

SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO



No. 04-042392-A-00006-0000

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Tra. 11 PATENTEIYII Eve: 379 FASENACIONALII
Act. 412 REPOSPRESRECU Folios: 51

Act. 422 APELARECUR Folios: 51

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Act. 412 REPOSPRESRECU Folios: 51

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SUPERINTENDENCIA DE INDUSTRIA Y COMERCIO
DIVISION DE NUEVAS CREACIONES
E. S. D.

Re: Expediente No. 04.042.392A

Solicitud de patente a nombre de **CARROLL, ROBERT, W.;
CARROLL, NOEL; CARROLL WILLIAM, F.; CARROLL,
MICHAEL.**

Yo, DILIA RODRIGUEZ D'ALEMAN, identificada como aparece al pie de mi firma, domiciliada en la carrera 11 No. 86-53, piso 6, obrando como apoderada de **CARROLL, ROBERT, W., CARROLL WILLIAM, F., CARROLL, MICHAEL., y CARROLL, NOEL** domiciliados en Bradbury, California y Londres, Reino Unido, solicitantes de la patente de la referencia,, interpongo recurso de reposición contra la resolución No. 1764 del día 26 de enero de 2012, expedida por el Superintendente de Industria y Comercio, por medio de la cual se niega el privilegio de patente para la solicitud contenida en el expediente de la referencia.

1. FUNDAMENTOS DEL RECURSO

1.1 Mi mandante se permite manifestar a ese despacho que se reafirma en todos y cada uno de los argumentos que hacen parte integrante de la respuesta al oficio de fondo No. 11672 notificado por fijación en lista el día 10 de septiembre de 2010, presentada ante ese despacho el 4 de enero de 2011.

1.2 El indebido análisis del nivel inventivo

En su Resolución, el examinador argumenta lo siguiente:

“La cantidad de catalizador que se adiciona en el método descrito en D1 es de 0,005 ppm a alrededor de 0,5 ppm (reivindicación 10, columna 9, líneas 26 a 31). Los catalizadores empelados son sales y complejos de rutenio, rodio, iridio, osmio, platino, paladio, renio. También se pueden emplear otros catalizadores metálicos tales como organometálicos y metales inorgánicos (columna 4, líneas 36 a 68; columna 5, líneas 1 a 66 y columna 6, líneas 1 y 2). Estos tipos de catalizadores se encuentran incluidos dentro de los catalizadores presentados en la solicitud.”

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Persigue el examinador argumentando que:

“La diferencia que se presenta entre el método revelado en la anterioridad y el presentado en la solicitud es que en ésta se especifica que el emulsionante (compuesto hidrofílico/oleofílico) es uno o más de isopropil, alcohol, metanol, etanol y MTBE, metilacetona, metilisobutilcetona y metanol; mientras que en el procedimiento revelado en la anterioridad D1 se enuncia la utilización de un emulsionante sin especificar el tipo de compuesto. No obstante, tal diferencia no conlleva una actividad creadora del hombre como la requerida para el otorgamiento de patente”

Por último, respecto a los argumentos presentados por el solicitante en respuesta a la última acción oficial, el examinador dice lo siguiente:

“Al respecto, cabe precisar que la cantidad de catalizador que se emplea en el proceso de la solicitud es de 1 parte por 500 millones de partes lo que equivale a 0,002 ppm y en la anterioridad se revela que la cantidad puede ser de 0,005 ppm, por lo que la diferencia es aproximadamente la mitad. De tal manera que una persona de nivel medio versada en la materia podría inferir el hecho de utilizar la mitad del catalizador en el proceso.”

Al respecto, el solicitante quisiera anotar lo siguiente:

El examinador insiste en que para el experto medio en la materia sería obvio reducir el contenido de catalizador, simplemente impulsado por el hecho de saber que es deseable emplear menos catalizador por motivos económicos. Si bien esta afirmación es cierta, el experto medio en la materia sabe que no siempre usar menos catalizador resulta beneficioso para un proceso.

Lo anterior se ve demostrado por los ejemplos proporcionados en la anterioridad D1. En el ejemplo II de D1, resultados en la tabla II, se puede observar que un uso de 0,03 ppm de catalizador da una eficiencia de entre 66% y 70%. Por en el ejemplo III, resultados en la tabla IIIA, se puede observar que con un contenido de 0,038 ppm la eficiencia aumenta a entre 79% y 81%. Por último, en el ejemplo IV, resultados en la tabla IV, se puede observar que un contenido de 0,51 ppm de catalizador, la eficiencia del proceso va del 83% al 88%. Lo anterior claramente significa que el documento D1 demuestra un incremento en la eficiencia del proceso a medida que se incrementa la concentración de catalizador en la mezcla.

Por lo tanto, para el experto medio en la materia que se basara en D1 para desarrollar emulsiones de catalizadores para su uso en motores de combustión interna, la conclusión lógica sería que reducir la cantidad de catalizador por debajo de 0,03 ppm no es beneficioso para el fin deseado. Más aún, los datos de

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los ejemplos II, III y IV de D1 dejan entrever un análisis retrospectivo de la solicitud, ya que no existe evidencia alguna que demuestre que concentraciones inferiores a 0,03 ppm son beneficiosas o deseables. Por lo que no es válido argumentar que emplear una cantidad inferior a 0,03 ppm sería obvio porque “... *es muy conocido en el estado de la técnica el hecho de utilizar bajas cantidades de catalizador para que los procesos sean eficientes...*”, particularmente cuando los ejemplos de D1 claramente demuestran que la eficiencia del proceso disminuye con la concentración de catalizador.

Por otro lado, el examinador no debe pasar por alto que la anterioridad D1 divulga un proceso en el que el mezclado del combustible con la emulsión de catalizador se lleva a cabo en línea, antes del ingreso del combustible a la cámara de combustión. Por su parte, la presente solicitud se refiere a una emulsión de catalizador en agua, mezclada con anterioridad, que es estable y puede transportarse largas distancias hasta un usuario final.

Desde el punto de vista técnico, existe una gran diferencia entre una emulsión que se genera en línea para su uso inmediato, y una emulsión que se produce para ser transportada a un destino diferente y no para ser empujada in situ. Lo anterior significa que, si bien D1 menciona emulsiones, no hay ninguna enseñanza que le permita al experto medio en la materia obtener una emulsión estable para ser transportada y empleada en un lugar diferente al sitio de producción. Es por esto que para los inventores de D1 la naturaleza del surfactante no es relevante ni importante, en tanto que la misma si es una característica clave para la solicitud en estudio.

La anterioridad D1 no enseña ni sugiere el mejor surfactante para obtener una emulsión estable y que no pierde su eficacia durante el transporte y el almacenamiento.

Finalmente, el solicitante anexa una ddeclaración del inventor en la cual se demuestra que otras compañías trabajando en el mismo campo, páginas 11 a 15, no esperaban que se pudiera obtener una composición efectiva empujando concentraciones tan bajas de catalizador. La declaración adjunta también incluye resultados de pruebas técnicas realizadas empleando una de las modalidades de la invención, donde se puede observar el efecto beneficioso de la misma, aún a concentraciones tan bajas.

Por lo tanto, para el solicitante es claro que se ha efectuado un indebido análisis de la altura inventiva de la solicitud por la siguiente razón:

a) Se está efectuando un análisis retrospectivo de la invención, buscando identificar aspectos de la misma en el estado del arte en lugar de establecer



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características del estado del arte que pueden anticipar la invención en estudio.

Nada en la anterioridad D1 le permite al experto medio en la materia derivar de manera obvia que sería aceptable emplear concentraciones de catalizador inferiores a 0,03 ppm. Así mismo, nada en D1 enseña o sugiere cómo obtener una composición que es estable durante el transporte y el almacenamiento, ya que las composiciones de D1 se producen y emplean en línea.

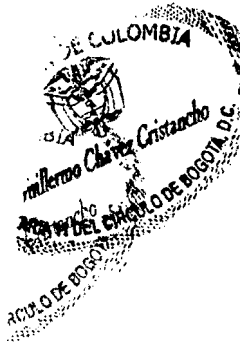
Teniendo en cuenta lo dicho anteriormente, solicito a usted lo siguiente:

- a) Que de conformidad con lo previsto por los artículos 3 (inciso 3); 35 (inciso 2) y 59 (inciso 2) del Código Contencioso Administrativo, se consideren y se resuelvan TODOS los argumentos y TODAS las cuestiones planteadas así como las que aparezcan con motivo de este recurso.
- b) Que se revoque la resolución No. 1764 del día 26 de enero de 2012 expedida por el Superintendente de Industria y Comercio, y se proceda a conceder el privilegio de patente de invención a la solicitud de mi mandante.

ANEXO

Declaración del inventor en la cual se demuestra que otras compañías trabajando en el mismo campo, páginas 11 a 15, no esperaban que se pudiera obtener una composición efectiva empelando concentraciones tan bajas de catalizador.

DILIA RODRIGUEZ D ALEMAN
C.C. 41.654.882 de Bogotá
T.P. 20824 del C.S.J.



