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EPA Evaluation of the Atomized Vapor Injector Device Under Section 511 of the Motor Vehicle Information and Cost Savings Act

by
John C. Shelton

February 1983

Test and Evaluation Branch
Emission Control Technology Divison
Office of Mobile Sources
U.S. Environmental Protection Agency

EPA Evaluation of the Atomized Vapor Injector Device Under Section 511 of the Motor Vehicle Information and Cost Savings Act

The Motor Vehicle Information and Cost Savings Act requires that EPA evaluate fuel economy retrofit devices and publish a summary of each evaluation in the Federal Register.

EPA evaluations are originated upon the application of any manufacturer of a retrofit device, upon the request of the Federal Trade Commission, or upon the motion of the EPA Administrator. These studies are designed to determine whether the retrofit device increases fuel economy and to determine whether the representations made with respect to the device are accurate. The results of such studies are set forth in a series of reports, of which this is one.

The evaluation of the "Atomized Vapor Injector" device was conducted upon the application of the inventor. This device is a vapor air bleed which bubbles air through a 50/50 mixture of water and alcohol. This vapor is said to cause more efficient combustion by "atomizing" the gasoline droplets and lowering the engine temperature. This is claimed to improve fuel economy and reduce emissions.

1. Title:

   Application for Evaluation of Atomized Vapor Injector Under Section 511 of the Motor Vehicle Information and Cost Savings Act

THE INFORMATION CONTAINED IN SECTIONS TWO THROUGH FIVE WHICH FOLLOW WAS SUPPLIED BY THE APPLICANT.

2. Identification Information:

   a. Marketing Identification of the Product:

      Atomized Vapor Injector

   b. Inventor and Patent Protection:

      (1) Inventor

      Lewis J. Schneller
      2019 West Sussex Avenue
      Missoula, MT 59801

      (2) Patent

      "N/A" [A copy of the patent was not submitted.]

c. Applicant:

(1) Name and address

Lewis J. Schneller
2019 West Sussex Avenue
Missoula, MT 59801
(406) 728-2752 or
(406) 721-1330, ext. 266

(2) Principals

Lewis J. Schneller
2019 West Sussex Avenue
Missoula, MT 59801

(3) Lewis J. Schneller is authorized to represent Atomized Vapor Injector in communication with EPA.

d. Manufacturer of the Product:

(1) Based on the information in the application, the manufacturer of the product has not yet been determined.

3. Description of Product:

a. Purpose:

"With the ever-increasing cost of gasoline, combined with the potential international oil supply system bordering on international crisis and the subsequent possible gas rationing, the need for a gas saver like a water/alcohol injector appears to be a matter of being at the right place at the right time; i.e., the time is ripe! The challenge exists to develop a readily available and inexpensive water/alcohol injection system to increase not only fuel conservation, but to increase engine operation efficiency as well. If for no other reason, it may become readily apparent that water/alcohol injection systems should be a mandatory requirement on all gas-powered vehicles, if only to prevent unnecessary engine repairs due to excessive carbon accumulation.

"Presently, there are a few varieties of water/alcohol injectors on the market today, ranging in price from $29.95 to nearly $400.00 per unit. Some of the proposed advantages of the Atomized Vapor Injector are the following:

"(1) Since the container for AVI is accomplished by recycling used hospital I.V. bottles, not only does this process contribute to our national philosophy of energy

conservation through recycling, but the I.V. hospital bottle seems to be an ideal container for the successful operation of a water/alcohol injector. The many personal testimonials and independent testing results by the City of Missoula's Street Maintenance Department seem to support this statement.

"(2) Since the AVI unit is the only glass container on the market today, it has an inherent advantage over all other units made of opaque plastic. AVI can be visually monitored during operation, thereby eliminating any need to install an expensive warning light system to warn the vehicle operator when the water/alcohol solution becomes too low for satisfactory operation. Because AVI is a glass container with graduated milliliter marketings, the vehicle operator can very easily monitor the desired consumption rate (approximately 100 ml of water/alcohol solution per 20 gallons of gasoline consumed) by simply adjusting the needle valve setting to correspond to the recommended consumption rate. No other water/alcohol injection system has these advantages.

"(3) The glass hospital I.V. bottle is designed to significantly exceed the maximum safety requirements for safe and durable operation. In the event of defect, a used hospital I.V. bottle is easily replaceable and inexpensive.

"(4) The simplistic design and operation of AVI water/alcohol injectors easily lends itself to satisfactory assembly and distribution programs by handicapped people. Successful experimentation with this concept has already been demonstrated with Missoula's Opportunity Workshop employing disabled adults.

"(5) Atomized Vapor Injectors lends itself to a variety of creative marketing programs, especially when viewed in light of our current local and national economic predicament. The potential exists for creating employment and services that may serve as a shining example of reflecting America's original philosophy of fostering independence through the spirit of innovation and novel creativity for self-determination. (Please find proposed budget analysis and marketing format enclosed for your convenience.)" [This document is found in Attachment A].

b. <u>Theory of Operation</u>:

"Atomized Vapor Injector is a hydroautomization system which adds a 50/50 water/alcohol vapor to an engine's intake system. A water/alcohol vapor injector produces a more efficient fuel

burn by atomizing the gasoline droplets and lowering the engine's temperature. This process will not only improve an engine's overall performance and increase gas mileage rates, but will also increase the engine's life span by eliminating excessive carbon deposits. This water/alcohol injection system, AVI, uses engine vacuum pressure to pull outside air through the glass I.V. hospital reservoir containing a 50/50 water/alcohol solution which is attached to the car under the hood. This causes the solution of water and alcohol to bubble and splash within the vacuum chamber forming a mist of water and alcohol droplets and vapor in the upper part of the glass reservoir. This mist is then drawn by the vacuum pressure through a plastic hose which is then connected to any intake manifold suction hose (the positive crankcase valve is the most desirable connection). This connection is made by very easily cutting the rubber vacuum hose with a sharp knife and then inserting the plastic "T". The plastic needle valve can then be easily adjusted to allow just the right amount of water/alcohol vapor to pass into the combustion chamber (best results are derived by adjusting consumption rate to allow 100 milliliters per 20 gallons of gasoline)."

c. Construction and Operation:

