 (%) :	8.86	8.80	8.88	8.90	8.88	8.86	0.43
CARB FLOW(g/s):	2.182	2.178	2.181	2.179	2.181	2.180	0.08
REYNOLDS NR. :	2.48E+04		TOTAL MILES ON TREATED FUEL:			4997	

PERCENTAGE CHANGE IN FUEL CONSUMPTION ((TREATED-BASE)/BASE*100) : **-7.3 %**

REMARKS:

Appendix III

Raw Data Sheets

BFS
0286

Carbon Mass Balance Field Data Form

Company: BFS Services Location: Cappell, Tx Date: 10-25-10

Water Temp: ø Oil Pres: ø Fan Clutch: on Smoke No: 4.41 mg/m3 Exhaust Diameter: 8" Inches

Test Portion: Baseline: X Treated: ___ Engine Make/Model: 2001 Van 4HEJXS Chev Air Inlet Velocity: .15

Exhaust Manifold Temp: ø Miles/Hours: 333,464 ID#: 0286 Fuel Specific Gravity: .8328

Type of Equipment: Chevrolet W3500 Van Exhaust Side: Only Barometric Pressure: 1030

RPM: 1600 Load: Static - AC/Heater off - Lights off Oil Pressure Temp. ø

Fuel Type	Exhaust Temp °C	P Inches Of H_2O	CO	HC PPM	CO_2	02	Ambient Temp. C.	Instrument Calibration	Observer	Time Begin To Time End
Diesel	136.6	87.2	.02	14	2.46	8.88	26.7	Yes		5:10 p.m.
	136.5	87.2	.02	14	2.44	8.86				
	136.5	87.2	.02	12	2.44	8.90				
	136.4	87.2	.02	14	2.46	8.92				
	136.5	87.2	.02	16	2.46	8.90				5:20 p.m.

Carbon Mass Balance Field Data Form

Company: BFS Services Location: Coppell, Tx Date: 12-7-20

Water Temp: ø Oil Pres: ø Fan Clutch: on Smoke No: 3.16 mg/m³ Exhaust Diameter: 86.6 ~~Inches~~ mm

Test Portion: Baseline: ____ Treated: X Engine Make/Model: 2001 Van 4HEIXS Chev. Air Inlet Velocity: .15

Exhaust Manifold Temp: ø Miles/Hours: 338,192 ID#: 0286 Fuel Specific Gravity: .832 @ 16.8°C

Type of Equipment: Chevrolet W3500 Van Exhaust Side: only Barometric Pressure: 1028

RPM: 1600 Load: static - AC/Heater off - Lights off Oil Pressure Temp. ø

Fuel Type	Exhaust Temp °C	P Inches Of H_2O	CO	HC PPM	CO_2	02	Ambient Temp. C.	Instrument Calibration	Observer	Time Begin To Time End
Diesel	134.6	86.9	.02	10	2.26	8.86	13.9	Yes		4:30 p.m.
	134.6	86.9	.02	10	2.27	8.88				
	134.7	86.9	.01	11	2.24	8.87				
	134.7	86.9	.02	10	2.26	8.92				
	134.8	86.9	.01	11	2.26	8.90				4:40 p.m.

Carbon Mass Balance Field Data Form

Company: BFS Services **Location:** Coppell, Tx **Date:** 10-25-10

Water Temp: Ø **Oil Pres:** Ø **Fan Clutch:** off **Smoke No:** .44 mg/m3 **Exhaust Diameter:** 123.75 ~~Inches~~ mm

Test Portion: Baseline: X **Treated:** ___ **Engine Make/Model:** 1999 11 L Cummins **Air Inlet Velocity:** .10

Exhaust Manifold Temp: Ø **~~Miles~~/Hours:** 960,858 **ID#:** 0601 **Fuel Specific Gravity:** .832@16.8C

Type of Equipment: Volvo Truck **Exhaust Side:** only **Barometric Pressure:** 1029

RPM: 1400 **Load:** static – AC/Heater off – Lights off. **Oil Pressure Temp.** Ø

Fuel Type	Exhaust Temp °C	P Inches Of H_2O	CO	HC PPM	CO_2	02	Ambient Temp. C.	Instrument Calibration	Observer	Time Begin To Time End
Diesel	126	112	.02	11	1.76	8.86	26.9	Yes		4:38 p.m.
	126.2	112	.02	12	1.76	8.90				
	126.4	112	.02	11	1.78	8.92				
	126.5	112	.02	12	1.78	8.94				
	126.5	112	.02	12	1.78	8.88				4:48 p.m.

