



EPA Evaluation of the Vitalizer III Aftermarket Retrofit Device

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Vehicle Programs and Compliance Division
Office of Mobile Sources
U.S. Environmental Protection Agency

NOTICE

*This technical report does not necessarily represent final EPA decisions or positions.
It is intended to present technical analysis of issues using data which are currently available.*

*The purpose in the release of such reports is to facilitate the exchange of
technical information and to inform the public of technical developments which
may form the basis for a final EPA decision, position, or regulatory action.*

EPA Evaluation of the Vitalizer III Aftermarket Retrofit Device
EPA420-R-99-015
(Original draft title: Emissions and Fuel Economy Effects of the Vitalizer III)

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OFFICE OF MOBILE SOURCES
U.S. ENVIRONMENTAL PROTECTION AGENCY

United States Environmental Protection Agency Evaluation of Vitalizer III

Under Section 511 of the Motor Vehicle Information and Cost Savings Act

The Motor Vehicle Information and Cost Savings Act (MVICSA) requires that, in response to certain requests, the U.S. Environmental Protection Agency (EPA) evaluate fuel economy retrofit devices and publish a summary of each evaluation in the Federal Register.

EPA evaluations are originated either 1) upon request of the Federal Trade Commission, 2) in response to a need identified by the EPA Administrator, or 3) upon the application of a manufacturer of a retrofit device and after that application has been carefully reviewed to assure it is consistent with established criteria. These studies are designed to determine whether the retrofit device increases fuel economy and/or decreases emissions and to address whether the advertised representations made with respect to the device are accurate. The results of such studies are set forth in reports such as this one. This Vitalizer III device evaluation was requested by the manufacturer. The EPA did follow-on testing to respond to Agency data needs.

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Introduction to the United States Environmental Protection Agency (EPA) Report, “EPA Evaluation of the Vitalizer III Aftermarket Retrofit Device” (EPA420-R-99-015); originally dated June 1997.

EPA conducted a laboratory evaluation of an aftermarket retrofit device named Vitalizer III to quantify effect on exhaust emissions and fuel economy. A report documenting the findings was drafted in 1997. A copy of the draft was sent to the device’s manufacturer, Metal Reaction, Inc. Metal Reaction, Inc., advised EPA that Vitalizer III would not be marketed in the United States, but it would be replaced with another product with the name Vitalizer (no suffix). EPA did not issue the Vitalizer III report since the tested product was not intended to be marketed in the United States.

It has been brought to EPA’s attention that advertising claims (located at Internet address <http://www.thevitalizer.com> as of May 5, 1999, copy attached) made for a product named Vitalizer include a statement that “This is the only retro-fit device for fuel economy and emission reduction to pass the E.P.A. 511 Retro-fit Evaluation Procedures”. This statement is incorrect because there are no pass or fail conditions in the evaluation procedure; the procedures are conducted to determine any difference, either positive or negative, when testing vehicles with and without the device. EPA has only evaluated a product named Vitalizer III, not the Vitalizer as stated in promotional claims. The report on the Vitalizer III concludes that the product makes no statistically significant difference in either fuel economy or exhaust emissions when tested by the EPA.

The term “511 Retro-fit Evaluation Procedure” refers to EPA’s testing program formerly conducted under the authority of Section 511 of the Motor Vehicle Information and Cost Savings Act. That authority was recodified; the current test program authority is 42 USC 7525 and 49 USC 32918. Regulations describing the program are found at 40 Code of Federal Regulations, Part 610.

EPA has decided that it should publish the original report on the Vitalizer III, although it is not claimed to be marketed in the United States, in order to answer public questions. There is no application with EPA to test the product simply named Vitalizer.

1.0 ABSTRACT

This report describes the testing by EPA of the Vitalizer III retrofit device under Section 511 of the Motor Vehicle Information and Cost Savings Act (MVICSA). This testing was conducted at the National Vehicle and Fuel Emissions Laboratory (NVFEL) in Ann Arbor, Michigan at the request of the manufacturer of the device, and after the application was carefully evaluated as being consistent with the established application acceptance criteria.