"The Atomized Vapor Injector consists of a recycled hospital I.V. bottle secured in a plastic holder, which is then attached under the hood to the inside of the engine compartment. A high quality rubber stopper with two holes is placed in the opening of the glass I.V. bottle. An 8 inch plastic tube with a plastic air-stone (aerator) on one end of the tube is attached to the rubber stopper, with the plastic air-stone (aerator) placed near the bottom of the bottle. Now a plastic needle valve is attached in the remaining opening in the rubber stopper, with a high quality four foot plastic tube attached to the other end of the plastic needle valve. All that remains is to insert the black plastic "T" into the rubber vacuum hose. Make sure that the four foot plastic tube between the AVI unit itself is completely straight, with no up or down bends in it, and that it is not in contact with any super-hot surfaces, as this may cause the plastic tube to collapse. The AVI unit itself should be installed lower than the "T" connection, as this facilitates vapor rising upward. It is also advisable to operate the AVI unit on the top half of the reservoir, as the vaporizing process diminishes on the bottom half of the bottle. This establishes another need to have a glass container for visual monitoring, as the glass container should be refilled when it is half-empty. The unit's effectiveness diminishes on the bottom half of the bottle."

d. Specific Claims for the Product:

"The introduction of AVI's water/alcohol vapor into the fuel air mixture through a vacuum line leading to an engine's intake system produces a cooling effect that increases the mixture density, extending the burning rate, and improving combustion efficiency. This process helps to eliminate engine ping (predetonation) and dieseling (after running of motor). Since steam is a good cleaning process, this helps to dissolve carbon deposits on the spark plugs and cylinder walls of older vehicles, and prevents carbon build-up in newer vehicles. Engine horsepower and octane can be increased because less fuel is needed to produce the same amount of energy when using a water/alcohol injector."

e. Cost And Marketing Information:

"Please see attached marketing and sales schedule [Attachment A]. Mr. Larry Wilkinson of Edwin K. Williams and Company, Missoula, Montana, had indicated a willingness to undertake this aspect of AVI." The listed cost of the unit is $29.95 each.

4. Product Applicability, Installation, Operation, Safety and Maintenance:

a. Applicability:

"Atomized Vapor Injector is designed to be implemented on all gas-powered vehicles. The only known restriction today is that certain vehicles with little or no extra available space in the engine compartment cannot accomodate insertion of a quart container the size of AVI. AVI is presently considering the feasibility of manufacturing units smaller than its present size with 1/2 quart containers in order to accommodate vehicles with less available engine space.

"It is not known whether operation of a water/alcohol injector is adversely affected by adverse weather conditions, types of driving or topographical differences."

b. Installation - Instructions, Equipment, and Skills Required:

"Please see attached installation instructions." [Attachment A]

c. Operation:

"Please see attached operation instructions." [Attachment A]

d. Effects on Vehicle Safety:

"It is not known whether the use of this product could result in any unsafe conditions for the vehicle occupants, or persons or property in close proximity."

e. Maintenance:

"There is no maintenance schedule or procedure for successful operation of AVI."

5. Effects on Emissions and Fuel Economy:

a. Unregulated Emissions:

"Information unavailable."

b. Regulated Emissions and Fuel Economy:

"Please see independent testing results of the City of Missoula Street and Maintenance Department." [Attachment A]

THE FOLLOWING SECTIONS CONTAINS EPA'S ANALYSIS OF THIS DEVICE.

6. Analysis

a. Description of Device:

The device is basically a controlled air bleed device where the air is bubbled through a mixture of alcohol and water. The resulting vapor is introduced into the intake manifold through vacuum line between the PCV valve and the carburetor.

b. Applicability Installation, Operation, Safety and Maintenance:

(1) Applicability:

The applicability of the device "to be implemented on all gas-powered vehicles" is judged valid for all gasoline fuel vehicles presently being produced.

(2) Installation - Instructions, Equipment and Skills Required:

The installation instructions are included in Attachment A. They appear to be complete and only average ability and simple tools are required for the installation.

(3) Device Operation:

No specific instructions were provided for operation of a vehicle with the device, and none were judged to be required. However, we have some concern for the recommendations made for the fluid. The applicant states you can use any alcohol additive like gasohol or gas line antifreeze. Gasohol normally contains 90% gasoline and could not be used. Gas line anti-freeze is almost entirely alcohol and would have to be mixed with water to obtain the 50/50 mixture.

(4) Effects on Vehicle Safety:

The applicant states "It is not known whether the use of this product could result in any unsafe conditions for the vehicle occupants or persons or property in close proximity". The addition of the device probably would not affect the vehicle safety.

(5) Maintenance:

The applicant states that "There is no maintenance schedule or procedure for successful operation of the Atomized Vapor Injector". He states "The glass container should be refilled when half empty". This appears to be the only maintenance required.

Since the device does not contain an inlet air filter, the mixture would be exposed to contamination from oil and gas fumes, dirt, road salt and bugs.

c. Effects on Emissions and Fuel Economy:

(1) Unregulated Emissions:

The applicant did not furnish any information on unregulated emissions. The small flow of alcohol/water mixture probably would have little or no effect on unregulated emissions.

(2) Regulated Emissions and Fuel Economy:

The applicant did not submit test data in accordance with the Federal Test Procedure and the Highway Fuel Economy Test. These two test procedures are the primary ones

recognized by EPA for evaluation of fuel economy and emissions for light duty vehicles.* Although the applicant did submit data from on-the-road tests the results were inconclusive because the program was not sufficiently controlled nor extensive enough to adequately quantify the worth of the device. Moreover, this testing did not include any measurements of exhaust emissions.

A few air-bleed devices tested by EPA have shown small improvements in emissions or fuel economy by leaning out the rich air/fuel mixtures of vehicles which were produced prior to emission standards. Without even using a device, however, these results could be approximated by adjusting the idle mixture screws. With the leaner calibrations of recent years, even these few devices would not show improvements and may cause driveability problems. Most of the current models now employ feedback carburetor systems. As a result, any changes attributable to the device would automatically be negated by the controls.