Carbon Mass Balance Field Data Form

Company: BFS Services **Location:** Coppell, Tx **Date:** 12-7-10

Water Temp: Ø **Oil Pres:** Ø **Fan Clutch:** off **Smoke No:** .352 mg/m3 **Exhaust Diameter:** 123.75 ~~Inches~~ mm

Test Portion: Baseline: ___ **Treated:** X **Engine Make/Model:** 1929 11 L Cummins **Air Inlet Velocity:** .10

Exhaust Manifold Temp: Ø **Miles/Hours:** 963,829 **ID#:** .0601 **Fuel Specific Gravity:** .832@16.8°C

Type of Equipment: Volvo Truck **Exhaust Side:** only **Barometric Pressure:** 1029

RPM: 1400 **Load:** Static - Ac/Heater off - Lights off **Oil Pressure Temp.** Ø

Fuel Type	Exhaust Temp °C	P Inches Of H_2O	CO	HC PPM	CO_2	02	Ambient Temp. C.	Instrument Calibration	Observer	Time Begin To Time End
Diesel	124.6	111.5	.01	8	1.66	8.74	14.1	Yes		4:55 p.m.
	124.7	111.5	.01	9	1.65	8.76				
	124.8	111.5	.01	9	1.67	8.80				
	124.8	111.5	.01	9	1.66	8.80				
	124.9	111.5	.01	8	1.65	8.79				5:05 p.m.

BFS
1510

Carbon Mass Balance Field Data Form

Company: BFS Services **Location:** Coppell, Tx. **Date:** 10-25-10

Water Temp: — **Oil Pres:** — **Fan Clutch:** on **Smoke No:** .10 mg/m³ **Exhaust Diameter:** 86.6 ~~Inches~~ mm

Test Portion: Baseline: X **Treated:** ____ **Engine Make/Model:** 2007 Isuzu 6.0 Ltr. **Air Inlet Velocity:** .10

Exhaust Manifold Temp: — Miles/**Hours:** 60,154 **ID#:** 1510 **Fuel Specific Gravity:** .746 @ 16.8 C

Type of Equipment: Isuzu NPR **Exhaust Side:** only **Barometric Pressure:** 1031

RPM: 1800 **Load:** static – Ac/Heater off – Lights off **Oil Pressure Temp.** —

Fuel Type	Exhaust Temp °C	P Inches Of H_2O	CO	HC PPM	CO_2	02	Ambient Temp. C.	Instrument Calibration	Observer	Time Begin To Time End
Gasoline	227.1	37.4	.0	5	16.28	8.88	22.1	Yes		5:38 p.m.
	227.3	37.4	.01	6	16.24	8.96				
	227.4	37.4	.0	5	16.26	8.92				
	227.4	37.4	.0	6	16.24	8.94				
	227.5	37.4	.01	5	16.24	8.90				5:48 p.m.

Carbon Mass Balance Field Data Form

Company: BFS Services Location: Coppell, Tx Date: 12-7-10

Water Temp: Ø Oil Pres: Ø Fan Clutch: on Smoke No: .08 mg/m3 Exhaust Diameter: 36.6 ~~Inches~~

Test Portion: Baseline: ___ Treated: X Engine Make/Model: 2007 Isuzu 6.0 HG Air Inlet Velocity: .10

Exhaust Manifold Temp: Ø Miles/Hours: 65,151 ID#: 1510 Fuel Specific Gravity: .746 @

Type of Equipment: Isuzu NPR Exhaust Side: only Barometric Pressure: 1028

RPM: 1800 Load: Static - Ac/Heater off - Lights off Oil Pressure Temp. Ø

Fuel Type	Exhaust Temp °C	P Inches Of H_2O	CO	HC PPM	CO_2	02	Ambient Temp. C.	Instrument Calibration	Observer	Time Begin To Time End
Gasoline	226.8	37.4	.01	8	15.08	8.76	14.3	Yes		5:20 p.m.
	226.9	37.4	.00	9	15.06	8.80				
	227	37.4	.00	9	15.08	8.78				
	227.1	37.4	.00	9	15.07	8.90				
	227.2	37.4	.00	8	15.09	8.88				5:30 p.m.

