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**New Technology Research & Development Program
Grant Contract 582-5-70807-M025**

Supplement to Final Report

The preparation of this report is based on work funded in part
by the State of Texas through a Grant from the
Texas Commission on Environmental Quality.

Final Report on the EPA testing performed by the University
of West Virginia for Proof of Concept of the CleanAir
Associates, Inc. retrofit emissions reducing device.

**Proof of Concept testing results as performed by West Virginia University with
references from the testing performed by the University of Texas at Arlington.**

Contract # 582-5-70807-M025

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On the behalf of
CleanAir Associates Incorporated
For the

Texas Commission on Environmental Quality
New Technology, Research & Development Program

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Preface

This final report is being submitted to the Texas Commission on Environmental Quality (TCEQ) as required under contract number 582-5-70807-M025 and has been prepared by Robert (BC) Crane, President, CLEANAIR ASSOCIATES, INC. on behalf of the grant recipient CLEANAIR ASSOCIATES, INC. (CAI)

Introduction

This is the final report as prepared for the TCEQ on the results of the grant funded project that was awarded to CLEANAIR ASSOCIATES, INC. in May of 2005 to test for Proof of Concept of the patented retrofit pre-combustion fuel modifying catalyst designed to lower PM, HC, CO and NOx emissions from diesel and gasoline fueled vehicles at the tailpipe. This testing proves the CLEANAIR ASSOCIATES, INC. emissions reducing concept as applied to diesel fueled vehicles using standard #2 diesel fuel. Testing was also performed in conjunction with North Central Texas Council of Government (NCTCOG) and the University of Texas at Arlington (UTA) on gasoline powered vehicles and the results show potential for emissions reduction in real world testing as well as the dynamometer testing as required by the Environmental Protection Agency (EPA) guidelines. These tests are the first in a series of tests to be performed by CLEANAIR ASSOCIATES, INC. to meet the goals of the EPA and the California Air Research Board (CARB) to reduce the emissions of NOx, PM, CO, and HC from diesel powered vehicles as well as gasoline powered vehicles and reduce the contribution to ozone particulates by older high emission emitting vehicles. The goal of CLEANAIR ASSOCIATES, INC. is to continue testing and gathering data as required by the EPA and CARB until such time the technology is verified and certified. At the point of technology verification by the EPA and CARB, the technology will be eligible under the State Implementation Plan (SIP) guidelines for the non-attainment areas in Texas at a reasonable cost for the tons of emissions removed from the air, as well as use for emissions reduction throughout the United States.

Technology Description

The CLEANAIR ASSOCIATES, INC. retrofit fuel catalyst consists of a patented catalytic alloy contained in a metal housing, that can be mounted on the firewall, fender well, frame rail, or other easily accessible mounting area, depending on the vehicle. The housing assembly has a threaded inlet and a threaded outlet that will accept a variety of fittings that will allow the device to be installed into the fuel supply line after the final fuel filter, before the combustion chamber. The fuel is directed into the inlet port of the housing assembly and directed into contact with the patented crystalline catalytic alloy. As the fuel passes over and through the catalyst an oxidation reduction reaction takes place and electrons are passed from the catalyst to the fuel to break the covalent bonding of the fuel molecules before the fuel enters the combustion chamber. This results in a more complete mix with the oxygen molecules and a more complete combustion of the fuel and oxygen mixture in the combustion chamber. More complete combustion of the fuel / air mix results in a reduction of HC, PM and CO at the exhaust as tested with an emissions analyzer. The catalytically treated fuel has been observed to remove existing carbon deposits from the combustion chamber, piston tops, valve heads, and other internal engine components allowing the combustion temperatures to migrate to the water jackets more readily due to the removal of the insulation (carbon), thus lowering the NOx emissions. The more complete combustion of the fuel results in more power being produced for the amount of fuel being consumed and a reduction in fuel consumption is often produced. The patented retrofit device can be used in conjunction with other existing emissions reducing technologies such as catalytic converters, particulate trap mufflers, and other technologies and will extend the life of these devices. The retrofit device can be used with #2 diesel fuel, low sulfur diesel fuel, ultra low sulfur diesel fuel, as well as bio diesel fuel with positive results in the reduction of emissions from vehicles using the CLEANAIR ASSOCIATES, INC. catalytic technology combined with other existing technologies and a variety of different fuels.