Several other devices tested by EPA have introduced liquids or vapors into the combustion chamber. In sufficient quantities, water injection can extend the detonation limits of the engine. This allows modifications or adjustments which can improve fuel economy (although usually at the expense of emission levels). In the case of the Atomized Vapor Injector, however, the amount of liquid introduced is relatively small. The device is stated to use 100 ml of liquid per 20 gallon tank of gasoline. For a vehicle achieving 20 miles per gallon, this rate is only 0.25 ml of liquid per mile. At this level, the energy content of the alcohol would have no discernible effect. The amount of water is also insignificant, especially considering that the applicant does not specify any engine parameter adjustments.

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*The requirement for test data following these procedures is stated in the policy documents that EPA sends to each potential applicant. EPA requires duplicate test sequences before and after installation of the device on a minimum of two vehicles. A test sequence consists of a cold start FTP plus a HFET or, as a simplified alternative, a hot start LA-4 plus a HFET. Other data which have been collected in accordance with other standardized procedures are acceptable as supplemental data in EPA's preliminary evaluation of a device.

(3) EPA Testing:

Because the test data submitted with the application was inconclusive, we asked that the applicant conduct appropriate testing at an independent laboratory (see Attachment B). A test plan was submitted by the applicant and approved by EPA (see Attachment C). Our evaluation of this test plan was conducted and transmitted in a letter of September 10, 1982 (see Attachment D). A second letter was sent November 2, 1982 also requesting additional test data (see Attachment E). At a later time, the applicant contacted EPA by telephone and stated he would not be able to supply any additional test data because of cost considerations. Therefore, lacking any data or reasonable theories to substantiate the applicant's claims, no EPA testing of the Atomized Vapor Injector was performed.

7. Conclusion

The evaluation of the Atomized Vapor Injector was based on the information submitted by the applicant, EPA's engineering judgment, and the results of EPA's evaluation of similar products. The overall conclusion from the EPA evaluation is that there is no reason to expect that the device will significantly improve the fuel economy or performance of a vehicle. Any changes in emission levels would be due solely to the air bleed aspect of the device.

FOR FURTHER INFORMATION CONTACT: Merrill W. Korth, Emission Control Technology Division, Office of Mobile Sources, Environmental Protection Agency, 2565 Plymouth Road, Ann Arbor, MI 48105, (313) 668-4299.

List of Attachments

Attachment A	Letter of June 24, 1982 from Lewis J. Schneller to EPA. This document contains the original application.
Attachment B	Letter of July 16, 1982 from EPA to Lewis J. Schneller evaluating his original application.
Attachment C	Letter of September 2, 1982 from Lewis J. Schneller to EPA. This document includes a proposal for testing the device from Olson Engineering, Inc.
Attachment D	Letter of September 10, 1982 from EPA to Lewis J. Schneller evaluating the test plan.
Attachment E	Letter of November 2, 1982 from EPA to Lewis J. Schneller.

Atomized Vapor Injectors
Federal I.D. #81-0393244
2019 West Sussex Avenue
Missoula, Montana 59801
June 24, 1982

United States Environmental Protection Agency
Motor Vehicle Emission Laboratory
Emission Control Technology Division
2565 Plymouth Road
Ann Arbor, Michigan 48105

Attention: Mr. Merrill W. Korth

Dear Mr. Korth:

I am writing this letter to formally submit my application to you in order to obtain EPA test requirements for an approved EPA evaluation of my water/alcohol injector called Atomized Vapor Injectors (AVI).

On June 11, 1982, I received a letter from the Honorable Pat Williams, Western Montana Congressman, detailing efforts on his behalf to obtain EPA test requirements and application format for my water/alcohol injector, AVI. Congressman Williams also included a letter with pertinent information submitted to Ms. Diane Hicks, Congressional Liasion Office of the Environmental Protection Agency, 401 "M" Street S.W., Washington, D.C., from you. I have included a copy of both of these letters for your convenience.

Also, please be advised that I have already received a willingness from the Private Industries Council of Montana, Inc., 517 Power Block Building, Helena, Montana, 59624, to undertake the funding requirements necessary to obtain independent testing data prior to marketing Atomized Vapor Injectors.

In your letter to Ms. Hicks, you stated that you could assist in the development of a satisfactory test plan. This service would be most desirable, as I am sure the Private Industries Council of Montana would positively respond to an EPA approved testing format for my water/alcohol injector. Furthermore, I would greatly appreciate your suggestions as to which independent testing laboratory would be most desirable to conduct the testing of my product.

Also, please be advised that I have included an independent testing format provided by the City of Missoula Street Maintenance Department for your convenience.

United States Environmental Protection Agency
Mr. Merrill W. Korth
June 24, 1982
Page Two

Thank you for any consideration you may give to my proposal, and please do not hesitate to contact me for any further assistance. I hope to hear from you soon.

Sincerely,

Lewis J. Schneller

Lewis J. Schneller
(406)728-2752, or
(406)721-1330/266(message phone)

PAT WILLIAMS
MONTANA
WESTERN DISTRICT
MAJORITY WHIP AT LARGE

WASHINGTON OFFICE:
1512 LONGWORTH BUILDING
WASHINGTON, D.C. 20515
TELEPHONE: (202) 225-3211

TOLL-FREE NUMBER
1-800-332-6177

CONGRESS OF THE UNITED STATES
HOUSE OF REPRESENTATIVES
WASHINGTON, D.C. 20515

COMMITTEES:
EDUCATION AND LABOR
ELEMENTARY, SECONDARY AND VOCATIONAL EDUCATION
LABOR STANDARDS
HUMAN RESOURCES
INTERIOR
PUBLIC LANDS AND NATIONAL PARKS
ENERGY AND ENVIRONMENT

June 8, 1982

Mr. Lewis J. Schneller
2019 West Sussex Avenue
Missoula, Montana 59801

Dear Lewie:

I've finally been able to obtain EPA's test requirements for your water/alcohol injectors. I'm enclosing the entire packet of information which EPA made available to me.

You will notice that the EPA will also evaluate your device upon submission of an application and the results of your independent tests.

I hope this covers what you'll need to have the necessary tests run in order to begin marketing. Please let me know if I can be of further assistance.

Best regards.

