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Emissions and Fuel Economy Effects
of the
Fuelon Power Gasoline Fuel Additive

September 1993

NOTICE

Technical Reports do not necessarily represent final EPA decisions or positions. They are 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 development which may form the basis for a final EPA decision, position or regulatory action.

Test and Evaluation Branch
Emission Control Technology Division
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Fuelon Power Gasoline Fuel Additive

by

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1.0 ABSTRACT

This report describes the Environmental Protection Agency's (EPA) testing of the "Fuelon Power" gasoline fuel additive as part of its evaluation under Section 511 of the Motor Vehicle Information and Cost Savings Act (MVICSA). This evaluation was conducted at the request of the Federal Trade Commission (FTC) to verify the claims for substantial exhaust emission reductions and for large -- greater than 15 percent -- fuel economy benefits.

Fuelon Power is an aftermarket gasoline fuel additive that is added to the vehicle tank by the operator when refueling the vehicle. The product consists of a proprietary blend of hydrocarbons products which are claimed to substantially reduce vehicle exhaust emissions and improve fuel economy.

The additive is claimed to substantially reduce exhaust emissions, improve fuel economy, raise the octane of gasoline, improve vehicle performance, reduce engine maintenance, and extend engine life. Only the emission and fuel economy claims for the additive were evaluated in this test program.

Two typical vehicles were tested at EPA's Motor Vehicle Emission Laboratory. The basic test sequence included 1,000 miles of mileage accumulation, duplicate Federal Test Procedures (FTP) and duplicate Highway Fuel Economy Tests (HFET). This test sequence was conducted both without and with the Fuelon Power additive.

The overall conclusion from these tests is that the Fuelon Power gasoline fuel additive did not significantly reduce vehicle emissions or improve fuel economy for either the FTP or HFET. The additive clearly did not reduce vehicle exhaust emissions nor produce the large -- greater than 15 percent -- fuel economy benefits claimed by the manufacturer. Therefore, users of the Fuelon Power gasoline additive are unlikely to realize either an emissions or fuel economy benefit in actual driving. Vehicle operation and performance were unchanged by the additive.

2.0 BACKGROUND

Under Section 511 of MVICSA, EPA is required to evaluate aftermarket retrofit devices and aftermarket fuel additives which are claimed to improve fuel economy for the effect of the device on both emissions and fuel economy. The results of these evaluations are published in the Federal Register.¹

EPA receives information about many products which appear to offer a potential for reduction in emissions and/or an improvement in the fuel economy in conventional engines and vehicles. EPA's Emission Control Technology Division is interested in evaluating all such systems because of the obvious benefits to the Nation. EPA invites developers of such systems to submit information on the principle of operation together with available test data. In those cases where the system shows promise in the screening tests at an independent laboratory, confirmatory tests are run at the applicant's expense at the EPA Motor Vehicle Emission Laboratory in Ann Arbor, Michigan. Most Section 511 evaluations were conducted at the request of the applicants.

Under the MVICSA, EPA is also required to evaluate devices "at the request of the FTC when it has reason to believe that fuel economy representation made for a retrofit device being marketed may be inadequate."² This test program was initiated at the request of the FTC to determine if the emission and fuel economy claims for the "Fuelon Power" gasoline fuel additive were reasonable. The results of such test projects are set forth in a series of test and evaluation reports, of which this is one.

The conclusions drawn from the EPA evaluation tests are necessarily of limited applicability. A complete evaluation of the effectiveness of a device or additive in achieving performance improvements on the many different types of vehicles that are in actual use requires a larger sample of test vehicles than is economically feasible in the evaluation

¹ The Section 511 evaluation report, of which this testing is part, is given in "EPA Evaluation of the Fuelon Power Gasoline Fuel Additive Under Section 511 of the Motor Vehicle Information and Cost Savings Act, EPA-AA-TEB-511-92-01. This document is available from the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161.

² 40 CFR Part 610, paragraph 610.12(a)

projects conducted by EPA. The conclusions from the EPA evaluation tests can be considered to be quantitatively valid only for the specific test cars used; however, it is reasonable to extrapolate the results from the EPA test 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.

3.0 INTRODUCTION

Fuelon Power is an aftermarket gasoline fuel additive that is added to the vehicle tank by the operator when refueling the vehicle. The product consists of a proprietary blend of hydrocarbons products which are claimed to substantially reduce vehicle exhaust emissions and improve fuel economy.

