PB81-229866

EPA-AA-TEB-511-81-10A

EPA Evaluation of the FUEL-MAX Device Under Section 511 of the Motor Vehicle Information and Cost Savings Act

by

Edward Anthony Barth

June, 1981

Test and Evaluation Branch
Emission Control Technology Division
Office of Mobile Source Air Pollution Control
Environmental Protection Agency

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(Please read Instructions on the reverse before completing)

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16. ABSTRACT

This document announces the conclusions of the EPA evaluation of the "FUEL-MAX" device under provisions of section 511 of the Motor Vehicle Information and Cost Savings Act.

On January 18, 1980, the EPA received a request from FIDCO, Fuel Injection Development Corporation, for evaluation of a fuel saving deviced termed"FUEL-MAX". This device is an air bleed device that replaces the EGR valve. It is claimed to conserve fuel.

The purpose of the EGR system is to control oxides of nitrogen (NOx). Removal of the EGR valve to install the "FUEL-MAX" disables the EGR system and would be expected to result in a large increase in NOx emissions. Test data submitted by the applicant confirmed this prediction as well as indicating that "FUEL-MAX" might improve fuel economy. Although the data did not adequately quantify the amount of this improvement, EPA chose to conduct confirmatory testing.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Tests Fuel Consumption Nitrogen Oxides	Gas Saving Devices Fuel Economy Air Bleed Devices EGR Valve	

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ENVIRONMENTAL PROTECTION AGENCY

[40 CFR Part 610]

[FRL ______________]

FUEL ECONOMY RETROFIT DEVICES

Announcement of Fuel Economy Retrofit Device Evaluation
for "FUEL-MAX"

AGENCY: Environmental Protection Agency (EPA).

ACTION: Notice of Fuel Economy Retrofit Device Evaluation.

SUMMARY: This document announces the conclusions of the EPA evaluation of the "FUEL-MAX" device under provisions of Section 511 of the Motor Vehicle Information and Cost Savings Act.

BACKGROUND INFORMATION: Section 511(b)(1) and Section 511(c) of the Motor Vehicle Information and Cost Savings Act (15 U.S.C. 2011(b)) requires that:

(b)(1) "Upon application of any manufacturer of a retrofit device (or prototype thereof), upon the request of the Federal Trade Commission pursuant to subsection (a), or upon his own motion, the EPA Administrator shall evaluate, in accordance with rules prescribed under subsection (d), any retrofit device to determine whether the retrofit device increases fuel economy and to determine whether the representations (if any) made with respect to such retrofit devices are accurate."

(c) "The EPA Administrator shall publish in the Federal Register a summary of the results of all tests conducted under this section, together with the EPA Administrator's conclusions as to -

(1) the effect of any retrofit device on fuel economy;

(2) the effect of any such device on emissions of air pollutants; and

(3) any other information which the Administrator determines to be relevant in evaluating such device."

EPA published final regulations establishing procedures for conducting fuel economy retrofit device evaluations on March 23, 1979 [44 FR 17946].

ORIGIN OF REQUEST FOR EVALUATION: On January 18, 1980, the EPA received a request from FIDCO, Fuel Injection Development Corporation, for evaluation of a fuel saving device termed "FUEL-MAX". This Device is an air bleed device that replaces the EGR valve. It is claimed to conserve fuel.

Availability of Evaluation Report: An evaluation has been made and the results are described completely in a report entitled; "EPA Evaluation of the FUEL-MAX Device Under Section 511 of the Motor Vehicle Information and Cost Savings Act." This entire report is contained in two volumes. The discussions, conclusions and list of all attachments are listed in EPA-AA-TEB-511-81-10A, which consists of 18 pages. The attachments are contained in EPA-AA-TEB-511-81-10B, which consists of 120 pages. The attachments include correspondence between the Applicant and EPA, all documents submitted in support of the Application and the EPA testing of the Device.

As a part of its evaluation EPA has actually tested the FUEL-MAX device. The EPA testing is described completely in the report "Emissions and Fuel Economy of FUEL-MAX, a Retrofit Device", EPA-AA-TEB-81-15, consisting of 8 pages. This report is contained in the preceding FUEL-MAX 511 Evaluation as an attachment and can be obtained separately or as part of the attachment package.

Copies of these reports may be obtained from the National Technical Information Service by using the above report numbers. Address requests to:

National Technical Information Service
U.S. Department of Commerce
Springfield, VA 22161
Phone: Federal Telecommunications System (FTS) 737-4650
Commercial 703-487-4650

Summary of Evaluation

EPA fully considered all of the information submitted by the Device manufacturer in the Application. The evaluation of the "FUEL-MAX" device was based on that information and the results of the EPA test program.

The "FUEL-MAX" is an air bleed device that replaces the Exhaust Gas Recirculation (EGR) valve which has been installed on almost all passenger cars since 1973. The purpose of the EGR System is to control oxides of nitrogen (NOx). Removal of the EGR valve to install the "FUEL-MAX" disables the EGR system and would be expected to result in a large increase in NOx emissions.

Test data submitted by the Applicant confirmed this prediction as well as indicating that "FUEL-MAX" might improve fuel economy. Although the data did not adequately quantify the amount of this improvement, EPA chose to conduct confirmatory testing.

The EPA Evaluation of the "FUEL-MAX" system included vehicle testing by the Federal Test Procedure (FTP) and the Highway Fuel Economy Test (HFET). These two tests are the basic means for evaluating exhaust emissions and fuel economy. During these tests, measurements were made of the fuel economy (FE) and the regulated emissions of hydrocarbon (HC), carbon monoxide (CO), and oxides of nitrogen (NOx).

EPA tested the "FUEL-MAX" device on a sample of three typical 1979 passenger cars. The findings are summarized below:

1. Use of the "FUEL-MAX" resulted in increased NOx emissions of between 440% to 1070% on the FTP and 280% to 770% on the HFET.

2. Use of the "FUEL-MAX" resulted in changes in fuel economy of between +1.6% to +4.1% on the FTP and -0.6% to +0.9% on the HFET.

3. Use of the "FUEL-MAX" resulted in a decrease in hydrocarbon emissions of between 15% to 24% on the FTP and 6% to 42% on the HFET.

4. Use of the "FUEL-MAX" resulted in a decrease in carbon monoxide emissions of between 7% and 44% on the FTP and 46% to 68% on the HFET.

5. On the road evaluations with "FUEL-MAX" showed that heavy knock existed in one car, that light knock occurred in one car and that knock was rarely noticed on the third car.

The Applicant's testing of the "FUEL-MAX" device showed the same emission and fuel economy trends noted in the EPA testing. The differences observed in the magnitude of these effects were due to the differences in the test fleets and the weaknesses noted in the Applicant's control of the vehicle test program.

Because EPA tests showed that use of the "FUEL-MAX" on the vehicles tested, caused emissions to exceed applicable standards, the installation of this Device by a person in the business of servicing, repairing, selling, leasing, or trading motor vehicles, fleet operators, or new car dealers will be considered a violation of Section 203(a)(3) of the Clean Air Act, the Federal prohibition against tampering with emission control systems. That is, there is currently no reasonable basis for believing that the installation or use of this device will not adversely affect emission performance. This determination does not preclude the use of the "FUEL-MAX" device on a different vehicle or vehicles than those tested by EPA if Federal Test Procedure tests performed on such vehicles clearly establish that emission performance on such vehicles is not adversely affected.

Many state laws prohibit the operation or registration for use on public highways of a motor vehicle on which the emission control system has been removed or rendered inoperative. EPA has concluded that this device will render inoperative an element of design of the emission control devices or systems of a motor vehicle on which it is installed. Therefore, the installation or use of this device by individuals may be prohibited under some state laws.

FOR FURTHER INFORMATION CONTACT: Merrill W. Korth, Emission Control Technology Division, Office of Mobile Source Air Pollution Control, Environmental Protection Agency, 2565 Plymouth Road, Ann Arbor, Michigan 48105, 313-668-4299.

Date

Edward F. Tuerk
Acting Assistant Administrator
for Air, Noise, and Radiation

EPA Evaluation of the "FUEL-MAX" Device under Section 511 of the Motor Vehicle Information and Cost Savings Act

The following is a summary of the information on the device as supplied by the Applicant and the resulting EPA analysis and conclusions.

1. Marketing Identification of the Device:

   Trade Name: "FUEL-MAX"

2. Inventors of the Device and Patents:

   A. Inventors

      Ervin Leshner
      1005 Lowber Drive
      Cherry Hill, New Jersey 08034

      Michael D. Leshner
      5 Betsy Court
      Glendora, New Jersey 08029

   B. Patent

      "Patent Applied for, 1979"

3. Manufacturer of the Device:

   Fuel Injection Development Corp.
   110 Harding Ave.
   Bellmawr, New Jersey 08030
   609/931-3168

4. Manufacturing Organization Principals:

   Charles Kaney
   Ervin Leshner
   Ira Belfer

5. Marketing Organization in U.S. Making Application:

   Fuel Injection Development Corp.
   110 Harding Ave.
   Bellmawr, New Jersey 08030
   609/931-3168

6. Applying Organization Principals:

   Charles Kaney
   Ervin Leshner
   Ira Belfer

   "Michael Leshner will represent the organization in correspondence."

7. Description of Device:

A. Purpose of the Device (as supplied by Applicant):

"FUEL-MAX is intended to be retrofitted to existing automobiles by the vehicle owner, for the purpose of conserving fuel."

B. Theory of Operation (as supplied by Applicant):

"FUEL-MAX is a direct replacement for the Exhaust Gas Recirculation (EGR) Valve installed on the intake manifold of automobile gasoline engines. The vacuum signal which normally operates the EGR Valve is used to operate FUEL-MAX. Instead of allowing exhaust gas to be drawn into the intake manifold, FUEL-MAX allows filtered, atmospheric air to be drawn into the intake manifold. The flow rate of air admitted to the engine through FUEL-MAX is adjustable, to allow the user to set the device for optimum fuel consumption. The Installation Instructions (Appendix A) give a thorough description of the procedure for setting the air flow rate." The installation instructions are Attachment A of this report.

"It was found by experiment that late model American cars using EGR cannot normally tolerate a leaner air-fuel mixture than the factory calibration. When the EGR system is disabled, however, the engine will tolerate a slightly leaner mixture, and at that leaner mixture a lower specific fuel consumption will result.

"Since the vacuum signal which operates the EGR Valve is not present during cold engine operation, idle, deceleration, and wide-open throttle operation, the FUEL-MAX also does not operate during those modes."

C. Construction and Operation (as supplied by Applicant):

"FUEL-MAX is a vacuum-operated air valve which is similar in construction to an EGR Valve. (without exhaust pressure feedback) The cross sectional area of the valve opening is plotted against input vacuum in figure 1. Figure 2 is a schematic drawing of the FUEL-MAX.

"The air flow rate adjustment is in series with the fresh air inlet, and acts as an upper limit to the air flow through the FUEL-MAX. Figure 3 shows the cross sectional area through the adjusting valve versus the notionation on the front of the FUEL-MAX case." Figures 1, 2, and 3 are Attachment D of this report.

8. Applicability of Device (as supplied by Applicant):

"One kit fits all of the makes, models, and years listed below.

MAKE	YEAR	ENGINE
General Motors	1973-79	All
Ford	1973-79	All
Chrysler	1973-79	All 4 cylinder All 6 cylinder
American Motors	1975-79	All

"None of the following affects the applicability of FUEL-MAX:

Model, carburetor, transmission type, ignition type.

"Exceptions: FUEL-MAX is not applicable to Diesel engines, or cars equipped with three-way catalysts."

9. Device Installation, Tools and Expertise Required (as supplied by Applicant):

A. "The Installation Instructions are provided in Appendix A." (Appendix A is Attachment A of this report.)

B. "There is only one general set of instructions."

C. "The tools required are a 3/8 or 1/2 and/or 9/16 inch open end, box, or socket wrench."

D. "No equipment is required to check the accuracy of the installation."

E. "No adjustments to the vehicle are required. There is one adjustment on the device. It is annotated from 1 through 5, and the user is instructed to set the pointer to the displacement of the engine, in cubis [sic] inches. For example, when using FUEL-MAX on a 305 C.I.D. engine, the pointer would be set to "3"."

F. "Average mechanical skills are required to install FUEL-MAX."

10. Device Operation (as supplied by Applicant):

"Complete instructions are supplied in Appendix A." (Appendix A is Attachment A of this report)

11. Device Maintenance (claimed):

"The only maintainance required is the removal (pinch and pull) washing the filter with soap and water, and re-installation of the filter (stuff it into a recess) once each year."

12. Effects on Vehicle Emissions (non-regulated) (claimed):

"There is no indication that FUEL-MAX has any effect on the vehicle's non-regulated emissions."

13. Effects on Vehicle Safety (claimed):

"The proper installation of FUEL-MAX does not affect the safety of the vehicle on which it is installed. The installation Instructions explicitly caution the installer to "check the throttle linkage to make sure there is no mechanical interference..."

"If a malfunction occurs, it could one of two types: open valve, or closed valve. If the FUEL-MAX air valve should malfunction in the open position, the mixture will be very lean at idle, and the engine will run rough or stall. If the valve malfunctions in the closed position, it will be equivalent to operation without EGR."

14. Test Results - Regulated Emissions and Fuel Economy (submitted by Applicant):

"Appendix B and C are reports of tests using the Federal Test Procedure and Highway Fuel Economy Tests. FUEL-MAX was evaluated on ten late model American cars, and compared with the baseline vehicle."

A. "Appendix B Technical Report on Evaluation of Fuel Economy Device" is Attachment B of this report.
   Set 1827 01 0979; September, 1979
   Scott Environmental Technology, Inc.,
   Plumsteadville, PA 18949

B. Appendix C, "Technical Report, Two Exhaust Emission Tests" is Attachment C of this report. 1975 Federal Cold-Start with Urban & Highway Fuel Economy;
   Set 1796 01 0379; March 27, 1979
   Scott Environmental Technology, Inc.
   Plumsteadville, PA 189499

15. Testing by EPA:

Because the test data submitted by the Applicant suggested the Device showed a fuel economy improvement, EPA conducted confirmatory testing. EPA developed a Test Plan/Test Agreement (Attachment E) which was sent to the Applicant for review and concurrence (Attachment F).

The Applicant concurred that this test plan (Attachments E and G) would accurately reflect the effectiveness of the Device. The Device testing was conducted in accordance with this test plan/testing agreement.

A detailed description of the testing conducted by the EPA in support of this evaluation is reflected in EPA report, EPA-AA-TEB-81-15, provided as Attachment H. A brief description of this testing effort is provided below:

Three production 1979 model year vehicles (Ford Pinto with a 2.3 litre engine, Mercury Zephyr with 302 CID engine, and an Oldsmobile Cutlass with a 231 CID) were tested for emissions and fuel economy. Tests were conducted according to the Federal Test Procedur (FTP) and Highway Fuel Economy Test (HFET). The test program consisted of baseline tests and "FUEL-MAX" tests. The "FUEL-MAX" tests consisted of a standard test procedure (FTP or HFET) with the Device installed on the vehicle.

Road tests were conducted on each of the preceding three vehicles to evaluate each vehicle's sensitivity to engine knock, since some vehicles are knock sensitive to EGR deactivation.

Additional tests were conducted on the Oldsmobile Cutlass as an evaluation tool. The tests consisted of hot start LA-4 cycles. The LA-4 driving cycle is the basic FTP driving cycle. The results of these hot start LA-4 tests are somewhat similar to bags 2 and 3 of the FTP.

16. Analysis

A. Description of the Device:

The Device is judged to be adequately described in Section 7.

B. Applicability of the Device:

The applicability of the device, as stated in the application, covers most American gasoline fueled vehicles including 1979 Fords. However, even though the instructions, Attachment A, make specific reference to Ford installations, the installation instructions/hardware did not adequately cover the installation in either Ford 2.3 litre or 302 CID vehicle (see Section 16 D.).

C. Costs:

FUEL-MAX is advertised at $29.95 postpaid from distributors (see Attachment I).

D. Device Installation - Tools and Expertise Required:

The Applicants claim that only simple tools and average mechanical skills are required for installation is judged to be true for some cases. However, numerous problems were encountered.

(1) On the Pinto, the installation instructions call for the EGR valve to be disconnected from the intake manifold, but to be left connected to the exhaust gas transfer pipe so as to close the end of the transfer pipe. On the test vehicle, the EGR valve and the exhaust gas transfer pipe had to be removed because the EGR valve configuration was different than that shown in the "FUEL-MAX" installation instructions and this configuration permitted an exhaust leak to occur under the hood when the EGR valve was disconnected from the intake manifold.

(2) On the Zephyr, the "FUEL-MAX" caused an exhaust leak at the manifold where the EGR valve is normally installed because the adapter specified for this application did not cover the EGR exhaust opening in the manifold. A sealing plate and additional gaskets had to be employed to prevent this underhood exhaust leak.

(3) The gasket sealer provided with the kit rapidly deteriorated and had to be replaced with a high temperature sealant.

(4) Replacement of the EGR valve gasket was impractical since automotive parts suppliers normally sell the gasket only with a new EGR valve.

(5) A prospective purchaser of the Device would be required to install the Device himself. Since this Device violates the anti-tampering provisions of the Clean Air Act, it is illegal for many automotive businesses to install this Device (see Section 17).

(6) If disabling the EGR causes the engine to knock, retarding the ignition may be required to correct engine knock. The Applicant was aware of this potential problem (see Question no. 3 in Attachment J), and offers two solutions:

(a) switch to higher octane fuel

(b) retarding ignition timing

Either solution will tend to alleviate the problem, although the Applicant makes no mention of this problem or potential solutions in the Installation Instructions (Attachment A). The Applicant states in Section 10 that the Installation Instructions are also the complete operating instructions. Note that:

(a) a higher octane fuel may not be readily available and will cost more,

(b) retarding the timing will require a timing light, hand tools, average mechanical skills, plus knowing how to time the vehicle.

E. Device Operation:
The operating instructions referred to in Section 10 consist only of the Installation Instructions - no mention is made to vehicle operation other than setting the air bleed to correctly correspond with an engine's displacement. However, as noted in 16 D (6), no mention is made of the potential knock problem or the remedy for it.

F. Device Maintenance:

In addition to the yearly cleaning of the Device's air filter, the vacuum lines attached to the Device would require the same periodic, albeit infrequent, maintenance accorded similar components in a vehicle's engine compartment.

G. Effects on Vehicle Emissions (non-regulated):

As claimed, the Device is judged to be unlikely to affect non-regulated emissions.

H. Effects on Vehicle Safety:

If use of the Device does not cause engine knock, the Device is judged to be unlikely to affect vehicle safety as claimed.

If use of the Device causes engine knock, the Device could lead to serious engine damage if the knock problem is not soon corrected.

If the Device malfunctions in the open position, the Applicant is judged to have correctly identified the potential problems, i.e., rough engine or stalling.

However, if the Device malfunctions in the closed position, the Device could again lead to engine knock problems.

I. Test Results Supplied by Applicant:

Applicant did submit test data per the Federal Test Procedure or Highway Fuel Economy Test. These are the only EPA recognized test procedures(1). This requirement for test data following these procedures is stated in the application test policy documents that EPA sends to potential applicants. The test data submitted by the Applicant are listed below and evaluated.

(1) The data submitted by the Applicant in Attachment B was for single test sequences (both FTP and HFET) with and without the "FUEL-MAX" device installed.

(a) A review of this data shows the following weaknesses in the test data:

(i) Vehicles were tested "as received". They were not checked for agreement with the manufacturer's engine design parameter settings (ignition timing, idle speed, idle mixture, etc.) (see EPA's request, Attachment K, and Applicant's response, Attachment L).

The Applicant stated that the vehicles were assumed to be set at manufacturer's specifications when originally leased new (Attachment L). Since these vehicles had accumulated between 7,000 and 48,000 miles, there may have been some need for readjustment.

However, a review of the emissions and fuel economy data submitted suggests that these vehicles were not greatly, if at all, out of specification.

(ii) The tires were not fully inflated for the dynamometer tests. For dynamometer testing, the tires are normally inflated to 45 psi to minimize

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(1) From EPA 511 Application test policy documents:

<u>Test Results (Regulated Emissions and Fuel Economy):</u>
Provide all test information which is available on the effects of the device on <u>vehicle emissions and fuel economy</u>.

The Federal Test Procedure (40 CFR Part 86) is the only test which is recognized by the U.S. Environmental Protection Agency for the evaluation of vehicle emissions. The Federal Test Procedure and the Highway Fuel Economy Test (40 CFR Part 600) are the only tests which are normally recognized by the U.S. EPA for evaluating vehicle fuel economy. Data which have been collected in accordance with other standardized fuel economy measuring procedures (e.g. Society of Automotive Engineers) are acceptable as supplemental data to the Federal Test Procedure and Highway Fuel Economy Data will be used, if provided, in the preliminary evaluation of the device. Data are required from the test vehicle(s) in both baseline (all parameters set to manufacturer's specifications) and modified forms (with device installed).

the heat buildup and added rolling resistance created by the dynamometer rolls. The tire pressures for these tests were 10 to 15 psi low.

(iii) Six of the nine vehicles in this nine vehicle study were not in compliance with the emission standards in baseline conditions. These vehicles failed HC or CO or both HC and CO. Only one vehicle failed to meet the NOx standard.

(iv) A review of the dynamometer horsepower loadings shows that the settings used were probably higher than should have been used. Erroneous dynamometer horsepower loadings would affect both emissions and fuel economy.

(v) The data does not address driveability. As noted in EPA test report, Attachment H, some vehicles are sensitive to EGR deactivation. (FUEL-MAX replaces the EGR valve, thus, deactivating it).

(b) A review of this data showed that:

(i) FTP HC and CO emissions decreased.

(ii) FTP NOx emissions increased substantially.

(iii) FTP fuel economy increased.

(iv) HFET fuel economy increased.

However, due to the weakness in the data noted above (Section 16 I (1)(a)), the data does not confirm these conclusions.

(2) The data submitted by the Applicant in Attachment C was for single test sequences (both FTP and HFET) with and without the "FUEL-MAX" device installed. In addition to having the data weakness noted for the nine vehicle test fleet, it appears the Device was improperly set for the engine's displacement. FUEL-MAX was set at 2 rather than 3 as required by the Device Installation Instructions.

J. Test Results Obtained by EPA:

The tests conducted by EPA are discussed in detail in Attachment H, therefore a duplicate presentation is not provided.

17. Conclusions

EPA fully considered all of the information submitted by the device manufacturer in the application. The evaluation of the FUEL-MAX device was based on that information and the results of the EPA test program.

The purpose of the EGR System is the control of NOx emissions. Removal of the EGR control valve to install the "FUEL-MAX" deactivates the EGR System and would be expected to result in a large increase in NOx emissions.

EPA tested the "FUEL-MAX" device on a sample of three typical 1979 passenger cars. The findings are summarized below:

1. Use of the FUEL-MAX resulted in increased NOx emissions of between 440% to 1070% on the FTP and 280% to 770% on the HFET.

2. Use of the FUEL-MAX resulted in changes in fuel economy of between +1.6% to +4.1% on the FTP and -0.6% to +0.9% on the HFET.

3. Use of the FUEL-MAX resulted in a decrease in hydrocarbon emissions of between 15% to 24% on the FTP and 6% to 42% on the HFET.

4. Use of the FUEL-MAX resulted in a decrease in carbon monoxide emissions of between 7% and 44% on the FTP and 46% to 68% on the HFET.

5. On the road evaluations with FUEL-MAX showed that heavy knock existed in one car, that light knock occurred in one car and that knock was rarely noticed on the third car.

The Applicant's testing of the "FUEL-MAX" device showed the same emission and fuel economy trends. The differences observed in the magnitute of these effects were due to the differences in the test fleets and the weaknesses noted in the control of the Applicant's vehicle test program.

Because EPA tests showed that use of the "FUEL-MAX" on the vehicles tested, caused emissions to exceed applicable standards, the installation of this Device by a person in the business of servicing, repairing, selling, leasing, or trading motor vehicles, fleet operators, or new car dealers will be considered a violation of Section 203(a)(3) of the Clean Air Act, the Federal prohibition against tampering with emission control systems. That is, there is currently no reasonable basis for believing that the installation or use of this device will not adversely affect emission performance. This determination does not preclude the use of the "FUEL-MAX" device on a different vehicle or vehicles than those tested by EPA if Federal Test Procedure tests performed on such vehicles clearly establish that emission performance on such vehicles is not adversely affected.

Many state laws prohibit the operation or registration for use on public highways of a motor vehicle on which the emission control system has been removed or rendered inoperative. EPA has concluded that this device will render inoperative an element of design of the emission control devices or systems of a motor vehicle on which it is installed. Therefore, the installation or use of this device by individuals may be prohibited under some state laws.

List of Attachments

Attachment A	Installation Instructions for FUEL-MAX (provided with 511 Application)
Attachment B	"Technical Report on Evaluation of Fuel Economy Device" Set 1827 01 0979; September 1979, Scott Environmental Technology, Inc., Plumsteadville, PA 18949 (specified as an Attachment B to 511, but not provided with 511 until January 5, 1981).
Attachment C	"Technical Report, Two Exhaust Emission Tests, 1975 Federal Cold Start With Urban & Highway Fuel Economy" Set 1796 01 00379; March 27, 1979 Scott Environmental Technology, Inc., Plumsteadville, PA 18949 (specified as an Attachment B to 511, but not provided 511 with until January 5, 1981).
Attachment D	Figures 1, 2, 3 for FUEL-MAX.
Attachment E	Test Plan/Test Agreement for FUEL-MAX.
Attachment F	Copy of letter dated January 23, 1981 from EPA to Fuel Injection Development Corporation transmitting Test Plan/ Test Agreement for their review and concurrence.
Attachment G	Copy of letter dated February 2, 1981 from Fuel Injection Development Corporation acknowledging their concurrence with the Test Plan/Test Agreement.
Attachemnt H	TEB Report EPA-AA-TEB-81-15, "Emissions and Fuel Economy of FUEL-MAX, a Retrofit Device".
Attachment I	Sales advertisement for "FUEL-MAX".
Attachment J	"FUEL-MAX Gasoline Conservation for Cars and Trucks" includes fuel conserving driving tips plus 20 questions and answers.
Attachment K	Copy of letter dated November 7, 1980 from EPA to Fuel Injection Development Corporation requesting vehicle test information.
Attachment L	Copy of letter dated December 29, 1980 from Fuel Injection Development Corporation providing test data and vehicle test settings.

EPA-AA-TEB-511-81-10B

Attachments to

EPA Evaluation of the "FUEL-MAX" Device Under Section 511
of the Motor Vehicle Information and Cost Savings Act

June, 1981

Test and Evaluation Branch
Emission Control Technology Division
Office of Mobile Source Air Pollution Control
Environmental Protection Agency

Attachment A

WARRANTY

If for any reason, the original purchaser of this Fuel-Max is not completely satisfied, they may return it with proof of purchase, within one year from the date of purchase, to the seller, for a full refund of the purchase price.

This warranty shall not apply to any Fuel-Max which is found to be modified, repaired, or altered in any way, or if defects have resulted from misuse, accident, or shipping.