Sincerely,

Pat

Pat Williams

Enclosures

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ANN ARBOR, MICHIGAN 48105

May 10, 1982

OFFICE OF
AIR, NOISE AND RADIATION

Ms. Diane Hicks
Environmental Protection Agency
Congressional Liasion Office
401 "M" Street, S.W.
Washington, DC 20460

Dear Ms. Hicks:

Except for this first sentence, these documents are identical to those we send to a device manufacturer who is interested in an EPA evaluation of his device. The Environmental Protection Agency is charged by Congressional mandate to evaluate fuel economy and emission control devices. While the EPA does not actually "approve" such devices, it does conduct evaluations for the purpose of increasing the common knowledge in the area. For this reason, the outcome of any testing by EPA becomes public information. It is this information which may be cited, although no claims can be made that any EPA findings constitute "approval" of the device or system.

Enclosed with this letter is a packet of materials which you will need to apply for an EPA evaluation of your device. This packet consists of 1) an application format, 2) a document entitled "EPA Retrofit and Emission Control Device Evaluation Test Policy", 3) "Basic Test Plans and Testing Sequences", and 4) a copy of the applicable Federal Regulations. Engine oils, oil additives, and other lubricants do not fall under the provisions of Section 511 of the Motor Vehicle Information and Cost Savings Act. Recently, there has been confusion over the wording in the regulation that gives EPA the authority to evaluate fuel additives. Until we are able to eliminate this confusion by modifying the regulation, we cannot accept applications for evaluations of fuel additives. If you wish to improve the credibility of your oil or fuel additives by performing tests on your own, we will try to help by commenting on your test plans.

In order for the EPA to conduct an evaluation of your device, we must have an application. Once you have reviewed all the documents in the packet, you should prepare an application in accordance with the guidelines of the application format. A critical part of the application is the substantiating test data. The required test results will have to be obtained at a laboratory of your choice. Such testing would be conducted at your expense. A list of laboratories, which are known to have the equipment and personnel to perform acceptable tests, has been included in the enclosed packet. The laboratory list is revised periodically, so be certain that the list you are using is current. Please allow EPA to comment on your test plan before beginning testing at an independent laboratory. If you desire, we can assist in the development of a satisfactory test plan.

There are, however, several aspects concerning testing at an outside laboratory which I would like to bring to your attention at this time:

Minimum Test Requirements - Although different types of devices may require a more complex test plan, the minimum we require involves two vehicles and two test sequences run in duplicate. The vehicles should be selected from those listed in Table 1; if possible. Each vehicle is to be set to manufacturer's tune-up specifications for the baseline tests.

The tests are conducted in a "back-to-back" manner, once with the vehicle in baseline condition, and again with the device installed with no vehicle adjustments between tests. If installation of the device also involves some adjustments, e.g. timing, fuel-air mixture, choke or idle speed, another test sequence with only these adjustments should be inserted between the first and last. If mileage accumulation is necessary in order to realize the full benefit, the same number of miles that are accumulated before the test runs must also be accumulated before baseline runs. In addition, the method of mileage accumulation should be kept constant. Also, as a minimum, the test sequence shall consist of a hot-start LA-4 portion (bags 1 and 2) of the Federal Test Procedure (FTP) and a Highway Fuel Economy Test (HFET). The details of these tests are contained in the enclosed packet. Although only a hot-start FTP is required to minimize the costs to you, you are encouraged to have the entire cold-start test performed, since any confirmatory testing and evaluation performed by EPA will be based on the complete FTP, and you may wish to know how a vehicle with your device performs over this official test. As a final requirement, the personnel of the outside laboratory you select should perform every element of your test plan. This includes preparation of the test vehicle, adjustment of parameters, and installation of the device.

Submission of Data - We require that all test data obtained from the outside laboratories in support of your application be submitted to us. This includes any results you have which were declared void or invalid by the laboratory. We also ask that you notify us of the laboratory you have chosen, when testing is scheduled to begin, what tests you have decided to conduct, allow us to maintain contact with the laboratory during the course of the testing, and allow the test laboratory to directly answer any questions at any time about the test program.

Cost of the Testing - The cost of the minimum test plan (two vehicles, two test sequences in duplicate) described above should be less than $3000 per vehicle and less than $6000 for the total test at any of the laboratories on the list. It should be recognized that additions to the minimum test plan (such as mileage accumulation, parameter adjustment, or additional testing) will result in additional costs. In any case, you will have to contact them individually to obtain their latest prices.

Outcome of the Tests - In order for EPA to best utilize our facilities, confirmatory testing will be performed only on those devices that demonstrate a statistically significant improvement in fuel economy or emissions based on data from an EPA-recognized independent laboratory. We have established some guidelines which will help you determine whether the test results with your device should be considered encouraging. These values have been chosen to assure both of us that a real difference in fuel economy exists, and that we are not seeing only the variability in the results. The table below presents the minimum number of cars that need to be tested for varying degrees of fuel economy improvement, assuming a typical amount of variability in fuel economy measurement. For a minimum test plan which was conducted on a fleet of two cars, the average improvement should be at least 6%. If at least a 6% difference in average fuel economy can be shown, then we would be able to say statistically at the 80% confidence level that there is a real improvement.

Similarly, we would expect a minimum of 3% improvement for a fleet of 5 vehicles. Test results which display a significant increase in emission levels should be reason for concern.

Minimum Fuel Economy Improvements versus Size of Test Fleet

Fleet Size	Average Improvement Required
2	6%
3	5%
4	4%
5	3%
10	2%

Once we receive your application, it will be reviewed to determine if it meets the requirements listed in the format. Please do not submit confidential, trade secret, or proprietary information as EPA cannot assure that such information can be protected in all situations. If your application is not complete, we will ask you to submit further information or data. After any missing information has been submitted, your application will be reconsidered, and once it meets our requirements, you will be advised of our decision whether or not EPA will perform any confirmatory testing. Any EPA testing will be performed at no cost to you and you will be given the opportunity to concur with our test plan. Once this testing is complete, an evaluation report will be written. If no further testing is required, the report will be written solely on the basis of the test data submitted and our engineering analysis.

EPA intends to process your application in as expeditious a manner as possible. We have established a goal of twelve weeks from the receipt of a complete application to the announcement of our report. The attainment of this objective requires very precise scheduling, and we are depending on the applicant to respond promptly to any questions, or to submit any requested data. Failure to respond in a timely manner will unduly delay the process. In the extreme case, we may consider lack of response as a withdrawal of the application.