PRESENTACION PERSONAL

El anterior escrito fue presentado ante el
NOTARIO ONCE DEL CIRCUITO DE BOGOTÁ, D.C.

personalmente por Diego Alejandro Rodríguez

Diego Alejandro Rodríguez

quien exhibió la c.c. 41634188 de Bogotá

y Tarjeta Profesional No. 205241 C.B.J. 27 FEB 2011

Fecha

Diego Alejandro Rodríguez

Guillermo Chávez Cristancho
NOTARIO

Guillermo Chávez Cristancho
NOTARIO
11 DEL CIRCUITO DE BOGOTÁ D.C.



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT : Robert W. Carroll
APPL. NO. : 10/494,907
FILED : November 29, 2004
TITLE : METHOD AND COMPOSITION FOR IMPROVING FUEL
COMBUSTION
CONF. NO. : 8447
TC/A.U. : 3611
EXAMINER : Cephia D. Toomer
DOCKET NO. : P06911US0

DECLARATION OF ROBERT W. CARROLL

Pursuant to 37 C.F.R. § 1.132, I, Robert W. Carroll, an inventor of the above identified application hereby declare:

1. I am an inventor of the subject matter of U.S. Patent Application Serial No. 10/494,907. I am the same person who executed the declaration filed with the response on 2 June 2006.

2. I am the Chief Executive Officer (CEO) of Biofriendly Corporation, who have commissioned tests performed by an independent laboratory, California Environmental Engineering (CEE). The results of the tests demonstrate that extremely low levels of combustion catalyst or enhancer, more specifically, at concentrations of less than 1 part catalyst or enhancer per 500 million parts of fuel, unexpectedly resulted in an increase in efficiency of combustion of the fuel.

3. Attached as Exhibit RWC-1 is a report (herein referred to as "Report 1") dated December 2003 produced by CEE for Biofriendly Corporation. This report details tests carried out with a liquid fuel catalyst referred to as GREEN PLUS in light-duty gasoline vehicles. Report 1 sets out how the tests were performed and sets out the results of the tests.

4. The GREEN PLUS product is a fuel additive that is used in the tests described in Report 1 in accordance with the claims of U.S. Patent Application Serial No. 10/494,907. The fuel used in the tests contains less than 1 part by weight combustion catalyst or enhancer per 500 million parts of fuel.

5. The results of the tests are tabulated and summarized in Table 1 of Report 1 and discussed in paragraph B at page 5. The results indicate that all gaseous tailpipe emissions exhibit a significant improvement between baseline tests and those after mileage accumulation using the fuel containing the GREEN PLUS catalyst. The improvement in fuel economy is also considered significant. It is also stated that the substantial decrease in NOx and HC emissions is considered conclusive and noteworthy. Report 1 concludes:

"We believe the test data verifies the viability of the technology and that more dramatic improvement could be achieved through additional testing."

6. Attached as Exhibit RWC-2 is a report (herein referred to as "Report 2") dated 21 June 2004 produced by CEE

and Biofriendly Corporation for the Texas Commission for Environmental Quality (TCEQ) (previously the Texas Center for Environmental Quality). Report 2 details tests carried out with the liquid fuel catalyst GREEN PLUS in heavy-duty diesel engines. This report sets out how the tests were performed and the results of the tests.

7. The GREEN PLUS product used in the tests described in Report 2 was used in accordance with the claims of U.S. Patent Application Serial No. 10/494,907. The diesel fuel used in the tests contains less than 1 part by weight combustion catalyst or enhancer per 500 million parts of diesel fuel.

8. Paragraph D.I.3 of Report 2 refers to adjusting the amount of GREEN PLUS from 19 ppm to 25 ppm. However, the 19 ppm and 25 ppm referred to in this paragraph refer to amounts of GREEN PLUS fuel additive composition added to the fuel and not the level of catalyst or enhancer in the fuel.

9. The test results demonstrate significant reductions in emissions and an improvement in fuel economy. Paragraph D.I.6 at page 19 of Report 2 indicates that the data presented provides conclusive evidence that GREEN PLUS added to diesel fuel reduces emissions and improves fuel economy. Report 2 concludes:

"It is clear that Green Plus produces significant reductions in emissions in modern heavy-duty diesel engines. Unlike many Technologies Green Plus reduces all

the major emissions. The results indicate that prolonged use of Green Plus will be even more effective than shown in this report."

10. Based on the results of Report 2 and other test results, the TCEQ gave conditional approval in July 2005 for use of GREEN PLUS in Standard No. 2 diesel fuel in Texas. Standard No. 2 diesel fuel contains up to 500 ppm of sulfur. Biofriendly Corporation is doing further testing using ULTRA LOW SULFUR DIESEL (ULSD, less than 15 ppm sulfur) that is now required for use in Texas and the rest of the U.S.A.

11. Before the discovery of the invention claimed in US 10/494,907, my belief is that the state of the art was that as the amount of catalyst or enhancer that was added to fuel decreased below 1 part by weight catalyst or enhancer per 500 million parts of fuel, the efficiency of combustion of that fuel mixture would decrease. I believe others working in the area of fuel catalysts also would have considered such low levels of catalyst to be ineffective.

12. Attached as Exhibit RWC-3 is an excerpt of a submission made to the TCEQ by ORYXE Energy International Inc. (ORYXE), a company that also specialises in the manufacture and use of fuel additives. The observations made by technical staff and scientific consultants for ORYXE include that the level of catalyst used is unprecedented, that the GREEN PLUS product is based on unprecedented science and that the

laboratory used to conduct testing was not a California Air Resources Board (CARB) approved laboratory.

13. The observation made by ORYXE entitled "Unprecedented Treat Rates" indicates their tests show the BF additive contains the noble metal platinum at concentration of a few parts per billion. When ORYXE refer to the BF additive, they are referring to Biofriendly Corporation's additive product "GREEN PLUS". Accordingly, they consider that when added to fuel, the concentration of platinum in the finished diesel fuel is at a level of about 1 part catalyst in 1 trillion parts of fuel. ORYXE states:

"It stretches the limits of scientific credulity to accept that at concentrations of 1 part active ingredient in 1,000,000,000,000 (1 trillion) parts of finished diesel, that BF additive can generate the claimed emissions."

14. Furthermore, the observation made by ORYXE entitled "Unprecedented Science" indicates that they performed an extensive search of the literature and could not find support that low levels of catalyst could generate NOx emission reduction. ORYXE concludes this paragraph stating:

"In fact, this low level of platinum in finished (treated) diesel fuel flies in the face of the existing body of knowledge on diesel combustion science and NOx formation."

15. It is clear from ORYXE's observations that it is and was prior to the discovery of the present invention unexpected that the use of extremely low levels of catalyst or enhancer such as less than 1 part by weight catalyst or enhancer per 500 million parts of fuel, would provide improved fuel combustion, reduced emissions and increased fuel economy as demonstrated by the results provided in the reports of Exhibits RWC-1 and RWC-2.

16. In their observations, ORYXE criticize the laboratory that provided at least some of Biofriendly Corporation's test results. ORYXE indicated that Olson-Ecologic Engine Testing Laboratories (Olson Labs) was not an approved testing laboratory. However, the TCEQ has accepted results produced in 2005 by Olson Labs and I understand that both CARB and the Environmental Protection Agency (EPA) have accepted results of testing provided by Olson Labs. TCEQ review test protocols and approve protocols and the laboratories that are to perform the testing before any testing is performed. Like many Federal agencies, TCEQ rely on CARB and EPA acceptance of data and quality control when approving a laboratory to perform a test protocol.

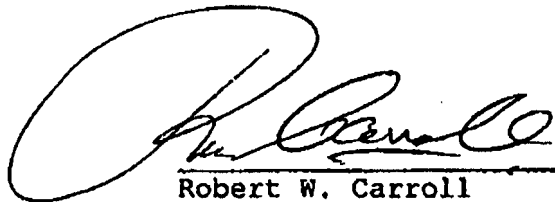
17. However, the test results provided in Exhibits RWC-1 and RWC-2 are provided by a different independent laboratory, namely CEE. Paragraph A.1 of Exhibit RWC-1 and the first full paragraph of page 5 of Exhibit RWC-2 indicate that CEE is EPA recognised and CARB-certified. Furthermore, CEE is one of 31

laboratories recognised nationally by the EPA as capable of performing emissions testing in accordance with the code of Federal Regulations. The appendix of Exhibit RWC-1 also provides evidence of certification of CEE by CARB.

18. It is my belief that before the discovery of the invention claimed in US 10/494,907, it was not expected that low levels of catalyst or enhancer, such as less than 1 part by weight catalyst or enhancer per 500 million parts of fuel, would provide improvements in fuel combustion as demonstrated by the test results provided in Exhibits RWC-1 and RWC-2. My belief that the results provided by the present invention are unexpected is supported by the comments made by ORYXE.

19. The foregoing statements are correct to the best of my knowledge and belief and are made with the knowledge of the laws and penalties of perjury.

29th JANUARY 2007.
Date


Robert W. Carroll

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT : Robert W. Carroll
APPL. NO. : 10/494,907
FILED : November 29, 2004
TITLE : METHOD AND COMPOSITION FOR IMPROVING FUEL
COMBUSTION
CONF. NO. : 8447
TC/A.U. : 3611
EXAMINER : Cephia D. Toomer
DOCKET NO. : P06911US0

EXHIBIT RWC-1

This is Exhibit RWC-1 referred to in the Statutory Declaration
of Robert W. Carroll.