The Vitalizer III is, as stated by the manufacturer, a copper tube whose core consists of percentages of precious metals. This tube is placed in the fuel line, and “when placed in operation, causes an interruption in the natural flow pattern of the fuel, activating an electrostatic charge within the fuel matrix, and thus forming an electrostatic colloidal matrix. When pumped into the engine’s combustion chambers, this matrix insures more complete combustion of the fuel utilized.” The manufacturer claims “Statistically significant improvement in HC (hydrocarbon) and CO (carbon monoxide) emissions and statistically significant improvement in fuel economy.”

In order to evaluate the claims of the manufacturer, three vehicles were selected. These were high-sales volume vehicles that, as a group, were considered adequately representative of the U.S. automotive fleet. The test plan sequence included a full vehicle preparation prior to introduction of the vehicle into the program, including a comprehensive inspection and appropriate maintenance. The vehicles were then driven on an established road route for about 1000 miles with the vehicle being stopped every 30 minutes per the device manufacturer’s request. The vehicles were then baseline tested over the Federal Test Procedure and Highway Fuel Economy Tests. The vehicles were tested on an electric dynamometer and with the vehicle grounded, per the request of the device manufacturer. The Vitalizer III was installed on each vehicle in accordance with the written and verbal instructions of the manufacturer. This was followed by additional road mileage accumulation of about 1000 miles under the conditions mentioned above. The vehicles were again tested over the same tests under the same conditions, as stated above. After this second round of testing, it was discovered that the baseline testing of one of the vehicles, a Ford Crown Victoria, had experienced undetected brake dragging. This rendered the testing of only this vehicle invalid. This concluded the first phase of the program to the written satisfaction of the device manufacturer (see letter from Metal Reaction, Inc., to EPA dated March 8, 1995, Appendix 4).

The program was extended to explore issues of interest to the EPA, at EPA’s expense. The device manufacturer agreed to the continued use of one of the devices. This phase of the program included additional, extended mileage accumulation and additional testing, including a repeat of the above test sequence on a different Ford Crown Victoria to further explore the impact of the Vitalizer III on this class of vehicle.

The EPA concludes the following from the testing reported herein:

Addressing the initial claim of the manufacturer that use of the Vitalizer III results in “Statistically significant improvement in HC and CO emissions and statistically significant improvement in fuel economy.”, the testing indicates the following:

- Use of the Vitalizer III resulted in emissions increases in 72% of the observations. When this whole body of emissions data are statistically analyzed together using the “Student’s t” test (95% level), the changes are not statistically significant. When the emissions data from the vehicles are analyzed individually, two of the emissions increases were significant at the 95% level of confidence. In one of these two cases, the use of the Vitalizer III resulted in the vehicle CO grams per mile (g/mi) going from lower-than to exceeding the numerical limit value of the CO standard.
- Use of the Vitalizer III resulted in increases in fuel economy in six of the observations, all of which were less than 1.0 %. When the fuel economy data are analyzed (using the Student’s t test) as a whole, there is no statistical difference in the fuel economy results as a function of use of the Vitalizer III. When these six observations were analyzed individually, the fuel economy increase data of 0.2 miles per gallon or lower from one vehicle were significant at the 95% level of confidence.

Relative to a follow-on claim of an a drop in emissions immediately after installation of the Vitalizer III, the following is concluded:

- There was little change in the emissions immediately after device installation.

Relative to a follow-on claim of an increase in emissions soon after device installation as a “cleaning cycle” begins, to be followed by a significant decrease at the end of this “cleaning cycle” (at 10% to 15% of the vehicle mileage at the time of installation), the following can be concluded:

- There was a one percent or less improvement in fuel economy after extended mileage accumulation, but this occurred while the emissions increased from 1.3 to 11.6 percent, contrary to the claims of the manufacturer.
- If, as the manufacturer states, there are many instances where the emissions do increase at the beginning of this “cleaning cycle” (an occurrence not observed by testing this particular vehicle), then one conclusion from the EPA results could be that emissions from Vitalizer III equipped vehicles may stay elevated, or even increase further, for at least 10% to 15% of the mileage-at-the-time-of-installation.