The additive is claimed to substantially reduce exhaust emissions, improve fuel economy, raise the octane of gasoline, improve vehicle performance, reduce engine maintenance, and extend engine life. Only the emission and fuel economy claims for the additive were evaluated in this test program.

4.0 PURPOSE OF THE TEST PROGRAM

The purpose of the EPA test program was to conduct a controlled technical evaluation of the device to determine if the Fuelon Power gasoline fuel additive met its advertised claims. Exhaust emissions, fuel economy, installation, and safety were to be specifically evaluated. The other claims -- extended engine life, increased octane, and reduced engine maintenance -- were not evaluated.

5.0 TEST PLAN

A test plan was developed by EPA (Appendix A).

The EPA test program consisted of the checkout of the test vehicles, mileage accumulation without the additive³, duplicate baseline tests on each vehicle, additive installation, mileage accumulation with the additive, and duplicate additive tests on each vehicle. The purpose of the vehicle checkout was to ensure each vehicle was representative of a properly-tuned vehicle and would provide a reasonable reference test condition. Installation was to be done per the instructions supplied with the product.

³ Mileage accumulation consisted of 1,000 miles of driving over a prescribed route of city and highway mileage. The same 150-mile route was used for all mileage accumulation.

The vehicles were to be tested using the FTP and HFET. The FTP is the official EPA test procedure for determining the exhaust emissions of a vehicle. The results of both of these tests are also used to determine the fuel economy of a vehicle. The FTP is described in the Federal Register (40 CFR Part 86; July 1, 1990) and the HFET is described in the Federal Register (40 CFR Part 600; July 1, 1990). The vehicles were not tested for evaporative emissions.

Claims for the Fuelon Power aftermarket gasoline fuel additive not specifically addressed were extended engine life, increased octane, and reduced engine maintenance. The reason for not using specific procedures to evaluate these claims is that several of these are in large part subjective and procedures for their evaluation are neither well defined nor routinely used by EPA to evaluate devices. Others require extensive vehicle mileage or engine (out of vehicle) operation.

Two typical vehicles were tested at EPA's Motor Vehicle Emission Laboratory. The basic test sequence included 1,000 miles of mileage accumulation, duplicate Federal Test Procedures (FTP) and duplicate Highway Fuel Economy Tests (HFET). This test sequence was conducted both without and with the Fuelon Power additive. A more detailed description of these vehicles is given in Appendix B.

5.1 CONDUCT OF TESTING

The testing (including mileage accumulation) was conducted by EPA. All tests were performed by the EPA at its Motor Vehicle Emission Laboratory in Ann Arbor. In general, the testing proceeded as planned. However, since the fuel economy pattern for the three test segments of the FTP did not follow the expected pattern on one vehicle, additional baseline tests were conducted on it to verify the results.

Test Results - Installation

The instructions were generally clear. However, there are problems encountered in pouring the correct amount of measured additive into a vehicle fuel tank.

The additive label instructions -- "Tilt bottle until FUELON enters the measuring chamber and lines up with the right gallon mark. If you add 10 gallons of gasoline, line FUELON up at the 10. For 20 gallons, line FUELON up at the 20, etc. Remove gas cap, insert funnel. Pour FUELON into tank. Replace bottle cap tightly." -- are simple and clear but cannot be properly followed due to problems with the design of the measurement chamber of the bottle. When attempting to pour out

the measured amount, additional additive spills over into the measuring chamber. If the user stops pouring before spillover, the chamber still holds additive near the 5 gallon mark. This problem occurs until the bottle is approximately half full.

Test Results - Fuel Economy and Emissions

The test results for each vehicle are summarized below. Emission levels are given in grams/mile while fuel economy is given in miles per gallon. The individual test results for each vehicle are given in Appendix C.

Summary of EPA Test Results

	FTP				HFET			
	HC	CO	NOx	MPG	HC	CO	NOx	MPG
Chevrolet Cavalier								
Baseline	.10	1.57	.35	23.5	.01	.16	.09	36.1
Fuelon Power additive	.14	1.90	.41	23.9	.01	.24	.12	36.3
Dodge Caravan								
Baseline	.36	3.46	.73	21.1	.07	1.52	.10	29.7
Fuelon Power additive	.39	4.07	.83	21.0	.07	1.60	.31	30.3

These data were analyzed for statistical significance using Student's t - test⁴ technique to determine if the differences observed were real or due solely to chance. This analysis showed that, except for an increase in CO emissions for one vehicle for the FTP test, the HC, CO and NOx differences