**EFFECTS OF 'GREEN PLUS' FUEL
CATALYST ON LIGHT-DUTY GASOLINE
VEHICLES**

December 2003

RESEARCH PROJECT CEE-422-10-3

Accomplished for:

BIOFRIENDLY CORPORATION

158 Sawpit Lane
Bradbury, California 91010

Accomplished by:

California Environmental Engineering
3231 South Standard Avenue
Santa Ana, California 92705

EFFECTS OF 'GREEN PLUS' FUEL CATALYST ON LIGHT-DUTY GASOLINE VEHICLES

A. INTRODUCTION

Over the past several years, there has been increased national and international interest in alternative methods to control emissions and improve fuel economy of both gasoline and diesel vehicles. This is particularly true in the United States where diesel particulates have been declared carcinogenic and gasoline vehicle emissions continue to be the largest single source of measured pollution. In the following study, a liquid fuel catalyst known as 'GREEN PLUS' was used to demonstrate the effects it would have on both vehicle 'Tailpipe emissions' and 'Overall Fuel Economy'. The research study was commissioned by the Bio-Friendly Corporation, the U.S. manufacturer and supplier of the catalyst.

The scope of the research was based on a short-set of transient dynamometer tests in a controlled environment. This included two 'Baseline' tests without "GREEN PLUS" and four with the GREEN PLUS liquid catalyst. The test series was conducted using a well-maintained light-duty gasoline vehicle selected by CEE and considered representative for its age and mileage.

A.1 TEST FACILITY

The independent test facility selected and used for the research was California Environmental Engineering (CEE) located in Santa Ana, California. The EPA recognized and CARB-certified laboratory has previously provided vehicle testing for all the major automotive vehicle manufacturers. CEE is one of 31 Labs recognized nationally by the Environmental Protection Agency (EPA) as capable of performing emission testing in accordance with the Code of Federal Regulations (CFR). CEE participates yearly in the multi-laboratory cross check program sponsored by the California Air Resources Board (CARB) and typically

registers in the top ten percent of test facilities that closely emulate the average emission readings of all participating Labs.

A.2 TYPE AND NUMBER OF TESTS

The chassis dynamometer test selected for the operational research was a 'HOT-505'. All testing was performed in accordance with the requirements of 40CFR86, EPA and CARB regulations, and was subjected to an in-house quality review prior to release.

The selected test is 505 seconds in duration and the 'one-bag' evaluation is considered as a good summary of vehicle emission levels and fuel economy.

The wide variability of 'speed with time' provides an excellent 'window of opportunity' in assessing possible improvement from use of fuel additives.

The Baseline HOT-505 Tests using indolene test fuel were run at the beginning. Those tests indicated a final calculated value difference that was within ten percent or less indicating a good test to test variability unrelated to changes in the test vehicle

Four Operational HOT-505 Tests were run using indolene containing the GREEN PLUS fuel catalyst. The actual treatment of the vehicle fuel and mileage accumulation after treatment was conducted by BioFriendly Corporation representatives and was not under the supervision or oversight of CEE. However, the BioFriendly Corporation has provided a written statement to CEE stating that: "No changes were made to the test vehicle other than normal maintenance". The indolene test fuel used for all tests came from the same petroleum refinery batch. Indolene is a high octane (92) fuel containing the oxygenate MTBE.

A.3 TEST PARAMETERS AND PROTOCOL

The specific test values and dyno coefficients used were obtained from General Motors to include the Inertia test weight and horsepower. The protocol was based on establishing and comparing an average of two baseline tests to the individual and cumulative data of four (4) operational testing sequences using the liquid fuel catalyst.

The test protocol used the HOT-505 test procedure (First phase of an FTP-75 emissions test) to determine the exhaust emissions during the test cycle. This test includes low and high speeds and simulates hill climbing during the 505 second run. Total Hydro-Carbons (HC), Oxides of Nitrogen (NOX) and Carbon Monoxide (CO) emissions were measured during the tests. The software calculated the fuel economy (MPG) of the vehicle based upon the carbon balance in the exhaust emissions as compared to the total carbon content of the fuel.

B. TEST RESULTS AND CONCLUSIONS

The test results for research project CEE-422-10-3 are tabulated and summarized as Table 1.

The results for all the gaseous tailpipe emissions exhibit a significant improvement between the Baseline test(s) and those after mileage accumulation using the liquid catalyst 'GREEN PLUS'. Additionally, the improvement in the fuel economy is considered significant for a vehicle of its age and accumulated miles especially since the vehicle was already running on a high-octane well oxygenated fuel (indolene). An overall reduction in emissions with mileage accumulation using the liquid catalyst is apparent. The substantial decrease in NOx and HC emissions is considered conclusive and noteworthy.

We believe the test data verifies the viability of the technology and that more dramatic improvement could be achieved through additional testing.

APPENDIX

. INDEPENDENT LAB LIST

.INDEPENDENT Lab CERTIFICATION

.TEST FUEL ANALYSIS

California Environmental Engineering (C.E.E.)

3231 South Standard Avenue

Santa Ana, California 92705

phone (714) 545-9822 fax (714) 545-7867

TEST RESULT SUMMARY (TABLE 1)

The Table below tabulates the test results for the vehicle

CADILLAC with 4.9L -V8

Vehicle : 1991 Cadillac Sedan

Engine : 4.9 L Gasoline

ODO : 118,541

Test WT-3875

Test HP-6.9

Test	Test Type	Date	Test ID	ODO	(Grams/per mile)				Miles per Gallon
					HC	CO	NOX	FE	
Baseline-1	HOT 505	10/22/03	V5025022	118,541	0.119	1.684	0.807	20.29	
Baseline-2	HOT 505	10/22/03	V5025023	118,550	0.124	1.518	0.849	20.19	
Average					0.122	1.601	0.828	20.24	
With Green Plus-1	HOT 505	10/24/03	V5025033	120,628	0.161	1.802	0.652	19.82	
With Green Plus-2	HOT 505	10/31/03	V5025064	122,832	0.081	1.535	0.856	20.53	
With Green Plus-3	HOT 505	10/31/03	V5025065	122,836	0.097	1.026	0.884	20.69	
With Green Plus-4	HOT 505	10/31/03	V5025068	122,849	0.073	0.877	0.750	20.60	
Average					0.103	1.310	0.786	20.41	
Baseline Average					0.122	1.601	0.828	20.24	
Additive Average					0.103	1.310	0.786	20.41	
% Difference					-15.2	-18.2	-5.1	0.8	
Baseline Average					0.122	1.601	0.828	20.24	
Green Plus (Test 4)					0.073	0.877	0.750	20.60	
% Difference					-39.9	-45.2	-9.4	1.8	

Program Management

Joe Jones

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INDEPENDENT LABORATORIES EQUIPPED TO CONDUCT EXHAUST/EVAPORATIVE EMISSIONS TESTS

While the California Air Resources Board (ARB) does not currently approve laboratories for Compliance testing, certain independent commercial laboratories have become accepted, based on information submitted to the ARB, as being properly equipped to perform specialized tests, in accordance with applicable Federal and California test procedures. Their equipment is similar or equivalent to that used at the Haagen-Smit Laboratory. However, these private laboratories are neither inspected nor supervised by the ARB to determine if candidate devices for Vehicle Code (VC) Section 27156 exemptions are tested in strict adherence to the ARB's test letter and the relevant test procedures. For this reason, the ARB relies on conformity tests conducted at its Haagen-Smit Laboratory for a final determination of the emission performance of add-on devices. Listed below are several such commercial laboratories.