2.0 BACKGROUND

Under Section 511 of Motor Vehicle Information and Cost Savings Act (MVICSA), EPA is required, in response to requests from certain sources, to evaluate aftermarket retrofit devices and fuel additives (collectively referred to as devices) that are claimed to improve fuel economy and emissions. EPA receives information about many of these devices that are represented by the device manufacturer as offering a potential for reductions in emissions and/or an improvement in the fuel economy of conventional automobiles. EPA's Office of Mobile Sources is interested in evaluating such devices because of the obvious benefits the test results and analysis have for the nation. EPA invites developers of devices to submit information on the principle of operation together with available preliminary test data. In those cases where the device manufacturer's application meets certain established program criterion, and the device shows promise in preliminary screening tests at an independent laboratory, confirmatory tests may be run at EPA's NVFEL in Ann Arbor, Michigan at the expense of the applicant. EPA is also required to evaluate devices at the request of the Federal Trade Commission and may perform such a device evaluation at the discretion of the EPA Administrator.

The conclusions drawn from EPA evaluation tests are necessarily of limited applicability. An all encompassing evaluation of the effectiveness of a device in achieving performance improvements on the many different types of vehicles that are in actual use would require a large sample of test vehicles. This is usually not economically feasible in the evaluation projects conducted by EPA. Therefore, the conclusions from EPA device evaluation tests can be considered to be quantitatively valid only for the specific test car(s) used; however, it is reasonable to extrapolate the results from EPA tests to other types of vehicles in a directional manner; i.e., to suggest that similar results are likely to be achieved on other types of vehicles.

Mr. Luis Gomez, of Hialeah, Florida, is the Principle Officer and Chief Executive of Metal Reaction, Inc., the principle company (the "manufacturer") responsible for manufacturing and marketing an automotive retrofit device referred to as the "Vitalizer III". The manufacturer contacted EPA prior to June 22, 1993 and applied for EPA section 511 protocol testing of a device referred by them as the "Vitalizer II". On June 22, 1993, the same manufacturer contacted EPA (see letter from L. Gomez to A. Barth, EPA, in Appendix 4) and requested that he withdraw his earlier application and replace it with an application to test an automotive retrofit device, the "Vitalizer III", in the EPA section 511 Protocol program.

Based on an analysis of the information supplied by the manufacturer, EPA concluded that the Vitalizer III is a category 1 device, in that EPA judges it to potentially affect exhaust emissions of current automobiles. EPA's device integrity analysis concludes that the device is likely standardized with regards to manufacturer and likely not sensitive to deterioration under either normal or abnormal operating conditions. The device could affect the surroundings of the installation, if the installation was done incorrectly or later movement brings it into contact with critical engine components. There are no test data to confirm these best-engineering analyses.

Also based on manufacturer-supplied information, the EPA judges that the device will likely be sensitive to installation and that this issue is presented in manufacturer-supplied installation instructions. Installation of the device will not violate Federal new-vehicle emission control regulations but may violate the Federal tampering prohibition contained in section 203 (a) (3) of the Clean Air Act, 42 U.S.C. 7522 (a) (3). EPA analyzed the test data supplied by the manufacturer and concluded that the test data supplied were adequately valid, yet barely met the criteria that EPA uses to determine if a device may have an emission/fuel economy benefit. However, the results were sufficient to qualify it for entry into the EPA 511 Program, even though the data had apparently large test differences. The manufacturer was cautioned that “EPA has evaluated several fuel-line devices and none have given a statistically significant reduction in emissions or fuel economy. Further, we are aware of no sound technical analysis or data that would lead us to believe otherwise.”

3.0 TEST PROGRAM INTRODUCTION

This report describes EPA’s testing of the Vitalizer III fuel line device under the Section 511 of MVICSA. The first phase of the testing was done in response to a request by the manufacturer and the second phase to satisfy internal EPA objectives. The evaluation was conducted to address claims of reduced emissions and improved fuel economy performance of the Vitalizer III device.

4.0 PURPOSE OF THE TEST PROGRAM

The purpose of the EPA 511 test program was to conduct a controlled technical evaluation of the Vitalizer III in-fuel-line device in a manner that was intended to address the manufacturer’s claims for “statistically significant improvement in HC and CO emissions and statistically significant improvement in fuel economy”. In the 511 application of June 22, 1993 (see Appendix 4), the manufacturer made the following statements with regards to the device:

Theory of Operation:

This unit when placed in operation, causes an interruption in the natural flow pattern of the fuel, activating an electrostatic charge within the fuel matrix, and thus forming an electrostatic colloidal matrix. When pumped into the engines (sic) combustion chambers, this matrix insures more complete combustion of the fuel utilized.