Fuel Max Industries shall not be liable for incidental or consequential damages, and the maximum compensation under this warranty is limited to the original purchase price.

There are no other warranties, expressed or implied, other than the foregoing warranty. Fuel-Max Industries makes no warranty of merchantability with respect to this equipment.

Fuel-Max does not operate when the engine is cold, idling, or at full power.

Federal E.P.A. Laws permit the vehicle owner to install Fuel-Max on his own vehicle.

Fuel-Max will not affect the exhaust pollution measured at State inspection.

FUEL-MAX INDUSTRIES
P.O. Box 726
Bellmawr, NJ 08031

INSTALLATION INSTRUCTIONS

FUEL-MAX IMPROVES FUEL ECONOMY AND DRIVEABILITY OF AMERICAN MADE CARS AND TRUCKS BUILT SINCE 1973. THIS KIT WILL MODIFY YOUR CAR'S POLLUTION CONTROL SYSTEM TO GIVE MAXIMUM FUEL ECONOMY AND PERFORMANCE.

FUEL MAX

INSTALLATION INSTRUCTIONS

Your Fuel-Max Kit contains all the parts necessary to: remove the E.G.R. valve, replace it with one of the three Fuel-Max adapter plates, and hook up the nylon air valve.

STEP 1: REMOVE AIR CLEANER.

Removal of the air cleaner will simplify the Fuel-Max installation. Be sure to note all the connecting tubes and ducts on the air cleaner so that you will be able to replace it properly.

STEP 2: REMOVE E.G.R. VALVE.

The E.G.R. (Exhaust Gas Recirculation) Valve is located on the intake manifold close to the carburetor. Keep track of the small rubber hose attatched to the E.G.R. Valve – it will be used to activate the Fuel-Max. If the vacuum hose has been disconnected from the E.G.R. Valve, check the vacuum hose diagram for your car to find the proper hose. (See figure 1)

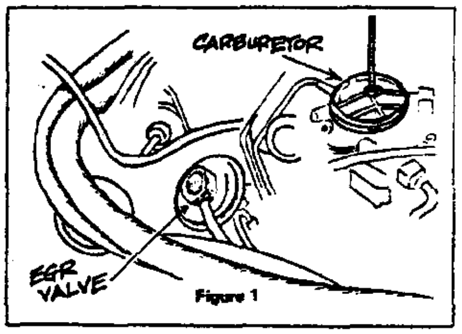
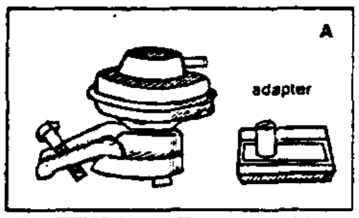


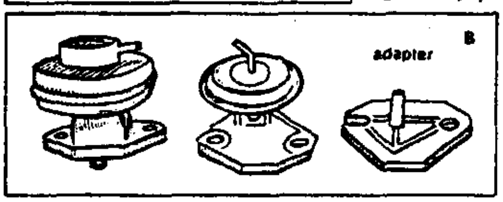
Figure 1



Most E.G.R. valves are fastened by two bolts. Some others use a clamp and a single bolt to hold the clamp in place. Save the nuts or bolts used to fasten the E.G.R. valve – they will be used to bolt down the Fuel-Max adapter plate.
For different types of E.G.R. valves, refer to fig. 2. If there appear to be two E.G.R. valves, refer to figure B.

NOTE: On some older vehicles, the E.G.R. bolts or studs may be rusted. It is a good idea to wet these rusted nuts and bolts with penetrating oil, and wait several minutes for the rust to loosen.

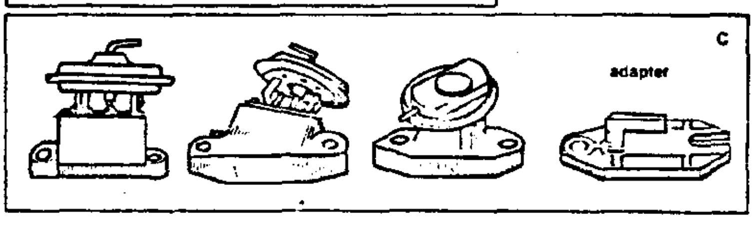
Figures 2 A, B, C.



STEP 3: INSTALL FUEL- MAX ADAPTER PLATE.

Three adapter plates are included in this kit. One of these adapter plates will replace your E.G.R. valve, and the other two may be discarded. The three basic types of E.G.R. valves with the proper adapter plates are illustrated in figures 2 A, B, C. On some Ford products you will need to break off a small piece of "flash" in the slotted end of the adapter plate.

Before bolting down the adapter plate, be sure the mating surfaces on the engine and plate are free of dirt, or pieces of old gasket.



Use the enclosed gasket sealer to insure a leak-proof connection. If the old gasket breaks, remove pieces with a knife blade. If the gasket remains in one piece, leave it in place. Spread an even layer of sealer on the bottom of the Fuel-Max adapter plate and secure it in place with the same nuts, bolts, or clamp that was used to secure the E.G.R. valve. If the Studs or bolts are too long for the Fuel-Max adapter, use the enclosed spacer washers.

On a few Chrysler 400 and 440 engines, none of the three adapter plates will fit. If this is the case, mail a brief note to Fuel-Max, and we will ship you the proper adapter.

STEP 4: INSTALL LARGE RUBBER HOSE.

[illegible] large rubber hose supplied in the kit. Do not bend the hose [illegible] will collapse or kink.

STEP 5: INSTALL SMALL RUBBER HOSE.

Connect the small rubber hose that was previously connected to the E.G.R. valve to the back of the Fuel-Max. An extension hose and two couplers are provided in the kit. Use the coupling connector which best fits into the old E.G.R. hose (see figure 3).

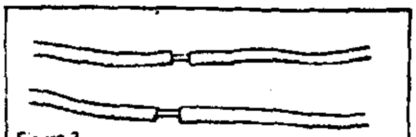


Figure 3

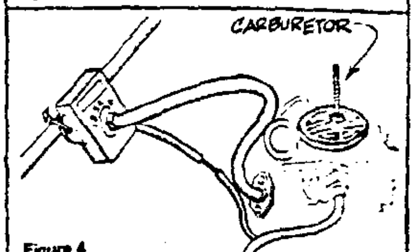


Figure 4

This is How Your Fuel-Max Installation Should Look.

STEP 6: MOUNT FUEL-MAX.

Find a convenient location in the engine compartment to mount the Fuel-Max. There are two plastic strap fasteners in the kit which may be used to secure the Fuel-Max in place. We suggest that the Fuel-Max be strapped to a heater or air conditioner hose, at a location where there will be no mechanical interference with the air cleaner or throttle linkages. Avoid mounting the Fuel-Max in hot spots near the exhaust manifold.

The large and small rubber tubes may be shortened if necessary (see figure 4).

STEP 7: SET FUEL-MAX TO THE CORRECT NUMBER FOR YOUR CAR.

The following table will give you the correct Fuel-Max setting based on the size of your engine. *

Set the Fuel-Max by turning the center tube (by hand or with a 1/2 inch wrench).

You will not need to readjust the Fuel-Max unless:

1. The installation causes a hesitation when you want to accelerate.

2. If you want to experiment to find the most efficient Fuel-Max setting for your engine.

Engine Displacement (cubic inches)		Fuel-Max Setting
100	4 cylinder	1
200		2
300	6 cylinder	3
400	8 cylinder	4
500		5

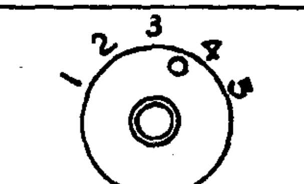


Figure 5

Fuel-Max Dial Set for Use with a 350 C.I.D. Engine.

* In general, you will want to set the Fuel-Max to the highest number your engine will tolerate without introducing hesitation. The highest setting is "5". Advancing the pointer beyond 5 is equivalent to a setting of zero. If the Fuel-Max causes hesitation, set it to a lower number and try again. The Fuel-Max does not operate until the engine is warmed up, so it will not have any effect when the engine is cold.

STEP 8: RE- INSTALL THE AIR CLEANER.

When replacing the air cleaner, be sure to reconnect all the tubes and ducts properly.

STEP 9: MAINTENANCE.

Clean the Fuel-Max filter once a year with soap and water. Pinch the filter in the middle and pull it out of the Fuel-Max case. After cleaning, allow the filter to dry, and insert it back into the case.

STEP 10: FINAL CHECK LIST.

a. Be sure Fuel-Max and case are clear of all moving carburetor parts or hot exhaust pipes. After installation, start engine and depress accelerator pedal. Be sure that the accelerator returns back to idle.

b. Do not drive away until you check that the adapter plate is installed properly. With the engine idling, pull the fat rubber hose off the Fuel-Max. There should be suction in the hose, and when air is let into the engine, the idle speed should change - or even stall. If there is no suction in the hose, check that the silicone sealer has not blocked the air passage through the adapter plate, or that the passages into the engine are not blocked with carbon. If there is exhaust coming out of the hose, the adapter plate is installed backwards. If you hear a "popping" exhaust noise at the adapter plate, the plate is not sealed or tightened completely.

Be sure to push the large and small rubber tubes onto both parts as far as they will go.

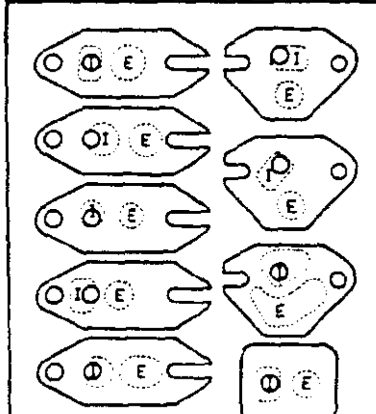


Figure 6

Dashed Lines Show the Various Port Configurations.

Note: Some EGR Systems are equipped with an exhaust pressure sensor as shown below.

If your vehicle uses this type of sensor, leave it in place, and install the Fuel-Max adapter plate in place of the EGR Valve. The same small rubber hose that went from the pressure sensor to the EGR Valve will now go from the pressure sensor to the Fuel-Max.

Special Instructions For Unusual EGR Valves

On some 4 and 6 cylinder Ford Products, a [illegible] carrying exhaust gas fastens directly [illegible] of the EGR Valve. Unbolt the Valve [illegible] engine, leaving the Valve attached to [illegible] steel tube. (The EGR Valve will [illegible] end of the tube.) Bend [illegible] slightly so that the EGR Valve [illegible] with the Fuel-Max adapter [illegible] Valve and steel tube down to [illegible] in the engine compartment so [illegible] not rattle or interfere with any [illegible]

[illegible] does not close completely, it [illegible]. If this is the case, remove [illegible] tube, and plug the exhaust [illegible] with a suitable pipe plug.

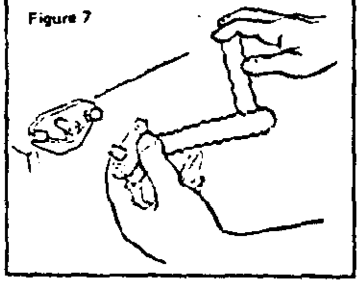


Figure 7

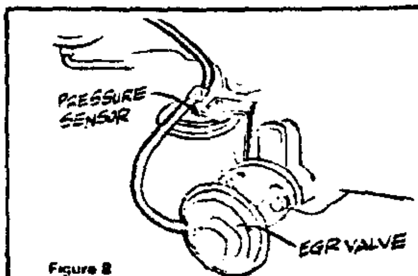


Figure 8

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TECHNICAL REPORT

ON

EVALUATION OF

FUEL ECONOMY DEVICE

Prepared For:

Prepared by

D. R. Gulick
Manager, Automotive Test Group

September 1979

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.
Plumsteadville, Pennsylvania 18949

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1.0 INTRODUCTION

During the month of August 1979, Scott Environmental Technology, Inc. performed a series of exhaust emission and fuel economy tests for Sherman Industries, Inc. (Sponsor). The tests were performed on a fleet of nine (9) late model domestic automobiles provided by the Sponsor. The objective of the test program was to determine the potential fuel saving and emission reducing capabilities of the Sponsor's Fuel-Max device. Each vehicle was tested first in the stock configuration to provide "baseline" exhaust emission and fuel economy data. The vehicles were then "retrofitted" with the "Fuel-Max" device and retested for exhaust emissions and fuel economy for a direct comparison of the resultant data between the "before and after" device tests.

In addition to the above mentioned tests, three (3) of the nine test vehicles received continuous measurements of the exhaust pipe temperature, to determine the effect on the exhaust temperature of the Sponsor's device. The remaining sections of this report describe the test fleet, device, test procedures, and the final results obtained.

This report does not constitute a "listing", "certification" or "approval" by Scott or any government regulatory agency, and makes no representations or claims other than as they appear in the complete report.

2.0 TEST FLEET DESCRIPTION

The test vehicles utilized for this program were all late model (1977, 1978 and 1979), light duty, domestic vehicles with both four and eight cylinder engine sizes. A general description of each vehicle is provided in Table 1.0. Additional descriptive information is included in the tables attached as Appendix A. All test vehicles were received in stock condition and were equipped with the manufacturer's standard emission control systems.

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TABLE 1.0 TEST FLEET VEHICLE DESCRIPTION

Model Year	Make	Model	Vehicle ID Number	Engine Size/Displacement	Initial Mileage
1978	Lincoln	Continental	8Y82A881792	V-8/460	07509.0
1979	Oldsmobile	Cutlass Salon	3G09H9G427788	V-8/305	07955.1
1977	Dodge	Aspen (Wagon)	NH45G7F252970	V-8/318	11393.0*
1979	Mercury	Wagon	9Z74F649208	V-8/305	06752.6*
1977	Mercury	Monarch	7W37F539757	V-8/302	31285.2
1978	Oldsmobile	Cutlass Cruiser	3H35H8G404250	V-8/305	48592.2*
1979	Oldsmobile	Cutlass Cruiser	3G35H92434400	V-8/305	20892.0
1979	Ford	Pinto	9T117158158	4 cyl/140	11379.5
1979	Chevrolet	Chevette	1B5809Y118162	4 cyl/98	07044.9

*Exhaust pipe (outside) temperature measured.

3.0 DEVICE DESCRIPTION

The Sponsor's device, called Fuel-Max, consists of two parts. Part one is a molded metal "adapter" plate (see Figure 1.0) which was designed to replace the Exhaust Gas Recirculation (EGR) valve. The EGR valve normally allows a portion of the exhaust gases (under certain engine temperature/manifold vacuum conditions) to be returned to the intake manifold, and subsequently into the combustion chamber of an engine whereby that portion of the exhaust gases are re-burned. The Fuel-Max plate (part one) blocks off the exhaust port normally utilized by the EGR system and leaves the intake port open via a vacuum hose fitting on the plate. Part two (see Figure 1.0) is the main control portion of the Fuel-Max device. It is simply a vacuum operated valve housed in a non-metalic case utilizing a spring loaded object to maintain an open position until closed by manifold vacuum. The vacuum source utilized to operate the device is the same as that which would normally operate the EGR valve. When installed and operational, at a manifold vacuum that would operate the EGR valve, the valve opens and allows fresh filtered air in part two, through part one (via a length of flexible vacuum tubing) and into the intake manifold where it mixes with and further leans the normal air/fuel (A/F) mixture of the vehicle's engine.

The control portion of the device (part two, Figure 1.0) has an adjustment knob, graduated in increments of one to five (1-5) which allows it to be adjusted to a setting corresponding to the engine size, e.g. on 200 cubic inch engine, the selected setting should be -2-. On a 250 cubic inch engine it should be set mid-way between -2- and -3-, etc. This adjustment knob simply applies more tension to the spring which in turn will require a higher manifold vacuum to open the valve since different engine sizes produce different amounts of vacuum at identical power or acceleration rates.

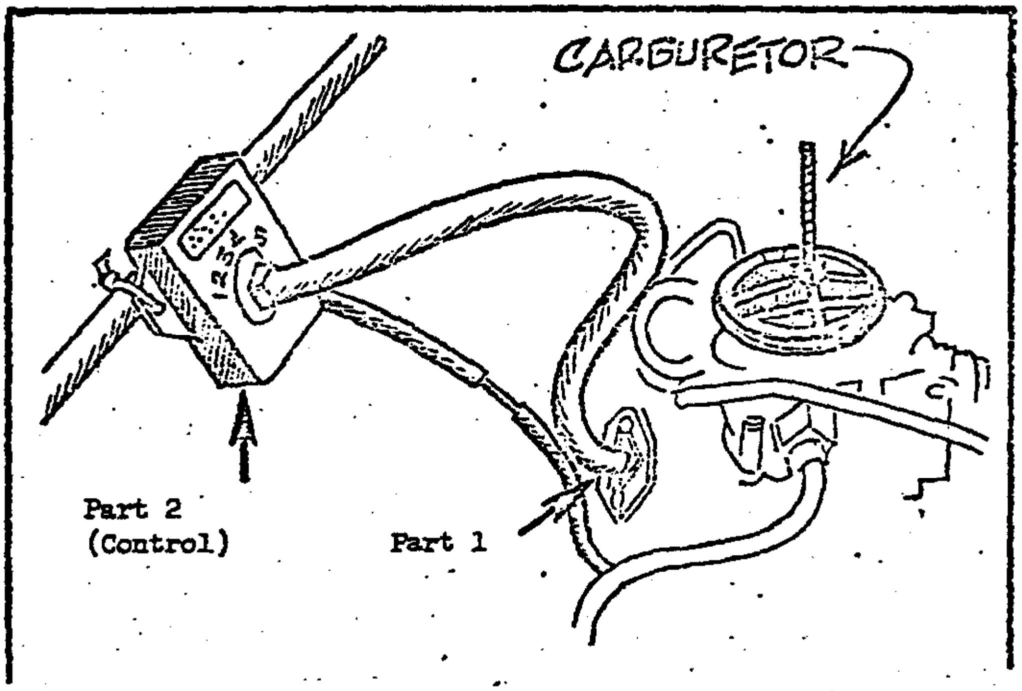

FIGURE 1.0

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4.0 DESCRIPTION OF TEST PROCEDURES

The test procedures used for determining the exhaust emissions and fuel economy data are as follows:

4.1 1975 FEDERAL TEST PROCEDURE (FTP)

The test procedure used by the Environmental Protection Agency to measure exhaust emissions from passenger cars, light trucks, and motorcycles is the 1975 Federal Test Procedure ('75 FTP). This procedure may also be referred to as the Federal Driving Schedule, CVS C/H Test, the Cold Start CVS Test, Urban Dynamometer Driving Schedule (UDDS), or LA-4.

The '75 FTP is the procedure used in the certification tests of new cars beginning with the 1975 model year. It is also the procedure EPA has been using since 1971 to evaluate prototype engines and emissions control systems. The '75 FTP provides the most representative characterization available of exhaust emissions and urban fuel economy.

The test is run in a controlled ambient cell where temperature and humidity conditions can be maintained within specified limits. During the '75 FTP, the vehicle is driven on a chassis dynamometer over a stop-and-go driving schedule having an average speed of 21.6 mph.

The Urban Dynamometer Driving Schedule or LA-4 is the result of more than 10 years of effort by various groups to translate the Los Angeles smog-producing driving conditions to dynamometer operations. It is a non-repetitive driving cycle covering 7.5 miles in 1372 seconds with an average speed of 19.7 mph. During the '75 FTP, the first 505 seconds of the LA-4 are rerun after the hot start so the distance traveled during a full '75 FTP is 11.1 miles and the average speed is 21.6 mph. The maximum speed attained during the LA-4 cycle (or '75 FTP) is 56.7 miles per hour. The LA-4 is derived from data taken from a vehicle driving under actual city traffic conditions, so it is typical of a vehicle operating in an urban environment.

Through the use of flywheels and a water brake, the loads that the vehicle would actually encounter on the road are reproduced. The vehicle's exhaust is collected, diluted and thoroughly mixed with filtered background air, and a known constant volume flow is obtained by the use of a positive displacement pump. This procedure is known as Constant Volume Sampling (CVS). The '75 FTP captures the emissions generated during a "cold" start and includes a "hot" start after a ten minute shut-down following the first 7.5 miles of driving.

A chassis dynamometer reproduces vehicle inertia with flywheels, and road load. For each inertia weight class, a road load which takes into account rolling resistance and aerodynamic drag for an average vehicle in each class is specified.

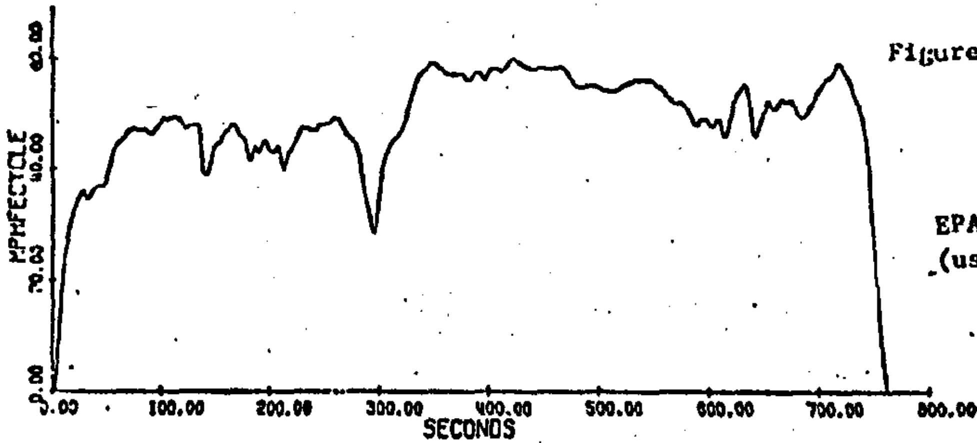
The vehicle must be parked for at least 12 hours prior to the exhaust emission test in an area where the temperature is maintained between 68°F and 86°F. This period is referred to as the "cold soak".

The '75 FTP is a cold start test, so the test vehicle is pushed onto the dynamometer without starting the engine. After placement of the vehicle on the dynamometer, the emission collection system is attached to the tailpipe, and a cooling fan is placed in front of the vehicle. The emission test is run with the engine compartment hood open.

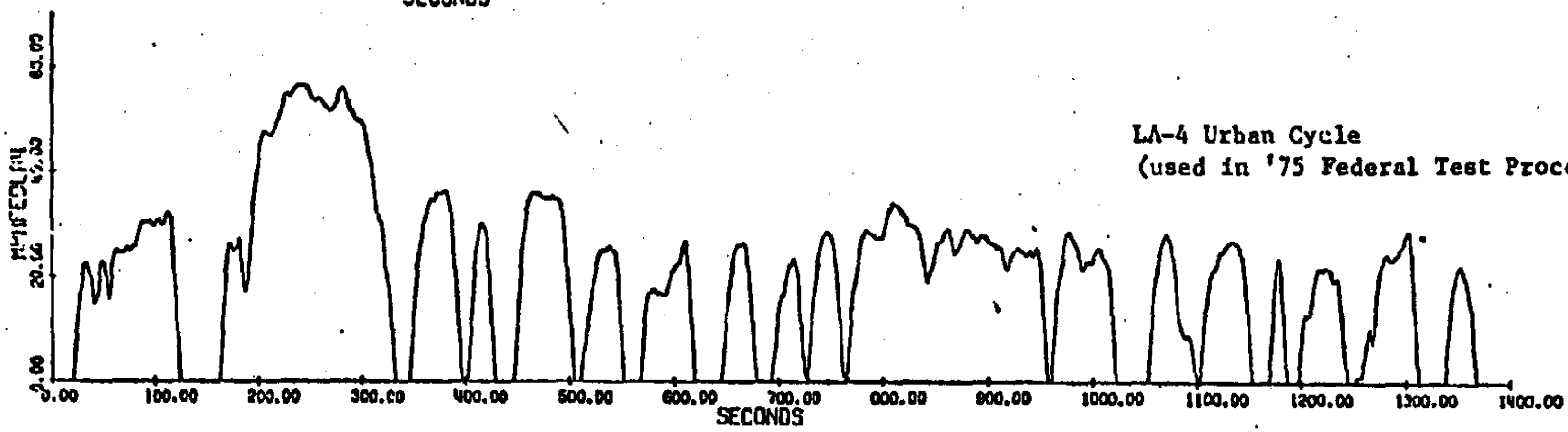
The emission sampling system and test vehicle are started simultaneously, so that emissions are collected during engine cranking. After starting the engine, the driver follows a controlled driving schedule known as the Urban Dynamometer Driving Schedule (UDDS) or LA-4, which is patterned to represent average urban driving. The driving schedule is displayed to the driver of the test vehicle, who matches the vehicle speed to that displayed on the schedule. (A copy of the LA-4 driving schedule can be found in Figure 2). The LA-4 driving cycle is 1372 seconds long and covers a distance of 7.5 miles. At the end of the driving cycle, the engine is stopped, the cooling fan and sample collection system shut off, and the hood closed. The vehicle remains on the dynamometer and soaks for 10 minutes. This is the "hot soak" preceding the hot start portion of the test. At the end of ten minutes, the vehicle and CVS are again restarted and the vehicle is driven through the first 505 seconds (3.59 miles) of the LA-4 cycle.

Figure 2: Official Federal Test Cycle

EPA Highway Cycle
(used in Highway Fuel Economy Test)



LA-4 Urban Cycle
(used in '75 Federal Test Procedure)



Exhaust emissions measured during the '75 FTP cover 3 regimes of engine operation. The exhaust emissions during the first 505 seconds of the test are the "cold transient" emissions. During this time period, the vehicle gradually warms up as it is driven over the LA-4 cycle. The emissions during this period will show the effects of choke operation and vehicle warm-up characteristics. When the vehicle enters into the remaining 867 seconds of the LA-4 cycle, it is considered to be fully warmed up. The emissions during this portion of the test are the "stabilized" emissions. The final period of the test, following the hot soak, is the "hot transient" section, and shows the effect of the hot start. The emissions from each of the three portions of the test are collected in separate bags.

4.2 1976 (FEDERAL) HIGHWAY FUEL ECONOMY TEST (HFET)

Since the '75 FTP does not represent the type of driving done in rural areas, especially on highways, a driving cycle to assess highway fuel economy was developed by the EPA. The EPA Highway Cycle was constructed from actual speed-versus-time traces generated by an instrumented test car driven over a variety of non-urban roads, and preserves the non-steady-state characteristics of real-world driving. The average speed of the cycle is 48.2 mph and the cycle length is 10.2 miles, approximating the average non-urban trip length. For this procedure the vehicle is fully warmed up and running at the start of the HFET. If the vehicle is shut off at the end of the '75 FTP and allowed to cool for an appreciable amount of time, a warm-up Highway Cycle (See Figure 2) is run before the actual HFET. This insures that the vehicle drivetrain is at full operating temperature.

A complete description of the procedures (Vol. 27, No. 221, Part II, Nov. 15, 1972) that are followed during a '75 FTP and '76 HFET can be found in the Federal Register.

Each of the above described procedures was performed on the test automobile, one each before device installation and one each after device installation.