Laboratory Name	Location Address	Contact Personnel	Telephone	Special Testing Capabilities	Comments
Arizona					
Automotive Testing Laboratory, Inc.	363 E. McDowell Street Mesa, AZ 85202	Mr. Dennis McClure	(480) 245-7666	Exhaust Temp. Evaluation test SFTP-4299, SCBS	
California					
Automotive Club of Southern California - Auto Test Dept.	3601 E. Highway 100 Los Angeles, CA 90007	Mr. Dave Meier	(310) 761-4444		
Automotive Testing & Development Services, Inc. (ATDS)	400 E. Edmonds Avenue Oxnard, CA 91321	Mr. Edward Farmer	(805) 296-1100	Exhaust Temp. Evaluation test Direct vehicle test Monocycle test	
California Analytical Services Corp. (CAS)	1124 West Ocean Ave Oceanside, CA 92054	Mr. Paul Nixon	(714) 974-3368	Exhaust Temperature Evaluation test	Formerly Environmental Testing Corp.
California Environmental Engineering (CEE)	3211 E. Broadway Ave Santa Ana, CA 92705	Mr. Joe Jones	(714) 343-8822	Direct vehicle, motorcycle, & CHROMO vehicles, Exhaust Temp., Road cycle engine test, Exhaust Temp. Evaluation test SFTP-4299	Exhaust Temp 15-minute steady-state test is applicable only to pre-1983 direct engines.
Close Air Vehicle Technology Center Exhaust Testing Services, Inc.	3433 Bonshire Place Hawthorne, CA 91543 3941 E. Mainland Ave Cana Mesa, CA 92627-3485	Mr. Bruce M. Berenson Mr. William R. Simmons	(310) 933-1188 (408) 374-7542	Exhaust Temp 15-minute steady-state test for on-road engine vehicles, if required. Exhaust vehicle test not available.	
Ecologic Engine Testing Laboratory	1170 E. Apollo Ave Palmdale, CA 91351	Mr. Larry Salsenda	(818) 774-3343	CVE-1317 on LRV, MGV, & motorcycles. Cooler test	
Edwards Corporation - Exhaust Laboratory	2700 California Street P.O. Box 2936 Torrance, CA 90501	Mr. Jack Murphy	(310) 781-3222		
General Motors Corp. - Powertrain Vm Mopar Vch. Research Lab.	14111 Oakridge Road Pomona City, CA 91767	Mr. David E. Pischel Mr. Thomas E. Arnold	(916) 397-3100	SFTP-2594	
Harold Die Vch. Development Company	2120 Cherry Industrial Circle Long Beach, CA 90802	Mr. Dale Gisher	(310) 438-1503	CHROMO vehicle test	
Northern Cal. Diagnostic Lab., Inc.	2140 Jefferson Street Hayward, CA 94541	Mr. Mike Symmes-Smith	(415) 238-1753	Motorcycle test	
Quantum Technology Exhaust Laboratory	21543 Arroyo Green Dr. Lake Forest, CA 92650	Mr. David Caron Dcaron@qtwr.com	(949) 330-3476	SFTP-4299, A/C (Exhaustive)	
University of California Riverside Vch. Exhaust Research Lab	1150 Columbia Ave Riverside, CA 92507	Mr. Dave Marks	(909) 781-3757	Direct vehicle test	
Colorado					
Colorado Inst. For Fuel & High Altitude Eng. Research - Colorado School of Mines	Golden, CO 80401-1897	Mr. Michael S. Gotschall	(303) 239-3141	Heavy-duty engine Dynam test Direct vehicle test	
Environmental Testing Corp.	1829 Jasper Street Aurora, CO 80011	Mr. Bob Buge	(303) 342-9478	Direct vehicle test	
MetWest Center for Vch. Exhaust Control & Safety-Dept of Industrial Sciences	Colorado State University Fort Collins, CO 98513	Mr. Ralph H. Wolf	(903) 491-9245		
Florida					
Curtis Exhaust Laboratory	370 Fessenden Blvd Daytona Beach, FL 32114	Mr. Bill Gierman	(904) 252-1131	Motorcycle test	
Illinois					
Auto Research Laboratories, Inc.	400 E. 54th Street Harvey, IL 60424	Dr. Fred Vach	(708) 216-3966	Direct vehicle test	

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT : Robert W. Carroll
APPL. NO. : 10/494,907
FILED : November 29, 2004
TITLE : METHOD AND COMPOSITION FOR IMPROVING FUEL
COMBUSTION
CONF. NO. : 8447
TC/A.U. : 3611
EXAMINER : Cephia D. Toomer
DOCKET NO. : P06911US0

EXHIBIT RWC-2

This is Exhibit RWC-2 referred to in the Statutory Declaration
of Robert W. Carroll.

Biofriendly Corporation, Contract # 03-R05-04G

FINAL REPORT

**PROOF OF CONCEPT TESTING USING
"GREEN PLUS" LIQUID FUEL COMBUSTION
CATALYST FOR HEAVY-DUTY ENGINES.**

Accomplished for:
TEXAS CENTER FOR ENVIRONMENTAL QUALITY
Austin, Texas
Project # 422-04-4
Grant Contract # 03-R05-04G

Accomplished by:
BIOFRIENDLY CORPORATION
622 Terado Dr..
Monrovia,
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And submitted
6-21-2004.

In cooperation with:
California Environmental Engineering
Santa Ana, CA 92707

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For Biofriendly, Colin Hill Ph.D. at 626-215-6202.

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PREFACE

The statements, conclusions and/or recommendations in this report are, primarily those of the contractor and not necessarily those of the Texas Center for Environmental Quality (TCEQ). The mention of commercial products herein is not to be construed as actual or implied endorsement of such products.

ACKNOWLEDGMENT (S)

We acknowledge the dedicated assistance of Mike Carter (CEE) and his untiring and professional support during the project. We appreciate the cooperation and guidance of Dr. Colin K. Hill and Mike Carroll of the Biofriendly Corporation.

Biofriendly Corporation, Contract # 03-R05-040

ABSTRACT

The grant activity and results reported herein is based on operationally testing a representative heavy-duty diesel engine utilizing a proprietary liquid fuel combustion catalyst (Green Plus) to enhance combustion. A CARB (California Air Resources Board) certified Detroit Diesel engine, series 60, was used and tested for emissions output, using the AVL urban 8 mode steady state cycle, with and without the liquid catalyst. This 8

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mode is designed to simulate the full United States EPA Federal test procedure (FTP). A comparative database with and without the "Green Plus" liquid fuel combustion catalyst indicates meaningful reductions in all tailpipe emissions and an improvement in fuel economy. In Brief after 150 hours of operation with "Green Plus" in the fuel, the last three 8 modes tests showed the volatile hydrocarbons (HC) were reduced by an average of 10.64%, the oxides of nitrogen (NOx) by an average of 5.09% and the Particulates (total PM) by 8.35%. For each emission, there was a clear continuing downward trend in emissions when the test was ended due to contractual constraints. During the period of the testing the fuel economy of the engine also improved. Tests looking at an engine mode simulating steady over-the-road driving under significant load showed an improvement in fuel economy that reached 5% by the end of the testing period.

PROOF OF CONCEPT TESTING USING GREEN PLUS LIQUID FUEL COMBUSTION CATALYST FOR HEAVY-DUTY ENGINES

A. INTRODUCTION

Over the past several years, there has been increased national and international interest in alternative methods to control emissions and improve fuel economy of both gasoline and diesel vehicles. This is particularly true in the United States where diesel particulates

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have been declared carcinogenic and gasoline vehicle emissions continue to be the largest single source of measured pollution. In the following study, a liquid fuel combustion catalyst known as 'GREEN PLUS' was used to demonstrate the effects it would have on both vehicle 'Tailpipe emissions' and 'Overall Fuel Economy'. The research study was commissioned by a grant from the Texas Center for Environmental Quality (TCEQ). The grant was awarded to the Biofriendly Corporation, the U.S. manufacturer and supplier of the catalyst.

The operational testing was accomplished at the California Environmental Engineering (CEE) Center for Environmental Research (see Appendix I for CEE's summary report). The CEE independent laboratory is located in Santa Ana, California and routinely provides testing support for vehicle manufacturers, agencies of the State and Federal Government and private institutions. This Premier test facility is EPA recognized and CARB-certified. CEE participates yearly in a multi-laboratory cross check program sponsored by the California Air Resources Board (CARB) and typically registers in the top ten per cent of test facilities that closely emulate the average emission readings of all participating Labs (Appendix II shows a recent example of CEE's certification papers).

A. I.1 Diesel Emissions: Particulate Matter (PM) emissions from Diesel-Fueled vehicles and engines are significant. These emissions typically come from a wide variety of sources including on and off-road vehicles, stationary and portable engines. A recent emission inventory database in California indicates that 27 percent of PM-Emissions come from on-road engines and 66 percent from off-road engines. Diesel engines, in particular those in mobile applications, are significant sources of oxides of nitrogen (NOx) emissions.

A. I.2 Biofriendly Corporation Mission:

Biofriendly Corporation's mission is to develop and bring to market fuel enhancing products that address the growing need for energy while safeguarding the environment.

Biofriendly recently introduced a revolutionary new product - Green Plus fuel catalyst. Green Plus, which is a true liquid catalyst that mixes completely with various types of

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fuel, is one of the world's most effective and economical solutions for significantly improving fuel economy and reducing emissions.

Biofriendly's patent-pending product is the only known solution that can both reduce emissions and improve fuel economy in gasoline, diesel, fuel oil and other hydrocarbon-based products. Green Plus has been under development for 16 years at a cost of over \$12 million dollars. Incorporated in 1997, Biofriendly has recently begun to make Green Plus available to the commercial market. Customers on three continents are now deploying it.

A. I.3. TCEQ (Then TCET) Grant funding.

In the spring of 2003, the Texas Center for Environmental Technology (now Texas Center for Environmental Quality) issued a request for proposals from companies needing help to support and verify new technologies that can demonstrate reductions in emissions from both on-road and off-road diesel engines. TCEQ is acting on behalf of the State of Texas legislature, which is implementing a multifaceted program to reduce air pollution in major urban centers in the state. This was a competitive grant application. Biofriendly applied for funding, and, after scientific review, was selected as one of several companies that received funds in the fall of 2003. In this, the first phase of the contract, Biofriendly was asked to perform a "proof of concept" screening test to demonstrate under rigorous independent testing that Green Plus could reduce emissions in a significant manner.

B. SCOPE OF EFFORT:

B.I.1. Contract and Engine: A technical contract was developed to select and test a heavy-duty, series 60, Detroit Diesel engine. The laboratory maintained engine had recently been rebuilt and included a new DDII master control module and fuel injectors. The engine is a 1992 MY rated at 450HP and a max RPM of 2100. Due to the engine being used only in the laboratory and being recently rebuilt its baseline emissions are mostly well below EPA and CARB limits for heavy-duty engines (See table 1).