Appendix IV

Carbon Footprint Data

All calculations are estimates only and are not based on actual fuel consumption:

Calculation of Greenhouse Gas Reductions

Assumptions: **Fleet Average (Estimate)**

* Fuel Type = Diesel
/Gas
*Annual Fuel Usage = 120,000 gallons, or 456,000 litres.
*Average 7.5% reduction in fuel usage with XFO fuel catalyst.

Discussion:

When fuel containing carbon is burned in an engine, there are emissions of carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_20), oxides of nitrogen (NO_x), carbon monoxide (CO), non methane volatile organic compounds (NMVOC's) and sulfur dioxide (SO_2). The amount of each gas emitted depends on the type and quantity of fuel used (the "activity"), the type of combustion equipment, the emissions control technology, and the operating conditions.

The International Greenhouse Partnerships Office section of the Federal Government Department of Science Industry and Technology has produced a workbook outlining how to calculate the quantities of greenhouse gas emissions (see Workbook attached) and is accepted internationally as the accepted approach. The workbook illustrates an example of how to calculate the mass of CO_2 for example on page 21, Table 3.1 and Example 3.1:

The CO_2 produced from burning 100 litres of diesel oil is calculated as follows:

* the CO_2 emitted if the fuel is completely burned is 2.716 kg CO2/litre (see Appendix A, Table A1)

* the oxidation factor for oil-derived fuels is 99% (see Table 3.1)

Therefore, the CO_2 produced from burning 100 litres of fuel is:

100 litres x 2.716 kg CO_2/litre x .99 = 268.88 kg

Based on the above calculations, the Greenhouse gas reductions for C02 are as follows:

Test Data Basis	Fuel Usage litres	kg CO_2 per litre fuel	Oxidation Factor	System CO_2 kg	System CO_2 tonnes
"Baseline"	456,000	2.716	0.99	1,226,111	1,226
"Treated"	421,800	2.716	0.99	1,134,153	1,134
C02 reductions with XFO fuel catalyst				**91,958**	**92**

The reduction of C02 greenhouse emissions in the amount of 92 tonnes (101 U.S. tons) is significant! Carbon Dioxide accounts for approximately 99.6% of the total greenhouse gas emissions produced. In other words, when diesel oil is burned in an internal combustion engine, the CH4 and N20 emissions contribute less than 0.4% of the greenhouse emissions. This low level is typical of most fossil fuel combustion systems and often is not calculated.

However, by way of additional information, the reduction in CH_4 and N_20 are calculated as follows:

CH_4 Emissions Reduction

* the specific energy content of the fuel is 36.7 MJ/litre (see Table A1), so the total energy in 100 litres is 3,670 MJ, or 3.67 GJ

* the CH_4 emissions factor for diesel oil used in an internal combustion engine is 4.0 g/GJ (see Table A2) so the total CH_4 emitted is 3.67 x 4 = 18.0g

"Baseline" [18.0g/100 litres] x [456,000] x [1kg/1000g] = 82 kg

"Treated" [18.0g/100 litres] x [421,800] x [1kg/1000g] = 76 kg

CH_4 Reduction = 6 kg

N_2O Emissions Reduction

* the N_2O emissions factor for diesel oil used in an internal combustion engine is 1,322 g/GJ so the total N2O emitted is 3.67 x 0.6 = 2.7 g

"Baseline" [2.7g/100 litres] x [456,000] x [1kg/1000g] = 12.3 kg

"Treated" [2.7g/100 litres] x [421,800] x [1kg/1000g] = 11.4 kg

N_2O Reduction = .9 kg