In addition to the exhaust gas and fuel economy measurements, exhaust pipe temperature was also measured on three vehicles in the test fleet. The measurements were obtained by clamping a type "K" (chromel-alumel) thermocouple to the exhaust pipe immediately after the "Y" junction from each cylinder bank. The temperature was measured continuously during each test series and recorded on strip chart paper to determine the effect of installation of the Fuel-Max device on the exhaust temperature.

The CVS is used to collect the exhaust emissions during the tests. A portion of the exhaust gas mixture is collected in Tedlar bags for subsequent analysis. After the sample has been collected, it is transferred to analyzers where the concentrations of hydrocarbons (HC), carbon monoxide (CO), carbon dioxide (CO_2) and oxides of nitrogen (NO_x) in the sample bag are determined. The analyzers provide for the determination of HC concentrations by flame ionization detector (FID), CO and CO_2 concentrations by non-dispersive infrared (NDIR) analysis and NO_x concentrations by chemiluminescence (CL) analysis. These concentrations are then converted to grams per mile (pgm) for each of the pollutants measured by calculating the mass (average, diluted) emission rates collected during each portion of the tests using the total volume flow of the CVS. Once the mass emissions for each test, or test phase are known, the emissions in grams per mile are calculated using the following formula:

$$Y_{wm} = (0.43\ Y_{ct} + 0.57\ Y_{ht} + Y_s) \div 7.5$$

where

Y_{wm} = Weighted mass emissions of each pollutant, i.e., HC, CO or NO_x in grams per vehicle mile.

Y_{ct} = Mass emissions as calculated from the "transient" phase of the cold start test, in grams per test phase.

Y_{ht} = Mass emissions as calculated from the "transient" phase of the hot start test, in grams per test phase.

Y_s = Mass emissions as calculated from the "stabilized" phase of the cold start test, in grams per test phase.

The cold start and hot start bags are weighted 0.43 and 0.57 respectively. (Detailed explanations of the calculations can be found in the Federal Register.)

Fuel economy is usually measured by either the carbon balance method or by using a remote source of fuel (such as a can) which is weighed before and after the test. Unless a special test requires the use of the weight method, the carbon balance method is used to determine fuel economy.

The carbon balance procedure for measuring fuel economy correlates the carbon products in the vehicle exhaust to the amount of fuel burned during the test. The major assumptions in using this technique are:

1. The carbon present in the HC, CO and CO_2 exhaust is the only carbon found in the emissions. This means that other carbon containing compounds, such as oxygenated hydrocarbons that are not detected by a flame ionization detector and carbonaceous particulates, are ignored.

2. All of the carbon that is measured in the exhaust in the form of HC, CO and CO_2 came from the fuel; there are no other sources of carbon.

3. All of the fuel consumed during the test can be accounted for by the carbon in the exhaust. This assumption implies that all of the fuel that leaves the tank passes through the engine, and that no carbon leaks from the exhaust system or evaporates from the vehicle before being analyzed.

Since the carbon weight fraction of the fuel is known, it is a simple matter to calculate the amount of fuel consumed during the test. Agreement between the carbon balance method and direct fuel consumption measurement is normally within 2%.

Exhaust emission concentrations as collected in the integrated bag samples, were calculated using appropriate instrument calibration factors. This "raw" concentration data was then converted to grams of pollutant per test mile (based on a 7.5 mile test) using the procedure outlined above. This data, including all measured parameters used in the mass emission computations, is included in the tables attached as Appendix B. Exhaust emissions collected during the Highway Fuel Economy tests were reduced in the same manner as described above, with mass emissions (grams per mile) based on a test of 10.242 miles. The tables attached as Appendix C summarize the exhaust emission data for these tests.

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Urban and Highway Fuel Economy for each test sequence was calculated using the procedure outlined in Federal Register Volume 41, Number 218, Part 600 "Fuel Economy of Motor Vehicles", November 10, 1976. The basic equation used to calculate the fuel economy of a vehicle, in miles per gallon, from the mass emissions data is as follows:

$$\text{MPG} = \frac{\text{grams of carbon/gallon of fuel}}{\text{grams of carbon in exhaust/mile}}$$

or:

$$\text{MPG} = \frac{0.866\ (\text{mean density of fuel - gpg})}{0.866(\text{gpm HC}) + 0.429(\text{gpm CO}) + 0.273(\text{gpm } CO_2)}$$

The three constants represent the carbon weight fractions of the fuel (HC, CO and CO_2). The urban and highway fuel consumption rates for each test are included at the bottom of the tables in Appendices B and C.

Table 2.0 gives the maximum temperature achieved during the test series on the three vehicles that were monitored for that purpose. This data indicates that there is no significant change in exhaust temperature with installation of the Fuel-Max device.

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TABLE 2.0

MAXIMUM TEMPERATURE ACHIEVED

		FTP	HE
1977 Dodge Aspen Wagon	Baseline	533°F	730°F
	Device	540°F	625°F
1979 Mercury Station Wagon	Baseline	552°F	650°F
	Device	500°F	600°F
1978 Oldsmobile Cutlass Cruiser (Wgn)	Baseline	570°F	660°F
	Device	486°F	690°F

5.0 STATISTICAL ANALYSIS

The prime objective of this study was to determine what effect the Fuel-Max device had on certain exhaust emission and fuel economy characteristics of late model automobiles. An evaluation of this objective was accomplished by selecting a typical sample of automobiles and subjecting them to identical tests before and after installation of the device.

A well known statistical test for determining device effects on a set of data is to perform a t-test on the differences of the test measurements before and after device installation. By taking differences, extraneous effects which might influence both members of a pair tend to cancel out, thus leaving only the effect (if any) of the device. The t-value is calculated as:

$$T_{calc} = \frac{\bar{x}}{SD/\sqrt{n}}$$

Where:

$\bar{x}$ = Mean of the paired difference

SD = Estimate of the standard deviation of the differences

n = Sample size

The test is carried out by considering the Null Hypothesis, H_o: $\mu_1 = \mu_2$. That is, the "before" and "after" treatment observations came from a universal population with equal means. In other words, there is no effect of treatment on the two sets of observations. The assertion of this hypothesis is stated with a certain degree of risk termed the level of significance (α). Standardized t-values for various levels of significance are available in statistical tables. Thus, if the calculated t-value is greater than the tabulated t-value, we can reject our Null Hypothesis and probably accept an Alternate Hypothesis, $H_1(\mu_1 > \mu_2$ or $\mu_1 < \mu_2)$ at an α level of significance. For the purposes of this study, a 95% level was considered 'significant' and a 99% level as 'very significant'.

Table 3.0 summarizes the paired differences of the mass emission and fuel economy characteristics of the test fleet with the HC, CO and NO_x expressed in grams per mile (gpm) and fuel economy in miles per gallon (mpg).

TABLE 3.0

SUMMARY OF EXHAUST EMISSIONS AND FUEL ECONOMY

Vehicle	Device	HC (GPM)	CO (GPM)	NO_x (GPM)	Fuel Economy Urban (MPG)	Fuel Economy Highway (MPG)
1978 Lincoln Continental	None	0.53	6.0	1.56	11.48	16.11
	Fuel-Max	0.47	2.0	7.17	12.07	17.14
1979 Oldsmobile Cutlass Salon	None	1.55	18.8	1.15	16.76	24.12
	Fuel-Max	1.10	9.6	3.33	17.18	24.72
1977 Dodge Aspen Wagon	None	2.98	35.0	1.73	15.02	21.81
	Fuel-Max	2.56	33.2	3.69	14.65	23.25
1979 Mercury Station Wagon	None	1.00	7.6	1.28	13.52	21.90
	Fuel-Max	0.77	4.1	8.23	15.14	22.37
1977 Mercury Monarch	None	2.38	28.4	2.46	15.43	23.69
	Fuel-Max	1.72	17.8	7.12	17.12	22.17
1978 Oldsmobile Cutlass Cruiser (Wgn)	None	1.36	20.8	1.20	15.55	23.91
	Fuel-Max	0.60	10.2	3.48	16.56	25.18
1979 Oldsmobile Cutlass Cruiser (Wgn)	None	1.56	13.8	1.33	14.43	21.15
	Fuel-Max	0.86	8.2	3.75	14.77	21.87
1979 Ford Pinto	None	1.04	25.3	2.04	18.47	28.80
	Fuel-Max	1.39	30.7	5.62	18.03	28.67
1979 Chevrolet Chevette	None	1.58	17.7	1.43	21.41	32.45
	Fuel-Max	1.03	10.0	5.17	22.20	33.58

1. Analysis on Reduction in HC Emissions

H_o: $\mu_1 = \mu_2$ Null Hypothesis that there is no effect

H_o: $\mu_1 < \mu_2$ Alternate Hypothesis that emissions after device installation are lower

$$\text{Calculated } t = \frac{0.38667}{0.33632/\sqrt{9}} = 3.449$$

$$t_{.90,\ \phi = 8} = 1.397$$
$$t_{.95,\ \phi = 8} = 1.860$$
$$t_{.99,\ \phi = 8} = 2.896$$
$$t_{.995,\ \phi = 8} = 3.355$$

Standard t values

Since the calculated t is greater than the tabulated t at a 99% (or even a 99.5%) level, there is, statistically, a very significant difference in exhaust hydrocarbons as a result of installing the Fuel-Max device. The mean HC emission reduction is 24.5%.

2. Analysis on Reduction in CO Emissions

H_o: $\mu_1 = \mu_2$ Null Hypothesis that there is no effect

H_o: $\mu_1 > \mu_2$ Alternate Hypothesis that emissions after device installation are lower

$$\text{Calculated } t = \frac{5.28889}{4.81789/\sqrt{9}} = 3.293$$

$t_{.90,\ \phi = 8} = 1.397$

$t_{.95,\ \phi = 8} = 1.860$ Standard t values

$t_{.99,\ \phi = 8} = 2.896$

$t_{.995,\ \phi = 8} = 3.355$

Since the calculated t is greater than the tabulated t at a 99% level, there is, statistically, a very significant difference in exhaust carbon monoxide as a result of installing the Fuel Max device. The mean CO emission reduction is 27.5%.

3. Analysis on Increase in NO_x Emissions

H_o: $\mu_1 = \mu_2$ Null Hypothesis that there is no effect

H_o: $\mu_1 < \mu_2$ Alternate Hypothesis that emissions after device installation are higher

$$\text{Calculated } t = \frac{-3.70889}{1.63776/\sqrt{9}} = -6.794$$

$$t_{.90,\ \phi = 8} = -1.397$$
$$t_{.95,\ \phi = 8} = -1.860$$
$$t_{.99,\ \phi = 8} = -2.896$$
$$t_{.995,\ \phi = 8} = -3.355$$

Standard t values

Since the calculated t is greater than the tabulated t at a 99.5% level, there is, statistically, a very significant difference in exhaust nitric oxides as a result of installing the Fuel-Max device. The mean NO_x emission increase is 234%.

4. Analysis on Increase in Urban Fuel Economy

H_o: $\mu_1 = \mu_2$ Null Hypothesis that there is no effect

H_o: $\mu_1 < \mu_2$ Alternate Hypothesis that urban fuel economy after device installation is higher

$$\text{Calculated } t = \frac{-0.62778}{0.7109/\sqrt{9}} = -2.649$$

$t_{.90,\ \phi = 8} = -1.397$

$t_{.95,\ \phi = 8} = -1.860$

Standard t values

Since the calculated t is greater than the tabulated t at a 95% level, there is, statistically, a significant difference in urban fuel economy as a result of installing the Fuel-Max device. The mean urban fuel economy increase is 4.5%.

5. Analysis on Increase in Highway Fuel Economy

H_o: $\mu_1 = \mu_2$ Null Hypothesis that there is no effect

H_o: $\mu_1 < \mu_2$ Alternate Hypothesis that highway fuel economy after device installation is higher

Calculated $t = \dfrac{-0.55667}{0.8604/\sqrt{9}} = -1.941$

$$t_{.90,\ \phi = 8} = -1.397$$
$$t_{.95,\ \phi = 8} = -1.860$$

Standard t values

Since the calculated t is greater than the tabulated t at a 95% level, there is, statistically, a significant difference in highway fuel economy as a result of installing the Fuel-Max device. The mean increase in highway fuel economy is 2.4%.

APPENDIX A

VEHICLE INFORMATION

DYNAMOMETER INFORMATION

TEST DATE/TIMES

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE A-1

VEHICLE INFORMATION

Make: Lincoln Model: Continental Year: 1978

Engine Serial No. - Chassis Serial No. 8Y82A881792

Transmission Automatic NJ 845-I4J

Odometer -7509.0

Engine Disp. 460 V-8

Idle RPM -

Fuel System 1 - 4 barrel carb.

Tank Capacity 24.2

Tank Location Left rear

Curb Weight 4880 lbs.

Drive Wheel Tire Press. 32 psi

Device Baseline - no device

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 5000 lbs.

Road Horsepower @ 50 MPH

Actual 14.7

Indicated 10.5

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 1 Project No. 1827

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/6/79	1700		1338	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/7/79	1338	07509.0	1418	07520.1
Hot Soak:					
Highway Fuel Economy:	8/7/79	1427	07523.2	1440	07533.2

Scott Environmental Technology Inc.

PLUMSTEADVILLE, PA. 18949 PHONE: 215–766-8861 TWX: 510-665-9344

TABLE A-3

VEHICLE INFORMATION

Make: Lincoln Model: Continental Year: 1978

Engine Serial No. - Chassis Serial No. 8Y82A881792

Transmission Automatic NJ 845-14J

Odometer 07534.5

Engine Disp. 460 V-8

Idle RPM -

Fuel System 1 - 4 bbl. carb.

Tank Capacity 24.2

Tank Location Left rear

Curb Weight 4880#

Drive Wheel Tire Press. 32 psi

Device Fuel-Max (4.6 set point)

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 5000#

Road Horsepower @ 50 MPH

Actual 14.7

Indicated 10.5

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 3 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/7/79	1700		1425	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/8/79	1425	07534.5	1506	07544.1
Hot Soak:					
Highway Fuel Economy:	8/879	1514	07548.0	1527	07558.8

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE A-2

VEHICLE INFORMATION

Make: Oldsmobile Model: Cutlass Salon Year: 1979

Engine Serial No. - Chassis Serial No. 3G09H9G427788

Transmission Automatic PA 951-309

Odometer 07955.1

Engine Disp. 305 V-8

Idle RPM -

Fuel System 1 - 4 bbl.

Tank Capacity 18.2

Tank Location Rear

Curb Weight 3298#

Drive Wheel Tire Press. 30 psi

Device Baseline (no device)

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia ~~3500~~

Road Horsepower @ 50 MPH

Actual 12.3

Indicated 9.0

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g)

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 2 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/6/79	1800		1505	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/7/79	1505	07955.1	1546	07965.2
Hot Soak:					
Highway Fuel Economy:	8/7/79	1552	07967.8	1605	07977.3

Scott Environmental Technology Inc.

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TABLE A-4

VEHICLE INFORMATION

Make: Oldsmobile Model: Cutlass Salon Year: 1979

Engine Serial No. - Chassis Serial No. 3G09H9G427788

Transmission Automatic

Odometer 07977.5

Engine Disp. 305 V-8

Idle RPM -

Fuel System 1 - 4 bbl.

Tank Capacity 18.2

Tank Location Rear

Curb Weight 3298#

Drive Wheel Tire Press. ?

Device Fuel-Max

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 3500#

Road Horsepower @ 50 MPH

Actual 12.3

Indicated 9.0

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 4 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/8/79	1630		0808	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/7/79	0808	07977.5	0849	07987.6
Hot Soak:					
Highway Fuel Economy:	8/9/79	0854	07989.4		0799.0

Scott Environmental Technology Inc.

PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE A-5

VEHICLE INFORMATION

Make: Dodge Model: Aspen Wagon Year: 1977

Engine Serial No. - Chassis Serial No. NH45G7F252970

Transmission Automatic

Odometer 11393.0

Engine Disp. 318 V-8

Idle RPM -

Fuel System 1 - 2 bbl.

Tank Capacity 20 gallon

Tank Location Left rear

Curb Weight 3585#

Drive Wheel Tire Press. 36 psi

Device Baseline

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 4000#

Road Horsepower @ 50 MPH

Actual 13.2

Indicated 9.8

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 5 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/12/79			1358	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/13/79	1358	11393.0	1340	11403.7
Hot Soak:					
Highway Fuel Economy:	8/13/79	1354	11409.8	1507	11418.7

Scott Environmental Technology Inc.
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TABLE A-6

VEHICLE INFORMATION

Make: Dodge Model: Aspen Wagon Year: 1977

Engine Serial No. - Chassis Serial No. NH45G7F252970

Transmission Automatic

Odometer 41418.3

Engine Disp. 318 V-8

Idle RPM -

Fuel System 1 - 2 bbl.

Tank Capacity 20 gallons

Tank Location Left rear

Curb Weight 3585#

Drive Wheel Tire Press. 36 psi

Device Fuel Max (set around 2.25)

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 4000#

Road Horsepower @ 50 MPH

Actual 13.2

Indicated 9.8

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 6 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/13/79	1522		1339	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/14/79	1339	41418.3	1421	41428.9
Hot Soak:					
Highway Fuel Economy:	8/14/79	1429	41432.1	1441	41442.2

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE A-7

VEHICLE INFORMATION

Make: Mercury Model: Station Wagon Year: 1979

Engine Serial No. - Chassis Serial No. 9Z74F649208

Transmission Automatic

Odometer 06752.6

Engine Disp. 302 V-8

Idle RPM -

Fuel System 1 2 bbl.

Tank Capacity 19 gallons

Tank Location Left rear

Curb Weight 3990#

Drive Wheel Tire Press. 34 psi

Device Baseline i.e. Temperature measurement

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 4500#

Road Horsepower @ 50 MPH

Actual 14.0

Indicated 10.5

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 7 Project No. 1827

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/14/79	1610		0946	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/15/79	0946	067526	1026	06763.3
Hot Soak:					
Highway Fuel Economy:	8/15/79	1034	06766.5	1046	06776.2

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TABLE A-11

VEHICLE INFORMATION

Make: Mercury Model: Station Wagon Year: 1979

Engine Serial No. - Chassis Serial No. 9Z74F649208

Transmission Automatic NJ 414-KHO

Odometer 06776.4

Engine Disp. 302 V-8

Idle RPM -

Fuel System 1 - 2 bbl.

Tank Capacity 19 gallons

Tank Location Left rear

Curb Weight 3990#

Drive Wheel Tire Press. 35 psi

Device Fuel-Max (around 3,2)

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 4500#

Road Horsepower @ 50 MPH

Actual 14.0

Indicated 10.5

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 11 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/16/79	1450		0839	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/17/79	0839	06776.4	0920	06787.2
Hot Soak:					
Highway Fuel Economy:	8/17/79	0924	6789.5	0938	06799.0

Scott Environmental Technology Inc.

PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE A-8

VEHICLE INFORMATION

Make: Mercury Model: Monarch Year: 1977

Engine Serial No. - Chassis Serial No. 7W37F539957

Transmission Automatic

Odometer 31285.2

Engine Disp. 302 V-8

Idle RPM -

Fuel System 1 - 2 bbl.

Tank Capacity 19.2

Tank Location Rear

Curb Weight 3459#

Drive Wheel Tire Press. 34 psi

Device Baseline

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 4000#

Road Horsepower @ 50 MPH

Actual 13.2

Indicated 9.8

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 8 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/14/79	1612		1059	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/15/79	1059	31285.2	1139	31295.5
Hot Soak:					
Highway Fuel Economy:	8/15/79	1146	31299.1	1159	31308.6

Scott Environmental Technology Inc.

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TABLE A- 12

VEHICLE INFORMATION

Make: Mercury Model: Monarch Year: 1977

Engine Serial No. - Chassis Serial No. 7W37F539757

Transmission Automatic

Odometer 31338.4

Engine Disp. 302 V-8

Idle RPM -

Fuel System 1 - 2 bbl

Tank Capacity 19.2 gallons

Tank Location Rear

Curb Weight 3459#

Drive Wheel Tire Press. 34 psi

Device Fuel-Max (setting around 3.02)

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 4000#

Road Horsepower @ 50 MPH

Actual 13.2

Indicated 9.8

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 12 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/20/79	1700		0823	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/21/79	0823	31338.4	0903	31348.2
Hot Soak:					
Highway Fuel Economy:	8/21/79	0918	31354.0	0931	31363.8

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE A-13

VEHICLE INFORMATION

Make: Oldsmobile Model: Cutlass Cruiser(Wgn) Year: 1979

Engine Serial No. - Chassis Serial No. 3G35H92434400

Transmission Automatic

Odometer 20892.0

Engine Disp. 305 V-8

Idle RPM -

Fuel System 1 - 2 bbl

Tank Capacity 18.2

Tank Location Left Rear

Curb Weight 3475#

Drive Wheel Tire Press. 37 psi

Device Baseline

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 4000#

Road Horsepower @ 50 MPH

Actual 13.2

Indicated 9.8

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 13 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/20/79	1645		1004	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/21/79	1004	20892.0	1045	20902.6
Hot Soak:					
Highway Fuel Economy:	8/21/79	1055	20906.8	1109	20916.6

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TABLE A-15

VEHICLE INFORMATION

Make: Oldsmobile Model: Cutlass Cruiser (Wagon) Year: 1979

Engine Serial No. - Chassis Serial No. 3G35H92434400

Transmission Automatic

Odometer 20916.8

Engine Disp. 305 V-8

Idle RPM -

Fuel System 1 -2 bbl.

Tank Capacity 18.2

Tank Location Lear Rear

Curb Weight 3475#

Drive Wheel Tire Press. 36 psi

Device Fuel-Max

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 4000#

Road Horsepower @ 50 MPH

Actual 13.2

Indicated 9.8

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 15 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/23/79	1644		0849	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/24/79	0849	20916.8	0929	20927.6
Hot Soak:					
Highway Fuel Economy:	8/24/79	0937	20931.2	0950	20940.0

Scott Environmental Technology Inc.
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TABLE A-14

VEHICLE INFORMATION

Make: Ford Model: Pinto Year: 1979
Engine Serial No. - Chassis Serial No. 9T11Y158158
Transmission Automatic
Odometer 11253.8
Engine Disp. 140 4-cyl.
Idle RPM -
Fuel System 1 - 2 bbl.
Tank Capacity 11.7
Tank Location Left Rear
Curb Weight 2449#
Drive Wheel Tire Press. 28 psi
Device Baseline

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P
Inertia 2500#
Road Horsepower @ 50 MPH
Actual 9.4
Indicated 6.4

CARBON TRAP INFORMATION

Serial No. -
Final Wt. (g) -
Initial Wt. (g) -
Net Wt. (g) -

TEST SEQUENCE: Test No. 14 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/22/79	1618		0919	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/23/79	0919	11253.8	1000	11265.0
Hot Soak:					
Highway Fuel Economy:	8/23/79	1010	11268.4	1023	11278.6

Scott Environmental Technology Inc.
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TABLE A-16

VEHICLE INFORMATION

Make: Ford Model: Pinto Year: 1979

Engine Serial No. - Chassis Serial No. 9T11Y158158

Transmission Automatic

Odometer 11279.5

Engine Disp. 140 4-cyl.

Idle RPM

Fuel System 1 - 2 bbl.

Tank Capacity 11.7

Tank Location Left rear

Curb Weight 2449#

Drive Wheel Tire Press. 28 psi

Device Fuel-Max - No exhaust back-pressure valve

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 2500#

Road Horsepower @ 50 MPH

Actual 9.4

Indicated 6.4

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 16 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/26/79	1610		1346	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/27/79	1346	11279.5	1427	11289.5
Hot Soak:					
Highway Fuel Economy:	8/27/79	1434	11293.5	1447	11303.5

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE A-17

VEHICLE INFORMATION

Make: Chevrolet Model: Chevette Year: 1979

Engine Serial No. -- Chassis Serial No. 1B6809Y118162

Transmission Automatic

Odometer 7044.9

Engine Disp. 98

Idle RPM --

Fuel System 1 - 2 bbl

Tank Capacity 12.5

Tank Location Left Rear

Curb Weight 2109

Drive Wheel Tire Press. 39 PSI

Device Baseline

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 2500#

Road Horsepower @ 50 MPH

Actual 9.4

Indicated 6.4

CARBON TRAP INFORMATION

Serial No. --

Final Wt. (g) --

Initial Wt. (g) --

Net Wt. (g) --

TEST SEQUENCE: Test No. 17 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/28/79	1615		1426	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/29/79	1426	07044.9	1506	07055.0
Hot Soak:					
Highway Fuel Economy:	8/29/79	1511	07057.2	1524	07066.8

Scott Environmental Technology Inc.

PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE A-18

VEHICLE INFORMATION

Make: Chevrolet Model: Chevette Year: 1979

Engine Serial No. -- Chassis Serial No. 1B6809Y118162

Transmission Automatic

Odometer 07074.3

Engine Disp. 98

Idle RPM --

Fuel System 1 - 2 bbl

Tank Capacity 12.5

Tank Location Left Rear

Curb Weight 2109#

Drive Wheel Tire Press. 39 PSI

Device Fuel-Max

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 2500#

Road Horsepower @ 50 MPH

Actual 9.4

Indicated 6.4

CARBON TRAP INFORMATION

Serial No. —

Final Wt. (g) —

Initial Wt. (g) —

Net Wt. (g) —

TEST SEQUENCE: Test No. 18 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/30/79	1750		0901	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/31/79	0901	07074.3	0942	07085.1
Hot Soak:					
Highway Fuel Economy:	8/31/79	0949	07088.1	1001	07097.7

Scott Environmental Technology Inc.

PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE A-9

VEHICLE INFORMATION

Make: Oldsmobile Model: Cutlass Cruiser Year: 1978

Engine Serial No. - Chassis Serial No. 3H35#8G404250

Transmission Automatic NJ 415-HRA

Odometer 48592.2

Engine Disp. 305 V-8

Idle RPM - -

Fuel System 1 - 2 bbl.