⁴ Student's t - test is a standard statistical method that provides a powerful technique for analyzing experimental data involving quantitative measurements especially for small numbers of tests (i.e. 30 tests or less on each vehicle). The method allows confidence levels to be attached to the estimates of the effects of the independent variable (i.e., additive effect). To minimize test costs for the screening tests conducted by applicants at independent laboratories, only hot start LA-4 (bags 1 and 2 of the FTP) are required and the data are screened at an 80 percent confidence level. For confirmatory tests conducted at EPA, FTP and HFET tests are used plus the data are screened at a 95 percent confidence levels. Note: At a 50 percent confidence level, there is an equal probability that the device does or does not have an effect.

were not statistically significant at the 95% confidence level for either the FTP or HFET tests. This analysis also showed that the fuel economy differences were not statistically significant at the 95% confidence level for either the FTP or HFET tests for either vehicle.

The overall conclusion from these tests is that the Fuelon Power gasoline fuel additive did not significantly reduce vehicle emissions or improve fuel economy for either the FTP or HFET. The additive clearly did not reduce vehicle exhaust emissions nor produce the large -- greater than 15 percent -- fuel economy benefits claimed by the manufacturer. Therefore, users of the Fuelon Power gasoline additive are unlikely to realize either an emissions or fuel economy benefit in actual driving. Vehicle operation and performance were unchanged by the additive.

Appendix A

Test Plan for EPA Testing of the Fuelon Power Gasoline Fuel Additive

Test Plan

The following is the test plan which will be used by the EPA in collecting data on the fuel economy and emission effects of the Fuelon Power fuel additive of Fuel Plus Technology Inc. Corporation (a retrofit device under Section 511 of the Motor Vehicle Information and Cost Savings Act). This testing is being conducted at the request of the FTC.

1. Representative vehicles will be identified and obtained by the EPA. Representativeness will be based upon the applicability of Fuelon Power as detailed in the manufacturer's literature; i.e., 1990 year or older, domestic, gasoline fueled and for engine size and manufacturer; i.e., small, medium, large engines from different manufacturers.
2. Vehicles will each be checked and adjusted to ensure that they are operating in accordance with vehicle manufacturer's specifications.
3. The test fuel will be commercial unleaded summer-grade gasoline from EPA storage facilities. This fuel is routinely used by EPA and its specifications are known.
4. All mileage accumulation will be with this same commercial unleaded summer-grade gasoline.
5. Baseline mileage accumulation. Each vehicle will accumulate 1,000 miles on an established road route using commercial unleaded summer-grade fuel. The vehicle will then be baseline tested.
6. Baseline tests. Duplicate, valid Federal Test Procedure (FTP) and Highway Fuel Economy Test (HFET) procedures will be performed on each test vehicle after baseline mileage accumulation. Basic vehicle driveability will be noted.
7. The Fuelon Power fuel additive will then be added to the fuel supply in accordance with the written installation instructions provided with the additive.
8. The addition of additives will be performed by EPA personnel. The vehicles may be checked, as necessary, for correct operation prior to initiation of these additive tests.

9. Additive Mileage Accumulation. Each vehicle will undergo mileage accumulation on the same road route sufficient to bring the total mileage with the additive to 1,000 miles (additive added to commercial unleaded summer-grade fuel). For each vehicle, the mileage accumulation procedure will be the same as that used prior to baseline testing.

10. Additive Tests. After mileage accumulation, the testing sequence performed for the baseline test will be repeated with the Fuelon Power additive used.

11. Data Analysis. Test results will be analyzed to determine if there is a statistically significant difference between the data sets (vehicles without and with Fuelon Power).

12. Additional testing may be undertaken by EPA to further investigate items noted during the course of the test program.

Fuelon Power Fuel Additive Detailed In-House Test Plan

I. Introduction

Comparative exhaust emission and fuel economy data are to be obtained on late model vehicles both without and with the Fuelon Power fuel additive. All mileage accumulation will be done using commercial unleaded summer-grade gasoline from EPA storage facilities as needed with fuel added as required.

II. Test Vehicles

Two vehicles will be tested.

III. Required Testing

A. Vehicle Prep

Prior to start of testing, each vehicle is to be tuned to manufacturer's specifications and parts replaced as required to ensure proper operation of the vehicle for 3,000 miles.

Parts

Air filter	check
Distributor cap	check
Fuel filter	check
Ignition wires	check
Oil	change use the same 10W30 oil in all test vehicles
Oil filter	change, use OEM
PCV filter	check
PCV valve	check
Rotor	check
Spark plugs	check
Tires	check

Adjustments (if adjustable)

Air/fuel mixture
Choke
Curb idle
Fast idle
Ignition timing

Checks

Compression

Record all items adjusted/checked/replaced. Record manufacturer's specifications and measured values for all items as appropriate.