I hope the information above and that contained in the enclosed documents will aid you in the preparation of an acceptable application for an EPA evaluation of your device. I will be your contact with EPA during this process and any subsequent EPA evaluation. My address is EPA, Motor Vehicle Emission Laboratory, 2565 Plymouth Road, Ann Arbor, Michigan, 48105. The telephone number is (313) 668-4299. Please contact me if you have any questions or require any further information.

Sincerely,

Merrill W. Korth

Merrill W. Korth, Device Evaluation Coordinator
Emission Control Technology Division

Enclosures

AVI - Lewis J. Schneller

1. Title: The following is an application for evaluation of Atomized Vapor Injectors under Section 511 of the Motor Vehicle Information and Cost Savings Act.

2. Identification Information:

   a. Marketing Information: This water/alcohol injector system will be marketed under the trade name of Atomized Vapor Injectors; Federal I.D. #81-0393244.

   b. Inventor and Patent Protection: NA

      (1) Lewis J. Schneller, 2019 West Sussex Avenue, Missoula, Montana 59801, designer and sole proprietor of Atomized Vapor Injectors.

   c. Applicant:

      (1) Name and address of individual applying for this evaluation:

      Lewis J. Schneller
      2019 West Sussex Avenue
      Missoula, Montana 59801

      (2) Principal officers and/or owners of this organization:

      Lewis J. Schneller
      2019 West Sussex Avenue
      Missoula, Montana 59801

      (3) The person who is authorized to represent Atomized Vapor Injectors in communications with the EPA:

      Lewis J. Schneller
      2019 West Sussex Avenue
      Missoula, Montana 59801
      Phone: (406)728-2752 or
      Message: (406)721-1330, ext. 266

d. Name and address of the individual or corporation who is (or will be) manufacturing the product: This information is undecided at this time, although, because of the simplistic design and operation of AVI, we have successfully experimented untilizing emotionally and physically disabled adults for assembly and distribution procedures at Missoula's Opportunity Workshop, 1005 Marshall Street, Missoula, Montana 59801. Mrs. Donna Booth was the supervisor in charge of this operation.

3. Description:

a. Purpose: With the ever-increasing cost of gasoline, combined with the potential international oil supply system bordering on international crisis and the subsequent possible gas rationing, the need for a gas saver like a water/alcohol injector system appears to be a matter of being at the right place at the right time; i.e., the time is ripe! The challenge exists to develop a readily available and inexpensive water/alcohol injection system to increase not only fuel conservation, but to increase engine operation efficiency as well. If for no other reason, it may become readily apparent that water/alcohol injection systems should be a manditory requirement on all gas-powered vehicles, if only to prevent unnecessary engine repairs due to excessive carbon accumulation.

Presently, there are a few varieties of water/alcohol injectors on the market today, ranging in price from $29.95 to nearly $400.00 per unit. Some of the proposed advantages of the Atomized Vapor Injector are the following:

(1) Since the container for AVI is accomplished by recycling used hospital I.V. bottles, not only does this process contribute to our national philosophy of energy conservation through recycling, but the I.V. hospital bottle seems to be an ideal container for the successful operation of a water/alcohol injector. The many personal testimonials and independent testing results by the City of Missoula's Street Maintenance Department seem to support this statement.

(2) Since the AVI unit is the only glass container on the market today, it has an inherent advantage over all other units made of opaque plastic. AVI can be visually monitored during operation, thereby eliminating any need to install an expensive warning light system to warn the vehicle operator when the water/alcohol solution becomes too low for satisfactory operation. Because AVI is a glass container with graduated milliliter markings, the vehicle operator can very easily monitor the desired consumption rate (approximately 100 ml of water/alcohol solution per 20 gallons of gasoline consumed) by simply adjusting

the needle valve setting to correspond to the recommended consumption rate. No other water/alcohol injection system has these advantages!

(3) The glass hospital I.V. bottle is designed to significantly exceed the maximum safety requirements for safe and durable operation. In the event of defect, a used hospital I.V. bottle is easily replaceable and inexpensive.

(4) The simplistic design and operation of AVI water/alcohol injectors easily lends itself to satisfactory assembly and distribution programs by handicapped people. Successful experimentation with this concept has already been demonstrated with Missoula's Opportunity Workshop employing disabled adults.

(5) Atomized Vapor Injectors lends itself to a variety of creative marketing programs, especially when viewed in light of our current local and national economic predicament. The potential exists for creating employment and services that may serve as a shining example of reflecting America's original philosophy of fostering independence through the spirit of innovation and novel creativity for self-determination. (Please find proposed budget analysis and marketing format enclosed for your convenience.)

b. Theory of Operation: Atomized Vapor Injectors is a hydroautomization system which adds a 50/50 water/alcohol

vapor to an engine's intake system. A water/alcohol vapor injector produces a more efficient fuel burn by automizing the gasoline droplets and lowering the engine's temperature. This process will not only improve an engine's over-all performance and increase gas mileage rates, but will also increase the engine's life span by eliminating excessive carbon deposits. This water/alcohol injection system, AVI, uses engine vacuum pressure to pull outside air through the glass I.V. hospital reservoir containing a 50/50 water/ alcohol solution which is attached to the car under the hood. This causes the solution of water and alcohol to bubble and splash within the vacuum chamber forming a mist of water and alcohol droplets and vapor in the upper part of the glass reservoir. This mist is then drawn by the vacuum pressure through a plastic hose which is then connected to any intake manifold suction hose (the positive crankcase valve is the most desireable connection). This connection is made by very easily cutting the rubber vacuum hose with a sharp knife and then inserting the plastic "T". The plastic needle valve can then be easily adjusted to allow just the right amount of water/alcohol vapor to pass into the combustion chamber (best results are derived by adjusting consumption rate to allow 100 milliliters per 20 gallons of gasoline).

c. Construction and Operation: The Atomized Vapor Injector consists of a recycled hospital I.V. bottle secured in a plastic holder, which is then attached under the hood to the inside of the engine compartment. A high quality rubber stopper with two holes is placed in the opening of the glass I.V. bottle. An 8 inch plastic tube with a plastic air-stone or airiator on one end of the tube is attached to the rubber stopper, with the plastic air-stone (airiator) placed near the bottom of the bottle. Now a plastic needle valve is attached in the remaining opening in the rubber stopper, with a high quality four foot plastic tube attached to the other end of the plastic needle valve. All that remains is to insert the black plastic "T" into the rubber vacuum hose. Make sure that the four foot plastic tube between the AVI unit itself is completely straight, with no up or down bends in it, and that it is not in contact with any super-hot surfaces, as this may cause the plastic tube to collapse. The AVI unit itself should be installed lower than the "T" connection, as this facilitates vapor rising upward. It is also advisable to operate the AVI unit on the top half of the reservoir, as the vaporizing process diminishes on the bottom half of the bottle. This establishes another need to have a glass container

for visual monitoring, as the glass container should be refilled when it is half-empty. The unit's effectiveness diminishes on the bottom half of the bottle.