Table 1. Emissions Standards for Certification of diesel engines:

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Model year 1988-2003 US federal (EPA) and 1987-2003 California (ARB) emission standards for heavy-duty diesel truck and bus engines are summarized in the following tables. Applicable to the 1994 and following year standards, sulfur content in the certification fuel has been reduced to 500 ppm wt. (Taken from the DieselNet web site).

Table 1.A
EPA Emission Standards for Heavy-Duty Diesel Engines,
g/bhp-hr

Heavy-Duty Diesel Truck Engines

Year	HC	CO	Nox	PM
1988	1.3	15.5	10.7	0.60
1990	1.3	15.5	6.0	0.60
1991	1.3	15.5	5.0	0.25
1994	1.3	15.5	5.0	0.10
1998	1.3	15.5	4.0	0.10

Table 1.B
California Emission Standards for Heavy-Duty Diesel Engines,
g/bhp-hr

Heavy-Duty Diesel Truck Engines

Year	NHMC	HC	CO	Nox	PM
1987	-	1.3	15.5	6.0	0.60
1991	1.2	1.3	15.5	5.0	0.25
1994	1.2	1.3	15.5	5.0	0.10

B.1.2. Fuel selection: Fuel (D-2 Control Diesel) for the in-depth testing was specially blended at the Haltermann products facility in Channel View, Texas. Haltermann is a subsidiary of the Dow Chemical Company. Six-55-gallon drums were prepared and shipped to the CEE Lab. This provided an assurance of obtaining all test fuel from the same batch and tank. Product information sheets for all test fuel used is provided in appendix II.

B.1.3. Test selection: An AVL 8-Mode "Urban" Heavy-duty test cycle was selected as the "test of choice". This test was developed by AVL, a company that designs and builds advanced transmissions and dynamometers, in collaboration with CARB and CEE. The test was primarily selected and used since the urban steady-state engine test cycle is designed to closely correlate with the exhaust emission results of the US FTP heavy-duty

engine transient cycle. The test involves 8 (eight) pre-defined steady state modes. Each operational mode is based on the correlation of engine speed with load and is assigned a relative weight factor. A matrix showing the sequential engine operating points and relative weights of particular modes is shown as Figure 1.

Table 2. AVL 8 mode test.

The AVL 8-Mode test is a steady-state engine test procedure, designed to closely correlate with the exhaust emission results of the US FTP heavy-duty engine transient cycle. The test involves 8 steady-state modes. The composite value is calculated by applying weighting factors on the modal results.

The sequential engine operating points are as follows:

AVL 8-Mode Heavy-Duty Cycle

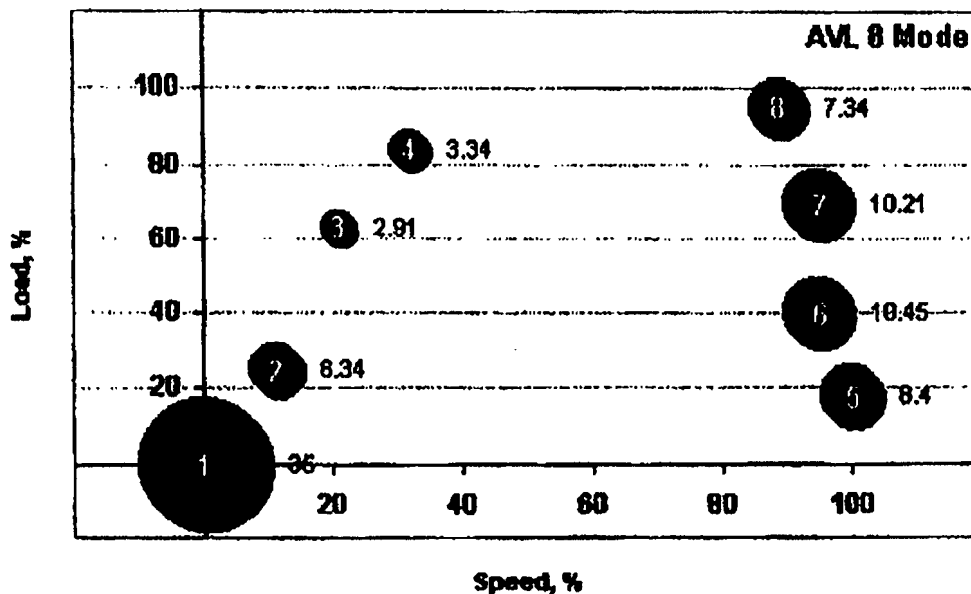
Mode	% Engine Speed*	% Load	Weight factor**
1	0	0	35.00
2	11	25	6.34
3	21	63	2.91
4	32	84	3.34
5	100	18	8.40
6	95	40	10.45
7	95	69	10.21
8	89	95	7.34

* - Normalized speed: 0% = low idle, 100% = rated speed

** - Relative weight factors, not normalized (they do not add to 100%)

The relative weights of particular modes are represented by the area of bubbles in the Figure below.

Figure 1. Relative weights of AVL 8 mode test.



Using the known engine rated speed, the percent value of engine speed for each mode is established during the initial "mapping" of the engine.

When running the 8-mode test each sequential mode speed value is obtained using the operational throttle control. Once the individual mode speed has been established, the engine is stabilized for a four-minute period followed by a two-minute sample period.

During each test mode, gas analyzers collect and measure the total weighted tailpipe emissions for HydroCarbons (HC), Carbon Monoxide (CO) and Oxides of Nitrogen (NOx). Additionally, Particulate Matter (PM) is collected on a filter set using an AVL "Smart Sampler Console". The filters are weighed before and after use to establish a weighed value of the Particulate Matter. Using pre-determined software, emission values are calculated and weighted for presentation as "grams per brake horsepower-hour"(g/bhp-h).

Fuel consumption is computed using a gravimetric system for micro weighing of the fuel. The fuel consumption is calculated and reported as "pounds per brake horsepower-hour"(lb/bhp-h).

B.I.4 Test protocol:

- 1). After the engine was set up in the test cell, an engine run-in of a minimum of 10 hours was performed with D2 fuel as specified. An AVL 8 mode test was performed by CEE at the beginning and end of this period to judge how well the engine had stabilized.
- 2). Baseline emissions: After the engine was warmed up for approximately 2 hours and engine coolant and oil temperature were within normal operating conditions a minimum of three AVL 8 mode tests were run by CEE to get reproducible and consistent base line emissions. Each test was performed in the same manner. The engine was put through each of the four modes mentioned above for 30 minutes ending with the 900-rpm 80lb torque mode, and then all the equipment checked. When all was ready, the engine speed was increased to 1596 and 443 lbs of torque and run until engine coolant and oil temperature were at "normal" operating temperatures. The engine was then turned down to idle (600 rpm) and the AVL 8 mode test begun.
- 3). Green Plus was added to the fuel at a specified rate. The engine was then run for about 150 hours using four of the 8 mode cycles repeated every two hours to vary load and engine speed. AVL 8 mode tests were performed about every 25 hours to determine how well the engine was performing with Green Plus present (the results of these tests are included in Appendix III).
- 4). A series of AVL 8 mode tests were run after the engine had reached the 150 hour mark to get three consistent tests that could be averaged to give an overall result for the test cycle.
- 5). Although fuel economy was determined during each two minute mode CEE also performed a separate fuel economy test after selected AVL 8 mode tests using three 10 minute periods with the engine running at 1591 rpm and 438 lbs of torque (mode 5) to get better precision on the fuel economy.

C. Test facility:

The CEE engine Lab utilizes a custom designed engine control bench with a Horiba Data acquisition interface. Lab quality control checks are performed routinely on a prescribed

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time basis (daily/weekly/monthly) on all functional systems and analytical components. All data computation is based on procedures provided in the Code of Federal Regulations (CFR 40, Part 86). The CBE Lab has been certified by the California Air Resources Board (CARB) and by Ford Motor Company (Allen Park, Michigan). A copy of the typical CARB certification is shown in appendix I.

D.I. Test Results and Conclusions:

D.I.1 Summary of three AVL 8 mode baseline data sets.

Table 3.

AVL 8 Mode test at CEE for the State of Texas on a Detroit series 60 diesel engine

CEE Total Weighted Emissions g/bhp-h

Baseline	1	2	3	
Date:	May-14-04	May-14-04	May-14-04	
Time:	10:57:53	12:25:53	2:41:32	
				Average
WBS HC:	0.0959173	0.0957804	0.0972981	0.0963319
WBS CO:	1.03626	1.04419	1.03891	1.03979
WBS NOx:	6.36023	6.47746	6.34541	6.39437
Partic:	0.011433	0.010505	0.010620	0.010853
WBSFC:	0.308	0.307	0.308	0.308

It is noteworthy that there is less than 1.5% variation between the three baseline tests for all endpoints except particulates. For particulates, the variation is less than 10.0%

Compared to the CARB standards for this engine series (see table 1.B) the HC, CO, and PM on this test engine are more than 90% percent below the standard, while the NOx is about 27% above the standard. The engine was not operating in a NOx reduction mode and had no other NOx reduction attachments. Thus, the engine was operating in a stable and very clean manner.

D.I.2. Conditioning Engine to Green Plus.