Construction and Operation:

The Vitalizer III is a copper tube whose core consists of percentages of precious metals. The core has elongated ridges that promote turbulence in the fuel flowing over the core.

Operation:

The flowing fuel molecules, upon striking the dissimilar metals of the core creates a reaction that electrostatically charges or polarizes the fuel molecules. Then when the fuel is sent into the combustion chamber and evaporates, the electrostatically charged fuel molecules (now having the same polarity tend to repel one another, causing them to disburse more thoroughly and evenly throughout each combustion chamber. Then the spark plugs fire off, the more evenly disbursed fuel vapor burns far more completely and efficiently. This naturally produces greater downward force against the pistons, more power and greater fuel economy.

At the conclusion of the first phase of testing, and in response to having reviewed the data from the first phase of testing, the manufacturer submitted additional information regarding the operation of the Vitalizer III. This additional information is summarized from a letter to EPA dated March 8, 1995 (Appendix 4) as follows:

- Emissions immediately after Vitalizer III installation: The manufacturer states “If the vehicle is tested within ten miles of installation of the Vitalizer III, it would show a significant reduction in emissions.”

- Emissions during a “cleaning cycle”: “The Vitalizer III is designed to clean an engine of carbon build-up, a process that has on several occasions raised emissions during the cleaning stage.” “Such clean-up process is estimated to last a number of miles equal to ten to fifteen percent of the actual mileage on the vehicle at the time of installation of the Vitalizer III.” The letter also states that a “significant number of cars have reacted in this fashion by showing an increase in emissions and a reduction in fuel economy immediately after the installation of the Vitalizer III.”

In a letter dated March 17, 1995 (Appendix 4), the manufacturer further discussed the cleaning cycle and repeated his belief that emissions will increase during this cleaning cycle, followed by a decrease.

In my own words the reason for a cleaning cycle is as follows: since the Vitalizer III burns the fuel more efficiently carbon deposits that are on the pistons and the heads will eventually be removed from the pistons and heads. The reason the emissions will get worse is because the carbon deposits are expelled through the exhaust valve and some will fall into the oil pan, causing worse emission readings. When the clean up cycle is completed there should be hardly any carbon build up on the pistons and the heads. Therefore your emissions readings will be better than before the Vitalizer’s installation.

5.0 TEST PLAN

In response to the stated desire of the manufacturer to engage in an EPA 511 Program evaluation of the Vitalizer III, EPA sent to the manufacturer, on June 2, 1994, a test plan and test agreement to be signed and returned by the manufacturer. The manufacturer responded, in a letter

dated June 14, 1994, with certain questions. These questions were addressed by EPA in a subsequent letter dated July 8, 1994. This letter contained a test plan, revised to incorporate certain clarified concerns of the manufacturer, and another test agreement document. Copies of these documents can be found in Appendix 4. The first-phase test plan developed by EPA, and approved by the device manufacturer, was essentially as follows:

- Select vehicles to be representative of current technology and in common use.
- Inspect and maintain vehicle to assure that it is tuned to manufacturer's specifications, replacing parts as needed.
- After vehicle checkout, and before baseline mileage accumulation, test vehicle over the Federal Test Procedure (FTP, Federal Register 40 CFR, Part 86, July 1, 1990) and Highway Fuel Economy Test (HFET, Federal Register 40 CFR, Part 600, July 1, 1990) to assure that the emissions and fuel economy are within the expected range. This testing, and all testing specified below, to be performed with an electric dynamometer and with a ground strap connected to a building ground, per the request of the manufacturer. All Phase I emissions tests performed with gasoline purchased specifically for this program. The fuels analysis results can be found in Appendix 3.
- Baseline mileage accumulation performed such that each vehicle accumulate no less than 1000 miles on an established road route. Per the device manufacturer's request, each vehicle to be stopped every 30 minutes during mileage accumulation, the engine turned off for two minutes, and the vehicle restarted and mileage accumulation resumed.
- Baseline testing using the FTP and HFET.
- Installation of the Vitalizer III in accordance with the written installation instructions provided by the manufacturer. Installation performed by EPA personnel, with applicant (or applicant's representative) observing, if desired.
- Device mileage accumulation performed such that each vehicle accumulate no less than 1000 miles on an established road route. Per the device manufacturer's request, each vehicle to be stopped every 30 minutes during mileage accumulation, the engine turned off for two minutes, and the vehicle restarted and mileage accumulation resumed. For each vehicle, the mileage accumulation procedure to be the same as that used prior to the baseline testing.
- Device testing using the FTP and HFET, followed by data analysis.