d. Specific Claims: The introduction of AVI's water/alcohol vapor into the fuel air mixture through a vacuum line leading to an engine's intake system produces a cooling effect that increases the mixture density, extending the burning rate, and improving combustion efficiency. This process helps to eliminate engine ping (predetonation) and diesling (after running of motor). Since steam is a good cleaning process, this helps to dissolve carbon deposits on the spark plugs and cylinder walls of older vehicles, and prevents carbon build-up in newer vehicles. Engine horsepower and octane can be increased because less fuel is needed to produce the same amount of energy when using a water/alcohol injector.

e. Cost and Marketing: Please see attached marketing and sales schedule. Mr. Larry Wilkinson of Edwin K. Williams and Company, Missoula, Montana, has indicated a willingness to undertake this aspect of AVI.

4. Installation, Operation, Safety and Maintenance:

a. Applicability: Atomized Vapor Injectors is designed to be implimented on all gas-powered vehicles. The only known restriction today is that certain vehicles

with little or no extra available space in the engine compartment cannot accomodate insertion of a quart container the size of AVI. AVI is presently considering the feasibility of manufacturing units smaller than its present size with ½ quart containers in order to accomodate vehicles with less available engine space.

It is not known whether operation of a water/alcohol injector is adversely affected by adverse weather conditions, types of driving or topographical differences.

b. Installation: Please see attached installation instructions.

c. Operation: Please see attached operation instructions.

d. Safety: It is not known whether the use of this product could result in any unsafe conditions for the vehicle occupants, or persons or property in close proximity.

e. Maintenance: There is no maintenance schedule or procedure for successful operation of AVI.

5. Effects on Emmissions and Fuel Economy:

a. Unregulated Emmissions: Information unavailable.

b. Regulated Emmissions and Fuel Economy: Please see independent testing results of the City of Missoula Street and Maintenance Department.

ATOMIZED VAPOR INJECTOR
(Water/Alcohol Vaporizer)

(Missoula Street Dept. tested)

* Saves Gas
* Increases Engine Power (RPM's)
* Increases Gas Octane Rating
* Eliminates Carbon
* Eliminates Ping
* Easier Starts
* Cleaner Exhaust
* Cleaner Spark Plugs
* Easy to Install
* Economical

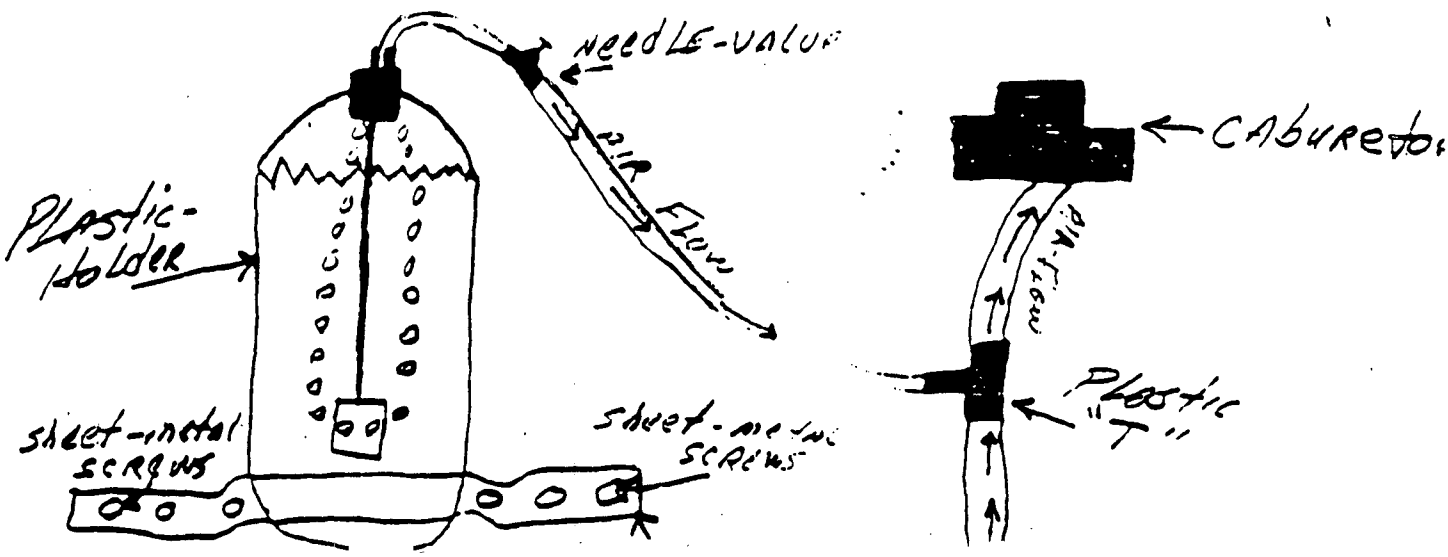
THIS ATOMIZED VAPOR INJECTOR is a hydroautomization system which adds a 50/50 water/alcohol vapor to an engine's intake system and produces the above-noted benefits. Water/alcohol vapor produces a more efficient fuel burning by "automizing" the gasoline droplets and lowering the engines temperature. This process not only improves an engine's over-all performance, but increases the engine's life span by eliminating carbon deposits.

OPERATIONAL INSTRUCTIONS: (Water/alcohol Formula)

Fill injector unit with a 50/50 ratio of water and methol alcohol. There are many commercial outlets for your alcohol supply, such as any gasoline additive like gasohol or preventive gas line freeze.