Tank Capacity 18.25

Tank Location Left rear

Curb Weight 3402#

Drive Wheel Tire Press. 37 psi

Device Baseline

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 3500

Road Horsepower @ 50 MPH

Actual 12.3

Indicated 9.0

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 9 Project No. 1827-01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	8/14/79	1630		1400	
Fuel Transfer:					
Heat Build:					
CVS Test:	8/15/79	1400	48592.2	1442	48602.8
Hot Soak:					
Highway Fuel Economy:	8/15/79	1448	48605.3	1501	48615.0

APPENDIX B

EXHAUST EMISSION DATA

1975 FEDERAL TEST PROCEDURE

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215–766-8861 TWX: 510-665-9344

TABLE B-1
EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh. 1978 Lincoln Continental	Odometer Reading:	Date 8/7/79	
Vin: 8Y82A881792	Finish 07520.1	Proj.# 1827.01	
Trans. Automatic	Start 07509.0	Run # 1	
Carbs. 1 bbls. 4	Miles/Kms -	Dev. Baseline	
Eng. CID: 460		Dyno RHP 14.7	@50 MPH
Idle RPM -	Timing -	Dyno Inertia 5000 #	
Analyst D. Gulick	Driver S. Stranick	Calculator D. Gulick	

Dry Bulb Temp.	80.0	°F	Barometric Press.	749.27	mm Hg
Wet Bulb Temp.	67.0	°F	CVS Pump Press.	15.80	mm Hg
Relative Himidity	54	%	(P) Sample Press.	733.47	mm Hg
Specific Humidity	78	gr/lb	(T) Sample Temp.	572.0	°R
K_H	1.0143		(V) CVS Pump Disp.	.3105	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9148	Revs									
CO_2	2.40	%	CO_2	.04	%	CO_2	2.36	%	CO_2	1335.6	gms
CO	1073.0	ppm	CO	9.0	ppm	CO	997.5	ppm	CO	35.7	gms
HC	140.69	ppm_c	HC	5.61	ppm_c	HC	136.13	ppm_c	HC	2.41	gms
NO_x	39.4	ppm	NO_x	.0	ppm	NO_x	39.40	ppm	NO_x	2.35	gms
Cold Stabalized Mode WF = 1.0											
N	15625	Revs									
CO_2	1.38	%	CO_2	.04	%	CO_2	1.34	%	CO_2	3012.1	gms
CO	52.0	ppm	CO	7.0	ppm	CO	43.5	ppm	CO	6.2	gms
HC	18.34	ppm_c	HC	5.57	ppm_c	HC	13.34	ppm_c	HC	.94	gms
NO_x	22.9	ppm	NO_x	.0	ppm	NO_x	22.93	ppm	NO_x	5.44	gms
Hot Transient Mode WF = .57											
N	9118	Revs									
CO_2	1.86	%	CO_2	.04	%	CO_2	1.82	%	CO_2	1360.8	gms
CO	82.0	ppm	CO	8.0	ppm	CO	70.8	ppm	CO	3.3	gms
HC	30.79	ppm_c	HC	4.26	ppm_c	HC	27.12	ppm_c	HC	.63	gms
NO_x	50.2	ppm	NO_x	.3	ppm	NO_x	49.99	ppm	NO_x	3.94	gms

Results:					
CO_2	5708	grams/test	CO_2	761.1	gpm
CO	45.3	grams/test	CO	6.0	gpm
HC	3.99	grams/test	HC	.53	gpm
NO_x	11.74	grams/test	NO_x	1.56	gpm

Urban Fuel Economy 11.48 MPG

TROY, MICHIGAN / SAN BERNARDINO, CALIFORNIA

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE B-3
EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh. 1978 Lincoln Continental	Odometer Reading:	Date 8/8/79
Vin: 8Y82A881792	Finish 07544.1	Proj.# 1827.01
Trans. Automatic	Start 07534.5	Run # 3
Carbs. 1 bbls. 4	Miles/Kms -	Dev. Fuel-Max
Eng. V-8 Disp. 460		Dyno RHP 14.7 @50 MPH
Idle RPM -	Timing -	Dyno Inertia 5000#
Analyst D. Gulick	Driver S. Stranick	Calculator D. Gulick

Dry Bulb Temp.	93.0	°F	Barometric Press.	746.05	mm Hg
Wet Bulb Temp.	68.0	°F	CVS Pump Press.	15.80	mm Hg
Relative Himidity	26	%	(P) Sample Press.	730.25	mm Hg
Specific Humidity	69	gr/lb	(T) Sample Temp.	572.0	°R
K_H	.9725		(V) CVS Pump Disp.	.3105	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9362	Revs									
CO_2	2.09	%	CO_2	.04	%	CO_2	2.05	%	CO_2	1182.0	gms
CO	277.0	ppm	CO	12.0	ppm	CO	253.5	ppm	CO	9.2	gms
HC	110.58	ppm_c	HC	3.99	ppm_c	HC	107.22	ppm_c	HC	1.94	gms
NO_x	190.5	ppm	NO_x	.0	ppm	NO_x	190.50	ppm	NO_x	11.12	gms
Cold Stabalized Mode WF = 1.0											
N	15578	Revs									
CO_2	1.36	%	CO_2	.04	%	CO_2	1.32	%	CO_2	2945.3	gms
CO	37.0	ppm	CO	10.0	ppm	CO	26.8	ppm	CO	3.7	gms
HC	17.27	ppm_c	HC	3.65	ppm_c	HC	13.99	ppm_c	HC	.98	gms
NO_x	116.5	ppm	NO_x	.5	ppm	NO_x	116.05	ppm	NO_x	26.22	gms
Hot Transient Mode WF = .57											
N	9114	Revs									
CO_2	1.85	%	CO_2	.04	%	CO_2	1.81	%	CO_2	1346.7	gms
CO	62.0	ppm	CO	9.0	ppm	CO	51.5	ppm	CO	2.4	gms
HC	30.22	ppm_c	HC	1.68	ppm_c	HC	28.77	ppm_c	HC	.67	gms
NO_x	218.0	ppm	NO_x	.0	ppm	NO_x	218.00	ppm	NO_x	16.42	gms

Results:

CO_2	5474	grams/test	CO_2	729.8	gpm
CO	15.4	grams/test	CO	2.0	gpm
HC	3.59	grams/test	HC	.47	gpm
NO_x	53.77	grams/test	NO_x	7.17	gpm

Urban Fuel Economy 12.07 MPG

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE B-2

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh. 1979 Oldsmobile Cutlass Salon	Odometer Reading:	Date	8/7/79
Vin: 3G09H9G27788	Finish 07965.2	Proj.#	1827-01
Trans. Automatic	Start 07955.1	Run #	2
Carbs. 1 bbls. 4	Miles/Kms -	Dev.	Baseline
Eng. V-8 CID: 305		Dyno RHP	12.3 @50 MPH
Idle RPM -	Timing -	Dyno Inertia	3500#
Analyst D. Gulick	Driver S. Stranick	Calculator	D. Gulick

Dry Bulb Temp.	85.0	°F	Barometric Press.	749.70	mm Hg
Wet Bulb Temp.	69.0	°F	CVS Pump Press.	15.80	mm Hg
Relative Himidity	44	%	(P) Sample Press.	733.90	mm Hg
Specific Humidity	81	gr/lb	(T) Sample Temp.	570.0	°R
K_H	1.0290		(V) CVS Pump Disp.	.3105	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9213	Revs									
CO_2	1.37	%	CO_2	.04	%	CO_2	1.33	%	CO_2	761.3	gms
CO	1354.0	ppm	CO	6.0	ppm	CO	1293.8	ppm	CO	46.9	gms
HC	226.93	ppm_c	HC	4.93	ppm_c	HC	222.56	ppm_c	HC	3.99	gms
NO_x	45.8	ppm	NO_x	.3	ppm	NO_x	45.54	ppm	NO_x	2.79	gms
Cold Stabalized Mode WF = 1.0											
N	15674	Revs									
CO_2	.93	%	CO_2	.04	%	CO_2	.89	%	CO_2	2015.5	gms
CO	500.0	ppm	CO	8.0	ppm	CO	476.6	ppm	CO	68.4	gms
HC	81.25	ppm_c	HC	3.98	ppm_c	HC	77.56	ppm_c	HC	5.51	gms
NO_x	13.6	ppm	NO_x	.0	ppm	NO_x	13.64	ppm	NO_x	3.30	gms
Hot Transient Mode WF = .57											
N	9126	Revs									
CO_2	1.28	%	CO_2	.04	%	CO_2	1.24	%	CO_2	931.9	gms
CO	572.0	ppm	CO	11.0	ppm	CO	540.0	ppm	CO	25.7	gms
HC	92.85	ppm_c	HC	3.65	ppm_c	HC	89.56	ppm_c	HC	2.11	gms
NO_x	32.0	ppm	NO_x	.0	ppm	NO_x	32.07	ppm	NO_x	2.58	gms

Results:						
	CO_2	3708	grams/test	CO_2	494.5	gpm
	CO	141.0	grams/test	CO	18.8	gpm
	HC	11.62	grams/test	HC	1.55	gpm
	NO_x	8.68	grams/test	NO_x	1.15	gpm

Urban Fuel Economy 16.76 MPG

Scott Environmental Technology Inc.

PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE B-4

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh.	1979 Oldsmobile Cutlass Salon	Odometer Reading:		Date	8/9/79
Vin:	3G09H9G427788	Finish	07987.6	Proj.#	1827-01
Trans.	Automatic	Start	07977.5	Run #	4
Carbs.	1 bbls. 4	Miles/Kms	-	Dev.	Fuel-Max
Eng.	V-8 Displ. 305			Dyno RHP	12.3 @50 MPH
Idle RPM	-	Timing	-	Dyno Inertia	3500#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp.	75.0	°F	Barometric Press.	749.96	mm Hg
Wet Bulb Temp.	67.0	°F	CVS Pump Press.	15.80	mm Hg
Relative Himidity	66	%	(P) Sample Press.	734.16	mm Hg
Specific Humidity	87	gr/lb	(T) Sample Temp.	565.0	°R
K_H	1.0597		(V) CVS Pump Disp.	.3105	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9336	Revs									
CO_2	1.35	%	CO_2	.04	%	CO_2	1.31	%	CO_2	766.8	gms
CO	850.0	ppm	CO	7.0	ppm	CO	803.6	ppm	CO	29.8	gms
HC	206.12	ppm_c	HC	4.12	ppm_c	HC	202.44	ppm_c	HC	3.71	gms
NO_x	108.5	ppm	NO_x	.0	ppm	NO_x	108.50	ppm	NO_x	7.00	gms
Cold Stabalized Mode WF = 1.0											
N	15658	Revs									
CO_2	.94	%	CO_2	.04	%	CO_2	.90	%	CO_2	2054.6	gms
CO	254.0	ppm	CO	11.0	ppm	CO	234.0	ppm	CO	33.8	gms
HC	50.48	ppm_c	HC	3.54	ppm_c	HC	47.19	ppm_c	HC	3.38	gms
NO_x	36.7	ppm	NO_x	.0	ppm	NO_x	36.72	ppm	NO_x	9.24	gms
Hot Transient Mode WF = .57											
N	9124	Revs									
CO_2	1.24	%	CO_2	.04	%	CO_2	1.20	%	CO_2	909.3	gms
CO	194.0	ppm	CO	8.0	ppm	CO	178.1	ppm	CO	8.5	gms
HC	53.07	ppm_c	HC	2.92	ppm_c	HC	50.42	Ppm_c	HC	1.20	gms
NO_x	104.9	ppm	NO_x	.0	ppm	NO_x	104.96	ppm	NO_x	8.78	gms

Results:						
	CO_2	3731	grams/test	CO_2	497.5	gpm
	CO	72.2	grams/test	CO	9.6	gpm
	HC	8.30	grams/test	HC	1.10	gpm
	NO_x	25.03	grams/test	NO_x	3.33	gpm

Urban Fuel Economy 17.18 MPG

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE B-5

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh. 1977 Dodge Aspen Wagon	Odometer Reading:	Date	8/13/79
Vin: NH45G7F252970	Finish 11403.7	Proj.#	1827-01
Trans. Automatic	Start 11393.0	Run #	5
Carbs. 1 bbls. 2	Miles/Kms -	Dev.	Baseline
Eng. V-8 Displ. 318		Dyno RHP	13.2 @50 MPH
Idle RPM -	Timing -	Dyno Inertia	4000#
Analyst D. Gulick	Driver S. Stranick	Calculator	D. Gulick

Dry Bulb Temp.	77.0	°F	Barometric Press.	747.84 mm Hg
Wet Bulb Temp.	63.0	°F	CVS Pump Press.	15.99 mm Hg
Relative Himidity	45	%	(P) Sample Press.	731.85 mm Hg
Specific Humidity	64	gr/lb	(T) Sample Temp.	567.5 °R
K_H	.9508		(V) CVS Pump Disp.	.3103 CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS		WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43										
N	9107	Revs								
CO_2	1.46	%	CO_2	.04	%	CO_2	1.42 %	CO_2	804.7	gms
CO	3900.0	ppm	CO	5.0	ppm	CO	3729.4 ppm	CO	133.8	gms
HC	599.18	ppm_c	HC	3.98	ppm_c	HC	595.70 ppm_c	HC	10.59	gms
NO_x	34.8	ppm	NO_x	.0	ppm	NO_x	34.81 ppm	NO_x	1.95	gms
Cold Stabalized Mode WF = 1.0										
N	15669	Revs								
CO_2	1.00	%	CO_2	.04	%	CO_2	.96 %	CO_2	2175.5	gms
CO	680.0	ppm	CO	13.0	ppm	CO	645.2 ppm	CO	92.6	gms
HC	116.41	ppm_c	HC	4.97	ppm_c	HC	111.83 ppm_c	HC	7.95	gms
NO_x	30.9	ppm	NO_x	.0	ppm	NO_x	30.91 ppm	NO_x	6.93	gms
Hot Transient Mode WF = .57										
N	9127	Revs								
CO_2	1.32	%	CO_2	.04	%	CO_2	1.28 %	CO_2	963.0	gms
CO	812.0	ppm	CO	12.0	ppm	CO	768.9 ppm	CO	36.6	gms
HC	165.17	ppm_c	HC	3.00	ppm_c	HC	162.48 ppm_c	HC	3.83	gms
NO_x	55.4	ppm	NO_x	.0	ppm	NO_x	55.42 ppm	NO_x	4.12	gms

Results:

CO_2	3943	grams/test	CO_2	525.7	gpm
CO	263.1	grams/test	CO	35.0	gpm
HC	22.38	grams/test	HC	2.98	gpm
NO_x	13.01	grams/test	NO_x	1.73	gpm

Urban Fuel Economy 15.02 MPG

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE B-6

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh. 1977 Dodge Aspen Wagon	Odometer Reading:	Date	8/14/79
Vin: WH45G7F252970	Finish 41428.9	Proj.#	1827-01
Trans. Automatic	Start 41418.3	Run #	6
Carbs. 1 bbls. 2	Miles/Kms -	Dev.	Fuel-Max
Eng. V-8 Displ. 318		Dyno RHP	13.2 @50 MPH
Idle RPM -	Timing -	Dyno Inertia	4000#
Analyst D. Gulick	Driver S. Stranick	Calculator	D. Gulick

Dry Bulb Temp.	82.0	°F	Barometric Press.	746.60	mm Hg
Wet Bulb Temp.	69.0	°F	CVS Pump Press.	15.99	mm Hg
Relative Himidity	52	%	(P) Sample Press.	730.61	mm Hg
Specific Humidity	85	gr/lb	(T) Sample Temp.	562.0	°R
K_H	1.0493		(V) CVS Pump Disp.	.3103	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9100	Revs									
CO_2	1.40	%	CO_2	.04	%	CO_2	1.36	%	CO_2	776.2	gms
CO	3070.0	ppm	CO	12.0	ppm	CO	2925.4	ppm	CO	105.7	gms
HC	424.32	ppm_c	HC	6.21	ppm_c	HC	418.91	ppm_c	HC	7.50	gms
NO_x	77.5	ppm	NO_x	.0	ppm	NO_x	77.50	ppm	NO_x	4.82	gms
Cold Stabalized Mode WF = 1.0											
N	15642	Revs									
CO_2	1.03	%	CO_2	.04	%	CO_2	.99	%	CO_2	2257.8	gms
CO	762.0	ppm	CO	10.0	ppm	CO	725.0	ppm	CO	104.7	gms
HC	117.44	ppm_c	HC	5.53	ppm_c	HC	112.37	ppm_c	HC	8.04	gms
NO_x	44.8	ppm	NO_x	.2	ppm	NO_x	44.70	ppm	NO_x	11.13	gms
Hot Transient Mode WF = .57											
N	9116	Revs									
CO_2	1.43	%	CO_2	.04	%	CO_2	1.39	%	CO_2	1052.9	gms
CO	847.0	ppm	CO	9.0	ppm	CO	801.6	ppm	CO	38.4	gms
HC	159.95	ppm_c	HC	4.87	ppm_c	HC	155.63	Ppm_c	HC	3.70	gms
NO_x	141.5	ppm	NO_x	.0	ppm	NO_x	141.50	ppm	NO_x	11.70	gms

Results:						
	CO_2	4087	grams/test	CO_2	544.9	gpm
	CO	249.0	grams/test	CO	33.2	gpm
	HC	19.24	grams/test	HC	2.56	gpm
	NO_x	27.67	grams/test	NO_x	3.69	gpm

Urban Fuel Economy 14.65 MPG

Scott Environmental Technology Inc.

PLUMSTEADVILLE, PA. 18949 PHONE: 215–766-8861 TWX: 510-665-9344

TABLE B-9

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh. 1978 Oldsmobile Cutlass Cruiser	Odometer Reading:	Date	8/15/79
Vin: 3H35H8G404250	Finish 48602.8	Proj.#	1827-01
Trans. Automatic	Start 48592.2	Run #	9
Carbs. 1 bbls. 2	Miles/Kms -	Dev.	Baseline
Eng. V-8 Displ. 305		Dyno RHP	12.3 @50 MPH
Idle RPM -	Timing -	Dyno Inertia	3500#
Analyst D. Gulick	Driver S. Stranick	Calculator	D. Gulick

Dry Bulb Temp.	69.0	°F	Barometric Press.	747.91	mm Hg
Wet Bulb Temp.	58.0	°F	CVS Pump Press.	15.71	mm Hg
Relative Himidity	49	%	(P) Sample Press.	732.20	mm Hg
Specific Humidity	54	gr/lb	(T) Sample Temp.	568.0	°R
K_H	.9101		(V) CVS Pump Disp.	.3105	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9155	Revs									
CO_2	1.50	%	CO_2	.04	%	CO_2	1.46	%	CO_2	831.8	gms
CO	3565.0	ppm	CO	9.0	ppm	CO	3398.0	ppm	CO	122.6	gms
HC	342.52	ppm_c	HC	3.26	ppm_c	HC	339.71	ppm_c	HC	6.07	gms
NO_x	34.3	ppm	NO_x	.0	ppm	NO_x	34.34	ppm	NO_x	1.85	gms
Cold Stabalized Mode WF = 1.0											
N	15677	Revs									
CO_2	1.00	%	CO_2	.04	%	CO_2	.96	%	CO_2	2176.8	gms
CO	185.0	ppm	CO	12.0	ppm	CO	167.6	ppm	CO	24.0	gms
HC	41.16	ppm_c	HC	2.94	ppm_c	HC	38.44	ppm_c	HC	2.73	gms
NO_x	21.5	ppm	NO_x	.3	ppm	NO_x	21.27	ppm	NO_x	4.57	gms
Hot Transient Mode WF = .57											
N	9148	Revs									
CO_2	1.35	%	CO_2	.04	%	CO_2	1.31	%	CO_2	937.9	gms
CO	212.0	ppm	CO	8.0	ppm	CO	196.0	ppm	CO	9.3	gms
HC	64.20	ppm_c	HC	2.62	ppm_c	HC	61.84	ppm_c	HC	1.46	gms
NO_x	37.1	ppm	NO_x	.4	ppm	NO_x	36.75	ppm	NO_x	2.62	gms

Results:						
	CO_2	3996	grams/test	CO_2	532.8	gpm
	CO	156.0	grams/test	CO	20.8	gpm
	HC	10.27	grams/test	HC	1.36	gpm
	NO_x	9.05	grams/test	NO_x	1.20	gpm

Urban Fuel Economy 15.55 MPG

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE B-10
EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh. 1978 Oldsmobile Cutlass Cruiser	Odometer Reading:	Date	8/16/79
Vin: 3H35H8G404250	Finish 48625.3	Proj.#	1827-01
Trans. Automatic	Start 48615.1	Run #	10
Carbs. 1 bbls. 2	Miles/Kms -	Dev.	Fuel-Max
Eng. V-8 Displ. 305		Dyno RHP	12.3 @50 MPH
Idle RPM -	Timing -	Dyno Inertia	3500#
Analyst D. Gulick	Driver S. Stranick	Calculator	D. Gulick

Dry Bulb Temp.	72.0	°F	Barometric Press.	752.25	mm Hg
Wet Bulb Temp.	59.0	°F	CVS Pump Press.	15.71	mm Hg
Relative Himidity	45	%	(P) Sample Press.	736.54	mm Hg
Specific Humidity	54	gr/lb	(T) Sample Temp.	567.0	°R
K_H	.9101		(V) CVS Pump Disp.	.3103	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9141	Revs									
CO_2	1.54	%	CO_2	.04	%	CO_2	1.50	%	CO_2	859.0	gms
CO	2068.0	ppm	CO	10.0	ppm	CO	1968.0	ppm	CO	71.4	gms
HC	131.74	ppm_c	HC	4.00	ppm_c	HC	128.26	ppm_c	HC	2.30	gms
NO_x	124.4	ppm	NO_x	.0	ppm	NO_x	124.41	ppm	NO_x	6.75	gms
Cold Stabalized Mode WF = 1.0											
N	15654	Revs									
CO_2	.96	%	CO_2	.04	%	CO_2	.92	%	CO_2	2097.6	gms
CO	23.0	ppm	CO	8.0	ppm	CO	14.9	ppm	CO	2.1	gms
HC	22.43	ppm_c	HC	3.96	ppm_c	HC	18.75	ppm_c	HC	1.34	gms
NO_x	53.6	ppm	NO_x	.0	ppm	NO_x	53.64	ppm	NO_x	11.59	gms
Hot Transient Mode WF = .57											
N	9119	Revs									
CO_2	1.26	%	CO_2	.04	%	CO_2	1.22	%	CO_2	923.6	gms
CO	82.0	ppm	CO	12.0	ppm	CO	68.1	ppm	CO	3.2	gms
HC	39.79	ppm_c	HC	2.98	ppm_c	HC	37.09	ppm_c	HC	.88	gms
NO_x	108.7	ppm	NO_x	.0	ppm	NO_x	108.79	ppm	NO_x	7.80	gms

Results:						
	CO_2	3880	grams/test	CO_2	517.3	gpm
	CO	76.8	grams/test	CO	10.2	gpm
	HC	4.52	grams/test	HC	.60	gpm
	NO_x	26.14	grams/test	NO_x	3.48	gpm

Urban Fuel Economy 16.56 MPG

TROY, MICHIGAN / SAN BERNARDINO, CALIFORNIA

Scott Environmental Technology Inc.

PLUMSTEADVILLE, PA. 18949 PHONE: 215–766-8861 TWX: 510-665-9344

TABLE B-8.

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh. 1977 Mercury Monarch	Odometer Reading:	Date	8/15/79
Vin: 7W37F539757	Finish 31295.5	Proj.#	1827-01
Trans. Automatic	Start 31285.2	Run #	8
Carbs. 1 bbls. 2	Miles/Kms -	Dev.	Baseline
Eng. V-8 Displ. 302		Dyno RHP	13.2 @50 MPH
Idle RPM -	Timing -	Dyno Inertia	4000#
Analyst D. Gulick	Driver S. Stranick	Calculator	D. Gulick

Dry Bulb Temp.	77.0	°F	Barometric Press.	747.96	mm Hg
Wet Bulb Temp.	67.0	°F	CVS Pump Press.	15.99	mm Hg
Relative Himidity	59	%	(P) Sample Press.	731.97	mm Hg
Specific Humidity	83	gr/lb	(T) Sample Temp.	567.0	°R
K_H	1.0390		(V) CVS Pump Disp.	.3103	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9164	Revs									
CO_2	1.47	%	CO_2	.04	%	CO_2	1.43	%	CO_2	816.0	gms
CO	2225.0	ppm	CO	9.0	ppm	CO	2111.9	ppm	CO	76.3	gms
HC	369.55	ppm_C	HC	2.62	ppm_C	HC	367.26	ppm_C	HC	6.57	gms
NO_x	93.5	ppm	NO_x	.0	ppm	NO_x	93.53	ppm	NO_x	5.77	gms
Cold Stabalized Mode WF = 1.0											
N	15655	Revs									
CO_2	.99	%	CO_2	.04	%	CO_2	.95	%	CO_2	2153.2	gms
CO	694.0	ppm	CO	10.0	ppm	CO	658.5	ppm	CO	94.5	gms
HC	110.10	ppm_C	HC	3.26	ppm_C	HC	107.09	ppm_C	HC	7.61	gms
NO_x	34.3	ppm	NO_x	.3	ppm	NO_x	34.07	ppm	NO_x	8.35	gms
Hot Transient Mode WF = .57											
N	9110	Revs									
CO_2	1.30	%	CO_2	.04	%	CO_2	1.26	%	CO_2	948.2	gms
CO	943.0	ppm	CO	10.0	ppm	CO	892.6	ppm	CO	42.5	gms
HC	158.20	ppm_C	HC	3.26	ppm_C	HC	155.28	ppm_C	HC	3.66	gms
NO_x	53.3	ppm	NO_x	.3	ppm	NO_x	53.55	ppm	NO_x	4.35	gms

Results:					
CO_2	3917	grams/test	CO_2	522.3	gpm
CO	213.5	grams/test	CO	28.4	gpm
HC	17.86	grams/test	HC	2.38	gpm
NO_x	18.48	grams/test	NO_x	2.46	gpm

Urban Fuel Economy 15.43 MPG

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215–766-8861 TWX: 510-665-9344

TABLE B-12

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh.	1977 Mercury Monarch	Odometer Reading:		Date	8/21/79
Vin:	7W37F539757	Finish	31348.2	Proj.#	1827-01
Trans.	Automatic	Start	31338.4	Run #	12
Carbs.	1 bbls. 2	Miles/Kms	-	Dev.	Fuel-Max
Eng.	V-8 Displ. 302			Dyno RHP	13.2 @50 MPH
Idle RPM	-	Timing	-	Dyno Inertia	4000#
Analyst	D. Gulick	Driver	B. Markley	Calculator	D. Gulick

Dry Bulb Temp.	73.0	°F	Barometric Press.	749.93	mm Hg
Wet Bulb Temp.	67.0	°F	CVS Pump Press.	15.80	mm Hg
Relative Himidity	73	%	(P) Sample Press.	734.13	mm Hg
Specific Humidity	90	gr/lb	(T) Sample Temp.	566.0	°R
K_H	1.0758		(V) CVS Pump Disp.	.3105	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9154	Revs									
CO_2	1.40	%	CO_2	.04	%	CO_2	1.36	%	CO_2	779.2	gms
CO	1446.0	ppm	CO	12.0	ppm	CO	1362.5	ppm	CO	49.4	gms
HC	252.58	ppm_c	HC	5.92	ppm_c	HC	247.35	ppm_c	HC	4.44	gms
NO_x	194.5	ppm	NO_x	.0	ppm	NO_x	194.51	ppm	NO_x	12.48	gms
Cold Stabalized Mode WF = 1.0											
N	15659	Revs									
CO_2	.91	%	CO_2	.04	%	CO_2	.87	%	CO_2	1982.9	gms
CO	510.0	ppm	CO	14.0	ppm	CO	476.3	ppm	CO	68.8	gms
HC	96.11	ppm_c	HC	9.72	ppm_c	HC	87.09	ppm_c	HC	6.23	gms
NO_x	97.2	ppm	NO_x	.3	ppm	NO_x	96.97	ppm	NO_x	24.75	gms
Hot Transient Mode WF = .57											
N	9167	Revs									
CO_2	1.19	%	CO_2	.04	%	CO_2	1.15	%	CO_2	874.5	gms
CO	351.0	ppm	CO	12.0	ppm	CO	324.0	ppm	CO	15.6	gms
HC	100.13	ppm_c	HC	6.70	ppm_c	HC	94.04	ppm_c	HC	2.24	gms
NO_x	190.5	ppm	NO_x	.6	ppm	NO_x	189.98	ppm	NO_x	16.18	gms

Results:						
	CO_2	3636	grams/test	CO_2	484.9	gpm
	CO	133.8	grams/test	CO	17.8	gpm
	HC	12.92	grams/test	HC	1.72	gpm
	NO_x	53.41	grams/test	NO_x	7.12	gpm

Urban Fuel Economy 17.10 MPG

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE B-13

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh.	1979 Oldsmobile Cutlass Cruiser	Odometer Reading:		Date	8/21/79
Vin:	3G35H92434400	Finish	20902.6	Proj.#	1327-01
Trans.	Automatic	Start	20892.0	Run #	13
Carbs.	1 bbls. 2	Miles/Kms	-	Dev.	Baseline
Eng.	V-8 Displ. 305			Dyno RHP	13.2 @50 MPH
Idle RPM	-	Timing	-	Dyno Inertia	4000#
Analyst	D. Gulick	Driver	B. Markley	Calculator	D. Gulick

Dry Bulb Temp.	69.0	°F	Barometric Press.	749.93	mm Hg
Wet Bulb Temp.	66.0	°F	CVS Pump Press.	15.80	mm Hg
Relative Himidity	81	%	(P) Sample Press.	734.13	mm Hg
Specific Humidity	90	gr/lb	(T) Sample Temp.	568.0	°R
K_H	1.0758		(V) CVS Pump Disp.	.3105	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9158	Revs									
CO_2	1.58	%	CO_2	.04	%	CO_2	1.54	%	CO_2	879.7	gms
CO	2045.0	ppm	CO	9.0	ppm	CO	1921.7	ppm	CO	69.5	gms
HC	399.20	ppm_c	HC	5.30	ppm_c	HC	394.61	ppm_c	HC	7.07	gms
NO_x	62.0	ppm	NO_x	.5	ppm	NO_x	61.56	ppm	NO_x	3.93	gms
Cold Stabalized Mode WF = 1.0											
N	15658	Revs									
CO_2	1.13	%	CO_2	.04	%	CO_2	1.09	%	CO_2	2475.0	gms
CO	117.0	ppm	CO	8.0	ppm	CO	104.2	ppm	CO	15.0	gms
HC	45.00	ppm_c	HC	6.57	ppm_c	HC	38.99	ppm_c	HC	2.77	gms
NO_x	15.6	ppm	NO_x	.3	ppm	NO_x	15.36	ppm	NO_x	3.90	gms
Hot Transient Mode WF = .57											
N	9149	Revs									
CO_2	1.43	%	CO_2	.04	%	CO_2	1.39	%	CO_2	1051.2	gms
CO	440.0	ppm	CO	9.0	ppm	CO	408.5	ppm	CO	19.5	gms
HC	83.35	ppm_c	HC	5.98	ppm_c	HC	78.03	Ppm_c	HC	1.85	gms
NO_x	26.1	ppm	NO_x	.3	ppm	NO_x	25.92	ppm	NO_x	2.19	gms

Results:

CO_2	4406	grams/test	CO_2	587.4	gpm
CO	104.1	grams/test	CO	13.8	gpm
HC	11.70	grams/test	HC	1.56	gpm
NO_x	10.04	grams/test	NO_x	1.33	gpm

Urban Fuel Economy 14.43 MPG

Scott Environmental Technology Inc.

PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE B-15

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh.	1979 Oldsmobile Cutlass Cruiser	Odometer Reading:		Date	8/24/79
Vin:	3G35H92434400	Finish	20927.6	Proj.#	1827-01
Trans.	Automatic	Start	20916.8	Run #	15
Carbs.	1 bbls. 2	Miles/Kms	-	Dev.	Fuel-Max
Eng.	V-8 Displ. 305			Dyno RHP	13.2 @50 MPH
Idle RPM	-	Timing	-	Dyno Inertia	4000#
Analyst	D. Gulick	Driver	B. Markley	Calculator	D. Gulick

Dry Bulb Temp.	76.0 °F		Barometric Press.	748.74 mm Hg
Wet Bulb Temp.	71.0 °F		CVS Pump Press.	1.80 mm Hg
Relative Himidity	78 %		(P) Sample Press.	746.94 mm Hg
Specific Humidity	107 gr/lb		(T) Sample Temp.	567.0 °R
K_H	1.1770		(V) CVS Pump Disp.	.3105 CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9133	Revs									
CO_2	1.60	%	CO_2	.04	%	CO_2	1.56	%	CO_2	905.7	gms
CO	1562.0	ppm	CO	12.0	ppm	CO	1464.3	ppm	CO	53.8	gms
HC	257.22	ppm_c	HC	13.85	ppm_c	HC	245.20	ppm_c	HC	4.46	gms
NO_x	117.6	ppm	NO_x	.0	ppm	NO_x	117.60	ppm	NO_x	8.36	gms
Cold Stabalized Mode WF = 1.0											
N	15643	Revs									
CO_2	1.09	%	CO_2	.04	%	CO_2	1.05	%	CO_2	2427.7	gms
CO	56.0	ppm	CO	12.0	ppm	CO	42.6	ppm	CO	6.2	gms
HC	30.21	ppm_c	HC	12.02	ppm_c	HC	19.17	ppm_c	HC	1.39	gms
NO_x	39.6	ppm	NO_x	.5	ppm	NO_x	39.23	ppm	NO_x	11.11	gms
Hot Transient Mode WF = .57											
N	9161	Revs									
CO_2	1.40	%	CO_2	.04	%	CO_2	1.36	%	CO_2	1049.6	gms
CO	41.0	ppm	CO	12.0	ppm	CO	28.3	ppm	CO	1.3	gms
HC	34.86	ppm_c	HC	11.73	ppm_c	HC	24.36	ppm_c	HC	.59	gms
NO_x	91.7	ppm	NO_x	.4	ppm	NO_x	91.43	ppm	NO_x	8.64	gms

Results:						
	CO_2	4383	grams/test	CO_2	584.4	gpm
	CO	61.5	grams/test	CO	8.2	gpm
	HC	6.45	grams/test	HC	.86	gpm
	NO_x	28.13	grams/test	NO_x	3.75	gpm

Urban Fuel Economy 14.77 MPG

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215–766-8861 TWX: 510-665-9344

TABLE B-14
EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh.	1979 Ford Pinto	Odometer Reading:		Date	8/23/79
Vin:	9T11Y158158	Finish	11265.0	Proj.#	1827-01
Trans.	Automatic	Start	11253.8	Run #	14
Carbs.	1 bbls. 2	Miles/Kms	-	Dev.	Baseline
Eng.	4-cyl. Displ. 140			Dyno RHP	9.4 @50 MPH
Idle RPM	-	Timing	-	Dyno Inertia	2500#
Analyst	D. Gulick	Driver	B. Markley	Calculator	D. Gulick

Dry Bulb Temp.	76.0	°F	Barometric Press.	751.72 mm Hg
Wet Bulb Temp.	69.0	°F	CVS Pump Press.	15.80 mm Hg
Relative Himidity	70	%	(P) Sample Press.	735.92 mm Hg
Specific Humidity	95	gr/lb	(T) Sample Temp.	566.0 °R
K_H	1.1037		(V) CVS Pump Disp.	.3105 CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS	
Cold Transient Mode WF = .43										
N	9209	Revs								
CO_2	1.36	%	CO_2	.04	%	CO_2	1.32 %		CO_2	762.7 gms
CO	1198.0	ppm	CO	10.0	ppm	CO	1130.8 ppm		CO	41.4 gms
HC	163.44	ppm_c	HC	5.90	ppm_c	HC	158.19 ppm_c		HC	2.86 gms
NO_x	72.3	ppm	NO_x	.2	ppm	NO_x	72.20 ppm		NO_x	4.79 gms
Cold Stabalized Mode WF = 1.0										
N	15610	Revs								
CO_2	.78	%	CO_2	.04	%	CO_2	.74	%	CO_2	1685.7 gms
CO	813.0	ppm	CO	9.0	ppm	CO	774.1	ppm	CO	111.7 gms
HC	55.15	ppm_c	HC	8.76	ppm_c	HC	46.95	ppm_c	HC	3.35 gms
NO_x	21.1	ppm	NO_x	.4	ppm	NO_x	20.76	ppm	NO_x	5.43 gms
Hot Transient Mode WF = .57										
N	9141	Revs								
CO_2	1.13	%	CO_2	.04	%	CO_2	1.0 [	%	CO_2	828.6 gms
CO	814.0	ppm	CO	10.0	ppm	CO	769.0	ppm	CO	37.0 gms
HC	72.05	ppm_c	HC	3.88	ppm_c	HC	68.52	ppm_c	HC	1.63 gms
NO_x	58.4	ppm	NO_x	.3	ppm	NO_x	58.14	ppm	NO_x	5.07 gms

Results:					
	CO_2	3277	grams/test	CO_2	436.9 gpm
	CO	190.2	grams/test	CO	25.3 gpm
	HC	7.86	grams/test	HC	1.04 gpm
	NO_x	15.30	grams/test	NO_x	2.04 gpm

Urban Fuel Economy 18.47 MPG

Scott Environmental Technology Inc.

PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE B-16

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh.	1979 Ford Pinto	Odometer Reading:		Date	8/27/79
Vin:	9T11Y158158	Finish	11289.5	Proj.#	1827-01
Trans.	Automatic	Start	11279.5	Run #	16
Carbs.	1 bbls. 2	Miles/Kms	-	Dev.	Fuel-Max
Eng.	4-cyl. Displ. 140			Dyno RHP	9.4 @50 MPH
Idle RPM	-	Timing	-	Dyno Inertia	2500#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp.	82.0	°F	Barometric Press.	747.17	mm Hg
Wet Bulb Temp.	71.0	°F	CVS Pump Press.	15.61	mm Hg
Relative Himidity	58	%	(P) Sample Press.	731.56	mm Hg
Specific Humidity	97	gr/lb	(T) Sample Temp.	579.5	°R
K_H	1.1153		(V) CVS Pump Disp.	.3106	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9218	Revs									
CO_2	1.36	%	CO_2	.04	%	CO_2	1.32	%	CO_2	741.4	gms
CO	905.0	ppm	CO	12.0	ppm	CO	853.8	ppm	CO	30.3	gms
HC	200.06	ppm_c	HC	9.11	ppm_c	HC	191.94	ppm_c	HC	3.38	gms
NO_x	146.0	ppm	NO_x	.0	ppm	NO_x	146.00	ppm	NO_x	9.52	gms
Cold Stabalized Mode WF = 1.0											
N	15614	Revs									
CO_2	.81	%	CO_2	.04	%	CO_2	.77	%	CO_2	1704.2	gms
CO	1107.0	ppm	CO	14.0	ppm	CO	1056.2	ppm	CO	148.1	gms
HC	76.59	ppm_c	HC	9.65	ppm_c	HC	67.60	ppm_c	HC	4.69	gms
NO_x	82.6	ppm	NO_x	.1	ppm	NO_x	82.54	ppm	NO_x	21.20	gms
Hot Transient Mode WF = .57											
N	9110	Revs									
CO_2	1.19	%	CO_2	.04	%	CO_2	1.15	%	CO_2	846.3	gms
CO	1178.0	ppm	CO	15.0	ppm	CO	1115.6	ppm	CO	52.0	gms
HC	110.87	ppm_c	HC	9.00	ppm_c	HC	102.75	Ppm_c	HC	2.37	gms
NO_x	134.3	ppm	NO_x	.1	ppm	NO_x	134.21	ppm	NO_x	11.46	gms

Results:

CO_2	3292	grams/test	CO_2	438.9	gpm
CO	230.5	grams/test	CO	30.7	gpm
HC	10.45	grams/test	HC	1.39	gpm
NO_x	42.19	grams/test	NO_x	5.62	gpm

Urban Fuel Economy 18.03 MPG

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE B-17

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

1976 Chevrolet			
Veh. Chevette	Odometer Reading:	Date 8/29/79	
Vin: 1B6809Y118162	Finish 07055.0	Proj.# 1827-01	
Trans. Automatic	Start 07044.9	Run # 17	
Carbs. 1 bbls. 2	Miles/Kms --	Dev. None (Baseline)	
Eng. L-4 Disp. 98		Dyno RHP 9.4	@50 MPH
Idle RPM --	Timing --	Dyno Inertia 6.4	
Analyst D. Gulick	Driver S. Stranick	Calculator D. Gulick	

Dry Bulb Temp.	85.0	°F	Barometric Press.	746.88	mm Hg
Wet Bulb Temp.	77.0	°F	CVS Pump Press.	15.80	mm Hg
Relative Himidity	70	%	(P) Sample Press.	731.08	mm Hg
Specific Humidity	128	gr/lb	(T) Sample Temp.	573.4	°R
K_H	1.3317		(V) CVS Pump Disp.	.3105	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9172	Revs									
CO_2	1.07	%	CO_2	.04	%	CO_2	1.03	%	CO_2	581.4	gms
CO	1980.0	ppm	CO	10.0	ppm	CO	1885.6	ppm	CO	67.4	gms
HC	382.26	ppm_c	HC	8.53	ppm_c	HC	374.55	ppm_c	HC	6.63	gms
NO_x	35.5	ppm	NO_x	.0	ppm	NO_x	35.54	ppm	NO_x	2.78	gms
Cold Stabalized Mode WF = 1.0											
N	15668	Revs									
CO_2	.74	%	CO_2	.04	%	CO_2	.70	%	CO_2	1569.2	gms
CO	309.0	ppm	CO	14.0	ppm	CO	284.7	ppm	CO	40.4	gms
HC	51.56	ppm_c	HC	8.21	ppm_c	HC	43.82	ppm_c	HC	3.08	gms
NO_x	16.0	ppm	NO_x	.1	ppm	NO_x	15.97	ppm	NO_x	4.96	gms
Hot Transient Mode WF = .57											
N	9133	Revs									
CO_2	.99	%	CO_2	.04	%	CO_2	.95	%	CO_2	707.6	gms
CO	572.0	ppm	CO	10.0	ppm	CO	539.1	ppm	CO	25.4	gms
HC	100.94	ppm_c	HC	7.14	ppm_c	HC	94.36	ppm_c	HC	2.20	gms
NO_x	29.7	ppm	NO_x	.2	ppm	NO_x	29.57	ppm	NO_x	3.05	gms

Results:

CO_2	2858	grams/test	CO_2	381.1	gpm
CO	133.3	grams/test	CO	17.7	gpm
HC	11.92	grams/test	HC	1.58	gpm
NO_x	10.79	grams/test	NO_x	1.43	gpm

Urban Fuel Economy 21.41 MPG

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215–766-8861 TWX: 510-665-9344

TABLE B-18

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh.	1979 Chevrolet Chevette	Odometer Reading:		Date	8/31/79
Vin:	1B6809Y118162	Finish	07085.1	Proj.#	1827-01
Trans.	Automatic	Start	07074.3	Run #	18
Carbs.	1 bbls. 2	Miles/Kms	--	Dev.	Fuel-Max
Eng.	L-4 Disp. 98			Dyno RHP	9.4 @50 MPH
Idle RPM	--	Timing	--	Dyno Inertia	2500#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp.	75.0	°F	Barometric Press.	749.77	mm Hg
Wet Bulb Temp.	67.0	°F	CVS Pump Press.	15.80	mm Hg
Relative Himidity	66	%	(P) Sample Press.	733.97	mm Hg
Specific Humidity	87	gr/lb	(T) Sample Temp.	567.2	°R
K_H	1.0597		(V) CVS Pump Disp.	.3105	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9388	Revs									
CO_2	1.08	%	CO_2	.04	%	CO_2	1.04	%	CO_2	609.7	gms
CO	825.0	ppm	CO	11.0	ppm	CO	780.4	ppm	CO	28.9	gms
HC	238.85	ppm_c	HC	5.97	ppm_c	HC	233.40	ppm_c	HC	4.29	gms
NO_x	167.8	ppm	NO_x	.0	ppm	NO_x	167.80	ppm	NO_x	10.85	gms
Cold Stabalized Mode WF = 1.0											
N	15667	Revs									
CO_2	.72	%	CO_2	.04	%	CO_2	.68	%	CO_2	1547.0	gms
CO	265.0	ppm	CO	12.0	ppm	CO	244.5	ppm	CO	35.2	gms
HC	36.05	ppm_c	HC	3.46	ppm_c	HC	32.78	ppm_c	HC	2.34	gms
NO_x	67.8	ppm	NO_x	.0	ppm	NO_x	67.83	ppm	NO_x	17.02	gms
Hot Transient Mode WF = .57											
N	9127	Revs									
CO_2	.96	%	CO_2	.04	%	CO_2	.92	%	CO_2	694.9	gms
CO	254.0	ppm	CO	13.0	ppm	CO	232.1	ppm	CO	11.1	gms
HC	50.91	ppm_c	HC	3.28	ppm_c	HC	47.87	ppm_c	HC	1.13	gms
NO_x	131.0	ppm	NO_x	.0	ppm	NO_x	131.00	ppm	NO_x	10.91	gms

Results:						
	CO_2	2851	grams/test	CO_2	380.2	gpm
	CO	75.3	grams/test	CO	10.0	gpm
	HC	7.77	grams/test	HC	1.03	gpm
	NO_x	38.79	grams/test	NO_x	5.17	gpm

Urban Fuel Economy 22.20 MPG

Scott Environmental Technology Inc.

PLUMSTEADVILLE, PA. 18949 PHONE: 215–766-8861 TWX: 510-665-9344

TABLE B-11

EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE

Veh. 1979 Mercury Station Wagon	Odometer Reading:	Date 8/17/79	
Vin: 9Z74F649208	Finish 06787.2	Proj.# 1827-01	
Trans. Automatic	Start 06776.4	Run # 11	
Carbs. 1 bbls. 2	Miles/Kms -	Dev. Fuel-Max	
Eng. V-8 Displ. 302		Dyno RHP 14.0	@50 MPH
Idle RPM -	Timing -	Dyno Inertia 4500#	
Analyst D. Gulick	Driver S. Stranick	Calculator D. Gulick	

Dry Bulb Temp.	70.0	°F	Barometric Press.	754.49	mm Hg
Wet Bulb Temp.	58.0	°F	CVS Pump Press.	15.80	mm Hg
Relative Himidity	48	%	(P) Sample Press.	738.69	mm Hg
Specific Humidity	53	gr/lb	(T) Sample Temp.	565.5	°R
K_H	.9062		(V) CVS Pump Disp.	.3105	CFR

EXHAUST BAG ANALYSIS			DILUTION AIR ANALYSIS			CORRECTED EXH. CONCENTRATIONS			WEIGHTED MASS EMISSIONS		
Cold Transient Mode WF = .43											
N	9126	Revs									
CO_2	1.62	%	CO_2	.04	%	CO_2	1.58	%	CO_2	908.7	gms
CO	727.0	ppm	CO	10.0	ppm	CO	684.4	ppm	CO	24.9	gms
HC	176.21	ppm_c	HC	3.00	ppm_c	HC	173.59	ppm_c	HC	3.13	gms
NO_x	227.2	ppm	NO_x	.0	ppm	NO_x	227.25	ppm	NO_x	12.33	gms
Cold Stabalized Mode WF = 1.0											
N	15658	Revs									
CO_2	1.06	%	CO_2	.04	%	CO_2	1.02	%	CO_2	2340.7	gms
CO	27.0	ppm	CO	8.0	ppm	CO	18.7	ppm	CO	2.7	gms
HC	26.90	ppm_c	HC	3.36	ppm_c	HC	23.80	ppm_c	HC	1.71	gms
NO_x	133.4	ppm	NO_x	.0	ppm	NO_x	133.42	ppm	NO_x	28.89	gms
Hot Transient Mode WF = .57											
N	9114	Revs									
CO_2	1.45	%	CO_2	.04	%	CO_2	1.41	%	CO_2	1073.5	gms
CO	85.0	ppm	CO	9.0	ppm	CO	73.4	ppm	CO	3.5	gms
HC	44.39	ppm_c	HC	3.36	ppm_c	HC	41.39	ppm_c	HC	.98	gms
NO_x	286.5	ppm	NO_x	.5	ppm	NO_x	286.08	ppm	NO_x	20.55	gms

Results:						
	CO_2	4323	grams/test	CO_2	576.4	gpm
	CO	31.2	grams/test	CO	4.1	gpm
	HC	5.83	grams/test	HC	.77	gpm
	NO_x	61.78	grams/test	NO_x	8.23	gpm

Urban Fuel Economy 15.14 MPG

APPENDIX C

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE C-1

HIGHWAY FUEL ECONOMY
EXHAUST EMISSION DATA SHEET

Vehicle	1978 Lincoln Continental	Odometer:		Date	8/7/79
VIN	8Y82A881792	Finish	07533.3	Project	1827.01
License	NJ 845-I4J	Start	07523.2	Run	1
Trans.	Automatic	Miles	-	Device	Baseline
Carb.	1 bbls. 4	Idle rpm	-	Dyn. Load	14.7
Engine	V8 CID 460	BIT	-	Dyn. Inertia	5000#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	91	Barometric Press., mm Hg	749.27
Wet Bulb Temp., F	72	CVS Pump Press., mm Hg	15.80
Gr. Water/Lb. Dry Air	87	(P) Sample Press., mm Hg	733.47
(K) Factor	1.0598	(V) CVS Pump Disp., CFR	.3105
(T) Sample Temp., R	582.5	(N) CVS Pump Revolutions	13782

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	16.05				
ppm HC Air	3.93				
ppm HC exh.	12.12	526.10869	11.348×10^{-6}	0.07	HC
ppm CO exh.	53	526.10869	22.905×10^{-6}	0.64	CO
% CO_2 exh.	2.90	526.10869	36.022×10^{-2}	549.59	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	78.96				
(ppm NO_x) (K)	83.68	526.10869	37.628×10^{-6}	1.66	NO_x
MPG	16.11				

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TABLE C-3

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1978 Lincoln Continental	Odometer:		Date	8/8/79
VIN	8Y82A881792	Finish		Project	1827-01
License	NJ 845-I4J	Start	07548.0	Run	3
Trans.	Automatic	Miles	-	Device	Fuel-Max
Carb. 1	bbls. 4	Idle rpm	-	Dyn. Load	14.7
Engine V-8	CID 460	BIT	-	Dyn. Inertia	5000#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	93	Barometric Press., mm Hg	746.05
Wet Bulb Temp., F	68	CVS Pump Press., mm Hg	15.80
Gr. Water/Lb. Dry Air	69	(P) Sample Press., mm Hg	730.25
(K) Factor	0.9726	(V) CVS Pump Disp., CFR	.3105
(T) Sample Temp., R	579.0	(N) CVS Pump Revolutions	13646

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	17.10				
ppm HC Air	3.29				
ppm HC exh.	13.81	521.76528	11.348×10^{-6}	0.08	HC
ppm CO exh.	41	521.76528	22.905×10^{-6}	0.49	CO
% CO_2 exh.	2.75	521.76528	36.022×10^{-2}	516.86	CO_2
ppm NO					
ppm NO_2					
ppm NO_x	385.13				
(ppm NO_x) (K)	374.58	521.76528	37.628×10^{-6}	7.35	NO_x
MPG	17.14				

Scott Environmental Technology Inc.
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TABLE C-2

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1979 Oldsmobile Cutlass Salon	Odometer:		Date	8/7/79
VIN	3G09H9G427788	Finish	07977.3	Project	1827-01
License	PA 9S1-309	Start	07967.8	Run	2
Trans.	Automatic	Miles	-	Device	Baseline
Carb.	1 bbls. 4	Idle rpm	-	Dyn. Load	12.3
Engine	V-8 CID 305	BIT	-	Dyn. Inertia	3500
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	85	Barometric Press., mm Hg	749.70
Wet Bulb Temp., F	71	CVS Pump Press., mm Hg	15.80
Gr. Water/Lb. Dry Air	92	(P) Sample Press., mm Hg	733.90
(K) Factor	1.0868	(V) CVS Pump Disp., CFR	.3105
(T) Sample Temp., R	576.5	(N) CVS Pump Revolutions	13574

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	12.98				
ppm HC Air	3.95				
ppm HC exh.	9.03	523.86845	11.348×10^{-6}	0.05	HC
ppm CO exh.	190	523.86845	22.905×10^{-6}	2.28	CO
% CO_2 exh.	1.93	523.86845	36.022×10^{-2}	364.21	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	79.0				
(ppm NO_x) (K)	85.86	523.86845	37.628×10^{-6}	1.69	NO_x
MPG	24.12				

Scott Environmental Technology Inc.
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TABLE C-4

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1979 Oldsmobile Cutlass Salon	Odometer:		Date	8/9/79
VIN	3G09H0G427788	Finish	07999.0	Project	1827-01
License	PA 9S1-309	Start	07989.4	Run	4
Trans.	Automatic	Miles		Device	Fuel-Max
Carb.	1 bbls. 2	Idle rpm		Dyn. Load	12.3
Engine	CID	BIT		Dyn. Inertia	3500
Analyst		Driver		Calculator	

Dry Bulb Temp., F	76	Barometric Press., mm Hg	749.96
Wet Bulb Temp., F	64	CVS Pump Press., mm Hg	15.80
Gr. Water/Lb. Dry Air	70	(P) Sample Press., mm Hg	734.16
(K) Factor	0.9770	(V) CVS Pump Disp., CFR	.3105
(T) Sample Temp., R	573	(N) CVS Pump Revolutions	13765

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	14.76				
ppm HC Air	3.54				
ppm HC exh.	11.22	534.67409	11.348×10^{-6}	0.07	HC
ppm CO exh.	27		22.905×10^{-6}	0.33	CO
% CO_2 exh.	1.86		36.022×10^{-2}	358.24	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	209.92				
(ppm NO_x) (K)	205.09		37.628×10^{-6}	4.13	NO_x
MPG	24.72				

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TABLE C-5

HIGHWAY FUEL ECONOMY
EXHAUST EMISSION DATA SHEET

Vehicle	1977 Dodge Aspen Wagon	Odometer:		Date	~~8/13/79~~
VIN	NB45G7F252970	Finish	11418.7	Project	~~1827-01~~
License	NJ 660-HOY	Start	11409.8	Run	5
Trans.	Automatic	Miles	-	Device	~~Baseline~~
Carb.	1 bbls. 2	Idle rpm	-	Dyn. Load	13.2
Engine	V-8 CID 318	BIT	-	Dyn. Inertia	4000#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	87	Barometric Press., mm Hg	747.84
Wet Bulb Temp., F	68	CVS Pump Press., mm Hg	15.99
Gr. Water/Lb. Dry Air	72	(P) Sample Press., mm Hg	731.85
(K) Factor	0.9861	(V) CVS Pump Disp., CFR	.3103
(T) Sample Temp., R	575.2	(N) CVS Pump Revolutions	13792