The above testing was performed on the three 1993 vehicles representing small vehicles (Saturn), mid-sized vehicles (Dodge Intrepid), and full sized vehicles (Ford Crown Victoria). The data will be discussed in the following section. During the conduct of the program, it became

apparent through inspection of both the testing results and the Ford Crown Victoria vehicle that its brakes were likely dragging somewhat during (at least) the first, baseline sets of tests. This rendered the data developed on the Crown Victoria vehicle invalid.

During the program, the device manufacturer was maintained fully informed of the progress of the program. The manufacturer observed, and approved, the installation of the Vitalizer III devices. The test plan called for triplicate testing in each configuration. However, certain cases, duplicate testing was performed and reported. Duplicate testing is in full compliance with the regulations found in 40 CFR Part 610 under which the 511 Program is conducted. The manufacturer was fully informed of this fact and accepted, under his signature (see note of February 6, 1995, Appendix 4), the baseline data that contained both triplicate and duplicate test results. At the conclusion of this phase of the program, the device manufacturer reviewed the Phase I data and confirmed in writing (see letter from Metal Reaction, Inc., to EPA dated March 8, 1995, Appendix 4) that “EPA has complied with all the requirements of the program between Metal Reaction, Inc., and the EPA.”

In the letter from Metal Reaction, Inc. to EPA of March 8, 1995 (Appendix 4), the manufacturer supplied EPA with certain representations as to why the emissions increased in the above, first phase of the program, additional presentations of the theory of operation, and additional information about emissions outcomes that one could expect as a result of use of the Vitalizer III. This included the statement that “A significant number of cars have reacted in this fashion by showing an increase in emissions and a reduction in fuel economy immediately after the installation of the Vitalizer III.” Further stated was that the engine “cleaning cycle” that is created by the use of the Vitalizer III does not conclude until the vehicle has accumulated 10 to 15 percent of the actual mileage at the time of device installation.

Partly in response to the above representations, EPA decided to perform an additional body of testing. This included further testing of a different 1993 Ford Crown Victoria to address 1) the emissions impact of the Vitalizer III on such a vehicle tested without brake drag, 2) emissions effects immediately after Vitalizer III device installation, and 3) emissions after extended mileage accumulation. This was testing paid for by the Agency to address Agency data needs and was not part of any formal testing agreement between the EPA and the Vitalizer III manufacturer.

The manufacturer, in communications about this additional phase of testing, requested that he be supplied with samples of oil from the test vehicle to be taken at certain points in the test program. EPA did not comply with this request because the manufacturer did not supply any information as to what hypothesis such samples would address nor supply a proposed test plan for a controlled experiment that would have likely resulted in data addressing this hypothesis. Neither had he provided data showing that he had performed experimentation to justify such a hypothesis. Further, it was the technical opinion of the Agency that understanding of the emissions and fuel economy behavior of a vehicle equipped with the Vitalizer III would not be increased by taking a single-point sample of oil and having it analyzed by the manufacturer.

The test plan for this additional EPA testing was substantially the following. To address the emissions change as a function of mileage, the vehicle selected had about 25, 800 miles on the odometer. Accumulating 15 percent additional mileage after Vitalizer III installation would mean accumulating 3,870 miles. The plan elements closely follow the test plan for the original, Phase 1 program, with some additions.