INSTALLATION INSTRUCTIONS:

1. Attach unit to engine fire wall or fender (or any available space) with sheet metal screws.
2. Next locate the positive crank case (PCV) line which leads to the base of the carburetor. If your car is not equiped with a PVC line, most vacuum lines will easily suffice.
3. Now simply cut PVC line (rubber hose) with a knife and insert plastic "T".
4. Last, fill unit with 50/50 mixture of water/alcohol, start engine, and adjust bubbling process with needle valve so that liquid is vigorously bubbling. NOTE: For best results, unit should use 100ml. of mixture per 20 gallons of gasoline and operate unit on top half of bottle only, as vaporizer action diminishes on bottom half of bottle.



THE GARDEN CITY
HUB OF FIVE VALLEYS

Missoula, Montana 59801

STREET DEPARTMENT
800 West Broadway
Phone: 721-4700, Ext. 248

TEST RESULTS

WATER VAPORIZOR

SUBMITTED TO THE CITY FOR TESTING BY LEWIS SCHNELLER, 728-2341

CONDITIONS:

1. Pickup #10 (Vehicle Maintennace department) with 50,000 + miles
2. Check #10 on scope and tune engine
3. Check all tires, 32 lbs.
4. Check wheel bearings
5. Install 1.1 gallons gas can with 3-way valve. Install at fuel pump
6. All tests shall be made off 1.1 gas tank
7. Highway test shall be made going west on Highway 10 toward Frenchtown. Speed within the city shall be 30 mph and 50 mph on the highway
8. City testing shall be on city streets at a speed of 20 to 25 mph
9. Temperature and wind speed will be recorded each test.

TEST I (ON HIGHWAY) 12-10-80

Base test without any gas-saving device.

Temperature 24°, no wind

Speedometer after	50,966.6
Speedometer before	50,947.9
Base mileage	18.7

TEST I (ON HIGHWAY, USING WATER VAPORIZER) 12-10-80

Temperature 30°, no wind

Speedometer after	51,015.7
Speedometer before	50,995.7
Mileage	20.0 = + 1.3 mpg improvement

TEST II (ON HIGHWAY, USING WATER VAPORIZER) 12-11-80

Temperature 40°, head wind 7-9 mph

Speedometer after	51,066.3
Speedometer before	51,045.7
Mileage	20.6 = +1.9 mpg improvement

TEST I (IN CITY, USING WATER VAPORIZER) 12-22-80

Temperature 36°, no wind

Speedometer after	51,236.5
Speedometer before	51,221.5
Mileage	15.0 = +.2 mpg improvement

TEST II (IN CITY, WITHOUT WATER VAPORIZER)

Temperature 41°, no wind

Speedometer after	51,252.2
Speedometer before	51,237.4
Mileage	14.8

NOTE: Vehicle was tested back on the scope. All standard tests were O.K.

REMARKS: Retest city driving so vehicle #10 is not in a stop light route. I believe the test will be more accurate.

TEST III (IN CITY, WITHOUT WATER VAPORIZER) 1-5-81

Temperature 37°, no wind

Speedometer after	51,364.4
Speedometer before	51,348.5
Mileage	14.9

TEST IV (IN CITY, USING WATER VAPORIZER) 1-5-81

Temperature 41°, no wind

Speedometer after	51,381.9
Speedometer before	51,366.8
Mileage	15.1 = +.2 mpg improvement

TESTING DONE BY ROY WILHELM, VEHICLE MAINTENANCE SUPERVISOR

1-23-81

ATOMIZED VAPOR INJECTORS

ESTIMATED PROJECTION AND FORECAST OF THREE YEARS EARNINGS

(Attach Narrative Explaining Basis for Figures Showing Receipts, Expenses, and Profits.)

YEAR		(5000 UNITS) 1982	(25000 UNITS) 1983	(100,000 UNITS) 1984
Gross Receipts	@ 29.95	$ 149,750.00	$ 748,750.00	$ 2,995,000.00
Merchandise Cost	@ 4.00	20,000.00	100,000.00	400,000.00
Gross Profit	@ 25.95	129,750.00	648,750.00	2,595,000.00

Expenses:

Officers' Salaries (If Corporation)	$ 12,000.00	$ 24,000.00	$ 60,000.00
Employee Wages	7,200.00	21,600.00	43,200.00
Accounting & Legal Fees	3,600.00	7,200.00	14,400.00
Advertising	2,156.40	4,312.80	8,625.60
Rent	6,000.00	12,000.00	12,000.00
Depreciation	-0-	-0-	-0-
Supplies	1,200.00	6,000.00	12,000.00
Electricity	600.00	1,200.00	2,400.00
Telephone	1,200.00	2,400.00	4,800.00
Interest	1,200.00	1,200.00	1,200.00
Repairs	500.00	1,000.00	2,000.00
Taxes	500.00	1,000.00	2,000.00
Insurance	350.00	350.00	700.00
Bad Debts	-0-	-0-	-0-
**Miscellaneous (Postage, etc) SALES	77,870.00	389,350.00	1,557,400.00
Total Expenses	$ 114,376.40	$ 471,612.80	$ 1,720,725.60
Net Profit	$ 15,373.60	$ 177,137.20	$ 874,274.40
Less Income Taxes	3,651.22	74,189.87	441,929.74
Net Profit After Taxes	$ 11,722.38	$ 102,947.33	$ 432,344.66
Less Withdrawals (Proprietorship/Partnership)	$	$	$

**If sum is large, please itemize.

SALES EXPENSE IS FIGURED ON 40% OF RETAIL FOR WHOLESALE AND 20% OF WHOLESALE FOR COST TO WHOLESALER

I certify the foregoing data fairly represents the financial situation to the best of my knowledge.

Signature Title

March 29, 1982

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ANN ARBOR, MICHIGAN 48105

July 16, 1982

OFFICE OF
AIR, NOISE AND RADIATION

Mr. Lewis J. Schneller
2019 West Sussex Avenue
Missoula, Montana 59801

Dear Mr. Schneller:

Our engineering evaluation group has reviewed your application for an evaluation of the Atomized Vapor Injector. Before your device can be fully evaluated by EPA, you must submit data from exhaust emission and fuel economy tests on at least two vehicles. These tests must be performed at an independent laboratory recognized by EPA. I am enclosing a current list of these laboratories and other documents which define our policy on acquistion of test data. This is the latest version of the information I sent to you with the application format.

We have also reviewed the road test data you submitted but do not feel that the program was sufficiently controlled or extensive enough to accurately quantify the worth of your device. Moreover, this testing did not include any measurements of exhaust emissions.