Project Goals

The primary goals of the project were to subject the CLEANAIR ASSOCIATES, INC. catalytic fuel conditioner to testing that would validate the Proof of Concept for the emissions reducing properties of the retrofit device when installed into the existing fuel system of diesel powered vehicles, for both on-road and non-road applications, without making any other modifications to the vehicle. With validation of Proof of Concept the next steps will be to verify and/or certify the patented emissions reducing technology with the EPA and CARB. Originally the testing was to be performed at Southwest Research Institute in San Antonio, (SwRI) under the supervision of Mr. Terry Ullman. After receiving a quote for the proposed testing protocol, CLEANAIR ASSOCIATES, INC. was informed that SwRI had a large backlog of work and that the proposed testing could not be performed within the allotted time frame required by the TCEQ. Mr. Ullman, with SwRI, in his proposal dated 3/28/2004, quoted CLEANAIR ASSOCIATES, INC. the amount of \$26,400.00 to perform a set of FTP tests prior to the installation of the patented retrofit device as well as a follow up set of FTP tests after installation of the retrofit device in a transit capable test cell that uses a relatively large electric dynamometer system to load and monitor the test engine through the transient cycle. Mr. Ullman, in the proposed quote, made a statement in his proposal that “It is assumed that the function of the in-line fuel catalyst is not affected in any way by magnetic or electrical fields that may be present in the test cell environment”. No previous tests had been conducted in the electromagnetic dynamometer environment. This statement will be addressed further in the “Test Procedures” section.

Test Procedures

The test procedure to be used by SwRI is the CFR 40, Part 86, subpart N. Due to the heavy workload of SwRI, CLEANAIR ASSOCIATES, INC. contacted Dr. Scott Wayne at the University of West Virginia, where complete test facilities are available to perform the required FTP testing as directed by the EPA and CARB. The University of West Virginia could also work our testing into their work schedule. CLEANAIR ASSOCIATES, INC. contacted the TCEQ and requested a change of testing facilities and permission was granted. Testing was then set for the first week of May 2005, under the supervision of Dr. Scott Wayne, PhD. The test engine is a 1995 Mack E7-400 V-Mack II, serial number 5A0796. The engine is a 6-cylinder turbocharged engine with a 12 Liter displacement producing 400 brake horsepower (bhp) at a rated speed of 1800 revolutions per minute (rpm) and 1460 foot-pounds (ft-lb) of torque at 1250 rpm. The test procedure consisted of engine mapping then one warm start FTP followed by three hot start FTP's without the retrofit device installed as a baseline. The device was then to be installed into the fuel system. The engine was to be run for a period of six hours at different load settings for conditioning. After conditioning, the engine mapping, warm start FTP test, followed by the three hot start FTP tests were then to be performed with the device installed. With the testing underway it was noted that the emissions reductions produced in the test cell were not the same as results produced in previous testing of emissions reduction monitored with the retrofit catalytic device installed in real world testing. It was noted that the particulate matter was being reduced but the hydrocarbons, which always show a substantial reduction, were remaining unchanged. CLEANAIR ASSOCIATES, INC. observed the electromagnetic field in the test cell to induce an effect of cancelling the emissions reducing properties of the catalyst on the fuel. A modification to the system was made to reduce the effects of the electromagnetic field produced by the dynamometer and one warm start and one hot start were performed to determine the results of the modification. An improved emissions reduction result was immediately realized. Since the time and costs allotted for the project were already met and only one additional hot start was performed at this point, the results of which confirmed an increased positive result of emissions reduction being produced, it has been determined that more testing needs to be performed to obtain the emissions reductions that have normally

been observed in preceding tests. It is clear the retrofit pre-combustion catalyst does reduce emissions of PM, HC, CO, and NO_x as shown by the testing for Proof of Concept that has been performed at the test facilities. Further testing of the device is needed to reproduce the required percentage of criteria pollutant reductions as called for by the EPA and CARB procedures for verification/certification testing. CLEANAIR ASSOCIATES, INC. has contacted Dr. Scott Wayne at UWV and has received quotes to have more diesel testing performed utilizing a chassis dynamometer and/or real world testing under the guidelines of the federal test procedures that will eliminate the problems associated with testing in an electromagnetic dynamometer type test cell.

Test Results

CLEANAIR ASSOCIATES, INC. observed, after the second set of tests were finished, that the catalyst was not performing the same in the test cell as real world tests had concluded in previous results. A modification to the system was performed and then engine mapping, followed by a warm start and then one hot start test was run to determine if there was any change in the results. Immediately after the test was started in the modified mode the catalyst performed as expected and it was determined that the electromagnetic field produced in the test cell did have a significant negative affect on the performance of the catalyst as originally cautioned by Mr. Ullman with SwRI. Even under adverse conditions the catalyst produced over 6% reduction in PM and lowered HC, CO and NO_x. It has been determined that more testing must be performed to obtain the emissions reductions that are normally observed in tests that have been conducted in real world applications or as produced on a chassis dynamometer. These results are shown in the reference test procedures that were produced at the test facilities at the University of Texas at Arlington under the watchful eye of the North Central Texas Council Of Government (NCTCOG). The testing was conducted by UTA under the direction of Dr. Melanie Sattler utilizing a large state of the art mobile emissions analyzer mounted into the test vehicle and monitoring the exhaust in a real world driving test for both city driving cycles and highway driving cycles. The results show a reduction of NO_x at 26.2% on gasoline with reductions of HC and CO also observed. The results are included from the UTA testing as reference to the emissions reductions that have been achieved with the CLEANAIR ASSOCIATES, INC. retrofit device when tested outside an electromagnetic dynamometer test cell.