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	69.11				
ppm HC Air	2.28				
ppm HC exh.	66.83	531.652	11.348×10^{-6}	0.40	HC
ppm CO exh.	286	531.652	22.905×10^{-6}	3.48	CO
% CO_2 exh.	2.09	531.652	36.022×10^{-2}	400.26	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	144.89				
(ppm NO_x) (K)	142.88	531.652	37.628×10^{-6}	2.86	NO_x
MPG	21.81				

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215–766-8861 TWX: 510-665-9344

TABLE C-6

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1977 Dodge Aspen Wagon	Odometer:		Date	8/14/79
VIN	NH45G7F252970	Finish	41442.2	Project	1827-01
License	NJ 660-HOY	Start	41432.1	Run	6
Trans.	Automatic	Miles	–	Device	Fuel-Max
Carb.	1 bbls. 2	Idle rpm	–	Dyn. Load	13.2
Engine	V-8 CID 318	BIT	–	Dyn. Inertia	4000#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	83	Barometric Press., mm Hg	746.60
Wet Bulb Temp., F	70	CVS Pump Press., mm Hg	15.99
Gr. Water/Lb. Dry Air	89	(P) Sample Press., mm Hg	730.61
(K) Factor	1.0704	(V) CVS Pump Disp., CFR	.3103
(T) Sample Temp., R	571	(N) CVS Pump Revolutions	13784

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	94.41				
ppm HC Air	5.19				
ppm HC exh.	89.22	534.34503	11.348×10^{-6}	0.54	HC
ppm CO exh.	546	534.34503	22.905×10^{-6}	6.68	CO
% CO_2 exh.	1.92	534.34503	36.022×10^{-2}	369.56	CO_2
ppm NO	–				
ppm NO_2	–				
ppm NO_x	224.85				
(ppm NO_x) (K)	240.68	534.34503	37.628×10^{-6}	4.84	NO_x
MPG	23.25				

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TABLE C-9

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1978 Oldsmobile Cutlass Cruiser	Odometer:		Date	8/15/79
VIN	3H35H8G404250	Finish	48615.0	Project	1827-01
License	NJ 415-HRA	Start	48605.3	Run	9
Trans.	Automatic	Miles	-	Device	Baseline
Carb.	1 bbls. 2	Idle rpm	-	Dyn. Load	12.3
Engine	V-8 CID 305	BIT	-	Dyn. Inertia	3500#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	70	Barometric Press., mm Hg	747.91
Wet Bulb Temp., F	59	CVS Pump Press., mm Hg	15.71
Gr. Water/Lb. Dry Air	57	(P) Sample Press., mm Hg	732.20
(K) Factor	0.9220	(V) CVS Pump Disp., CFR	.3105
(T) Sample Temp., R	567.5	(N) CVS Pump Revolutions	13792

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	39.93				
ppm HC Air	3.28				
ppm HC exh.	36.68	539.47077	11.348×10^{-6}	0.22	HC
ppm CO exh.	69		22.905×10^{-6}	0.85	CO
% CO_2 exh.	1.90		36.022×10^{-2}	369.22	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	67.33				
(ppm NO_x) (K)	62.08		37.628×10^{-6}	1.26	NO_x
MPG	23.91				

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TABLE C-10

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1978 Oldsmobile Cutlass Cruiser	Odometer:		Date	8/16/79
VIN	3H35H8G404250	Finish	48639.2	Project	1827-01
License	NJ 415-HRA	Start	48629.3	Run	10
Trans.	Automatic	Miles	-	Device	Fuel-Max
Carb.	1 bbls. 2	Idle rpm	-	Dyn. Load	12.3
Engine	V-8 CID 305	BIT	-	Dyn. Inertia	3500#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	73	Barometric Press., mm Hg	752.25
Wet Bulb Temp., F	59	CVS Pump Press., mm Hg	15.99
Gr. Water/Lb. Dry Air	52	(P) Sample Press., mm Hg	736.26
(K) Factor	0.9024	(V) CVS Pump Disp., CFR	.3105
(T) Sample Temp., R	571.5	(N) CVS Pump Revolutions	13793

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	40.13				
ppm HC Air	3.31				
ppm HC exh.	36.82	538.70441	11.348×10^{-6}	0.23	HC
ppm CO exh.	31		22.905×10^{-6}	0.38	CO
% CO_2 exh.	1.81		36.022×10^{-2}	351.23	CO_2
ppm NO					
ppm NO_2					
ppm NO_x	230.91				
(ppm NO_x) (K)	208.38		37.628×10^{-6}	4.22	NO_x
MPG	25.18				

Scott Environmental Technology Inc.

PLUMSTEADVILLE, PA. 18949 PHONE: 215–766-8861 TWX: 510-665-9344

TABLE C-7

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1979 Mercury Station Wagon	Odometer:		Date	8/15/79
VIN	9Z74F649208	Finish	06776.2	Project	1827-01
License	NJ 414-KHO	Start	06766.5	Run	7
Trans.	Automatic	Miles	-	Device	Baseline
Carb.	1 bbls. 2	Idle rpm	-	Dyn. Load	14.0
Engine	V-8 CID 302	BIT	-	Dyn. Inertia	4500#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	69	Barometric Press., mm Hg	748.16
Wet Bulb Temp., F	58	CVS Pump Press., mm Hg	15.99
Gr. Water/Lb. Dry Air	54	(P) Sample Press., mm Hg	732.17
(K) Factor	0.9102	(V) CVS Pump Disp., CFR	.3103
(T) Sample Temp., R	568	(N) CVS Pump Revolutions	13790

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	41.38				
ppm HC Air	2.63				
ppm HC exh.	38.75	548.43854	11.348×10^{-6}	0.24	HC
ppm CO exh.	56		22.905×10^{-6}	0.69	CO
% CO_2 exh.	2.08		36.022×10^{-2}	403.51	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	58.78				
(ppm NO_x) (K)	53.50		37.628×10^{-6}	1.08	NO_x
MPG	21.90				

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE C-11

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1979 Mercury Station Wagon	Odometer:		Date	8/17/79
VIN	9Z74F649208	Finish	06799.0	Project	1827-01
License	NJ 414-KHO	Start	06789.5	Run	11
Trans.	Automatic	Miles	-	Device	Fuel-Max
Carb.	1 bbls. 2	Idle rpm	-	Dyn. Load	14.0
Engine	V-8 CID 302	BIT	-	Dyn. Inertia	4500#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	76	Barometric Press., mm Hg	754.49
Wet Bulb Temp., F	60	CVS Pump Press., mm Hg	15.80
Gr. Water/Lb. Dry Air	52	(P) Sample Press., mm Hg	738.69
(K) Factor	0.9024	(V) CVS Pump Disp., CFR	.3105
(T) Sample Temp., R	573.5	(N) CVS Pump Revolutions	13720

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	34.63				
ppm HC Air	3.03				
ppm HC exh.	31.60	535.74696	11.348×10^{-6}	0.19	HC
ppm CO exh.	23		22.905×10^{-6}	0.28	CO
% CO_2 exh.	2.05		36.022×10^{-2}	395.62	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	98.71				
(ppm NO_x) (K)	89.08		37.628×10^{-6}		NO_x
MPG	22.37				

Maximum Temperature = 600°F

Scott Environmental Technology Inc.

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TABLE C-8

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1977 Mercury Monarch	Odometer:		Date	8/15/79
VIN	7W37F539757	Finish	31308.6	Project	1827-01
License	NJ 677-HPA	Start	31299.1	Run	8
Trans.	Automatic	Miles	-	Device	Baseline
Carb.	1 bbls. 2	Idle rpm	-	Dyn. Load	13.2
Engine	V-8 CID 302	BIT	-	Dyn. Inertia	4000
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	74	Barometric Press., mm Hg	747.96
Wet Bulb Temp., F	69	CVS Pump Press., mm Hg	15.99
Gr. Water/Lb. Dry Air	98	(P) Sample Press., mm Hg	731.97
(K) Factor	1.1212	(V) CVS Pump Disp., CFR	.3103
(T) Sample Temp., R	569	(N) CVS Pump Revolutions	13789

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	103.60				
ppm HC Air	3.29				
ppm HC exh.	100.31	537.41622	11.348×10^{-6}	0.61	HC
ppm CO exh.	756	537.41622	22.905×10^{-6}	9.31	CO
% CO_2 exh.	1.85	537.41622	36.022×10^{-2}	358.14	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	73.62				
(ppm NO_x) (K)	83.54	537.41622	37.628×10^{-6}	1.67	NO_x
MPG	23.69				

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TABLE C-12

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1977 Mercury Monarch	Odometer:		Date	8/21/79
VIN	7W37F539757	Finish	31363.8	Project	1827-01
License	NJ 677-HPA	Start	31354.0	Run	12
Trans.	Automatic	Miles	-	Device	Fuel-Max
Carb. 1 bbls. 1		Idle rpm	-	Dyn. Load	13.2
Engine V-8 CID 02		BIT	-	Dyn. Inertia	4000#
Analyst	D. Gulick	Driver	B. Markley	Calculator	D. Gulick

Dry Bulb Temp., F	70	Barometric Press., mm Hg	749.93
Wet Bulb Temp., F	67	CVS Pump Press., mm Hg	15.80
Gr. Water/Lb. Dry Air	95	(P) Sample Press., mm Hg	734.13
(K) Factor	1.1038	(V) CVS Pump Disp., CFR	.3105
(T) Sample Temp., R	573.5	(N) CVS Pump Revolutions	13802

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	48.94				
ppm HC Air	6.61				
ppm HC exh.	42.33	535.62196	11.348×10^{-6}	0.26	HC
ppm CO exh.	205		22.905×10^{-6}	2.52	CO
% CO_2 exh.	2.05		36.022×10^{-2}	395.53	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	435.15				
(ppm NO_x) (K)	480.32		37.628×10^{-6}	9.68	NO_x
MPG	22.17				

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TABLE C-13

HIGHWAY FUEL ECONOMY
EXHAUST EMISSION DATA SHEET

Vehicle	1979 Oldsmobile Cutlass Cruiser (Wgn)	Odometer:		Date	8/21/79
VIN	3G35H92434400	Finish	20916.6	Project	1827-01
License	NJ 952-JP1	Start	20906.8	Run	13
Trans.	Automatic	Miles	-	Device	Baseline
Carb.	1 bbls. 2	Idle rpm	-	Dyn. Load	13.2
Engine	V-8 CID 305	BIT	-	Dyn. Inertia	4000#
Analyst	D. Gulick	Driver	B. Markley	Calculator	D. Gulick

Dry Bulb Temp., F	80	Barometric Press., mm Hg	749.93
Wet Bulb Temp., F	69	CVS Pump Press., mm Hg	15.80
Gr. Water/Lb. Dry Air	89	(P) Sample Press., mm Hg	734.13
(K) Factor	1.0704	(V) CVS Pump Disp., CFR	.3105
(T) Sample Temp., R	570	(N) CVS Pump Revolutions	13779

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	52.44				
ppm HC Air	9.23				
ppm HC exh.	43.21	538.01281	11.348×10^{-6}	0.26	HC
ppm CO exh.	205	538.01281	22.905×10^{-6}	2.53	CO
% CO_2 exh.	2.14	538.01281	36.022×10^{-2}	414.74	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	52.56				
(ppm NO_x) (K)	56.26		37.628×10^{-6}		NO_x
MPG	21.15				

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TABLE C-15

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1979 Oldsmobile Cutlass Cruiser (Wagon)	Odometer:		Date	8/24/79
VIN	3G35H92434400	Finish	20940.0	Project	1827-01
License	NJ 952-JPI	Start	20931.2	Run	15
Trans.	Automatic	Miles	-	Device	Fuel-Max
Carb.	1 bbls. 2	Idle rpm	-	Dyn. Load	13.2
Engine	V-8 CID 305	BIT	-	Dyn. Inertia	4000#
Analyst	D. Gulick	Driver	B. Markley	Calculator	D. Gulick

Dry Bulb Temp., F	79	Barometric Press., mm Hg	748.74
Wet Bulb Temp., F	73	CVS Pump Press., mm Hg	15.80
Gr. Water/Lb. Dry Air	113	(P) Sample Press., mm Hg	732.94
(K) Factor	1.2174	(V) CVS Pump Disp., CFR	.3105
(T) Sample Temp., R	572.5	(N) CVS Pump Revolutions	13785

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	31.77				
ppm HC Air	9.83				
ppm HC exh.	21.94	535.02802	11.348×10^{-6}	0.13	HC
ppm CO exh.	31	535.02802	22.905×10^{-6}	0.38	CO
% CO_2 exh.	2.10	535.02802	36.022×10^{-2}	404.73	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	193.41				
(ppm NO_x) (K)		535.02802	37.628×10^{-6}	4.74	NO_x
MPG	21.87				

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TABLE C-14

HIGHWAY FUEL ECONOMY
EXHAUST EMISSION DATA SHEET

Vehicle	1979 Ford Pinto	Odometer:		Date	8/23/79
VIN	9T11Y158158	Finish	11278.6	Project	1827-01
License	NJ 392-KHL	Start	11268.4	Run	14
Trans.	Automatic	Miles	-	Device	Baseline
Carb.	1 bbls. 2	Idle rpm	-	Dyn. Load	19.4
Engine	4-cyl. CID 140	BIT	-	Dyn. Inertia	2500#
Analyst	D. Gulick	Driver	B. Markley	Calculator	D. Gulick

Dry Bulb Temp., F	75	Barometric Press., mm Hg	751.72
Wet Bulb Temp., F	68	CVS Pump Press., mm Hg	15.80
Gr. Water/Lb. Dry Air	91	(P) Sample Press., mm Hg	735.92
(K) Factor	1.0813	(V) CVS Pump Disp., CFR	.3105
(T) Sample Temp., R	572	(N) CVS Pump Revolutions	13786

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	24.20				
ppm HC Air	3.87				
ppm HC exh.	20.33	537.71193	11.348×10^{-6}	0.12	HC
ppm CO exh.	190	537.71193	22.905×10^{-6}	2.34	CO
% CO_2 exh.	1.57	537.71193	36.022×10^{-2}	304.10	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	90.54				
(ppm NO_x) (K)	97.90	537.71193	37.628×10^{-6}	1.98	NO_x
MPG	28.80				

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TABLE C-16

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1979 Ford Pinto	Odometer:		Date	8/27/79
VIN	9T11Y158158	Finish	11303.5	Project	1827-01
License	NJ 392-KHL	Start	11293.9	Run	16
Trans.	Automatic	Miles	-	Device	Fuel-Max
Carb.	1 bbls. 2	Idle rpm	-	Dyn. Load	9.4
Engine	4-cyl CID 140	BIT	-	Dyn. Inertia	2500#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	86	Barometric Press., mm Hg	747.17
Wet Bulb Temp., F	74	CVS Pump Press., mm Hg	15.61
Gr. Water/Lb. Dry Air	108	(P) Sample Press., mm Hg	731.56
(K) Factor	1.1836	(V) CVS Pump Disp., CFR	.3106
(T) Sample Temp., R	580	(N) CVS Pump Revolutions	13776

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	36.51				
ppm HC Air	7.11				
ppm HC exh.	29.41	526.9407	11.348×10^{-6}	0.18	HC
ppm CO exh.	279		22.905×10^{-6}	3.37	CO
% CO_2 exh.	1.60		36.022×10^{-2}	303.70	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	221.57				
(ppm NO_x) (K)	262.25		37.628×10^{-6}	5.20	NO_x
MPG	28.67				

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TABLE C-17

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1979 Chevrolet Chevette	Odometer:		Date	8/29/79
VIN	1B6809Y118162	Finish	07066.8	Project	1827.01
License	PA A53-258A	Start	07057.2	Run	17
Trans.	Automatic	Miles	--	Device	Baseline
Carb.	1 bbls. 2	Idle rpm	--	Dyn. Load	9.4
Engine	L-4 CID 98	BIT	--	Dyn. Inertia	2500#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	84	Barometric Press., mm Hg	746.88
Wet Bulb Temp., F	79	CVS Pump Press., mm Hg	15.80
Gr. Water/Lb. Dry Air	143	(P) Sample Press., mm Hg	731.08
(K) Factor	1.4697	(V) CVS Pump Disp., CFR	0.3105
(T) Sample Temp., R	573.2	(N) CVS Pump Revolutions	13782

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	44.83				
ppm HC Air	6.49				
ppm HC exh.	38.34	532.90252	11.348×10^{-6}	0.23	HC
ppm CO exh.	212	532.90252	22.905×10^{-6}	2.59	CO
% CO_2 exh.	1.40	532.90252	36.022×10^{-2}	268.75	CO_2
ppm NO	--				
ppm NO_2	--				
ppm NO_x	69.03				
(ppm NO_x) (K)	101.45	532.90252	37.628×10^{-6}	1.38	NO_x
MPG	32.45				

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TABLE C-18

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1979 Chevrolet Chevette	Odometer:		Date	8/31/79
VIN	1B6809Y118162	Finish	07097.7	Project	1827-01
License	PA A53-258A	Start	07088.1	Run	18
Trans.	Automatic	Miles	—	Device	Fuel-Max
Carb.	1 bbls. 2	Idle rpm	—	Dyn. Load	9.4
Engine	L-4 CID 98	BIT	—	Dyn. Inertia	2500#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	77	Barometric Press., mm Hg	749.77
Wet Bulb Temp., F	67	CVS Pump Press., mm Hg	15.80
Gr. Water/Lb. Dry Air	83	(P) Sample Press., mm Hg	733.97
(K) Factor	1.0391	(V) CVS Pump Disp., CFR	0.3105
(T) Sample Temp., R	571.4	(N) CVS Pump Revolutions	13793

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	19.90				
ppm HC Air	2.98				
ppm HC exh.	16.92	537.12284	11.348×10^{-6}	0.10	HC
ppm CO exh.	45	537.12284	22.905×10^{-6}	0.55	CO
% CO_2 exh.	1.36	537.12284	36.022×10^{-2}	263.14	CO_2
ppm NO	—				
ppm NO_2	—				
ppm NO_x	234.98				
(ppm NO_x) (K)	244.16	537.12284	37.628×10^{-6}	4.93	NO_x
MPG	33.58				

SET 1796 01 0379

FUEL-MAX

TECHNICAL REPORT

TWO EXHAUST EMISSION TESTS

1975 FEDERAL COLD-START

WITH URBAN & HIGHWAY

FUEL ECONOMY

Prepared For:

Mr. Mike Leshner
Fuel-Max Industries
110 Harding Ave.
Bellmawr, NJ 08031

March 27, 1979

SCOTT ENVIRONMENTAL TECHNOLOGY, INC.
Plumsteadville, Pennsylvania 18949

Scott Environmental Technology Inc.

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SET 1796 01 0379

1.0 INTRODUCTION

On March 14 and 15, 1979, Scott Environmental Technology, Inc. performed a series of exhaust emission tests on a late model automobile provided by Mr. Mike Leshner (Sponsor) of Fuel-Max Industries. These tests consisted of exhaust emission measurements of hydrocarbons (HC), carbon monoxide (CO), carbon dioxide (CO_2), and nitric oxides (NO_x) from which (with the exception of NO_x) urban and highway fuel economy were calculated. The primary objective of these tests was to determine the effectiveness of the Sponsor's device in improving fuel economy, and secondarily, in reducing exhaust emissions. This technical report describes the test vehicle, test procedures utilized, and the final results of the test performed.

SET 1796 01 0379

2.0 TEST VEHICLE DESCRIPTION

The exhaust emission tests were performed on a 1977 Chevrolet Caprice Classic (VIN: 1N6947S212474) equipped with a 305 cubic inch V-8 engine, 2-bbl. carburetor, and an automatic transmission. The vehicle was received in stock condition for the first emission test. The mileage prior to the initial test was 25528.4. The vehicle was registered in the state of Pennsylvania under license number 480-62Z. The first (baseline, vehicle in stock condition) test was performed as received, with no tune-up or adjustments made. Tables 1.0 and 2.0 describe the test vehicle used and include the chassis dynamometer inertia and road horsepower settings. Also shown is the data/time sequence for each test series performed.

3.0 DESCRIPTION OF DEVICE

The Sponsor's device, called Fuel-Max, consists of two parts: part one is a plate and tube arrangement that replaces the exhaust gas recirculation (EGR) valve, which is used to connect the control device to the intake manifold and close the exhaust port normally used by the EGR valve. Part two is the main control portion of the device which is simply a vacuum operated valve installed between part one and the carburetor. When the valve is activated, it allows fresh filtered air into part two, through part one and into the intake manifold of the vehicle. The purpose of the device is to allow fresh air rather than exhaust gases into the intake manifold of the vehicle, further leaning the air/fuel mixture at high engine vacuum operating conditions.

The control portion (#2) of the device has an adjustment knob graduated in increments of one to five (1-5) which allows it to be adjusted for nearly any operational vacuum desired. The settings required are dependent upon specific vacuum of a given engine, and can be adjusted for optimum performance of that engine. For this program, the control device was at the number two (2) increment setting.

SET 1796 01 0379

4.0 TEST PROCEDURE DESCRIPTION

Two 1975 Federal Cold Start exhaust emission tests were performed in accordance with Federal Register Volume 42, Number 124, "Control of Air Pollution from New Motor Vehicles and New Motor Vehicle Engines". Deviations from this procedure included the use of the vehicle's in-tank fuel supply and the elimination of the Evaporative Emission test sequence. Immediately following each "cold start" test, a 1976 Federal Highway Fuel Economy test was performed in accordance with Federal Register Volume 41, Number 218.

The initial minimum 12 hour "soak" period was begun at 1525 hours on March 13, 1979 with the first Baseline exhaust emission test starting at 0931 hours on March 14, 1979. Immediately following the exhaust emission test the Highway Fuel Economy test procedure was initiated.

Following this baseline test series, the Sponsor removed the vehicle's EGR valve and installed the Fuel-Max device. No adjustments to the test vehicle's engine parameters were made and the vehicle was again "soaked" for the prescribed time period. This soak period started at 1630 hours on March 14, 1979 and ended with the beginning of the second (device) cold start test series at 0928 hours on March 15, 1979.

Prior to the cold start tests, the chassis dynamometer was warmed up using a non-test vehicle. The inertia and power settings were 4000# and 13.2 road horsepower respectively.

5.0 TEST RESULTS

Exhaust emission concentrations as collected in the integrated bag samples, were calculated using appropriate instrument calibration factors. This "raw" concentration data was then converted to grams of pollutant per test mile (based on a 7.5 mile test) using the procedure outlined in the aforementioned Federal Register. This data, including all measured parameters used in the mass emission computations for the FTP, is included in Tables 3.0 and 5.0. Exhaust emissions collected during the Highway Fuel Economy tests were reduced in the same manner as described above, with mass emissions (grams per mile) based on a test of 10.242 miles. Tables 4.0 and 6.0 summarize the exhaust emission data for these tests.

Urban and Highway Fuel Economy for each test sequence was calculated using the procedure outlined in Federal Register Volume 41, Number 218, Part 600 "Fuel Economy of Motor Vehicles", November 10, 1976. The basic equation used to calculate the fuel economy of a vehicle, in miles per gallon, from the mass emission data is as follows:

$$\text{MPG} = \frac{\text{Grams of carbon/gallon of fuel}}{\text{Grams of carbon in exhaust/mile}}$$

The Urban and Highway fuel consumption rates for each test are included at the bottom of Tables 3.0 through 6.0.

The data presented in Table 7.0 summarizes the vehicle exhaust emission and fuel economy tests performed. The exhaust emissions are presented in grams per mile (GPM) for total hydrocarbons (HC), carbon monoxide (CO) and oxides of nitrogen (NO_x). Fuel economy measurements are shown in miles per gallon (MPG).

6.0 DISCUSSION

The data in Summary Table 7.0 show that the Fuel-Max improved the fuel economy for the Urban and Highway tests by 12.45% and 33.3% respectively as compared to the baseline tests. At the same time there was a small decrease in CO, a small increase in HC and a substantial increase in NO_x emissions.

The tests described in this report indicate that the device produced improved fuel economy from the test vehicle. However, great care must be taken in interpreting results obtained from any tests involving a single vehicle. The data cannot be extrapolated to estimate the effects of the device on other vehicles or on the overall vehicle population. Valid conclusions regarding the general effectiveness of this device cannot be rendered until additional tests on representative vehicles are performed.