Biofriendly usually expects the performance of any engine to gradually improve after Green Plus is added to the fuel. Therefore, for this test it was planned to run the engine

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for up to 100 hours with testing periodically to see how the engine was performing. During this run despite the best effort of the CEE staff the engine encountered several transient problems that caused it to misfire for a few seconds. As far as any one could tell this was an intermittent electrical fault that was not in the computer, and happened only every 25 to 50 hours for a few seconds. However, because the engine misfired unburned fuel entered the engine, exhaust system each time, and had an adverse effect on the emissions for several hours after each problem. CEE agreed to run the engine for an extra 50 hours to allow a better idea of how Green Plus was performing.

D.1.3 AVL 8 mode testing during engine run-in with Green Plus:

During the run-in phase after Green Plus was added AVL 8 mode tests were run periodically to determine what effect the Green Plus was having on emissions and fuel economy. These were done at approximately 25-hour intervals. After the first two tests, Biofriendly adjusted the concentration of Green Plus from the original 19-ppm to 25-ppm mix based on the data seen at that time. Based on these a series of back-to-back AVL 8 mode tests were done on June 3 and 4th. The EPA and CARB standards call for three tests that have less than a 10 percent variation in each parameter measured. This was difficult to achieve in this test because the engine was continually changing and improving with time after Green Plus was added. The last three AVL 8 mode tests came the closest to satisfying the criteria and are reported here as the primary "test fuel" result in table 4.

Table 4.

**AVL 8 Mode test at CEE for the state of Texas using
Detroit Diesel series 60 engine.
CEE Total Weighted Emissions g/bhp-h**

Treated Date: Time:	25 PPM New CPU		25 PPM New CPU		25 PPM New CPU	
	June-4-04	Percent change	June-4-04	Percent change	June-4-04	Percent change
	16:56:42		18:26:34		19:23:34	
WBS HC:	0.0849168	-11.85	0.0854568	-11.29	0.0878719	-8.78
WBS CO:	1.08110	2.05	1.05348	1.32	1.02723	-1.21
WBS NOx:	6.07694	-4.96	6.03653	-5.60	6.09311	-4.71
Partic:	0.010073	-7.18	0.009997	-7.88	0.009769	-9.99
WBSFC:	0.304	-1.19	0.306	-0.54	0.306	-0.54

The average improvement from these three AVL 8 mode tests is shown below in table 4.A.

Table 4. A.
Average Decrease in each emission from the
baseline average for the last three AVL 8 mode tests.

	Average of	Average
	last three	percent
treated	8 modes	change
Date:		
Time:		
WBS HC:	0.086082	-10.64
WBS CO:	1.04727	0.72
WBS NOx:	6.06886	-5.09
Partic:	0.009946	-8.35
WBSFC:	0.305333	-0.76

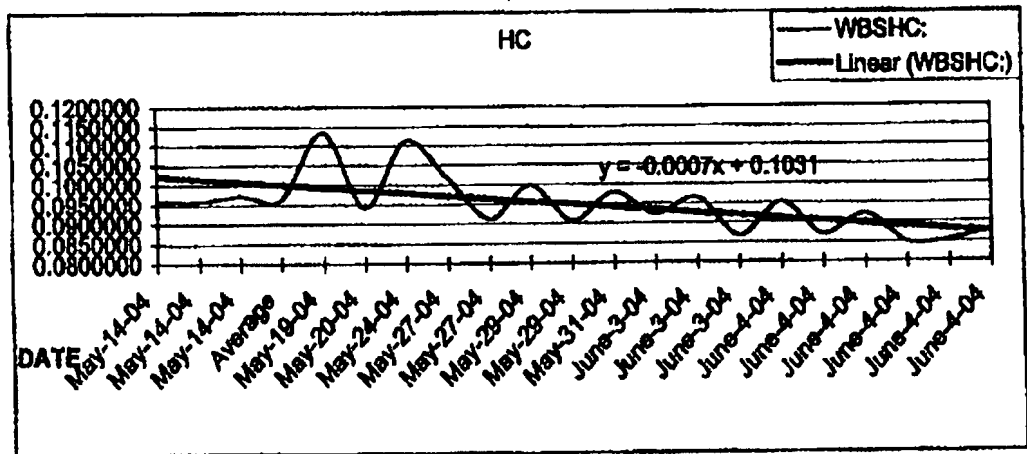
From the data shown above, it is clear there is a significant reduction in hydrocarbons (HC), Oxides of Nitrogen, and particulates.

This result is particularly pleasing as the AVL 8 mode test places a heavy weighting on the idle mode (35%). We actually found significantly larger decreases in all emissions in some of the modes that simulate on road driving under substantial loads. Selections of the full 8 mode data sheets are shown in appendix III.

D. I. 4. Downward trend in emissions after Green Plus added to the fuel.

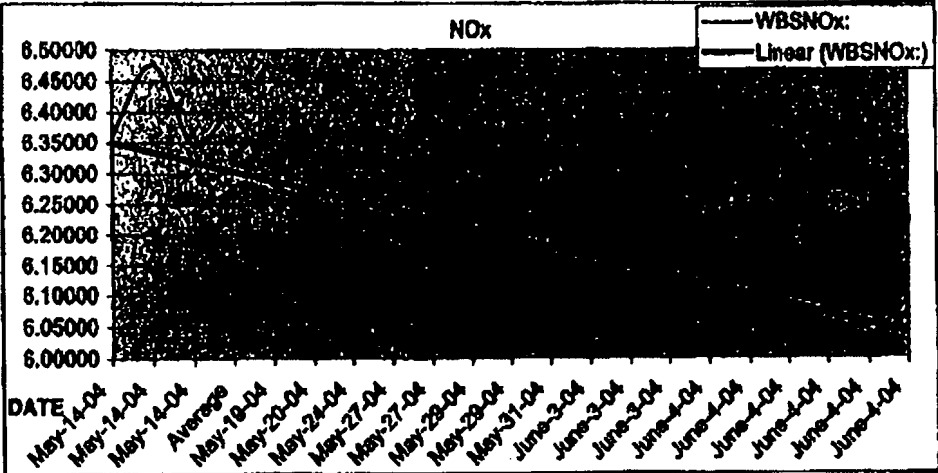
During the testing period, there were times when even larger decreases were recorded. Green Plus is thought to gradually allow the engine to clean itself and as this occurs, the combustion improves leading to more efficient power production. Most modern engines have a sophisticated computer controller monitoring many activities in the engine. We commonly find that emissions and fuel economy fluctuate after Green Plus has been added but that the overall trend is a continual improvement with gradually decreasing fluctuations. In this study we were fortunate to have collected a fairly large number of AVL 8 mode tests and can demonstrate the improvement trend by plotting the effect of Green plus with time (Figures 2-5).

Figure 2. Hydrocarbon emissions plotted against date of test. The first four are the base line tests and their average used for comparisons.



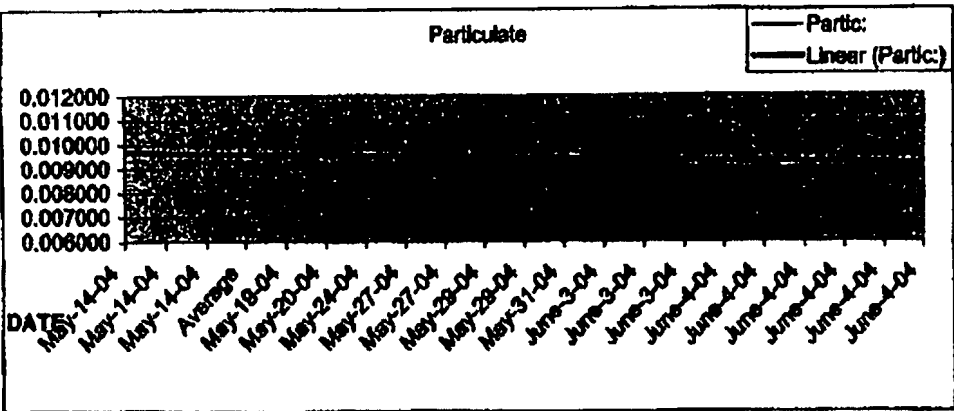
Note that the first two times the engine encountered minor control problems clearly show as major upward fluctuations in the HC emissions. However, despite these problems there is a clear downward trend in the rate of HC emissions with time after Green Plus was added. It is also clear that at the end of the testing period the downward movement in HC had not leveled out.

Figure 3. Oxides of Nitrogen emissions plotted against date of test. The first four are the base lines and their average.



This figure shows very clearly that Green Plus reduces NOx and that there is a definite downward trend in the NOx emissions. This downward movement was still continuing at the end of the testing period.

Figure 4. Total particulates collected during each AVL 8 Mode test plotted against date of the test.



In figure 4, the first four data points are again the base lines and their average. It is clear there was an initial drop in particulates, typical of the effect of Green Plus. After that, there were some quite large fluctuations in the emissions, at least partly due to the minor engine problems that were encountered. Overall, there is a continuing downward trend in particulate emissions. Again, in Appendix III, there is some individual mode data for modes where there is substantial load that showed very significant decreases in particulates.

D.I.5. Simulation of EPA non-road 8 mode test.

The AVL 8 mode urban heavy duty cycle test puts a heavy weighting on the idle mode (35% of the 80% percent total). CARB and AVL explain this is due to the test design being to simulate heavy duty, truck activity in highly urbanized areas of the country such as the Los Angeles City basin. In such areas trucks may sit for significant amounts of time in traffic jams and slow downs with the engine at or near idle.