- Select vehicle - Ford Crown Victoria, 1993, not same vehicle as that of Phase I
- Inspect/maintain vehicle - same
- Preliminary vehicle check-out test (FTP and HWET) - same
Vehicle test conditions - same
- Baseline mileage accumulation - same
- Baseline tests (FTP and HWET) - same
- Vitalizer III installation - same
- Immediate effects testing (FTP and HWET) - Testing performed after device installation
- Device mileage accumulation - 1000 miles - same
- Device testing (FTP and HWET)- same
- Extended mileage program-element baseline tests (FTP and HWET) using CAAB fuel. (All subsequent emissions testing done on this “Clean Air Act Baseline”fuel. The analysis results of this fuel can be found in Appendix 3.)
- Device mileage accumulation - 1000 miles (total of 1000 miles after Baseline tests) - same
- Device testing (FTP and HWET)- same
- Device mileage accumulation - 1000 miles (total of 2000 miles after Baseline tests) - same
- Device testing (FTP and HWET)- same
- Device mileage accumulation - 1000 miles (total of 3000 miles after Baseline tests) - same
- Device testing (FTP and HWET)- same

- Device mileage accumulation - 1000 miles (total of 4000 miles after Baseline tests) - same
- Device testing (FTP and HWET)- same

6.0 **RESULTS**

The results of the first phase of testing can be found in Table 1. (The results of the Crown Victoria testing with the undetected brake dragging problem can be found in Table A of the Appendix.) The results from the EPA testing of the second Ford Crown Victoria can be found in Table 2. The data from both of these tables, Table 1 and Table 2, have been analyzed and show the following:

- There are emissions results from three vehicles (Saturn, Intrepid and second Crown Victoria), two test types (FTP and HWFET), three regulated emissions (HC, CO and NOx) and two conditions ('baseline' and 'with device'). The two conditions are compared with a percent-difference calculation.
 - There are 18 percent-difference values from these vehicles/test types/regulated emissions, and of these 18 values, 13 of them (72 %) increase.
 - These increases range from 3.1 % to 65.2%.
 - There were five decreases (28%), ranging from 0.1% to 7.4%.
- The "Student's t" test statistical test (see Table 3) was applied at the 95% level of confidence to the data.
 - The "Student's t" test statistical analysis applied to the individual vehicle/emissions/test type show that of the 13 increases in emissions, two are statistically significant at the 95% level of confidence.
 - Of these two statistically significant increases, one of them is the Federal Test Procedure carbon monoxide result from the Intrepid. These values go from below the numerical limit value of the standard (the standard is 3.4 g/mi) to above the numerical limit value of the standard.
 - When the "t" test is applied to the data set as a whole, there is no significant difference in the results when the baseline and with-device data are compared.
- There are six miles-per-gallon percent-change values, and all six of these values were positive, ranging from 0.2 % to 0.9% .

- The “Student’s t” test statistical analysis applied at the 95% level of confidence to all of the fuel economy data showed no statistical difference in the fuel economy levels as a function of the use of the Vitalizer III.

- When applied to the data from the individual vehicles, there was a statistical difference in the fuel economy data of the Crown Victoria, where the fuel economy increased at a value of 0.2 miles per gallon or lower.

Other results of the second, EPA, phase of the testing can be found in Table 2. The results from this phase of testing are as follows:

- Testing was performed to observe the impact on emissions immediately after installation of the device.
- This was done in response to the claim of the manufacturer that: “If the vehicle is tested within ten miles of installation of the Vitalizer III, it would show a significant reduction in emissions.
- The data are reported in Table 2. The comparison data are reported as “1000 MILES” after the baseline and “AFTER DEVICE.”

- Of the three regulated emissions and two test types, for a total of 6 observations, one half of them increased and one half of them decreased. The two fuel economy values were higher, by less than 1%.

- The results from this vehicle are not consistent with the claim of the manufacturer that there will be a significant reduction in emissions immediately after installation.

- The impact of extended mileage accumulation was tested by performing a baseline test (after the test that followed the 1000 miles accumulation - with the device installed) using an alternative fuel (CAAB fuel), followed by an additional 4000 miles of accumulation (in 1000 mile increments).
- This testing was performed to address statements by the manufacturer that: “The Vitalizer III is designed to clean an engine of carbon build-up, a process that has on several occasions raised emissions during the cleaning stage.” “Such clean-up process is estimated to last a number of miles equal to ten to fifteen percent of the actual mileage on the vehicle at the time of installation of the Vitalizer III.”
- When considering the three regulated emissions (HC, CO and NOx), two test types (FTP and HWFET), and four mileage accumulation increments beyond baseline (1000, 2000,

3000 and 4000 miles), there are 24 observations.