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TABLE 1.0

VEHICLE INFORMATION

Make: Chevrolet Model: Caprice Classic Year: 1977

Engine Serial No. - Chassis Serial No. 1N69U7S 212474

Transmission Automatic

Odometer 25528.4

Engine Disp. 305

Idle RPM 500

Fuel System 1 - 2 bbl

Tank Capacity -

Tank Location Rear

Curb Weight 3838#

Drive Wheel Tire Press. 34.5 psi

Device Baseline - no device

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 4000#

Road Horsepower @ 50 MPH

Actual 13.2

Indicated 9.8

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE: Test No. 1 Project No. 1796:01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	3/13/79	1525		0931	
Fuel Transfer:					
Heat Build:					
CVS Test:	3/14/79	0931	25528.4	1012	25539.0
Hot Soak:					
Highway Fuel Economy:	3/14/79	1018	25540.0	1031	25549.8

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TABLE 2.0

VEHICLE INFORMATION

Make: Chevrolet Model: Caprice Classic Year: 1977

Engine Serial No. - Chassis Serial No. 1N69U75212474

Transmission Automatic

Odometer 25549.8

Engine Disp. 305

Idle RPM 550

Fuel System 1 - 2 bbl

Tank Capacity -

Tank Location Rear

Curb Weight 3838#

Drive Wheel Tire Press. 34.5 psi

Device Fuel-Max

DYNAMOMETER INFORMATION

Serial No. Clayton 1289P

Inertia 4000#

Road Horsepower @ 50 MPH

Actual 13.2

Indicated 9.8

CARBON TRAP INFORMATION

Serial No. -

Final Wt. (g) -

Initial Wt. (g) -

Net Wt. (g) -

TEST SEQUENCE:

Test No. 2 Project No. 1796:01

	Date	Start Time	Odometer Start	End Time	Odometer End
Road Precondition:					
Dyno Precondition:					
Cold Soak:	3/14/79	1630		0928	
Fuel Transfer:					
Heat Build:					
CVS Test:	3/15/79	0928	25549.8	1008	25560.4
Hot Soak:					
Highway Fuel Economy:	3/15/79	1015	25565.0	1028	25574.8

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EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE
TABLE 3.0

Veh. 1977 Chevrolet Caprice Classic	Odometer Reading:	Date 3/14/79
Vin: 1N69475212474	Finish 25539.0	Proj. 1796-01
Trans. Automatic	Start 25528.4	Run No. 1
Carbs. 1 bbls. 2	Miles -	Dev. none (Baseline)
Eng. V8 CID: 305		Dyno RHP 13.2 @ 50 MPH
Idle RPM 500 (D)	Timing 11^{o} BTDC	Dyno Inertia 4000#
Analyst D. Gulick	Driver S. Stranick	Calculator D. Gulick

Dry Bulb Temp.	79.0 °F		Barometric Press.	738.71 mm Hg
Wet Bulb Temp.	61.0 °F		CVS Pump Press.	14.96 mm Hg
Relative Humidity	34 %		(P) Sample Press.	723.75 mm Hg
Specific Humidity	51 gr/lb		(T) Sample Temp.	577.0 °R
K_H	.8986		(V) CVS Pump Disp.	.3110 CFR

EXHAUST BAG ANALYSIS		DILUTION AIR ANALYSIS		CORRECTED EXH. CONCENTRATIONS		WEIGHTED MASS EMISSIONS	
Cold Transient Mode WF = .43							
N	9141 Revs						
CO_2	1.88%	CO_2	.04 %	CO_2	1.84 %	CO_2	1019.7 gms
CO	1960.0 ppm	CO	12.0 ppm	CO	1857.5 ppm	CO	65.2 gms
HC	222.54 ppm_c	HC	15.51 ppm_c	HC	209.44 ppm_c	HC	3.64 gms
NO_x	42.7 ppm	NO_x	.0 ppm	NO_x	42.70 ppm	NO_x	2.21 gms
Cold Stabilized Mode WF = 1.0							
N	15705 Revs						
CO_2	1.35%	CO_2	.04 %	CO_2	1.31 %	CO_2	2900.2 gms
CO	508.0 ppm	CO	8.0 ppm	CO	482.1 ppm	CO	67.6 gms
HC	56.36 ppm_c	HC	13.08 ppm_c	HC	44.65 ppm_c	HC	3.10 gms
NO_x	17.8 ppm	NO_x	.2 ppm	NO_x	17.69 ppm	NO_x	3.66 gms
Hot Transient Mode WF = .57							
N	9162 Revs						
CO_2	1.81%	CO_2	.04 %	CO_2	1.77 %	CO_2	1303.0 gms
CO	871.0 ppm	CO	10.0 ppm	CO	822.6 ppm	CO	38.3 gms
HC	138.43 ppm_c	HC	11.67 ppm_c	HC	128.42 ppm_c	HC	2.96 gms
NO_x	31.8 ppm	NO_x	.3 ppm	NO_x	31.55 ppm	NO_x	2.17 gms

Results:

CO_2	5223 grams/test	CO_2	696.4 gpm
CO	171.2 grams/test	CO	22.8 gpm
HC	9.71 grams/test	HC	1.29 gpm
NO_x	8.05 grams/test	NO_x	1.07 gpm
		Urban Fuel Economy	12.04 MPG

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TABLE 4.0

EXHAUST EMISSION DATA SHEET

Vehicle	1977 Chevrolet Caprice Classic	Odometer:		Date	3/14/79
VIN	1N69U7S212474	Finish	25549.8	Project	1796:01
License	480-62Z PA	Start	25540.0	Run	1
Trans.	Automatic	Miles	-	Device	none
Carb.	1 bbls. 2	Idle rpm	500 (D)	Dyn. Load	13.2 @ 50 mph
Engine	V8 CID 305	BIT	11° BTDC	Dyn. Inertia	4000
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	82	Barometric Press., mm Hg	738.71
Wet Bulb Temp., F	62	CVS Pump Press., mm Hg	14.96
Gr. Water/Lb. Dry Air	53	(P) Sample Press., mm Hg	723.75
(K) Factor	.9063	(V) CVS Pump Disp., CFR	.3110
(T) Sample Temp., R	577.5	(N) CVS Pump Revolutions	13307

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/T	FACTOR	GRAMS/MILE	
ppm HC dil.	199.98				
ppm HC Air	10.23				
ppm HC exh.	189.75	525.42595	1.513×10^{-6}	1.13	HC
ppm CO exh.	3263	525.42595	3.054×10^{-6}	39.26	CO
% CO_2 exh.	2.55	525.42595	4.803×10^{-2}	482.64	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	39.08				
(ppm NO_x) (K)	35.42	525.42595	5.017×10^{-6}	0.70	NO_x
MPG	16.18				

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EXHAUST EMISSION DATA SHEET 1975 FEDERAL TEST PROCEDURE
TABLE 5.0

Veh.	1977 Chevrolet Caprice Classic	Odometer Reading:		Date	3/15/79
Vin:	1N 69U7S212474	Finish	25560.4	Proj.	1796:01
Trans.	Automatic	Start	25549.8	Run No.	2
Carbs.	1 bbls. 2	Miles		Dev.	Fuel-Max
Eng.	V8 CID: 305			Dyno IHP	13.2 @ 50 MPH
Idle RPM	550	Timing	11° BTDC	Dyno Inertia	4000
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp.	76.0 °F		Barometric Press.	751.50 mm Hg
Wet Bulb Temp.	51.0 °F		CVS Pump Press.	15.43 mm Hg
Relative Humidity	11 %		(P) Sample Press.	736.07 mm Hg
Specific Humidity	16 gr/lb		(T) Sample Temp.	563.0 °R
K_H	.7829		(V) CVS Pump Disp.	.3107 CFR

EXHAUST BAG ANALYSIS		DILUTION AIR ANALYSIS		CORRECTED EXH. CONCENTRATIONS		WEIGHTED MASS EMISSIONS	
Cold Transient Mode WF = .43							
N	9138 Revs						
CO_2	1.92 %	CO_2	.04 %	CO_2	1.88 %	CO_2	1084.6 gms
CO	2054.0 ppm	CO	9.0 ppm	CO	1963.2 ppm	CO	71.7 gms
HC	254.64 ppm_c	HC	3.36 ppm_c	HC	251.81 ppm_c	HC	4.55 gms
NO_x	132.6 ppm	NO_x	.0 ppm	NO_x	132.60 ppm	NO_x	6.23 gms
Cold Stabilized Mode WF = 1.0							
N	15674 Revs						
CO_2	1.08 %	CO_2	.04 %	CO_2	1.04 %	CO_2	2392.9 gms
CO	400.0 ppm	CO	10.0 ppm	CO	381.1 ppm	CO	55.5 gms
HC	69.45 ppm_c	HC	5.37 ppm_c	HC	64.53 ppm_c	HC	4.66 gms
NO_x	49.9 ppm	NO_x	.0 ppm	NO_x	49.93 ppm	NO_x	9.36 gms
Hot Transient Mode WF = .57							
N	9143 Revs						
CO_2	1.58 %	CO_2	.04 %	CO_2	1.54 %	CO_2	1178.0 gms
CO	288.0 ppm	CO	10.0 ppm	CO	269.4 ppm	CO	13.0 gms
HC	73.81 ppm_c	HC	7.38 ppm_c	HC	67.31 ppm_c	HC	1.61 gms
NO_x	139.1 ppm	NO_x	.4 ppm	NO_x	138.76 ppm	NO_x	8.65 gms

Results:

CO_2	4655 grams/test	CO_2	620.7 gpm
CO	140.4 grams/test	CO	18.7 gpm
HC	10.83 grams/test	HC	1.44 gpm
NO_x	24.25 grams/test	NO_x	3.23 gpm
		Urban Fuel Economy	13.54 MPG

Scott Environmental Technology Inc.
PLUMSTEADVILLE, PA. 18949 PHONE: 215-766-8861 TWX: 510-665-9344

TABLE 6.0

HIGHWAY FUEL ECONOMY

EXHAUST EMISSION DATA SHEET

Vehicle	1977 Chevrolet Caprice Classic	Odometer:		Date	3/15/79
VIN	1N69U75212474	Finish	25574.8	Project	1796:01
License	480-62Z PA	Start	25565.0	Run	2
Trans.	Automatic	Miles	--	Device	Fuel-Max
Carb. 1	bbls. 2	Idle rpm	550	Dyn. Load	13.2 RHP @ 50 MPH
Engine V8	CID 305	BIT	10° BTDC	Dyn. Inertia	4000#
Analyst	D. Gulick	Driver	S. Stranick	Calculator	D. Gulick

Dry Bulb Temp., F	82	Barometric Press., mm Hg	751.5
Wet Bulb Temp., F	54	CVS Pump Press., mm Hg	15.43
Gr. Water/Lb. Dry Air	18	(P) Sample Press., mm Hg	736.07
(K) Factor	.7887	(V) CVS Pump Disp., CFR	.3107
(T) Sample Temp., R	575.5	(N) CVS Pump Revolutions	13801

DILUTE EXHAUST MEASUREMENTS

COMPONENT		PVN/TM	FACTOR	GRAMS/MILE	
ppm HC dil.	56.59				
ppm HC Air	7.46				
ppm HC exh.	49.13	535.47696	11.348×10^{-6}	0.30	HC
ppm CO exh.	468	535.47696	22.905×10^{-6}	5.74	CO
% CO_2 exh.	2.08	535.47696	36.022×10^{-2}	401.21	CO_2
ppm NO	-				
ppm NO_2	-				
ppm NO_x	195.72				
(ppm NO_x) (K)	154.36	535.47696	37.628×10^{-6}	3.11	NO_x
MPG	21.57				

TABLE 7.0

SUMMARY OF TEST RESULTS

Test No.	Test Type	HC (GPM)	CO (GPM)	NO (GPM)*	Fuel Economy Urban	(MPG) Highway
1	Baseline (no device)	1.29	22.8	1.07	12.04	16.18
2	Device (Fuel-Max)	1.44	18.7	3.23	13.54	21.57

SAME ART WORK AS
BOX TOP

INSTALL IT YOURSELF

o ____

o ____

o ____

FITS - APPLICATIONS

G.M.	ALL CARS LIGHT TRUCKS & VANS EXCEPT DIESEL	1973 - 1979
FORD	ALL CARS LIGHT TRUCKS & VANS EXCEPT DIESEL	1973-1979
CHRYSLER	ALL CARS & VANS EXCEPT V-8 ENGINES	1973-1979

FEDERAL EPA REGULATIONS PERMIT THE VEHICLE OWNER TO INSTALL FUEL MAX ON 1973 - 1979 GASOLINE POWERED VEHICLES

TEST RESULTS PER FEDERAL REG. VOL 42 TEST 124 AND [illegible] VOL 41 TEST 218 (1975 FEDERAL, EPA, EMISSIONS TEST WITH URBAN AND HIGHWAY FUEL ECONOMY PERFOR

PART No. FM-1

FUEL INJECTION DEVELOPMENT CORP
110 HARDING AVE.
BELLMAWR, N. J. [illegible]30

I F.

FIG 3

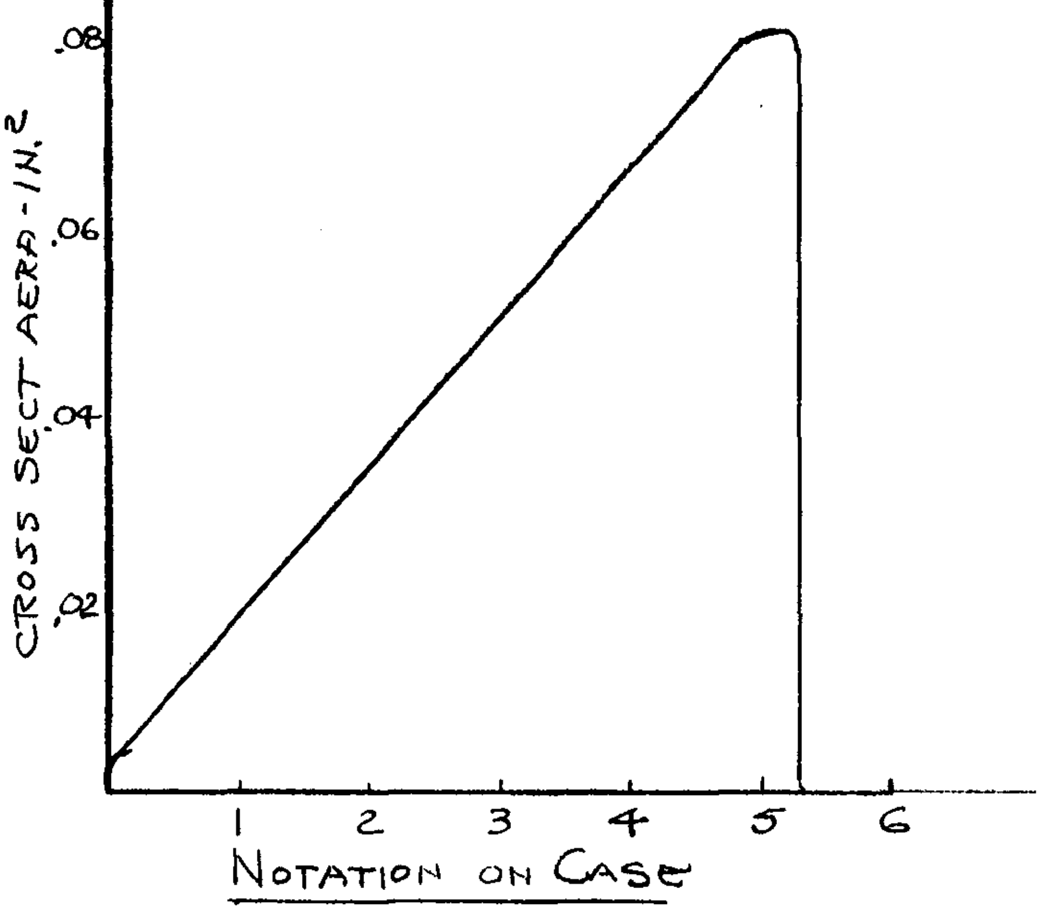
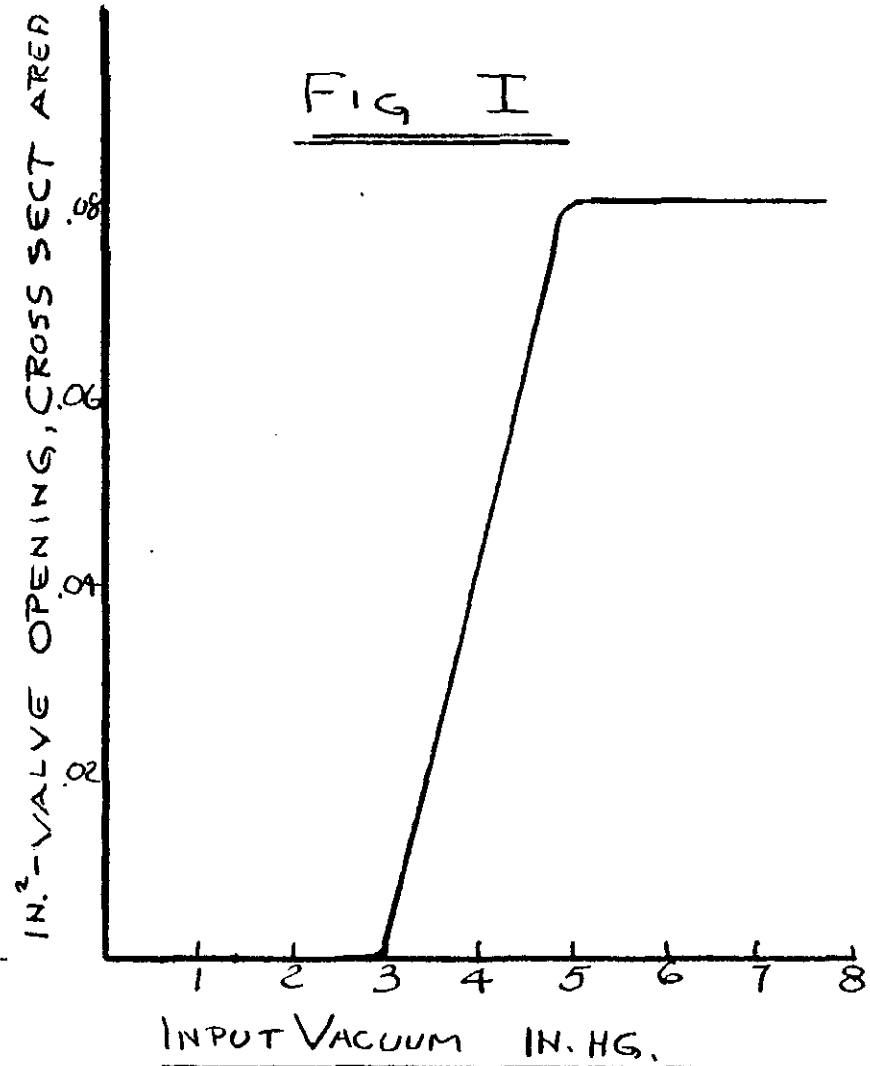


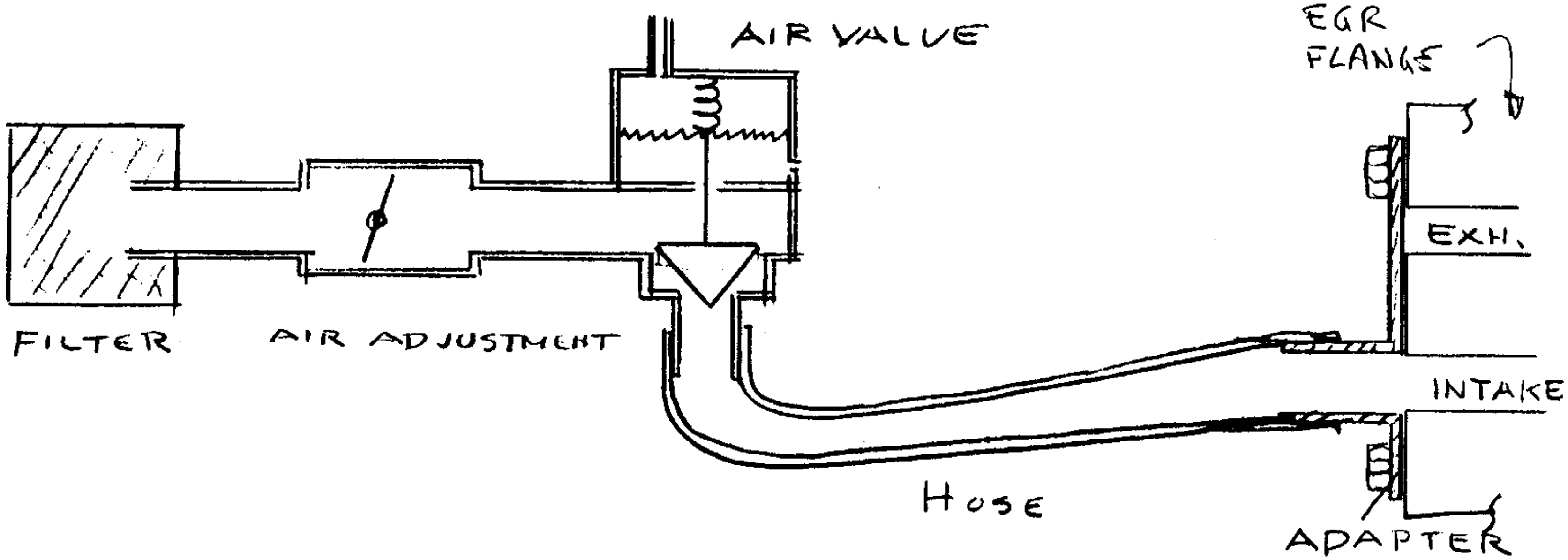
FIG I



116

FUEL INJECTION DEVELOPMENT CORP.		
THIS DRAWING IS THE PROPERTY OF FUEL INJECTION DEVELOPMENT CORP. AND SHALL NOT BE REPRODUCED OR DISCLOSED TO OTHERS EXCEPT BY PRIOR WRITTEN PERMISSION OF FUEL INJECTION DEVELOPMENT CORP.	TITLE Fig. 1 - Fig 3 (EPA Test Results)	
	SCALE	DWG. No. Fuel Mix 6M 123
	DRAWN BY E.L	DATE 1-8-80 REV.

Attachment D



117

FUEL INJECTION DEVELOPMENT CORP.

TITLE Schematic
Fuel Max
EPA Test Submission

SCALE ~

DRAWN BY EL

DWG. No. Fuel Max

DATE 1-16-80 REV.

Test Plan/Testing Agreement - EPA Testing of Fuel Max

Testing will be initiated after the Test Plan and Testing Agreement have been signed by the applicant.

Test Plan

The following is the test procedure plan which will be used by the EPA in collecting data on the fuel economy and emission effects of Fuel Max (a retrofit device) under Section 511 of the Energy Policy and Conservation Act.

1. A minimum of three representative vehicles will be identified and obtained by the EPA. Representativeness will be based upon the appliciability of Fuel Max as detailed in the application; i.e. 1979 year or older, domestic, gasoline fueled, non three-way catalyst, 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. Baseline Tests - Duplicate valid Federal Test Procedure (FTP) and Highway Fuel Economy Test (HFET) procedures will be performed on each test vehicle. Basic vehicle driveability will be observed.

4. Fuel Max will be installed on each vehicle in accordance with the installation instructions provided with the application. The installations will be performed by EPA personnel with the applicant's representative observing. The vehicles may be checked, as necessary, for correct operation prior to initiation of the device tests.

5. Device Tests - The testing sequence performed for the baseline tests will be repeated.

Test Agreement

The following constitutes the agreement which must be signed prior to the initiation of testing of "Fuel Max" by the EPA. It is agreed:

1. That the applicant concurs with the test plan as specified above, and that the applicant will be notified if there is need for changes to the test plan.

2. That the applicant will be provided a copy of the test scheduled and that up to two representatives of the applicant are welcome to be on site at the EPA laboratory to observe the vehicle check-out, device installation, and dynamometer testing.

3. That a copy of the data collected will be provided to the applicant after all testing has been completed and the EPA test report is written.

4. That the test data and results from the evaluation will not be released by the applicant prior to the official release by the EPA at the completion of the entire evaluation.

5. That Merrill Korth will be the official EPA point of contact during the evaluation, and Peter Hutchins will be in charge of the Fuel Max evaluation.

6. That the fact that the EPA is testing Fuel Max shall not be publicized during the evaluation process.

7. That the following persons shall be the official contacts for the applicant:

	All non-technical issues	All technical issues
Name	SAME	M. LESHNER
Title		CHIEF ENGINEER
Street		110 HARDING AV
City		BELLMAWR NJ 08031
Phone		609 931 3168

Signed: Michael D. Leshner Date 2 FEB 81
For

... INJECTION DEVELOPMENT CO...
110 HARDING AVENUE
...LLMAWR, N. J. 08030 609-931-3...

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ANN ARBOR MICHIGAN 48105

OFFICE OF
AIR, NOISE AND RADIATION

January 23, 1981

Mr. Michael D. Leshner, Chief Engineer
FIDCO Fuel Injection Development Corporation
110 Harding Avenue
Bellmaur, NJ 08030

Dear Mr. Leshner:

Enclosed for your review is the test plan which we have developed for evaluation of the "Fuel-Max" device. The work will begin as soon as feasible, after we receive your concurrence and three devices for our test vehicles. Other than these three devices, there will be no cost to you or your company. The testing should require a total of six to eight weeks to complete. Another two to four weeks should be allowed for us to evaluate the results and to prepare the technical report. Although EPA does not "approve" devices under Section 511, you will receive official notification of our findings and a synopsis of the test results will be published in the Federal Register.

All testing is to be performed at the EPA's Motor Vehicle Emission Laboratory in Ann Arbor. A minimum of three late-model passenger cars will be tested in a baseline condition (set to manufacturer's tune-up specifications), and after the Fuel-Max has been installed.

The tests to be performed in each of these configurations are the Federal Test Procedure and the Highway Fuel Economy Test. These tests are the ones which result in the published values for city and highway fuel economies. Each of these tests will be performed at least two times at each test point to increase the confidence in the results. You should find the remainder of our test procedure to be described in sufficient detail in the enclosed test plan.

If you concur that the results of testing conducted in accordance with this test plan will accurately reflect the effectiveness of your device, please sign the agreement portion and return the document to me. You will be notified of the testing schedule as soon as possible. You should also be aware that the EPA reserves the right to conduct any additional testing which may be necessary to resolve questions arising from the basic test program. This is required of us by the regulations under 40 CFR 610.

Peter Hutchins will oversee the EPA evaluation of the Fuel-Max. If you have any questions or require further information before returning the agreement form, please contact me at (313) 668-4299.

Sincerely,

Merrill W. Korth
Senior Project Manager
Test and Evaluation Branch

Enclosures

cc: P. Hutchins
T. Penninga
511 File, "Fuel-Max"

Attachment G

FDCO Fuel Injection Development Corporation

2 February 1981

Mr. Merrill W. Korth
Senior Project Manager
Test and Evaluation Branch
U.S. Environmental Protection Agency
Ann Arbor, Michigan 48105

Dear Mr. Korth,

I have enclosed the Test Plan/Testing Agreement for EPA testing of FUEL-MAX. The plan is approved as written.

Three FUEL-MAX kits will be shipped to your attention under seperate cover. Please notify me when the tests have been scheduled. I look forward to meeting you at that time.

Best regards,

Michael D. Leshner

Michael D. Leshner

110 Harding Avenue • Bellmawr, N.J. 08030 • 609/931-3168

Attachment H

EPA-AA-TEB-81-15

Emissions and Fuel Economy of FUEL-MAX, a Retrofit Device

F. Peter Hutchins
John T. White

May, 1981

Test and Evaluation Branch
Emission Control Technology Division
Office of Mobile Source Air Pollution Control
Environmental Protection Agency

Abstract

This report describes the results of testing the "FUEL-MAX" device as part of an evaluation under Section 511 of the Motor Vehicle Information and Cost Savings Act. The FUEL-MAX is an air-bleed device which replaces a vehicle's Exhaust Gas Recirculation (EGR) valve. The amount of air bled into the intake manifold is determined by the vacuum signal which once controlled the action of the EGR valve. This device is claimed to conserve fuel. The primary purpose of this project was to evaluate the effect of the FUEL-MAX on exhaust emissions and fuel economy.

Testing of three typical 1979 model year passenger cars was conducted during March, 1981. The basic test sequence included the Federal Test Procedure (FTP) and the Highway Fuel Economy Test (HFET). These tests were performed both before and after installation of the FUEL-MAX. As a result of the testing, average hydrocarbon and carbon monoxide emissions decreased somewhat while oxides of nitrogen displayed substantial increases. Fuel economy was found to increase approximately three percent on the FTP but exhibited no change over the HFET. The occurrence of engine knock was obvious on two of three vehicles. EPA's Office of Enforcement has determined that the FUEL-MAX can violate the anti-tampering provisions of the Clean Air Act.

Background

Section 511 of the Motor Vehicle Cost Savings and Information Act empowers the Environmental Protection Agency (EPA) to evaluate devices or fuel additives which may improve the fuel economy of conventional motor vehicles. The EPA has developed and instituted a procedure whereby an individual or organization may apply for an evaluation of the device or fuel additive. This procedure requires the applicant to submit a technical description of the system in conjunction with results from actual testing. Once a complete application is received, the EPA will conduct an engineering evaluation and publish the results in the Federal Register. In those cases where the device or additive shows promise, the EPA will conduct tests as a part of its evaluation. Such testing is performed at EPA's Motor Vehicle Emission Laboratory in Ann Arbor.

In February, 1980, EPA received an application from Fuel Injection Development Corporation for an evaluation of the FUEL-MAX. This device is an air-bleed mechanism which replaces the Exhaust Gas Recirculation (EGR) valve. The amount of air bled into the intake manifold is determined by the vacuum signal which once controlled the action of the EGR valve.

Based on an evaluation of the test results submitted to support the claims for the FUEL-MAX, EPA chose to conduct confirmatory testing. The basic purpose of the testing was to determine the effect of the device on fuel economy and exhaust emissions. Secondary purposes included an evaluation of the installation instructions and driveability factors.