For over the road trucks that spend much of their time on the open road and non-road engines that are stationary or mobile there is a much less idle time. Although the budget did not allow us to repeat the test with a second engine, we took the EPA non road 8 mode test (see table 5 below) and applied it to the data from the AVL 8 mode test.

Table 5. Code of Federal regulations Title 40 EPA non-road 8 mode test schedule.

**PART 89—CONTROL OF EMISSIONS FROM NEW AND IN-USE NONROAD
COMPRESSION-IGNITION ENGINES**
Appendix B to Subpart E of Part 89—Tables
Table 1_8-Mode Test Cycle for Variable-Speed Engines

Test segment	Mode number	Engine speed \\	Observed torque \\2\\ (percent of max. observed)	Minimum time in mode (minutes)	Weighting factors
1.....	1.....	Rated.....	100	5.0	0.15
1.....	2.....	Rated.....	75	5.0	0.15
1.....	3.....	Rated.....	50	5.0	0.15
1.....	4.....	Rated.....	10	5.0	0.10
2.....	5.....	Int.....	100	5.0	0.10

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2.....	6.....	Int.....	75	5.0	0.10
2.....	7.....	Int.....	50	5.0	0.10
2.....	8.....	Idle.....	0	5.0	0.15

\1\ Engine speed (non-idle): ± 2 percent of point. Engine speed (idle): Within manufacturer's specifications. Idle speed is specified by the manufacturer.

\2\ Torque (non-idle): Throttle fully open for 100 percent points. Other non-idle points: ± 2 percent of engine maximum value. Torque (idle): Throttle fully closed. Load less than 5 percent of peak torque.

In Table 6, we show the results of these calculations for the three base line and the last three AVL 8 mode data sets.

Table 6. Emissions calculations for simulated 8 mode non road test.
CEE Total Weighted Emissions g/bhp-h

	Baseline 1	Baseline 2	Baseline 3	Baseline average
WBS HC	0.0733298	0.0709347	0.0721565	0.072148
WBS CO	1.08827	1.09405	1.1115	1.09794
WBS NOx	5.97297	6.05947	5.95838	5.99694
WBS FC	0.299	0.296	0.299	0.298

Treated 1	Treated 2	Treated 3	Treated average	% change compared to baseline average
0.059122	0.0613976	0.062426	0.0619118	-14.18%
1.11208	1.08888	1.05821	1.069545	-2.59%
5.65766	5.61108	5.65969	5.635385	-6.03%
0.295	0.297	0.297	0.297	-0.34%

There is a clear and significant reduction in all the tail pipe emissions. NOx and HC reductions of 6% and 14% are particularly noteworthy. This simulation could not be done for the particulates as they are measured as from one filter that collects particles from all 8 modes.

D.I.5. Fuel Economy after Green Plus treatment.

Many fuel treatments reduce emissions at the cost of loss in fuel economy. In general, Biofriendly has found that Green Plus improves fuel economy. During the 8 mode tests

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fuel economy by CBE staff was estimated both from the 8 mode values and from an extra test at the end of each 8 mode where the fuel economy was measured for three 10 minute periods with the engine running in one particular mode deemed representative of over the road travel. The average fuel economy was then calculated from the average of these three ten minute runs.

Table 7 shows fuel economy for a set of runs before Green Plus was added and again several runs soon after it was added.

Table 7.

Table 7:										
10 min Baseline test			RPM:	1591	Torque:	438	Oil Temp:	195		
grams fuel /10mins										
	May-11-04	May-11-04	May-11-04		May-27-04	May-27-04	May-27-04	May-27-04	May-27-04	May-27-04
Start:	19000	22020	25030		21410	24430	27432	1500	4497	7515
End:	22020	25030	28045		24430	27432	30433	4497	7515	10534
Total (g):	3020	3010	3015		3020	3002	3001	2997	3018	3019
Average		3015				3008			3011	
% Change						-0.24			-0.12	
		May-29-04	May-29-04	May-29-04	May-31-04	May-31-04	May-31-04	June-4-04	June-4-04	June-4-04
		3000	5986	8966	17100	20081	23050	16300	19297	22250
		5986	8966	11935	20081	23050	26035	19297	22250	25208
		2986	2980	2989	2981	2969	2985	2997	2953	2958
			2985			2978			2969	
			-1.00			-1.22			-1.51	

The values in red in table 7 are the average improvement in fuel economy. Even though there were some fluctuations, it is clear there is a gradual improvement in fuel economy in the Series 60 engine as the time with Green Plus present increased. Due to lack of time on the last day of the test, fuel economy runs were not done for the last three runs of the day that have been shown else where as the definitive emissions test. Therefore, a final set of fuel economy runs was done on June 9, 2004. These are shown below in table 8.

Table 8.

10 min baseline test			RPM:1680	Torque:200		Oil Temp: 195						
	May-11-04	May-11-04	May-11-04	June-9-04	June-9-04	June-9-04	June-9-04	June-9-04	June-9-04	June-9-04	June-9-04	June-9-04
Start	19000	22020	25030	2000	3881	5756	7629	9492	11350	13214	15048	16871
End	22020	25830	28945	3881	5756	7629	9492	11350	13214	15048	16871	18684
Total (g)	1915	1920	1925	1881	1875	1873	1863	1858	1864	1823	1834	1813
		1920			1876			1862			1823	
% Change					-2.29			-3.03			-5.03	

The values in red are the percent improvement in fuel economy compared to the baseline from May 11, 2004. Overall, the fuel economy improved by 5% after 155 hours of engine running time after Green Plus was added.

D.I.6 Concluding summary:

The data developed for Biofriendly by CEE and presented in this report in summary form are conclusive evidence that Green Plus added to diesel fuel reduces emissions and improves fuel economy. Even though Green Plus was tested in a clean CARB certified engine using a relatively clean fuel it achieved remarkable results. After only 155 hours of engine running time, there were significant reductions in HCs, NOx, and particulates in the AVL urban 8 mode test. When the weightings of the 8 mode were adjusted to be more consistent with over the road long distance driving or off road engine use (Similar to EPA 8 mode) the results were even more significant and CO also showed a significant drop. Green Plus also produced a meaningful improvement in fuel economy. The overall results as demonstrated in the graphs suggest strongly that the engine was still improving when the test was completed.

It is clear that Green Plus produces significant reductions in emissions in modern heavy-duty diesel engines. Unlike many Technologies Green Plus reduces all the major

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emissions. The results indicate that prolonged use of Green Plus will be even more effective than shown in this report.

Respectfully submitted this 21st day of June 2004.

APPENDIX L SUMMARY FINAL REPORT FROM CEE

Biofriendly Corporation, Contract # 03-R05-04G

APPENDIX II. SAMPLE CERTIFICATION PAPERS FROM CEE.

Biofriendly Corporation, Contract # 03-R05-04G

**APPENDIX III. FINAL WEIGHTED DATA SHEETS FROM EACH 8 MODE
TEST PERFORMED DURING THE BIOFRIENDLY "GREEN PLUS"
EMISSIONS TESTING ON A DETROIT DIESEL, SERIES 60 ENGINE.**

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICANT : Robert W. Carroll
APPL. NO. : 10/494,907
FILED : November 29, 2004
TITLE : METHOD AND COMPOSITION FOR IMPROVING FUEL
COMBUSTION
CONF. NO. : 8447
TC/A.U. : 3611
EXAMINER : Cephia D. Toomer
DOCKET NO. : P06911US0

EXHIBIT RWC-3

This is Exhibit RWC-3 referred to in the Statutory Declaration
of Robert W. Carroll.

8. ORYXE ENERGY OBSERVATIONS

To date, ORYXE Energy has been able to determine the following regarding the BF additive:

- The components consist primarily of platinum, magnesium and lead in isopropyl alcohol.
- The concentration of the components are present in treated diesel fuel in parts per trillion.
- The proposed Texas market treat rate is reported to be 1 gallon treats 20,000 gallons of diesel fuel.
- Emission test results have been conducted at independent, qualified and California Air Resources Board (CARB)-approved labs like WVU and SwRI.
- Emission test results have been conducted at Olson-EcoLogic Engine Testing Laboratories (Olson Labs).

Based on the above, ORYXE Energy has made the following observations regarding the BF additive:

- Unprecedented Treat Rates – As determined (twice) by sophisticated ICP-MS analysis, it was determined that the noble metal platinum was present at a few parts per billion in the BF additive. In addition, the proposed (and reported) Texas market treat rate of the BF additive is 1 gallon treats 20,000 gallons of diesel fuel. This translates to a treat rate of approximately 0.19 milliliters/gallon. At such an addition rate, the concentration of platinum in finished diesel is effectively negligible. It stretches the limits of scientific credulity to accept that, at concentrations of 1 part active ingredient in 1,000,000,000,000 (1 trillion) parts of finished diesel, that BF additive can generate the claimed emissions reductions.
- Unprecedented Test Results – During testing at Olson Labs, ORYXE Energy personnel understand that Biofriendly used a greater than 35% total aromatic candidate fuel in testing their BF additive to achieve a Texas alternative fuel formulation certification [the protocol is believed to be run in accordance with Texas Administrative Code, Title 30, section 114.316(c)(4)(ii)] (the TCEQ Certification Test). Based on an almost identical diesel emissions testing program instituted and carried out by the state of California (via CARB) over the last 13 years, additive technology capable of showing emissions equivalency between a 36-39% aromatic candidate fuel and a 10% aromatic reference fuel is simply unprecedented. As shown in the (first) attached, based on EPA's Unified Diesel Emissions Predictive Model, a NOx emission of almost 12% is needed to offset the incremental emission increase of the "dirty" candidate fuel over the "clean" reference fuel.
- Unprecedented Science – After an extensive search, there is nothing in the literature to suggest that a few parts per trillion of a noble metal active ingredient, like platinum, can generate a NOx emission reduction of almost 12%. In fact, this

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existing body of knowledge on diesel emissions control.