As you requested, we have also enclosed a set of test plans. Unfortunately, none of the testing laboratories are located near you and we cannot recommended one laboratory over another. Any of the ones on our list will be satisfactory.

You are probably aware that the design of your device is quite similar to a number of devices which are, or have been, on the market. We have also included a listing of the devices which EPA has evaluated. Your device would be categorized as a "vapor air bleed". Upon your request, I will give you more information on any of these devices.

In order to maintain our overall schedule for evaluating devices, we need to know when we will receive the above information. Please contact me by August 9 with your choice of laboratories and a schedule for testing. We expect that the results will be submitted to us by September 15, 1982. If you have any question or require further information, please contact me.

Sincerely,

John T. White for

Merrill W. Korth
Device Evaluation Coordinator
Test and Evaluation Branch

Enclosures

Lewis J. Schneller
Atomized Vapor Injectors
2024 South Avenue West
Missoula, Montana 59801
September 2, 1982

United States Environmental Protection Agency
Motor Vehicle Emission Laboratory
Emission Control Technology Division
2565 Plymouth Road
Ann Arbor, Michigan 48105

Attention: Mr. Merrill W. Korth

Dear Mr. Korth:

Please find enclosed the proposed testing format for Atomized Vapor Injectors from Olson Engineering, Inc. As soon as I can secure some financial assistance to defray the costs for these testing requirements, please be assured that I will proceed as soon as possible.

Thank you for all your assistance, and please do not hesitate to offer any further suggestions.

Sincerely,

Lewis J. Schneller

Lewis J. Schneller
(406) 728-2752 OR 728-2720

Olson Engineering Inc.
Automotive Research Center
15442 Chemical Lane, Huntington Beach, California
Zip Code 92649, Telephone (714) 891-4821, Telex 685-599

August 25, 1982

Mr. Lewis J. Schneller
Atomized Vapor Injectors
2019 West Sussex Avenue
Missoula, Montana 59801

Dear Mr. Schneller:

This letter will serve as a proposal to provide testing and evaluation services to you as requested in your letter of August 10, 1982.

Specifically, Olson Engineering, Inc. (OEI) will test and evaluate the Atomized Vapor Injector (AVI) device as specified in the EPA guideline for aftermarket vapor-air bleed device evaluations to satisfy the requirements of Section 511. The test program will utilize two vehicles as required of a type compatible with the EPA test car fleet to insure that EPA will have an available basis for comparison. Our normal computer printout includes all the exhaust emission values necessary as well as accurate fuel mileage figures calculated from the emission test data by the carbon balance method. The OEI test equipment and methodology is approved by EPA and conforms to the accepted standards.

The test sequence will be as follows:

1. Obtain two test vehicles compatible with the EPA fleet and suitable for use with the AVI device, probably by renting.
2. Inspect each vehicle for legality and compliance with the manufacturers emission parameters.
3. Remove the cylinder head(s), inspect and photograph the combustion chambers and piston crowns to determine the deposit characteristics and levels.
4. Replace the cylinder head(s) and adjust to manufacturers specifications.
5. Conduct "baseline" tests:

   1 each 75 FTP CVS-II
   1 each HFET

Mr, Lewis Schneller
August 25, 1982
Page Two

6. Install the AVI device according to manufacturers instructions.

7. Conduct on-road "conditioning" mileage accumulation if required.

8. Conduct "device" test with the system fully operational:

   1 each 75 FTP CVS-II
   1 each HFET

9. Conduct "device" test with the system fluid resevoir dry but with the system otherwise operational:

   1 each 75 FTP CVS-II
   1 each HFET

10. Remove the cylinder head(s), inspect and photograph the combustion chambers and piston crowns with particular regard to variations in deposit characteristics.

11. Restore the vehicles to the original condition.

12. Analyze the test data and the deposit inspections and prepare a comprehensive report.

Cost Analysis

The cost of the test program to satisfy the requirements of Section 511 as outlined by EPA is based on renting two vehicles for a period of four weeks, the testing, teardown (twice) of the engines and the preparation of the final report. OEI does not know of any requirement to accumulate mileage after installation of the AVI device but that task is listed as item No. 7 in the test program and will be considered an option.

Basic cost for both vehicles:	$11,750.00
Mileage Accumulation Option:	$1.00/mile

Mr. Lewis Schneller
August 25, 1982
Page Three

I hope that OEI may be of service to you and that your project will be successful. Please do not hesitate to call at any time if you have further questions.

Best regards,

H. James Law

H. James Law
Senior Project Engineer

HJL:rb

ATTACHMENT D

September 10, 1982

Mr. Lewis J. Schneller
Atomized Vapor Injectors
2024 South Avenue West
Missoula, MT 59801

Dear Mr. Schneller:

We have evaluated your test plan which we received on September 7, 1982. Our comments are as follows:

1. We require duplicate tests sequences on each vehicle at each test point. Your plan indicated that only a single test sequence would be conducted.

2. While we do not require removal and inspection of the cylinder head(s) for our purposes, we do not object. Our concern is that no changes other than the installation of the device are made to the vehicle during the testing portion of the program.

3. Step 9 of your plan requires that the vehicles is tested with your device installed but with the reservoir dry. We do not require this step for our evaluation.

We hope the above comments are helpful to you in conducting a test program to evaluate the "Atomized Vapor Injector". We ask that you submit the results from your tests by October 29, 1982. If you have any questions, please contact me at (313) 668-4299.

Sincerely,

Merrill W. Korth
Device Evaluation Coordinator
Test and Evaluation Branch

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

November 2, 1982

Mr. Lewis J. Schneller
Atomized Vapor Injectors
2024 South Avenue West
Missoula, MT 59801

Dear Mr. Schneller:

We still have not received data from your test plan which we approved on September 10. As a result, we lack test data which may support your claims for the Atomized Vapor Injector.

As I explained in our earlier letters and telephone conversations, we are obligated to publish the results of our evaluation in the Federal Register. We cannot delay that action indefinitely. If we do not receive the results of your testing by November 15, 1982, we will conclude our evaluation with the information we have in hand.

If you do not understand this course of action or require further information, please contact me at (313) 668-4299.

Sincerely,

Merrill W. Korth
Device Evaluation Coordinator
Test and Evaluation Branch