Summary of Project Activities

The CLEANAIR ASSOCIATES, INC. retrofit catalytic fuel conditioner was at a disadvantage as tested in the electromagnetic dynamometer test cell due to the high electromagnetic field produced. The catalyst performs far better when it is not subjected to this intense electromagnetic field. With this fact in mind, future testing results as performed on a chassis dynamometer or in the real world driving applications will show the true emissions reductions that can be obtained using the patented catalyst. The testing that was performed at UTA on gasoline under real world testing conditions produced a 26.2 % reduction of NO_x. CLEANAIR ASSOCIATES, INC. is dedicated to testing its patented catalyst under the guidelines set forth by the EPA and CARB until such satisfactory results can be achieved using #2 diesel fuel, LSDF, ULSD, and also bio-diesel. CLEANAIR ASSOCIATES, INC. has been testing large EMD diesel engines in the locomotive field, and in a 10 month private study conducted with RS & S RR Company the patented catalyst has been shown to reduce PM, HC, CO and NO_x substantially along with a resulting 10% reduction in fuel consumption in a 3000 hp EMD engine. The CLEANAIR ASSOCIATES, INC. patented catalyst is the answer to low cost emissions reduction in school buses and other diesel powered on-road and non-road vehicles and equipment due to its easy installation, no maintenance (requires no cleaning or replacement), transferability (can be moved from one vehicle to another easily) and lifetime catalyst guarantee. CLEANAIR ASSOCIATES, INC. will continue testing and evaluation work until such a time that our patented catalyst passes the EPA and CARB testing requirements and can be used in the industry to lower the criteria emissions and help clean the air we breathe.

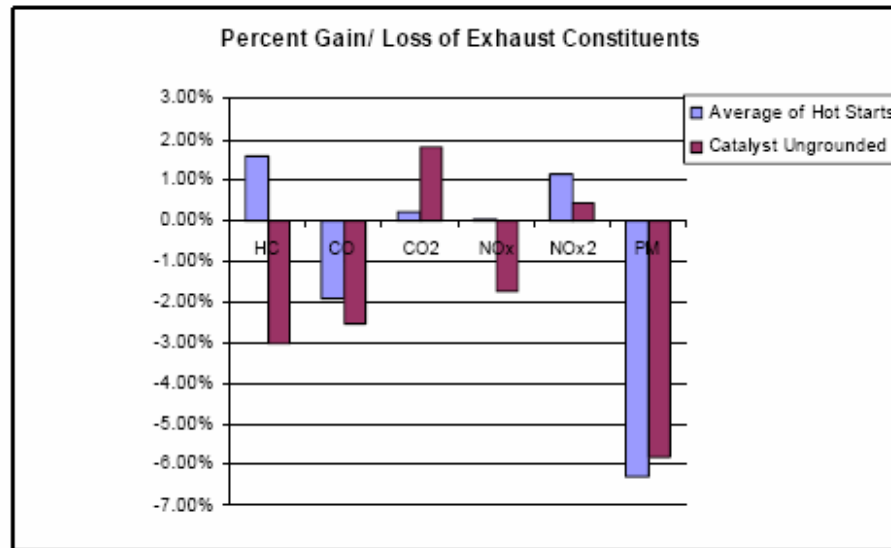


Figure 10: Percentage Change in Emissions after Catalyst Installation

Figure 10 shows the percentage difference between the averages of the three hot runs of the stock and modified configurations. Any exhaust constituent found to have a negative percentage illustrates a reduction in that constituent.

References

1. Code of Federal Regulations, Title 40, Part 86, "Protection of Environment," US Government Printing Office, 2005.

The chart above shows the reductions observed in the emissions testing as performed on the 1995 Mack E7-400 V-Mack II serial # 5A0796 using #2 diesel fuel for Proof of Concept evaluation as performed by the University of West Virginia thru a grant provided by the Texas Commission on Environmental Quality, New Technology, Research & Development Program Emissions-Reducing Grant to CleanAir Associates Inc.