- Mechanisms of Action - It is alleged that the BF additive needs to run continuously on an engine for three to six months before one can expect a benefit. It is further understood that the BF additive is claimed to have an engine cleaning effect so in the first couple of days of testing an increase in emissions may actually be observed. If the previous two statements are true, it is peculiar to note that the SwRI test protocol (see Section 2) was run on only four total days of testing.
- Detection/Enforcement Problems - At 1 part active ingredient in 1 trillion parts of finished diesel fuel, the detection of the BF additive in diesel fuel should raise detection issues and hence regulatory enforcement concerns. Regulatory agencies such as CARB and the TCEQ will be placed at a severe handicap in trying to stop attempts to circumvent a low emission diesel fuel regulation by parties claiming to be using the BF additive in their diesel at the parts per trillion level.
- Non-Approved Testing Lab - The TCEQ Certification Test was carried out by Biofriendly using the BF additive at Olson Labs. However, according to CARB, Olson Labs is specifically not approved to perform testing for alternative CARB diesel certifications under CARB regulations [the protocol specified in Title 13, California Code of Regulations, Section 2282(g)(4)(A)] (the CARB Certification Test). Olson Labs has not been audited by CARB, and CARB's requirements in terms of quality of testing equipment, staff experience and adequacy of QA/QC procedures has not been satisfied by Olson Labs.
- Questionable Claims Made by Olson Labs I - Although Olson Labs has stated (and claims) in its own written and publicly available test report (the Public Report) to be, "...officially recognized and listed by EPA and CARB as a capable emission test facility for the protocols conducted in this project...", this statement is misleading. The "protocols conducted in this project" include those specified in the Texas Administrative Code, Title 30, section 114.315(c)(4)(C) and more specifically, was a protocol carried out on behalf of a company (GTAT California) that had requested and received funding from the TCEQ (TCEQ Solicitation #582-5-70807-M; Application #2005-2-005N; Title of Report: "Exhaust Emission Equivalence Testing Comparing TxLED Reference Fuel To a No. 2 Diesel Candidate Fuel Treated with Viscon Polymer Additive (1 oz. to 20 gal.) Using a Cummins Model M-11 400 HP Diesel Engine). These are the same protocols specified in Title 13, California Code of Regulations, Section 2282(g)(4)(A). Currently, there are only two CARB approved laboratories capable of carrying out emissions testing in accordance with the specified TCEQ and CARB regulations. These two laboratories are WVU and SwRI.

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low level of platinum in finished (treated) diesel fuel flies in the face of the

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- Questionable Claims Made by Olson Labs II – In the same Public Report, Olson Labs attempts to support its claim of being a "officially recognized and listed..." CARB and EPA testing laboratory by including a letter from CARB (dated 4/13/05). However, this letter indicates and recognizes that Olson Labs can perform emissions testing on small off-road engines "solely for the purpose of providing Vehicle Code Section 27156 exemption applicants with...emissions testing for aftermarket parts evaluation" (emphasis added). See the (second) attached letter. Even under this limited recognition, CARB reserves the right to require confirmation with additional in-house testing. As confirmed above, this limited recognition granted by CARB to Olson Labs is not equivalent to the approval CARB has granted to both WVU and SwRI to perform the requisite and required diesel emissions tests as defined in the California Code of Regulations, Section 2282(g)(4)(A) – the same diesel emissions tests required by the state of Texas in their own regulations (the TCEQ Certification Test)
- Proof of Inadequacy at Olson Labs I – As stated above, Olson Labs is not a CARB approved testing laboratory capable of performing the CARB Certification Test. This suggests that Olson Labs may not be as reliable as the two laboratories that have undergone the rigorous verification procedures required of regulatory agencies such as the EPA and CARB. Having a program in place to qualify and approve testing laboratories assures the EPA and CARB that the data generated is reliable and true. And not having a program in place creates a risk that the data being generated cannot be confidently relied on. In this regard, and in reading through the Public Report, it was discovered that reference fuel testing took place on 6/3/05 and 6/4/05. However, untreated candidate fuel testing did not take place until 6/9/05 (5 days or 12 hot starts later) and treated candidate fuel testing did not take place until 6/28/05 (14 days or 23 hot starts later). This testing protocol is in direct violation of Texas Administrative Code, Title 30, section 114.315(c)(4)(D), which states, "The test schedule...must provide for conducting the test without substantial interruptions other than those resulting from the normal hours of operations at the test facility." Waiting 5 days (or 12 hot starts) between reference fuel runs and untreated candidate fuel runs and waiting 14 days (or 23 hot starts) between untreated candidate fuel runs and treated candidate fuel runs is, in ORYX Energy's interpretation, a direct violation of the cited Texas Administrative Code.
- Proof of Inadequacy at Olson Labs II – According to the same Public Report issued by Olson Labs, the test protocol carried out seems to have been done in accordance with Texas Administrative Code, Title 30, section 114.315(c)(4)(C)(ii)(IV), which states, "Alternative 4: RR CCC RR..." When reading through the Public Report, it was discovered that after running three sets of official treated candidate fuel tests (between 6/28/05 and 6/29/05), only one set of reference fuel tests were conducted (on 6/29/05). Once again, this testing protocol is in direct violation of the cited Texas Administrative Code. Instead of running just one set of reference fuel runs after the three sets of treated candidate fuel runs, Olson Labs should have carried out two sets of reference fuel runs. This is further evidence of the lack of internal quality control measures

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being adhered to by a lab such as Olson Labs and is the reason why only CARB-approved labs should be used (e.g., WVU or SwRI).

- Other Olson Lab Concerns I - Because Olson Labs is not CARB approved and lacks rigorous QA/QC procedures, there is no way to confirm that the BF additive treat rate used when Biofriendly carried out the TCEQ Certification Test was not in a more concentrated form than what Biofriendly intends to offer to the marketplace. It is peculiar that NOx emission reductions estimated at almost 12% can be obtained by the BF additive at a treat rate of 1 gallon per 20,000 gallons of fuel when a 2 to 8% NOx reduction is claimed by Clean Diesel Technologies (CDT), which offers an additive with platinum, noble metal technology at a treat rate of 1 gallon per 1,500 gallons of fuel.
- Other Olson Lab Concerns II - To evaluate all candidate fuel testing applications on a level playing field, it is necessary to control not only the reference and candidate fuel parameters but also the engine(s) on which testing is performed. It is well known that emissions can fluctuate wildly between engine types and, even within the same engine type, across model years. Furthermore, engine selection is a far more significant determinant of overall emissions level than fuel selection. For this reason, CARB Certification Testing has been standardized in terms of laboratory and engine type/model. Given the nature of the BF additive (using platinum as a active ingredient), regulatory agencies such as CARB and the TCEQ need to exercise special care to ensure that engine "pre-conditioning" did not take place (possibly using a more concentrated form of the additive) before data was gathered and submitted at Biofriendly's nominal (i.e., recommended) treat rate. Again, because Olson Labs is not CARB approved and lacks rigorous QA/QC procedures, there is no way to confirm what conditioning took place with the engine tested, if any.
- BF Additive Health Risks - Analysis of the BF additive reveals the presence of metals such as platinum, magnesium and lead. To ORYXE Energy's knowledge, some platinum-containing compounds are known to interact with cellular processes. In addition, the EPA is concerned about the human health effect of a noble metal-based technology sold by CDT. As mentioned above, CDT produces a platinum-based additive that claims a NOx reduction. As shown in the (third) attachment, CDT's platinum additive is subject to EPA health and toxicity impact review (more specifically, the EPA is seeking to understand the potential for increased allergen impact). In direct communications with Marian Hoyer of the EPA (phone: 734-214-4513), ORYXE Energy has confirmed that EPA's review of the CDT technology has been pending for the past six months and that EPA does not expect to make a final determination on it before the end of August 2005. This suggests that serious considerations should be given to the potential health impacts associated with the use of the BF additive and consultation should take place with the EPA on the resolution of the CDT review.

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- BF Additive Engine Risk/Impact - Regulatory agencies like CARB and the TCEQ should consult with engine manufacturers regarding the long-term impacts of metal deposition on their engines and the potential that fuel use containing heavy metals may void the user's engine warranty. Platinum-based fuel additive technology like that employed by Biofriendly and CDT typically deposit molecular level metal catalysts on combustion surfaces. It is for this reason that a conditioning or "break-in" period is required before the metal catalyst's effectiveness can become apparent. Regulatory agencies would best be served to determine the cumulative impact of a metal fuel additive technology over the life of any particular diesel engine type before the product is introduced into commerce.

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