Test Vehicles

Three typical 1979 production vehicles were used: a Ford Pinto with a 4-cylinder engine, an Oldsmobile Cutlass with a 6 cylinder engine, and a Mercury Zephyr with an 8 cylinder engine. All vehicles were equipped with automatic transmissions. A more detailed description of each vehicle is provided in Appendix A.

Test Fuel

Commercial, unleaded regular fuel was used in the testing of the FUEL-MAX. A single batch of the fuel was purchased and stored at the EPA. The motor octane number was 83 while the research octane number was 91. The decision to use a commercial fuel was based upon the knock sensitivity of some engines to EGR deactivation. The Indolene fuel used in EPA testing has a higher octane rating than typical commercial unleaded gasoline. Thus, use of commercial fuel was appropriate for this evaluation where the possibility of increased knock was probable.

Type of Tests

Exhaust emission tests were conducted according to the 1977 Federal Test Procedure (FTP) described in the Federal Register of June 28, 1977, and the EPA Highway Fuel Economy Test (HFET) described in the Federal Register of September 10, 1976. The vehicles were not tested for evaporative emissions.

Other tests were also conducted as an additional aspect of this evaluation. These tests consisted of hot start LA-4 cycles. The LA-4 driving cycle is the basic FTP driving cycle. The results of these hot start LA-4 tests are generally similar to bags 2 and 3 of the FTP.

Device Installation

Installation of the FUEL-MAX on the test vehicles was performed in accordance with the device installation instructions. Following installation, a dial on the FUEL-MAX was set for the size of the engine as specified in the instructions; i.e., set at 1.4 for the Pinto (140 CID), 2.3 for the Cutlass (231 CID), and 3.0 for the Zephyr (302 CID).

The following problems were experienced during the installations:

1. On the Pinto, the installation instructions call for the EGR valve to be disconnected from the intake manifold, but to be left connected to the exhaust gas transfer pipe so as to close the end of the transfer pipe. On the test vehicle, the EGR valve and the exhaust gas transfer pipe had to be removed because the configuration of the EGR valve was different than that shown in the installation instructions and an exhaust leak occurred.

2. On the Zephyr, the FUEL-MAX caused an exhaust leak at the manifold where the EGR valve is normally installed. A sealing plate and additional gaskets had to be employed to prevent this underhood exhaust leak.

Vehicle Test Configurations

Baseline testing was performed after each vehicle was set to the vehicle manufacturer's tune-up specifications. The second test configuration was with the FUEL-MAX installed in accordance with the installation instructions. A third configuration was employed in testing the Pinto. In this configuration (along with the FUEL-MAX), the ignition was retarded by 5° from specifications. This was done to correct the heavy knock which had been exhibited in the road evaluation.

Test Results

The vehicles were tested during March of 1981. All tests were performed by EPA at its Motor Vehicle Emission Laboratory in Ann Arbor. Table 1 summarizes the results of this testing. Emission levels are listed in grams/mile while fuel economy is shown in miles per gallon. The results of the individual tests on each vehicle are presented in Appendices B, C, and D.

Table 1
Summary of Test Results

		FTP				HFET			
Vehicle	Configuration	HC	CO	NOx	MPG	HC	CO	NOx	MPG
Ford Pinto	Baseline	2.08	26.0	1.35	21.5	.76	5.2	2.38	29.0
	FUEL-MAX	1.58	18.6	6.03	22.4	.61	2.8	6.83	29.3
	Average Change	-24%	-28%	+350%	+4.2%	-20%	-46%	+190%	+1.0%
Oldsmobile Cutlass	Baseline	1.89	21.0	1.55	18.2	.40	4.7	1.56	26.4
	FUEL-MAX	1.46	19.4	7.44	18.5	.23	1.6	8.72	26.4
	Average Change	-23%	-8.0%	+380%	+1.6%	-43%	-66%	+460%	-0-
Mercury Zephyr	Baseline	2.47	25.5	0.67	15.2	.89	2.7	1.17	22.9
	FUEL-MAX	2.08	14.2	7.17	15.7	.83	1.2	9.03	22.8
	Average Change	-16%	-44%	+970%	+3.3%	-7.0%	-5.6%	+670%	-0.4%
Overall Fleet	Baseline	2.15	24.2	1.19	17.9	.68	4.2	1.70	25.8
	FUEL-MAX	1.71	17.4	6.88	18.5	.56	1.8	8.19	25.9
	Average Change	-20%	-28%	+480%	+3.4%	-18%	-57%	+380%	+0.4%

The Pinto exhibited heavy knock during the road evaluation. In this case, the basic timing was retarded 5° and the vehicle was retested. The results are shown in Table 2 below:

Table 2
Summary of Test Results on Pinto with Retarded Timing

		FTP				HFET			
Vehicle	Configuration	HC	CO	NOx	MPG	HC	CO	NOx	MPG
Ford Pinto	Baseline	2.08	26.0	1.35	21.5	.76	5.2	2.38	29.0
	FUEL-MAX	1.58	18.6	6.03	22.4	.61	2.8	6.83	29.3
	FUEL-MAX (-5°)	1.20	18.3	4.46	22.2	.50	2.0	5.24	29.8
	Average Change (from baseline)	-42%	-30%	+230%	+3.3%	-34%	-62%	+120%	+2.8%

On-Road Evaluations and Observations

Pinto: With FUEL-MAX installed, the vehicle exhibited the following knock characteristics;

a) Cold engine, light acceleration - moderate knock
b) Heavy knock on light accelerations or while maintaining speed on a minor grade
c) Under wide-open throttle accelerations to 55 mph, knock did not occur
d) Idle quality was poor (rough) with a warmed-up engine

Ignition timing retard of approximately 5° removed the knock. Vehicle acceleration performance deteriorated.

Cutlass: With FUEL-MAX, this vehicle exhibited stumble and hesitation attributable to a lean air/fuel mixture. Knock (trace) occurred under heavy accelerations, moderate accelerations and light accelerations. Intermittant, light knock occurred under highway cruise conditions with FUEL-MAX.

Zephyr: This vehicle exhibited occasional occurrences of trace knock. When cold, the vehicle exhibited stumble at 20 mph.

Conclusions

As a result of EPA testing of FUEL-MAX on three 1979 passenger cars, the following conclusions were drawn:

1. The installation instructions and the material packaged with the device were not adequate in all cases.

2. Use of the FUEL-MAX resulted in a decrease in hydrocarbon emissions. The average decrease was 20% for the FTP and 18% for the HFET.

3. Carbon monoxide emissions were also reduced; 28% over the FTP and 57% over the HFET.

4. NOx emissions increased substantially; 480% over the FTP and 380% over the HFET.

5. Use of the FUEL-MAX resulted in a three percent increase in fuel economy on the FTP but essentially no change on the HFET.

6. During the road evaluations, FUEL-MAX caused heavy knock on one car, and light knock in another. Knock was rarely noted on the third car.

7. Installation of the FUEL-MAX device is considered "tampering" under the provisions of the Clean Air Act*.

---

*"EPA tests showed that the use of this device, on the vehicles tested caused emissions to exceed applicable standards. Thus, the installation of this device by a person in the business of servicing, repairing, selling, leasing, or trading motor vehicles, fleet operators, or new car dealers will be considered in violation of Section 203(a)(3) of the Clean Air Act, the Federal prohibition against tampering with emission control systems. That is, there is currently no reasonable basis for believing that the installation or use of this device will not adversely affect emission performance. This determination does not preclude the use of the FUEL-MAX device on a different vehicle or vehicles than those tested by EPA if Federal Test Procedure tests performed on such vehicles clearly establish that emission performance of those particular vehicles is not adversely affected.

Appendix A

Test Vehicle Descriptions

Make/Model	Ford Pinto	Oldsmobile Cutlass	Mercury Zephyr
Model Year	1979	1979	1979
Type	2 door	2 door	2 door
Vehicle I.D.	9T11Y186165	3R47A9M523280	9E35F621630
Initial Odometer	23540	34880	31760
Engine Type	Spark Ignition	Spark Ignition	Spark Ignition
Configuration	In-line 4	V6	V8
Displacement	140 CID	231 CID	302 CID
Fuel Metering	2V Carburetor	2V Carburetor	2V Carburetor
Fuel Requirement	Unleaded	Unleaded	Unleaded
Transmission	Automatic	Automatic	Automatic
Tires	B78-13	P195/75R14	CR78-14
Inertia Weight	3000	4000	3500
Actual HP @50 mph	10.3	12.0	11.2
Emission Control Systems	EGR Catalyst	EGR Catalyst	EGR Air Pump Catalyst

Appendix B

Test Results - Ford Pinto, 140 CID, 4 Cylinder

Test Date.	Test #	Configuration	Federal Test Procedure HC	CO	NOx	MPG	Highway Fuel Economy Test HC	CO	NOx	MPG
3-3-81	5560	Baseline	2.09	26.1	1.37	21.44				
3-3-81	5561	Baseline					0.74	5.0	2.35	28.87
3-4-81	5562	Baseline	2.06	26.0	1.33	21.56				
3-4-81	5563	Baseline					0.77	5.3	2.40	29.19
3-5-81	5564	FUEL-MAX	1.66	20.2	5.84	22.06				
3-5-81	5565	FUEL-MAX					0.64	3.2	6.57	29.17
3-6-81	5566	FUEL-MAX	1.50	17.0	6.22	22.71				
3-6-81	5567	FUEL-MAX					0.58	2.3	7.08	29.42
3-25-81	5568	Fuel Max (-5°)*	1.00	18.8	4.36	21.97				
3-25-81	5569	Fuel Max (-5°)					0.49	1.9	4.93	29.80
3-26-81	5570	Fuel Max (-5°)	1.41	17.8	4.56	22.48				
3-26-81	5571	Fuel Max (-5°)					0.51	2.1	5.56	29.90

*For this series of tests, the device remained in place but the basic timing was retarded 5° to correct a heavy knock condition.

Appendix C

Test Results - Oldsmobile Cutlass, 231CID, V-6

Test Date.	Test #	Configuration	Federal Test Procedure HC	CO	NOx	MPG	Highway Fuel Economy Test HC	CO	NOx	MPG
3-4-81	6845	Baseline	1.95	22.3	1.56	18.16				
3-4-81	6848	Baseline					0.55	7.1	1.52	26.17
3-5-81	6849	Baseline	1.82	20.3	1.52	18.37				
3-5-81	6850	Baseline					0.43	5.0	1.44	26.61
3-6-81	6851	Baseline	1.90	20.5	1.57	18.16				
3-6-81	6852	Baseline					0.36	4.2	1.58	26.34
3-10-81	6853	FUEL-MAX	1.40	18.9	7.44	18.43				
3-10-81	6854	FUEL-MAX					0.22	1.4	8.57	26.32
3-11-81	6855	FUEL-MAX	1.51	20.0	7.45	18.62				
3-11-81	6856	FUEL-MAX					0.24	1.6	8.76	26.53
3-19-81	8359	Baseline					0.40	4.6	1.61	26.43
3-19-81	8361	Baseline					0.25	2.6	1.63	26.40
3-19-81	6858	FUEL-MAX					0.23	1.9	8.82	26.42

HOT START LA-4

			HC	CO	NOx	MPG
3-19-81	8358	Baseline	1.14	13.4	1.50	19.25
3-19-81	8360	Baseline	1.32	15.1	1.54	19.54
3-19-81	6857	FUEL-MAX	1.24	16.5	7.90	19.71
3-19-81	6859	FUEL-MAX	1.37	15.6	7.73	13.06*

*Fuel economy void - error in CO_2 readings.

Appendix D

Test Results - Mercury Zephyr, 302CID, V-8

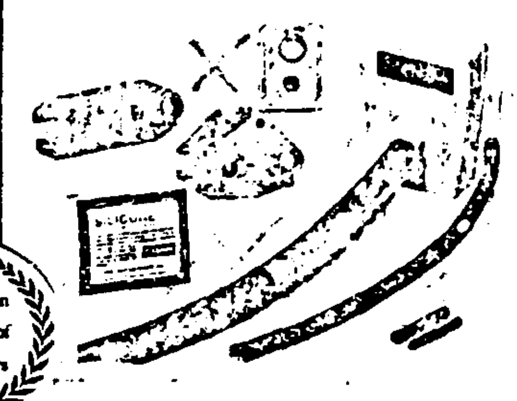
Test Date.	Test #	Configuration	Federal Test Procedure HC	CO	NOx	MPG	Highway Fuel Economy Test HC	CO	NOx	MPG
3-3-81	6771	Baseline	2.42	25.2	0.66	15.10				
3-3-81	6772	Baseline					0.94	1.4	1.34	23.08
3-4-81	6773	Baseline	2.42	24.1	0.69	15.25				
3-4-81	6774	Baseline					0.86	3.8	1.07	22.58
3-5-81	6775	Baseline	2.46	23.2	0.71	15.23				
3-5-81	6776	Baseline					0.86	2.8	1.11	23.09
3-10-81	8094	FUEL-MAX	2.05	14.3	7.20	15.72				
3-10-81	8095	FUEL-MAX					0.81	1.2	9.31	22.77
3-11-81	8125	FUEL-MAX	2.12	14.2	7.14	15.72				
3-11-81	8126	FUEL-MAX					0.85	1.1	8.75	22.80
3-18-81	8302	Baseline	2.58	29.5	0.61	15.04				

Award Winning Automotive Engineers MAKE BREAKTHROUGH SLASH GAS CONSUMPTION with FUEL MAX

Tests prove Savings up to 12½ mpg (city), Up to 33% mpg (highway)

DEVELOPED BY THE INVENTORS OF THE YEAR 1979

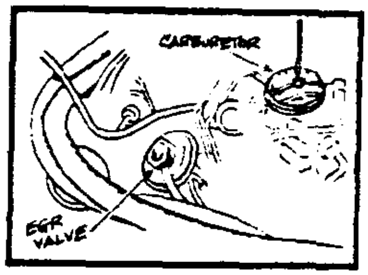
American Society of Inventors

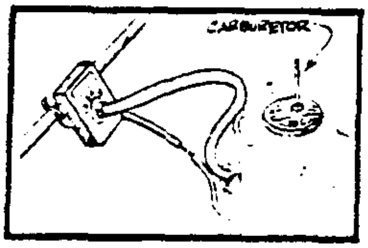


What is Fuel Max? Pollution control systems, used on cars built since 1973 to help meet Federal emissions control standards, drive down gas mileage and performance. Fuel Max* is a precision engineered device that enables a car owner to change the air/fuel ratio and eliminate the negative effects of exhaust gas recirculation. Fuel Max can add up to 12½%** more mpg in city driving, up to 33%** more on the highway. When Fuel Max was tested on 50 randomly selected '73 to '79 cars and trucks, gas savings averaged a dramatic 10½%! Fuel Max also saves gas and improves performance on 1980 models, but to a lesser degree.

How does Fuel Max work? **The pollution control system on '73—'80 automobiles works by recirculating exhaust gas back into the engine by means of an EGR (Exhaust Gas Recirculating) Valve. This reduces the exhaust emissions but also decreases the car's smoothness, acceleration and response. It causes more gas to be burned. Fuel Max is a precision built vacuum operated valve that uses the existing EGR system but allows MORE AIR into the engine intake and eliminates recirculation of exhaust gas. More air in the combustible mixture means a leaner mix—you use less gas, get better performance, and lower total overall emissions.**

Fuel Max is easy to install. Easy-to-follow instructions included—simpler than changing your car's sparkplugs.
No carburetor adjustment necessary!
Federal EPA regulations permit vehicle owner to install Fuel Max on own vehicle.





WARRANTY
Fuel Max is warranted against defects in materials and workmanship for one year from date of purchase.

Only $29.95 postpaid right to your door. Fuel Max soon pays for itself with the gas savings you get! Exclusive only through this offer.

Order today. Start saving gas and getting better performance from your car.

*Patent pending.
**Results of tests using E.P.A. procedures on a 1977 Chevy with a 305 cubic inch V-8 engine

OGI Group Ltd.
114 East 32 Street
New York, New York 10016
Please send me ___ FUEL MAX @ $29.95 ppd
Name ______________
Address ______________
City ________ State ________ Zip ________
Enclosed is my check or money order for $______
Visa & Mastercharge card holders dial toll free #800-228-2028
Satisfaction Guaranteed or Money Refunded

Attachment J

13. Will I Really Save Gas by Driving 55 MPH Instead of 60 or 65?
Yes. The most efficient driving speed is usually between 30 and 40 miles per hour. For each 10 mph speed increase,there is a fuel economy penalty of about 10 percent. At speeds above 65 mph, the penalty is even greater.

14. Does the Air Conditioner Reduce Fuel Economy?
Yes. The air conditioner uses engine power, which causes a decrease in fuel economy of a few percent.

15. Why Do Some Cars Run after They Are Turned Off?
After-Run, or so-called dieseling, is aggravated by an excessively fast idle speed. Engines should be tuned when warmed up to idle at the minimum speed which gives a smooth idle. (Check automatic transmission cars in "drive".) If cold idling is a problem, the automatic choke may be set to stay on longer. (Automatic choke also boosts idle speed.)

16. Is There Really a Fuel Shortage?
Yes and No. There is no shortage of energy resources, but there is a very real shortage of cheap energy. We have become accustomed to buying gasoline for 50¢ per gallon, which is less than we pay for beer, milk, soft drinks, or even distilled water.

17. What Kind of Tires Give the Best Gas Mileage?
Radial tires have less rolling resistance than bias-ply tires, and give a fuel economy improvement of a few percent. Higher tire pressures can also add a few percent to fuel economy, but safety is more important. Stick to the manufacturer's recommened tire pressures.

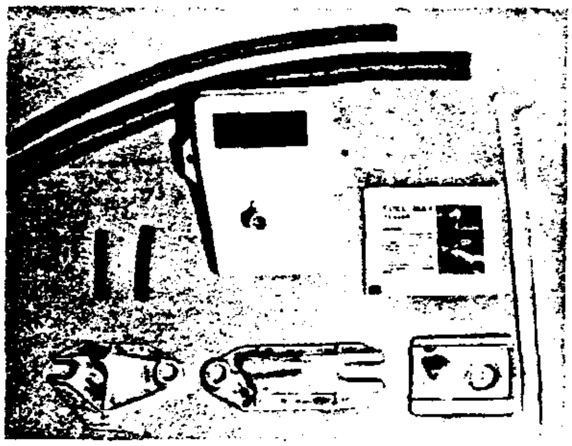
18. Do Special Oils Really Work?
Some of the synthetic oil products and "slippery" oils can make a small improvement in fuel economy by reducing engine friction.

19. Is It Legal for Me to Change My Car's Emission Control System?
If you are not a Professional Mechanic, Dealer Representative, or Fleet Operator, the Federal EPA Laws do not apply to you. Some individual states are considering legislation which might apply. Check your owns state's legislation if you are not sure.

20. Can Fuel-Max Damage an Engine?
No. Fuel-Max can actually prolong the life of an engine by eliminating the corrosive effect of exhaust gas recirculation.

P. O. Box 726
Bellmawr, NJ 08031

FUEL MAX



FUEL-MAX — GASOLINE CONSERVATION FOR CARS AND TRUCKS

Fuel-Max has been designed for the motorist who wants to improve his vehicle's fuel economy. The Fuel-Max installation has shown an average improvement in fuel economy better than ten percent. For those serious about conserving fuel, an additional ten to twenty percent may be saved by careful attention to driving habits.

Driving Habits can make the difference between 15 MPG and 25 MPG on the same car. Careful use of your car's power can save more fuel than any other technique.

Most of the gasoline your car uses is consumed during accelerations. The harder you accelerate, the more fuel is wasted. It is for this reason that highway driving gives better economy than city driving.

While only about 10 horsepower are needed to maintain your car at 55 miles per hour on the highway, you can use all of your engine's horsepower to accelerate. The economical driver uses the minimum horsepower required for any driving situation. A good way to retrain yourself for economical driving habits is to pretend there is a glass of water on the dashboard, and drive in such a way as to avoid getting wet.

REMEMBER THESE GAS-SAVING TIPS —
- **AVOID PROLONGED IDLING**
- **DON'T CARRY AROUND UNNECESSARY WEIGHT**
- **ACCELERATE GRADUALLY, DRIVE SMOOTHLY**
- **FOLLOW THE SPEED LIMITS — HIGHER SPEEDS WASTE FUEL**

FUEL ECONOMY — QUESTIONS AND ANSWERS

To help you understand some of the technical aspects, we have listed answers to the 20 most frequently asked questions about fuel economy.

1. What is EGR? (Exhaust Gas Recirculation)
Exhaust Gas Recirculation is used on all cars built after 1973. The EGR Valve is controlled by a vacuum signal that comes from the carburetor whenever the throttle is in the cruising range. Most cars also have a temperature-controlled vacuum switch in the control line to keep the EGR Valve from opening when the engine is cold.

EGR allows some of the exhaust gas to bleed back into the engine intake, which helps to control one of the emissions, Oxides of Nitrogen. When the EGR system is disconnected, fuel economy improves a few percent, performance is improved noticeably. Oxides of Nitrogen emissions increase, and the engine may knock or ping more than before.

Fuel-Max uses the controls and passages of the EGR system for another purpose.

2. How does the Fuel-Max work?
Fuel-Max makes use of an engine's existing EGR system, but bleeds air into the engine instead of exhaust gas. The Fuel-Max improves fuel economy and performance, and causes a change in the balance of the three regulated exhaust emissions. In general, Hydrocarbon and Carbon Monoxide emissions go down, and Oxides of Nitrogen emissions go up. The total of the three emissions usually goes down.

Fuel-Max causes the engine to run on a leaner air-fuel mixture, only when the engine is warmed up. Fuel-Max does not operate at idle, or on wide-open throttle accelerations. For this reason a better fuel economy improvement should be expected in highway driving than urban driving.

3. What is Engine Knock or Ping?
Knock is the sound made by a small "explosion" in the combustion chamber, when the fuel and air burn abruptly instead of smoothly. Heavy and prolonged knocking can cause damage to the engine. There are two remedies for excessive knock:

1. Switch to a higher octane fuel.
2. Retard the ignition timing, which will also cause the fuel economy to decrease.

4. Should I Change the Ignition Timing?
To get the maximum fuel economy, ignition timing should be advanced as far as the engine will tolerate without knocking. (Usually not more than 8 degrees beyond factory specifications.) Advanced timing will usually cause the emissions to increase.

5. What is Octane? Octane is a measure of a fuel's resistance to knock. For example, an engine which knocks on 86 octane fuel might not knock on 90 octane fuel.

6. What is Unleaded Gasoline?
Before 1975, almost all gasoline contained a Lead-Compound additive. Lead increases the octane of the gasoline, but may not be used in catalyst-equipped vehicles. The lead is deposited on the inside of the catalytic converter and spoils the catalyst.

7. Why does Unleaded cost more than Regular?
If lead is not used to boost a fuel's octane, the fuel must go through additional refining to raise its octane. The extra refining uses energy, so unleaded fuel costs more to manufacture than leaded fuel of the same octane.

8. What is Air-Fuel Ratio?
The mixture of fuel and air supplied by the carburetor or fuel injection system must be carefully set to the right ratio. Most vehicles operate in the range of 15 to 18 Air-Fuel Ratio. (15 pounds of air for each pound of fuel.)

The most efficient mixture is the leanest (highest air-fuel ratio) that the engine will tolerate without rough running or hesitation. There is no external adjustment on the carburetor for air-fuel ratio, except the idle mixture.

9. How Should I Adjust the Idle Mixture?
Turn the mixture screw (or screws) to the leanest setting (clockwise is leaner) that gives a smooth idle. Some cars have plastic limiter caps on the idle screws to restrict the range of adjustment.

10. Will a Lean Mixture "Burn Valves"?
No. All modern cars operate at air-fuel ratios greater than 15. The air-fuel ratio which gives the highest combustion temperature is 14.7. Temperatures drop as the mixture gets richer or leaner than 14.7.

Before 1970, many vehicles used mixtures richer than 14.7, and leaning the mixture could raise combustion temperatures, and "burn valves".

11. Will it help to remove the Catalytic Converter?
No. The catalytic converter has no direct effect on fuel economy. Its removal would not produce any change except increased exhaust emissions.

12. How Should I Measure Gas Mileage?
Anyone can measure fuel economy by keeping a record of each fuel purchase. Start by noting the odometer reading when the tank is full. Then note the number of miles on the odometer and the gallons purchased every time you buy fuel. After using several tankfuls of fuel, divide the total miles travelled by the total gallons used. The result will be the miles per gallon. Be sure to average several tankfuls of fuel, to get accurate measurements over a long period.

Attachment K

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ANN ARBOR, MICHIGAN 48105

OFFICE OF
AIR, NOISE AND RADIATION

November 7, 1980

Mr. Michael D. Leshner, Chief Engineer
FIDCO Fuel Injection Development Corporation
110 Harding Avenue
Bellmaur, NJ 08030

Dear Mr. Leshner:

During our analysis of your firm's application for evaluation of the "Fuel-Max" fuel economy retrofit device under Section 511 of the Motor Vehicle Information and Cost Savings Act we have found deficiencies in the data you enclosed with your application.

First, the appendices to one of the Scott reports were not included with the application. We requested a complete copy of the report from Scott Environmental Technology, Inc. but they will not release the information to us without prior authorization from the sponsoring company. Please forward to us Appendices A, B, and C for Scott Report #1827 01 0979, "Technical Report on Evaluation of a Fuel Economy Device".

Second, in the test reports provided with your firm's application, the baseline data were collected by the testing laboratory on vehicles in an "as received" condition. The independent laboratory can not verify the status of the engine design parameter settings. Please provide detailed information regarding the engine design parameter settings (ignition timing, idle speed, idle mixture, etc.) for each vehicle used for the baseline and device installed testing supporting your firm's application for evaluation.

Thank you very much for your help on this problem. Your cooperation will facilitate the evaluation process.

Sincerely,

Merrill W Korth
Merrill W. Korth, EPA Device Evaluation Coordinator
Test and Evaluation Branch

Received 1-5-81 Attachment L

FDC Fuel Injection Development Corporation

29 December 1980

Mr. Merrill W. Korth
U.S. Environmental Protection Agency
Ann Arbor, Michigan 48105

Dear Mr. Korth,

I have enclosed a complete copy of Scott Environmental Technology Report #1827 01 0979. The copy which was originally sent with our Section 511 Application did not include the appendices. These appendices were not available to our company until today. The company which sponsored the test program was not willing to share the appendices without compensation, and we had to negotiate a special agreement for their release.

Second, we did some checking on the engine design parameter settings for the test vehicles. All of the vehicles were leased by the sponsoring company for their employees. The vehicles were all delivered new by factory dealerships, and were not adjusted after initial new-car preparation. Since these calibrations were not measured, we can only assume they were all set to factory specifications.

I apologize for the delay in forwarding this information. Please let me know if I can help you to expedite this evaluation.

Sincerely,

Michael D. Leshner

Michael D. Leshner
Chief Engineer

110 Harding Avenue • Bellmawr, N.J. 08030 • 609/931-3168