B. Test Schedule

All vehicles will be tested using the same test schedule:

1. Check tire pressure set for road.
2. Drain and pressure check fuel system. Then refuel with commercial unleaded summer-grade gasoline from EPA fuel supply.
3. 1,000 miles of mileage accumulation on an established road route using commercial unleaded summer-grade gasoline from the EPA storage facilities.
4. Drain and refuel (approximately 3 gallons).
5. Set tire pressure for dyno.
6. Drain and refuel to 40% fill for prep.
7. LA-4 prep.
8. Overnight soak
9. Drain and 40% fill with chilled fuel. Heat build with no evaps. Then FTP and HFET tests with commercial unleaded summer-grade gasoline.
10. Repeat steps 6 to 9.
11. Add Fuelon Power to chilled fuel cart in ratio specified per manufacturer's written instructions.
12. Mileage accumulation to 1,000 miles with Fuelon Power additive using commercial unleaded summer-grade gasoline with Fuelon Power EPA fuel cart. For each vehicle, the mileage accumulation route with the additive will be the same as that used prior to baseline testing.
13. Drain and refuel (approximately 3 gallons).
14. Duplicate FTP and HFET tests with the Fuelon Power fuel additive (steps 6 to 9 completed twice).

C. General

The same driver and dynamometer should be used to test a given vehicle whenever possible. Driveability should be evaluated on the road and during testing. Written driveability comments are needed. Mileage accumulation will be performed by EPA drivers using an established road route. All fuel will be from EPA supplies.

Appendix B

Test Vehicle Description

<u>Make/Model</u>	<u>Chevrolet Cavalier</u>	<u>Dodge Caravan</u>
Model Year	1990	1990
Vehicle ID	1G1JC84G2LJ187797	2B4FK2530LR611818
Type	Four-door wagon	Mini van
Initial Odometer	10128 miles	17198 miles
Engine Family	2.2L/I-4 L1G2.2V5JFG2	3.0L/V-6 LCR3.0T5B67
Fuel Metering	Fuel injected	Fuel injected
Evaporative Family	LAO-1E	LCRTB
Emission Control System	EGR 3-way catalyst Closed-Loop	EGR 3-way catalyst Closed-Loop
Transmission	Automatic	Automatic
Tires	P185/80R13	P195/75R14
Test Parameters		
Inertia Weigh	3,000 lbs	3,875 lbs
hp @ 50 mph	7.0	10.2

Appendix C

Test Results

1990 Chevrolet Cavalier, 2.2 liter, 4 cylinder

FTP					HFET				
Emissions in Grams/Mile					Emissions in Grams/Mile				
<u>Test No.</u>	<u>HC</u>	<u>CO</u>	<u>NOx</u>	<u>MPG</u>	<u>Test No.</u>	<u>HC</u>	<u>CO</u>	<u>NOx</u>	<u>MPG</u>
Baseline									
91-4705	.12	1.75	.32	24.4	91-4706	.01	.18	.07	37.2
					91-4708	.01	.13	.08	37.1
91-4709	.10	1.59	.32	23.5	91-4710	.01	.16	.08	36.3
91-4711	.10	1.42	.39	23.1	91-4712	.01	.17	.10	34.7
91-4848	.08	1.33	.34	23.2	91-4849	.01	.17	.10	35.2
Fuelon Power additive									
91-4850	.15	1.91	.39	24.1	91-4851	.01	.18	.12	36.7
91-5234	.12	1.89	.43	23.8	91-5235	.01	.30	.12	35.8

1990 Dodge Caravan, 3.0 liter, V-6

FTP					HFET				
Emissions in Grams/Mile					Emissions in Grams/Mile				
<u>Test No.</u>	<u>HC</u>	<u>CO</u>	<u>NOx</u>	<u>MPG</u>	<u>Test No.</u>	<u>HC</u>	<u>CO</u>	<u>NOx</u>	<u>MPG</u>
Baseline									
91-4697	.38	3.48	.68	21.2	91-4688	.07	1.58	.27	29.2
91-4699	.35	3.44	.78	21.0	91-4700	.07	1.46	.26	30.2
Fuelon Power additive									
91-4701	.40	3.93	.83	21.1	91-4702	.07	1.49	.29	30.3
91-4702	.39	4.22	.84	21.0	91-4704	.08	1.70	.32	30.3