- Of these, 11 were higher than baseline, 11 were lower than baseline and 2 were unchanged.

- When a linear least squares regression is performed on this data, the slopes of the lines are, in all cases, positive. In other words, emissions results for HC, CO and NOx for both the test types (FTP and HFET) at 4000 miles are all higher than the baseline. The percent increase of the 4000 mile data relative to the baseline data are the following:

Test Type	HC, % change	CO, % change	NOx, % change	MPG, % change
FTP	8.3%	3.0 %	6.3 %	1.0 %
HFET	11.6 %	1.8 %	1.3 %	0.7 %

- These data indicate that for this vehicle, the fuel economy was higher by 1.0 percent or less after extended mileage accumulation. However, emissions as a function of mileage increased, rather than decreased, and thus do not support the claim of the manufacturer that the “cleaning cycle” that is created by the use of the Vitalizer III concludes (and emissions are reduced) after the vehicle has accumulated 10 to 15 percent of the actual mileage at the time of device installation.

7.0 CONCLUSIONS

The EPA concludes the following from the testing reported above:

Addressing the initial claim of the manufacturer that use of the Vitalizer III results in “Statistically significant improvement in HC and CO emissions and statistically significant improvement in fuel economy.”, the testing indicates the following:

- Use of the Vitalizer III resulted in emissions increases in 72% of the observations. When this whole body of emissions data are statistically analyzed together using the “Student’s t” test (95% level), the changes are not statistically significant. When the emissions data from the vehicles are analyzed individually, two of the emissions increases were significant at the 95% level of confidence. In one of these two cases, the use of the Vitalizer III resulted in the vehicle CO (g/mi) going from lower-than to exceeding the numerical limit value of the CO standard.

- Use of the Vitalizer III resulted in increases in fuel economy in six of the observations, all of which were less than 1.0 %. When the fuel economy data are analyzed (using the Student's t test) as a whole, there is no statistical difference in the fuel economy results as a function of use of the Vitalizer III. When these six observations were analyzed individually, the fuel economy increase data of 0.2 miles per gallon or lower from one vehicle were significant at the 95% level of confidence.

Relative to a follow-on claim of an a drop in emissions immediately after installation of the Vitalizer III, the following is concluded:

- There was little change in the emissions immediately after device installation.

Relative to a follow-on claim of an increase in emissions soon after device installation as a “cleaning cycle” begins, to be followed by a significant decrease at the end of this “cleaning cycle” (at 10% to 15% of the vehicle mileage at the time of installation), the following can be concluded:

- There was a one percent or less improvement in fuel economy after extended mileage accumulation, but this occurred while the emissions increased from 1.3 to 11.6 percent, contrary to the claims of the manufacturer.
- If, as the manufacturer states, there are many instances where the emissions do increase at the beginning of this “cleaning cycle” (an occurrence not observed by testing this particular vehicle), then one conclusion from the EPA results could be that emissions from Vitalizer III equipped vehicles may stay elevated, or even increase further, for at least 10% to 15% of the mileage-at-the-time-of-installation.

The EPA draws no conclusions from this data because the baseline testing was apparently performed with the vehicle experiencing undetected brake drag. This brake drag was detected and repaired prior to the “with device” testing. Thus, a comparison of the data is not appropriate and is not being made by EPA. However, an interested observer may note that:

- Brake drag during the baseline testing would likely result in lower fuel economy values than would be the case had there been no brake drag. Brake drag during the baseline testing would, in turn, likely make the percent difference in fuel economy between the baseline and “with device” data higher than would be the case if the baseline tests were conducted without brake drag.

- One can not state with certainty the effect of brake drag on the baseline emissions values. Never the less, the increase in emissions reported in the data table are all greater than 8.6%.

Tables 1-3 with test results and data analysis and Appendices 1-4 follow.